

Collins

Cambridge IGCSE®

Geography

TEACHER'S GUIDE

Also for Cambridge O Level and Cambridge IGCSE® (9–1)

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Downloadable resources
see page 5

Published by Collins
An imprint of HarperCollins Publishers
1 London Bridge Street
London
SE1 9GF

Browse the complete Collins catalogue at
www.collins.co.uk

© HarperCollins Publishers Limited 2018
10 9 8 7 6 5 4 3 2 1
ISBN 978-0-00-826016-3

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British Library Cataloguing in Publication Data.
A Catalogue record for this publication is available from the British Library.

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Originally commissioned by Andrew Campbell
Design by Hugh Hillyard-Parker
Picture research by Caroline Green and Sheena Shanks
Cover design by Kevin Robbins

With thanks to Elaine Anderson at the Geographical Association.

Printed and bound by CPI Group (UK) Ltd, Croydon, CR0 4YY

ACKNOWLEDGEMENTS

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p. 9 Diagram adapted from Roberts, M. (2003) *Learning through Enquiry*.
Sheffield: Geographical Association.

Cover illustration: Maria Herbert-Liew

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Introduction

Welcome to the Collins IGCSE®/O Level Geography Teacher Guide, which we hope will provide invaluable support to teachers worldwide, preparing students for the Cambridge IGCSE (syllabus 0460) or O Level (syllabus 2217) in Geography.

IGCSE/O Level Geography syllabus

The Cambridge IGCSE/O Level Geography syllabus is designed to introduce students to many issues in the modern world at local, regional and global scales. Students will learn about different communities throughout the world and gain an awareness of the contrasting opportunities and constraints presented by different environments.

The Collins IGCSE/O Level Geography course supports the syllabus through: the Student Book, the Teacher Guide and the accompanying downloadable resources.

Student Book

There is a single book for the whole course. The Student Book covers all the content necessary for the IGCSE/O Level Geography syllabus. It is divided into five sections and a Glossary. Sections 1, 2 and 3 match the three themes of the syllabus. Topics within each section closely follow the order of contents within the syllabus.

Teacher Guide

This is intended to help teachers to deliver interesting and informative lessons that cover the whole syllabus. There is a detailed lesson plan for each double-page spread of Sections 1, 2 and 3 of the Student Book. Each lesson plan includes:

- **assessment objectives** for the lesson
- clear reference to the appropriate section of the **syllabus**
- **differentiated learning outcomes** for students of different ability levels
- a list of teaching **resources** available for the lesson
- suggestions of relevant **weblinks**
- **key concepts** covered in the lesson
- suggestions for a **starter** and a **plenary activity**
- a variety of different **learning activities** suitable for different abilities and learning styles
- suggested guidance where **extra support** may be needed with difficult concepts
- suggested guidance where **extra challenge** may be introduced into tasks
- reference to relevant **geographical skills** which are covered in more detail in Section 4 of the Student Book
- suggestions on ways to use the accompanying **worksheets** and **Now investigate** tasks in the Student Book.

The worksheets included on the downloadable resources encompass a wide range of activities and investigations, including:

- templates for answering **Now investigate** questions in the Student Book

- writing frames for written responses to questions (to help with differentiation)
- copies of images and maps where useful for activities
- topic quizzes and assessment activities
- frameworks to produce factfiles
- recording sheets for fieldwork investigation
- data and frameworks to practise graph construction
- outline maps of the world for annotation about topics
- activities for paired and group work
- frameworks for internet research.

This Teacher Guide also contains an overview of the investigative/enquiry approach to learning from the teachers' perspective and a suggested scheme of work to cover the two-year course.

Teacher Guide downloadable resources

The downloadable resources will support the Student Book and Teacher Guide with:

- all lesson plans and worksheets in Word format (as well as PDF format) so that they can be edited to suit the needs of individual classes or departmental schemes of work
- a wide selection of images to illustrate your lessons
- the suggested scheme of work as an editable Word file.

The resources are available at this location:
www.collins.co.uk/GeogIGCSEtgrED3

Guide to sections of the Student Book

Sections 1, 2 and 3

These sections cover the syllabus themes broken down into separate topics. The topics follow the curriculum themes closely.

Each topic in the Student Book is clearly identified and contains:

- objective statements
- highlighted key terms
- **Now investigate** exercises for use in class or by students individually
- case studies from many different parts of the world
- **Fantastic facts** to interest, enthuse and intrigue the students
- suggestions for further individual research
- links to other, related topics in the book.

Sections 1, 2 and 3 include many case studies taken from different parts of the world. The syllabus gives teachers opportunities to select their own case studies to illustrate the content. In each syllabus topic it is specified where a case study is required and teachers should select appropriate examples where specified. For example, in topic 1.6 a case study of an urban area is required. Teachers can select any urban area from any part of the world, which should illustrate all the content listed for that topic.

Case studies are a key component of the syllabus and are included in all topics in the Student Book. Guidance is also given on how students could research and produce their own case study material.

The key terms are highlighted in the text and are explained/defined in the Glossary. The IGCSE/O Level syllabus does not include a prescribed list of key terms. Those terms highlighted are suggested by the authors as being helpful for students to know.

Sections 1, 2 and 3 put an emphasis on the enquiry-based or investigative approach to learning. The topics present students with many questions to consider and investigate.

The topics in the Student Book are covered on a local to global scale. Students are introduced to the topic at a personal level and given the opportunity to compare their own experience with the one presented to them. The topic is then dealt with in an appropriate wider context, which may be regional, national, continental or global. An appropriate case study or example is also included.

Sections 1, 2 and 3 will prepare students for the Geographical Themes paper time-zone variants, which mainly test knowledge, understanding and decision-making. There are also 'Skills links' to Section 4 to enable students to revise and learn key skills that will be tested in the Geographical Themes paper.

Section 4

This section concentrates on preparing students for the Geographical Skills paper and the Alternative to Coursework paper time-zone variants (IGCSE) and the Geographical Investigations paper (O Level), which mainly test geographical skills and analysis. The skills required by the syllabus are integrated into the themes and applied to different contexts. Many maps, diagrams and graphs are used for illustration in Sections 1, 2 and 3, so students must be able to read and construct similar figures. Section 4 contains clear guidance on how to interpret large-scale maps and smaller-scale maps such as atlas maps. This section also includes guidance on how to construct and interpret graphs and diagrams. Most students will use Section 4 through the 'Skills links' in the earlier sections. This section will also teach many of the skills applied in Section 5.

For students who take the IGCSE Coursework option, this section includes guidance on how to undertake common fieldwork techniques, and students who take the Alternative to Coursework option (IGCSE) or the Geographical Investigations paper (O Level) will gain an understanding of fieldwork techniques that are used in the examination. All students should be given the opportunity to do fieldwork during their course, as this is a basic learning tool in geography.

Section 5

This section concentrates on preparing students for different examinations. Each type of examination paper is dealt with in turn and allows students to use what they have learned in Sections 1, 2 and 3 to the best effect in examinations. Advice is given on many aspects of the examination including:

- preparing for each examination paper
- command words
- effective use of time in the examination
- understanding the question
- how to make the best use of examination resources.

Specific guidance is also given on the different assessment component, as follows.

Geographical Themes exam

- How to make the best choice of questions to answer

- The best way to answer case study questions
- How a case study may be marked

Geographical Skills exam

- Focus on answering map questions
- How to prepare for 'skills' questions

Coursework

- How to plan, undertake and write about fieldwork
- Practical hints to make fieldwork successful
- How a coursework assignment may be marked
- How to achieve a high level grade in a coursework assignment

Alternative to Coursework exam (IGCSE)/Geographical Investigations exam (O Level)

- How to tackle examination questions that test a hypothesis
- Preparation through fieldwork

There are examples of past examination questions from each paper. For each question there are two example answers – one answer should achieve a high mark and the other answer should achieve a medium level mark. Each answer is followed by a suggestion of how the answer may be marked and possibly improved.

Throughout the section there are tip boxes giving advice and useful hints to students taking these examinations.

Access to the internet

Within Sections 1, 2 and 3, suggestions are included of possible websites to search for further information and to do individual research. Whilst there is an assumption that all schools will have some level of internet access, this should not be a barrier to students fully engaging with the material and being able to achieve the highest grades. Alternative activities and research ideas are provided in the lesson plans in the Teacher Guide. These could be carried out in the school library.

John Belfield
Consultant editor

Investigative/enquiry-based Geography

Setting the scene

The IGCSE Geography specification aims to develop students who are able to understand the world, and develop their knowledge of it. Students are encouraged to become independent learners, and to develop a sense of place and an understanding of relative location at a range of scales along with an appreciation of, and concern for the environment. They should also be able to understand geographical data and information, and exemplify this with relevant case studies.

All of these aims provide justification for the *enquiry approach* that we have adopted for the Student Book. The Teacher Guide provides more guidance on using *geographical enquiry* with students, and taking the ideas in the Student Book further. Every school is different, and we hope that teachers will take the book as the starting point for an investigative approach that supports learners towards being more *independent*.

As learners take more control over their learning, they will need to be provided with *appropriate tools, strategies and templates for their research*, and a range of options for presenting their work. The Student Book provides examples of these, which teachers can feel free to use, edit or leave out depending on how comfortable they feel and on the perceived academic ability of the students in the classes that they teach.

What is geographical enquiry?

Geographical enquiry starts from the idea of *constructivism*: that we learn about the world by *making sense of it* for ourselves. The Student Book contains a great deal of information and factual content, but simply copying this down is unlikely to develop your students into geographers: they will just 'know more stuff' (for a while at least). Of course 'knowing stuff' is important when it comes to passing exams, but the ability to remember, understand, and then write about the content accurately is just as important, and geographical enquiry can help develop all those abilities in learners.

The Student Book attempts to provide the basis for students to construct learning by setting up short enquiry sequences. A good enquiry question should 'make you want to answer it', and each section is based around significant questions.

The aim of the Student Book is to provide a range of contexts for use in the examination, which provide a wide global spread, so that students are introduced to both familiar and unfamiliar locations. What it cannot do is take account of students' existing knowledge: teachers are better placed to do that, and this should form part of the early discussions when a new topic is introduced, where there are opportunities for student stories to be integrated into the lessons.

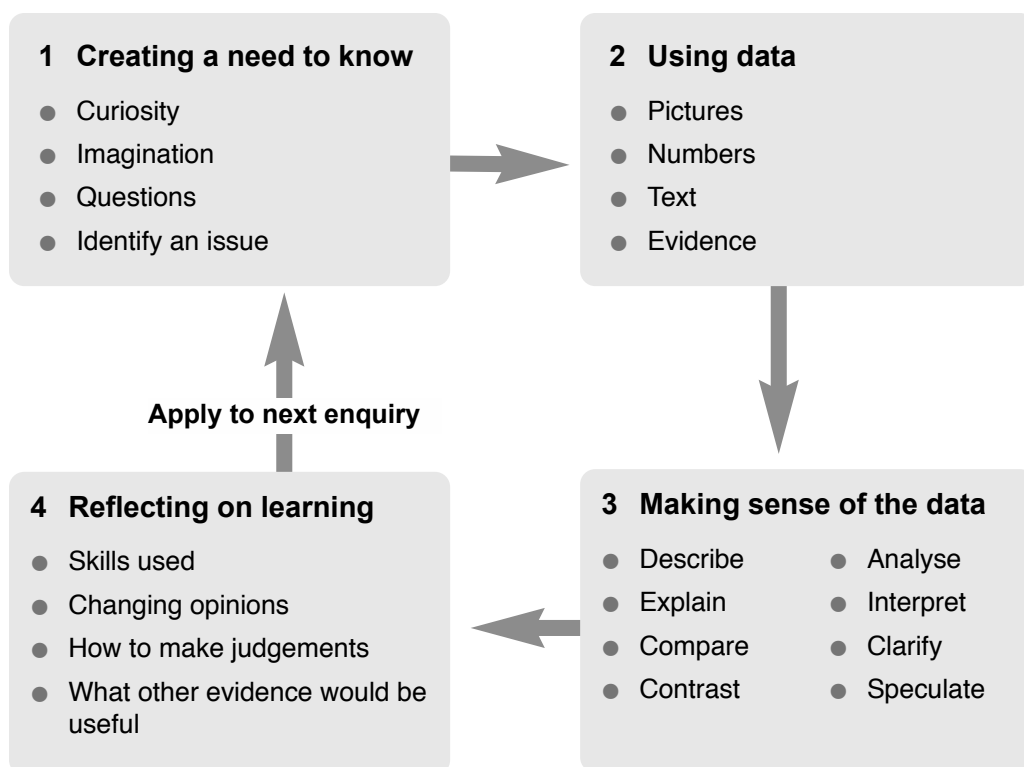
These are times when the teacher, acting as a 'curriculum maker', takes the Student Book material and adds the extra local knowledge that brings breadth and context, or a particular resource that has been proven to work in the past.

What does geographical enquiry involve?

Geographical enquiry, as described by Margaret Roberts, is usually represented as a four-stage process:

- Creating a need to know
- Using data
- Making sense of the data
- Reflecting on learning

How are each of these to be achieved, when the Student Book is the main resource in the geography classroom?



Creating a need to know

Geographical enquiry starts with a 'hook' – a resource of some kind that creates the 'need to know' in the students. This is a key element of any narrative, and the Student Book should be seen as a series of stories that the students form part of. The link with personal geographies is vital to developing enquiries that have authenticity. It is not easy to decide on content for a textbook: a choice that might be relevant and appropriate for students in one location will seem irrelevant or possibly repetitive for others. One size rarely fits all. This is why teachers and learners should shape the case studies, and see the Student Book as the starting point of the story, rather than the whole story.

With some stories, the ending is uncertain, or the narrative can take many different turns. We have provided suggestions for images and multimedia to support the production of a hook, but these are not the only images that could have been chosen.

Baiting the hook – some suggestions

- Source striking Creative Commons licensed images from Flickr.
- <http://vimeo.com> is a community of film-makers who have generated a range of striking clips, particularly on urban themes – one particular genre here is the time lapse, which provides a different perspective on familiar scenes.
- Use the websites of local and national newspapers to source intriguing and amusing stories relevant to the topics in the Student Book. Keep an eye out for unusual stories that offer a 'twist' on what you would expect. These could be curated into a personalised newspaper using an app like Flipboard.
- Ask colleagues about stories and personal experiences related to the topics in the book. One of them might have experienced an earthquake or been on holiday in an exotic or extreme location.
- Take the images in the Student Book as a starting point – use the 5Ws format (Who? What? Where? When? and How?).
- Sign up for Twitter, and follow accounts related to topics you are teaching. This often allows for conversations to be started, and can lead to other perspectives.
- Use QR codes to link to media. Students scan the codes to reveal the media and a question. The Vocal Recall app makes this process straightforward.

Teachers should encourage questions from the students themselves. The big questions will often form the 'hook', but may develop as secondary questions, once the students get to work on the data that has been provided. Education should be *personal* and not just *personalised*.

Some key questions for students and teachers to consider when developing enquiries include the following:

- What do I know from my own experience?
- Where have I been?
- In what ways am I aware of places through indirect experiences?

Using data

Students need to use a range of data through the course of their study. The specification states that particular data should be used, and some of these will also form part of the exam paper. The Student Book contains a range of data, and guidance on how these should be used. There are also a range of mathematical skills which should be introduced into the teaching of each topic.

While we have provided a range of data, there is scope here for teachers to add something that is more appropriate, or more challenging, or (in time) more up to date. New data-rich websites such as Worldmapper appear frequently. Don't limit yourself to Google searching. Use fiction and non-fiction writing (including travel writing), advertisements, cartoons, graphs and data visualisations, maps, memories and artefacts. Keep a constant eye out for suitable materials – you might start looking at everything as a potential resource.

Data should also be in a relatively 'unprocessed' state. Leave scope for students to do some work. As Roberts says:

Students could answer the question 'Where in the world do earthquakes occur?' by using a textbook, which provides a list of generalisations about the distribution of earthquakes. They can transfer this information to their exercise book without

really thinking much about the question or the answer. If they can copy accurately, they will have the 'correct' answer to the question ... Alternatively, they can search for the data and try to make sense of it themselves ... This way of answering the question involves the students in constructing knowledge for themselves...

Students should be encouraged to collect their own data in a range of ways. Survey design is a useful activity to promote discussions between students on the purpose of questions, the importance of collecting appropriate data, and avoiding bias. Google Forms allow students to collect data, and have it analysed automatically. It can also be mapped using ArcGIS Online.

Making sense of the data

Once the data have been sourced, students will need to engage in activities that help them to make sense of them. Once again, the Student Book provides suggestions that relate to the specification, but there are still opportunities for teachers to add some further analysis and options for presentation. A key skill here is that of explanation, and while the Student Book offers some explanations, it does not (and could not) explain everything.

Some additional ideas suggested in this Teacher Guide include:

- Presentation: use a range of techniques and styles of writing – technology can support students here – remembering that geography means ‘writing the Earth’; so don’t avoid chances to tell stories in different ways. Access to tablets enables the creation of presentations and movies in a short space of time, which can then be shared.
- Be specific about audience and purpose: if writing is being done for a specific audience, this can improve focus – presentation could include video commentary, news reports, information boards for tourist attractions, letters to members of the government or local councils, or even an email or text message.
- Explore a range of graphic organisers to help students to make sense of complicated information, for example KWL grids, fishbone diagrams etc.
- If you have access to the internet, the Classtools website allows the creation of a range of useful interactive diagrams: <http://classtools.net/>

Reflecting on learning

This final stage is the crucial one for embedding the understanding, and providing a suitable platform for the next enquiry. There are important evaluation skills to be learned, so that students can be more critical about the value of what they see and hear. These will enable them to judge the value of their own (and others’) work and have confidence to know how to improve it. Evaluate not only what has been learned, but *how* it has been learned.

How can students communicate their reflections?

- Structured feedback forms and documents could be provided with some key questions based on those in the Student Book.
- Blogging: websites such as Blogger and Wordpress enable students and teachers to set up websites that can then have student comments added. This provides evidence of engagement.
- Use sticky notes to annotate work, or to offer the chance for students to edit each other’s work.
- Although you may not have access to a lot of technology, many mobile phones can be used to capture audio and video clips that can be used to construct a story. Use craft materials to construct simple stop-motion-style animations.

Conclusion

Textbooks are a vital tool in the teacher's toolbox, but like any tool they need to be used appropriately, and a range of tools will generally be needed to complete a difficult task. Teachers should look for opportunities to enhance and update the material in the Student Book, to ensure that they support students most effectively in their exam preparations. Remember that the examination involves a range of writing, from one-word answers to more extended pieces.

References

Davidson, G. (2002) 'Planning for Enquiry' in Smith, M. (ed.) *Aspects of Teaching Secondary Geography*, London: Routledge Falmer

Davidson, G. (2006) 'Start at the Beginning', *Teaching Geography* 31, 3, pp. 105–8

www.geography.org.uk/gtip/thinkpieces/geographicalenquiry – a short piece by Gill Davidson on the Geographical Association website

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Two-year scheme of work

The tables on the following four pages suggest a structure for using the materials in the Student Book and Teacher Guide over a two-year course.

In **Year 1** it is suggested that the focus is on:

- Section 1: Population and Settlement *and*
- Section 2: The Natural Environment.

In **Year 2** it is suggested that the focus is on:

- Section 3: Economic Development *and*
- Section 5: Exam Preparation.

It is suggested that Section 4: Geographical Skills is incorporated into teaching Sections 1, 2 and 3. Skills links are provided in the Student Book.

Sections 1, 2 and 3 could each be covered in approximately 50 to 60 hours' teaching time, including the appropriate geographical skills. Section 5 could be covered in approximately 40 to 50 hours, but it is probable that some examination preparation will be done throughout the course. If a centre enters candidates for the IGCSE Coursework paper (3) then Topic 5.3 will be covered at an appropriate time. A coursework assignment should normally occupy about four to five weeks (12 to 15 hours) in the classroom following some introductory work.

Words and figures in italics on the next four pages refer to the Student Book.

Year 1 Section 1: Population and Settlement

Topics	Case studies <i>Exam preparation 5.1</i>	Fieldwork <i>Exam preparation 5.3</i>	Geographical Skills <i>Exam preparation 5.1, 5.2, 5.3, 5.4</i>
Population dynamics Population growth and resources Over and under population Population control policies <i>Topic 1.1</i>	Liberia – high natural population growth rate Canada – an under-populated country and Tanzania – an over-populated country China – low natural population growth rate		Line graph <i>Topic 4.3</i> Thematic map <i>Topic 4.2</i> Scatter graph <i>Topic 4.3</i>
Population migration <i>Topic 1.2</i>	International migration – Senegal to Europe	Journey to work questionnaire Migration questionnaire <i>Topic 4.5</i>	Flow line map <i>Topic 4.3</i>
Population structure Age/sex pyramids at different stages of economic development <i>Topic 1.3</i>	Japan – high dependent population	Classroom census	Age/sex pyramid <i>Topic 4.3</i>
Population density Population distribution <i>Topic 1.4</i>	Singapore – a densely populated country Sahel – a sparsely populated area		Photograph interpretation <i>Topic 4.4</i> Climate graph <i>Topic 4.3</i> Choropleth map <i>Topic 4.2</i>
Settlements and service provision Rural settlements and life in rural areas Settlement hierarchy Service provision in an area <i>Topic 1.5</i>	Isle of Wight – service provision	Resident questionnaire Sampling <i>Topic 4.5</i>	Map interpretation <i>Topic 4.1</i> Climate graph <i>Topic 4.3</i> Interview and questionnaire <i>Topic 4.5</i>
Urban settlements Land use zones in urban areas Urban pollution Urban growth effects on the rural-urban fringe Urban change <i>Topic 1.6</i>	London – changing urban land use and urban sprawl	Sphere of influence investigation Pedestrian questionnaire Features and delimitation of CBD Contrasts in housing areas Traffic survey	Map interpretation <i>Topic 4.1</i> Annotated sketch map <i>Topic 4.4</i> Scatter graph <i>Topic 4.3</i> Transect and land use mapping <i>Topic 4.3</i> Photograph interpretation <i>Topic 4.4</i>
Urbanisation Problems of urban growth Squatter settlements Improving residential areas Sustainable cities <i>Topic 1.7</i>	Mumbai – a rapidly growing urban area	Air and noise pollution Quality of life survey	Photograph interpretation <i>Topic 4.4</i>

Year 1 Section 2: The Natural Environment

Topics	Case studies <i>Exam preparation 5.1</i>	Fieldwork <i>Exam preparation 5.3</i>	Geographical Skills <i>Exam preparation 5.1, 5.2, 5.3, 5.4</i>
Earthquakes and volcanoes Plates and plate boundaries <i>Topic 2.1</i>	Japan – earthquake and tsunami Soufriere Hills – volcano in Montserrat		Map interpretation <i>Topic 4.2</i>
Drainage basin processes River erosion, transport and deposition processes River features Opportunities and hazards created by rivers <i>Topic 2.2</i>	Mekong delta – Vietnam Mississippi – USA	River measurements – velocity – discharge – width and depth – load – long profile – cross-section <i>Topic 4.5</i>	Fieldwork sketch of the landscape <i>Topic 4.4</i> Maps – identifying landscape features <i>Topic 4.1</i> Maps – describing a river and river valley <i>Topic 4.1</i>
Changing coasts and waves Coastal erosion, transport and deposition processes Coastal landforms Coral reefs and mangrove swamps <i>Topic 2.3</i>	Great Barrier Reef – Australia	Coastal measurements – longshore drift – beach material – wave frequency – beach profile <i>Topic 4.5</i>	Sketching a landscape <i>Topic 4.4</i> Map interpretation <i>Topic 4.1</i> Sketching from a map <i>Topic 4.4</i>
Weather and climate Measuring and recording the weather Types of cloud <i>Topic 2.4</i>		Using instruments to measure – temperature – rainfall – relative humidity – atmospheric pressure – wind speed and direction	Map interpretation <i>Topic 4.2</i> Drawing and interpreting a climate graph <i>Topic 4.3</i> Drawing and interpreting a wind rose <i>Topic 4.3</i>
Climate and natural vegetation Equatorial climate Tropical rainforest vegetation and environment Hot desert climate Hot desert vegetation and environment Human activity in the hot desert Natural hazards including tropical storms and flooding <i>Topic 2.5</i>	Borneo – tropical rainforest Namib Desert – Namibia		Comparing topographical maps <i>Topic 4.2</i> Climate graph interpretation <i>Topic 4.3</i> Line graph <i>Topic 4.3</i> Choropleth map <i>Topic 4.2</i> Drawing a sketch map <i>Topic 4.4</i> Interpretation of a satellite image <i>Topic 4.6</i>

Year 2 Section 3: Economic Development

Topics	Case studies <i>Exam preparation 5.1</i>	Fieldwork <i>Exam preparation 5.3</i>	Geographical Skills <i>Exam preparation 5.1, 5.2, 5.3, 5.4</i>
Economic development and quality of life Development indicators Classifying industry Employment in changing countries Industry in NICs Globalisation <i>Topic 3.1</i>	NIKE – a transnational corporation		Line graph <i>Topic 4.3</i> Pie chart <i>Topic 4.3</i> Divided bar graph <i>Topic 4.3</i> Triangular graph <i>Topic 4.3</i>
Food production and farming systems Commercial farming Subsistence farming Food shortages – causes, effects, tackling the problem <i>Topic 3.2</i>	Sarawak – plantation agriculture Bangladesh – rice farming Bolivia – food shortages	Farm study	Bar graph <i>Topic 4.3</i> Map interpretation <i>Topic 4.2</i> Choropleth map <i>Topic 4.2</i>
Employment options Industrial location Manufacturing industries High-technology industries <i>Topic 3.3</i>	Bangladesh – textile and clothing industry	Location of local industry	Thematic map <i>Topic 4.2</i> Bar graph <i>Topic 4.3</i>
Growth and importance of global tourism Tourism in LEDCs <i>Topic 3.4</i>	France – tourism in an MEDC Kenya – tourism in an LEDC	Growth of a tourist area Positive and negative effects of tourism <i>Topic 4.5</i>	Line graph <i>Topic 4.3</i> Climate graph interpretation <i>Topic 4.3</i>
Energy consumption Fossil fuels Fuelwood crisis Renewable energies Electricity production and consumption Nuclear power Hydro-electric power <i>Topic 3.5</i>	China – coal industry	Impacts of electricity generation on local people	Compound line graph <i>Topic 4.3</i> Pie graph <i>Topic 4.3</i> Flow line map <i>Topic 4.3</i> Choropleth map <i>Topic 4.2</i> Graphing numerical data <i>Topic 4.3</i> Climate graph interpretation <i>Topic 4.3</i>
Water supplies Meeting water demand Water shortage <i>Topic 3.6</i>	Northern India – supplying water		Comparing maps <i>Topic 4.2</i> Climate graph interpretation <i>Topic 4.3</i>
Natural environments – problems and opportunities Exploiting the natural environment Environmental damage Global warming Forest destruction Conservation and management Sustainable development <i>Topic 3.7</i>	Aral Sea – Kazakhstan and Uzbekistan Greenland – tourism and mining Carteret Islands – effect of climate change Borneo – deforestation Great Barrier Reef Marine Park – Australia Yorkshire Dales National Park – England	Measuring air and water pollution Environmental quality survey <i>Topic 4.5</i>	Bar graph interpretation <i>Topic 4.3</i> Pie graph <i>Topic 4.3</i> Photograph interpretation <i>Topic 4.4</i> Interpretation of a satellite image <i>Topic 4.6</i> Multiple line graph <i>Topic 4.3</i> Choropleth map <i>Topic 4.2</i>

Year 2 Section 5: Exam preparation

Paper 1 Geographical Themes <i>Exam Preparation 5.1</i>	Paper 2 Geographical Skills <i>Exam Preparation 5.2</i>	Paper 3 Coursework <i>Exam Preparation 5.3</i>	Paper 4 Alternative to Coursework (IGCSE) Paper 3 Geographical Investigation (O Level) <i>Exam Preparation 5.4</i>
Explanation of what the exam paper is testing	Explanation of what the exam paper is testing	Explanation of what the coursework is testing	Explanation of what the exam paper is testing
Using the examination time effectively	Using the examination time effectively	Explanation of why fieldwork is done	Using the examination time effectively
Choosing correct questions		Route to Geographical Enquiry	
Understanding the question	Understanding the question	Practical hints for fieldwork	Understanding the question
Case study questions	Answering a map interpretation question	Explanation of how coursework may be marked	
Explanation of how a case study question may be marked	Answering other geographical skills questions	Explanation of how to achieve a high level grade in coursework	
Command words	Command words	Fieldwork techniques	Command words
Resources	Resources		Resources
Preparation for the Geographical Themes examination	Preparation for the Geographical Skills examination	Preparation for the Coursework assignment	Preparation for the Alternative to Coursework examination
Example answers and teacher's comments	Example answers and teacher's comments	Example coursework investigations and teacher's comments	Example answers and teacher's comments

1.1 (1)

Why are some families larger than others?

Assessment objectives

- Candidates should be able to demonstrate knowledge and understanding of the nature and progress of world population growth.
- Candidates should be able to recognise ways in which different economies and societies influence family size, in particular the MEDC/LEDC contrasts.

0460/2217 syllabus

1.1 Population dynamics

- Describe and give reasons for the rapid increase in the world's population

Differentiated learning outcomes

- **All students must** be able to describe the progress and pattern of population growth in the world as a whole and the differences in timing and numbers involved in both the richer and poorer regions of the world (Grade E/D).
- **Most students should** be able to describe accurately graphs showing growth, understand a range of factors leading to these patterns of growth and be able to illustrate these with case studies (Grade C/B).
- **Some students could** discuss the positive aspects of growth in both LEDCs and MEDCs (Grade A/A*).

Resources

- **Student Book:** pp. 2–3
- **Worksheets:** None
- **Photographs:**
1.1 An Afghan family
1.2 A German family
- **Further reading and weblinks:**
None

Key concepts

- Population growth has occurred throughout historical time.
- Population decrease is a recent occurrence in MEDCs.
- The situations and factors affecting natural change vary between countries/regions.

Starter suggestions

Begin the lesson with the **Fantastic fact** quoted on p. 2 of the Student Book. Ask the students to consider the likely implications of such growth. Question 2 in **Now investigate** supports this idea and takes it further. Question 2 could also be used later.

Use the two family situations of Kadlin (Norway) and Daksh (India): read out loud each of these sections and either ask for student comment or allow brief discussion.

Ask students about:

- the size of their family (i.e. number of children)
- how many siblings their parents had
- how many siblings their grandparents had.

This may reveal a pattern of decreasing family size over the generations, or stability, depending on the country you live in. Link this to Question 1 in **Now investigate** on p. 3 of the Student Book.

Main lesson activities

- 1 Look with students at graph **D** on p. 3 of the Student Book. Link its shape to a letter of the alphabet (J curve concept). **Now investigate** questions **4a** and **4b** on p. 3 could be useful here (or you may prefer to use it at the start of the lesson with the **Fantastic fact**). Ask students what the shape means in terms of population growth over time.

- 2 If not used as a starter activity, students can copy and complete the table in **Now investigate** question 3a. This should support the idea that growth rates increase over time. Students should consider the gradient of graph **D** and what it shows in this context.
- 3 Look with students at graph **C** on p. 2 of the Student Book. Ask them to comment on the shape of the top line (the world total): as this continues to 2050, gradient decreases and it becomes an S shape. Students should write a description of what the graph shows. Follow this with a class discussion on the points they have made. Highlight the differences in the patterns of growth in MEDCs and LEDCs. Ensure that students understand that LEDCs are represented by the green section – that is, the area above the MEDC line only. Some students may find this type of compound graph quite difficult to read.
- 4 Over-population: ask students what they think this term means and ensure they have the correct definition. Use photos **1.1** and **1.2** from the downloadable resources to consider contrasting family sizes in LEDCs and MEDCs (Afghanistan, Germany). Invite students to comment on the photos – aim for some balance of advantages and disadvantages of these contrasting families.
- 5 A comparison of the problems and benefits of a growing population: students should write lists or an extended piece of writing (depending on ability) showing these, referring to the Student Book text. Daksh's experience can be included.

Give extra support by ensuring that students understand the more difficult concepts like population growth rate, and the compound nature of graph **C** on p. 2 of the Student Book.

Give extra challenge by including a second piece of writing to highlight the obvious benefits, but also the problems, of being an only child like Kadlin. There is less material in the text to give clues, so students will have to think independently. Students with time and ability could draw a line graph to show growth for a country like Norway where very small families dominate (extend the S curve idea).

Plenary suggestions

Ask students whether they think graphs **C** and **D** show the concept of population growth clearly or not. Encourage them to give reasons for their points.

Skills notes	Students here make use of simple and compound line graphs.
Assessment suggestions	Using Now investigate question 4 on p. 3 of the Student Book as homework will check whether students have grasped the use of the J curve line graph.

1.1 (2)

Why did the population explosion happen?

Assessment objectives

- Candidates should understand the reasons behind the growth processes – why people make certain decisions.
- Candidates should be able to show empathy, putting themselves in the place of various decision-making parents.

0460/2217 syllabus

1.1 Population dynamics

- Understand the main causes of a change in population size
- Give reasons for contrasting rates of natural population change

Differentiated learning outcomes

- **All students must** understand the concepts of birth rate (BR), death rate (DR) and natural change (NC) and their impacts on population size. They should also grasp the timescale differences in the population explosion occurring in MEDCs and then in LEDCs (Grade E/D).
- **Most students should** understand the four main reasons for population growth (Grade C/B).
- **Some students could** apply their historical knowledge, for example of the Industrial Revolution, to give greater depth to their understanding of the demographic processes (Grade A/A*).

Resources

- **Student Book:** pp. 4–6
- **Worksheets:**
1.1 How do we calculate natural change?
1.2 Calculating natural change
- **Photographs:**
1.3 Children at work
1.4 Modern farming machinery
- **Further reading and weblinks:**
None

Key concepts

- The population explosion happened in different places at different times and at different speeds.
- Reasons for the population explosion were fairly constant between MEDCs and LEDCs.

Starter suggestions

Referring to photo **B** on Student Book p. 4 (photo **1.3** from the downloadable resources), identify the type of country this represents (LEDC). Use this information to make a comparison with what children of equivalent age would be doing in an MEDC. Explore possible reasons for this key difference.

Main lesson activities

- 1 Ask the question, 'What makes population grow?' seeking the response that more people are born than die. Definitions of birth rate, death rate, natural change (increase + decrease) need to be written down by students. A brief question-and-answer session using **Worksheet 1.1** should reinforce this task and ensure that these facts are understood by students.
- 2 Use **Now investigate** question 1 (p. 5) to introduce the idea of remembering facts through mnemonics and spider diagrams.
- 3 Use **Worksheet 1.2** to teach students how to calculate natural change. The first box on the worksheet explains the difference between positive and negative change. Work through the second box (the example). This is followed by two national data sets: Estonia, chosen to illustrate typical natural decrease in eastern Europe, and Pakistan, chosen to show rapid natural increase in an LEDC. Conclusions should be shared across the class.

- 4 Repeat that growth occurs when $BR > DR$. Ask the question, 'What makes the BR high?' Use the text on p. 4 of the Student Book headed 'Economic', 'Care of the elderly' and 'Infant mortality'. Students should understand the impacts of each of these factors, and explore the relevant issues further through either class or group discussion.
- 5 The fourth reason for population explosion is 'Life expectancy'. The Student Book considers food production increases – photo C on p. 4 (photo 1.4 from the downloadable resources) helps here as a focus. Ask the students what health provision protects them (vaccinations, hospital care, midwives, etc.). What are the likely impacts of these? How would these contribute to population growth today in an LEDC?

Give extra support by prompting weaker students in making the conclusions on **Worksheet 1.1**, and give hints to help them with **Worksheet 1.2** for homework.

Give extra challenge by guiding students to calculate natural change for a variety of countries to illustrate all economic levels, for example western Europe, USA, NICs, and the poorest countries like Afghanistan (refer back to photos 1.1 and 1.2 from the downloadable resources).

Plenary suggestions

Now **investigate** question 2 is a useful consolidation exercise for homework and/or group work.

Construct a spider diagram to link the ideas explored in this lesson. Place 'Population' in the centre and draw four 'legs'. Ask students to offer ideas for each one.

Skills notes	Locating multiple bar graphs on a map demonstrates a useful higher-level skill that students could use when writing up a fieldwork study.
Assessment suggestions	<p>Supply your students with current BR and DR data for your country (and for others, if you wish).</p> <p>Students can then calculate the natural increase or decrease.</p> <p>They should then write one or two paragraphs to explain what this situation (increase or decrease) means for their country.</p>

1.1 (3)

Why do populations grow at different rates?

Assessment objectives

- Candidates should know the main causes of death in LEDCs and MEDCs.
- Candidates should understand the factors affecting birth rate and death rate.
- Candidates should be aware of the potential impact of natural hazards, but understand that only occasionally are large numbers of people killed in such events.

0460/2217 syllabus

1.1 Population dynamics

- Understand the main causes of a change in population size
- Explain how birth rate and death rate contribute to the population of a country increasing or declining

Topic links: more on migration can be found in Topic 1.2 pp. 21–26; more on birth and death rates can be found in Topic 1.1 pp. 2–5.

Differentiated learning outcomes

- **All students must** know which factors affect population growth/decline and how and when they have affected both MEDCs and LEDCs (Grade E/D).
- **Most students should** understand that the different factors operate in different places and at different times and speeds (Grade C/B).
- **Some students could** evaluate the relative importance of physical and human factors – that is, natural hazards versus human conflict (Grade A/A*).

Resources

- **Student Book:** pp. 6–8
- **Worksheet:** 1.3 Why did the birth rate stay high in LEDCs?
- **Photographs:** None
- **Further reading and weblinks:** None

Key concepts

- The key factors affecting population growth are: birth and death rates (infant mortality rate in particular), disease, natural hazards, human conflict, and migration.

Starter suggestions

Ask students to look back to Topic 1.1 pp. 2–5 as a reminder about population increase. Then quiz them on:

- the key factors affecting population growth/decline when most growth occurred (LEDCs)
- in which type of country (MEDC/LEDC) greater growth happened (LEDCs)
- in which type of country growth is continuing today (LEDCs)
- places now experiencing population decline (eastern Europe and some countries in western Europe).

Revise definitions that will be needed in this lesson, of: death rate, birth rate, infant mortality rate, natural hazard, famine, migration.

Main lesson activities

- 1 The three most basic factors affecting population growth in your country are birth rate, death rate and international migration.
 - (a) Birth rate: explore the circumstances that keep birth rate high in LEDCs. Students should try to put themselves in the places of poor people and write down three reasons for having many children, for example lack of access to birth control (rarely the case now), tradition, religious reasons, labour supply, caring for elderly parents, desire for sons. Use **Worksheet 1.3** to summarise the points raised in your class discussion.

- (b) Death rate: as a country develops, death rate decreases. Ask students which groups in society are the weakest physically (the elderly and the very young – concentrate here on the very young). Infant mortality rate not only raises the death rate as a whole, but it encourages parents to have more children to ensure that some will survive. This keeps the birth rate high. Add an extra leg to the diagram on **Worksheet 1.3** to represent this factor.
- (c) International migration: take a minute only to define *emigration* and *immigration* and ask students to work out the impact of each of these on a country's population. (This topic is explored in more detail in Topic 1.2)
- 2** Impact of natural hazards on population levels: Ask students to recall recent natural disasters, for example the Japanese earthquake/tsunami (March 2011), Indian Ocean tsunami (December 2004), Haiti earthquake (March 2010), followed only 10 months later by Hurricane Tomas. 2016 and 2017 brought Hurricanes Matthew and Irma to Haiti. These all had high death rates – emphasise that disasters affect both property and life in LEDCs. In MEDCs property is affected more than life. Hurricane Irene (USA, August 2011, 21 deaths) and the eruption of Eyjafjallajökull (Iceland, March 2010, 0 deaths) are examples. Most hazards have little impact on population growth. A useful homework exercise would be to research results of selected, contrasting events.
- 3** **Now investigate** question 1 (p. 8) fits well here. Map A (p. 6) shows only the most lethal hazards in recent history. Students can answer part (a), but for (b) only China stands out from the map, so you should point them towards, say, the Philippines and Indonesia. There are links here with Topic 2.1 (on earthquakes and volcanoes). Introduce the idea of hazard hotspots here. The Philippines, Indonesia and parts of China can be classed like this.
- 4** Famine can be seen as a natural hazard or one brought about by people. Work through **Now investigate** question 2 to help students understand the impact of famine on population growth. You could take this as an opportunity to discuss with students the type/s of graphs most suitable for displaying such data.
- 5** Some areas of the world have experienced civil wars and other human conflicts in recent decades. These too have an impact on population growth. Graph B shows the number of fatalities in these events in Africa, Asia and Europe. Use this data to answer **Now investigate** question 3.

Give extra support by completing **Worksheet 1.3** with small mixed ability groups, to support those who find the explanations more difficult.

Give extra challenge by encouraging the most able to work on the worksheet explanations themselves.

Plenary suggestions

Construct a spider diagram or similar to show the factors affecting population growth.

Skills notes	In this lesson students describe distribution of features on a map, use line and bar graphs, and consider the most appropriate type of graph for a particular purpose.
Assessment suggestions	Students should write a summary of the factors affecting population growth, based on the work in this lesson.

1.1 (4)

How are population growth and resources linked?

Assessment objectives

- Students should acquire the concepts of over- and under-population
- Students should understand exactly what 'lack of resources' means
- Students should be able to apply this knowledge, and possibly other case studies, when answering questions.

0460/2217 syllabus

1.1 Population dynamics

- Show an understanding of over-population and under-population
- Understand the causes and consequences of over-population and under-population

Differentiated learning outcomes

- **All students must** have a basic knowledge of the evidence for Liberia's poverty (Grade E/D).
- **Most students should** have some knowledge of population growth statistics (Grade C/B).
- **Some students could** understand the cause/effect links between high population growth rate and persistent poverty (Grade A/A*).

Resources

- **Student Book:** pp. 8–10
- **Worksheets:** None
- **Photographs:**
 - 1.5 Oasis in the Sahara Desert
 - 1.6 Houses crowded together in Liberia
- **Further reading and weblinks:** None

Key concepts

- Population and resources available act together to affect standard of living and economic development in a country.

Starter suggestions

Use the **Fantastic fact** on p. 8; it is very striking. You could illustrate this with an atlas or wall map of the world, a globe, or an image of Earth from space. Whichever you choose, it is clear that most of the image is sea!

Show the photos on the downloadable resources of an African desert landscape and of urban Liberia. Ask students to comment on what they see. You could introduce the concept of what these show regarding over-/under- population, having read the text on p. 8 of the Student Book.

Main lesson activities

- 1 Ask students to close their Student Book and to write their own definitions of over- and under-population. You could use mini-whiteboards if you have them available. Students could then show their ideas to each other as well as to you.
- 2 In pairs or small groups, discuss the **Now investigate** question 1 on p. 10 of the Student Book. Report back to the class. To what extent do your students agree with each other?
- 3 Stay in pairs or small groups. Ask students to define what they think a resource is. They should also give their own examples. This could be done in the context of their own lives.
- 4 Find out more about Liberia, the case study on p. 9. Allow time for some internet research, individually, and then reporting back.

- 5 Liberia was growing at a rate of 4.5% per annum, one of the fastest rates in the world, although by 2017 this had reduced to 2.4% per annum. What does this mean to the birth/death rate balance and therefore to population growth? You should explain to students (or revise if they have met this already) that the death rate, despite the war deaths, is low due to the youthfulness of the population; and that the birth rate stays high in a very poor nation, plus the reasons for this. Diagram **B** on p. 9 in the Student Book, will assist here. Students can then consider the equivalent situation in their own country.
- 6 Students can draw a large spider diagram, based on that in Figure **B** to show the impacts of poverty and reasons for the continuing high birth rate. The spider as in Figure **B** can then have extra legs extending from the existing ones for students' own ideas.
- 7 Whole class or Extension exercise:
Refer back to **Now investigate** question 1, on p. 10 in the Student Book: Use Figure **A** on p. 9 to describe what is expected to happen to global population growth up to the year 2100. Able students should tackle this on their own, to stretch them. Or, if doing this as a whole class task, mix small groups in terms of ability, so the less able can learn from the ideas of the more able students.

Homework assignment

Answer this question: To what extent does Liberia's economy supply people's needs as shown in Figure **C** on p. 10 in the Student Book?

Give extra support to weaker students by mixed ability group working, as suggested above.

Give extra challenge to more able students by having them work independently on the most difficult tasks, and work with weaker students to enhance everybody's understanding.

Plenary suggestions

Students can review the situation in Liberia and in their own country. Which is in a more favourable population/resource balance situation, and why?

Skills notes

In this lesson students have the opportunity to grasp a new concept, to analyse several data sets on the same country, and to make some comparisons with their own country.

Assessment suggestions

- In a test situation:
- (a) Define the term *over-population*.
 - (b) Describe the characteristics of a country in this situation.

1.1 (5)

Over-population and under-population

Assessment objectives

- Candidates should acquire knowledge of contrasting countries' population balance situations.
- Candidates should be able to apply this knowledge to answering questions.

0460/2217 syllabus

1.1 Population dynamics

- Show an understanding of over-population and under-population
- Understand the causes and consequences of over-population and under-population

Differentiated learning outcomes

- **All students must** understand the differences between over- and under-populated countries (Grade E/D).
- **Most students should** be able to interpret some of the statistics given for Tanzania and Canada (Grade C/B).
- **Some students could** be able to understand how Tanzania and similar countries can develop from their current base (Grade A/A*).

Resources

- **Student Book:** pp. 11–13
- **Worksheets:**
 - 1.4 Singapore
 - 1.5 A case study of over-population
- **Photographs:**
 - 1.7 The Canadian West
 - 1.8 Central Toronto
 - 1.9 Uninhabited Canadian landscape
- Google Earth images of Kibera, or similar in Dodoma or Dar-es-Salaam (Tanzania); Google Earth images of rural savanna grassland areas of Tanzania, such as the Serengeti
- **Further reading and weblinks:** None

Key concept

- The relationship between population numbers, area of a country/region and quantity of resources is essential in controlling standard of living.

Starter suggestions

Consider the **Fantastic Fact**, p. 11 in the Student Book.

Use photos 1.7, 1.8 and 1.9 from the downloadable resources. Students should think about densely and sparsely populated areas and how this might relate to over- and under-populated areas. Does dense equate to over-populated? Does sparse equate to under-populated?

Main lesson activities

- 1 Students should consider the location of Canada and its size in comparison with other countries in the world (e.g. it is second in area after Russia). They should use an atlas, but remember that areas on the flat page can be deceptive.
- 2 Locate Tanzania and its main cities, Dodoma and Dar-es-Salaam. Look at an urban shanty area and rural Tanzania (savannah grassland) on Google Earth. (You will need to have researched your locations for this in order to be efficient in the classroom. Perhaps take a snapshot to speed you up.) Ask students to compare the images they have seen.
- 3 Ask the students to consider the Canada/Tanzania factfile on p. 11 of their Student Book. They should take each piece of data at a time and evaluate it. For example, for the population size, they should make a direct comparison between the two and also between their own country and others with which they are familiar. Students could create an extended table to show these comparisons. **Now**

investigate question **2a** will support this activity. Stretch your most able students by encouraging them to make more comparisons.

- 4** Population/resource case study: Canada is a huge country in terms of its area. Diagram C on p. 12 shows the wide range of its natural resources. Students can use **Now investigate** question **1** to decide whether Canada is under-populated.
- 5** Population/resource case study: Tanzania
Use **Now investigate** questions **2b** and **3** to consider the population balance situation in Tanzania.
- 6** Homework suggestions:
 - (a) **Worksheet 1.4** on Singapore involves differentiation – the last question is very definitely for your brightest students only.
 - (b) **Worksheet 1.5** on Bangladesh is more accessible to all students. You might want to utilise one of these two worksheets in a number of weeks as revision.

Give extra support to weaker students when setting the assessment question to ensure that they understand the demands of each part of the question. Ask them to recall the images shown to supply evidence.

Give extra challenge to the brightest students by expecting them to make comparisons between as many of the countries considered as possible.

Plenary suggestions

All return to class to compare internet research information. Discuss the students' findings in terms of whether each country is over-populated, under-populated or has an optimal population (or close to that situation).

Skills notes	In this lesson students have the opportunity to compare sets of statistics, construct tables and use case studies in answering examination questions.
Assessment suggestions	<p>Present students with an examination-style case study question (potential marks are indicated):</p> <ol style="list-style-type: none"> (a) Define the terms <i>over-population</i> and <i>under-population</i>. (2) (b) Describe the characteristics of a country in each of these situations. (3 + 3) (c) Name one country which illustrates <i>either</i> over-population <i>or</i> under-population and explain your choice using facts and figures relating to your chosen country. (8)

1.1 (6)

Diseases are deadly!

Assessment objectives

- Candidates should understand the range of diseases suffered in the tropics, especially by the poor.
- Candidates should be able to link this information to the consequences for population growth.

0460/2217 syllabus

1.1 Population dynamics

- Give reasons for contrasting rates of natural population change
- Understand the impacts of social, economic and other factors (including HIV/AIDS) on birth rates and death rates

Differentiated learning outcomes

- **All students must** know about a limited range of diseases and their impact on people, e.g. increase in death rate, inability to work and produce food (Grade E/D).
- **Most students should** have a wider range of knowledge on disease and its impacts and use case studies, such as HIV/AIDS in Botswana (Grade C/B).
- **Some students could** project such impacts onto the economy and rate of development of the country (Grade A/A*).

Resources

- **Student Book:** pp. 13–15
- **Worksheets:**
 - 1.6 Types of disease affecting people in LEDCs
 - 1.7 The malaria cycle
- **Photographs:**
 - 1.10 Malarial mosquito
 - 1.11 An AIDS patient
 - 1.12 A patient with river blindness
 - 1.13 A new AIDS hospital in Lusaka, Zambia
- **Further reading and weblinks:**
 - www.avert.org/worldwide-hiv-aids-statistics.htm
 - www.who.int/csr/disease/swineflu/en/index.html

Key concepts

- Diseases in LEDCs fall into three main groups: those caused by parasites, by poor hygiene and by poor diet.
- Diseases of the poor in the tropics affect both population growth and development.
- Most diseases can be controlled, and even wiped out.

Starter suggestions

Ask students to name any tropical diseases they know of (answers will depend on the country in which you live). Ask also about HIV/AIDS – is it a tropical or a global disease? Where in the world is it most common? Diseases affecting children are often those caused by poor diet and hygiene. This is covered on **Worksheet 1.6** – see below.

Use photos **1.10–1.12** to illustrate a selection of diseases. Unless students are already personally familiar with the diseases, you can expect a reaction.

Main lesson activities

- 1 **Now investigate** question 1 encourages students to use complex pie charts and increases their awareness of diseases.
- 2 Together read the first part of the Student Book text. Use **Worksheet 1.6** to categorise the main LEDC diseases which still affect death rates and therefore population growth. In class, go through the 'tree' diagram so that students see the three categories of disease. (The questions might be more appropriate for homework.)

- 3** Malaria example: this disease weakens people, and kills a million people a year. Using diagram **B**, explain how the parasite moves through the body and on to the next victim. By completing **Worksheet 1.7**, students will have more understanding of the 'cycle' of malaria. Ask them to find out the symptoms of malaria.

How would these affect people's productivity, death rate, birth rate and well-being? Students can work out the overall impact on natural change. **Now investigate** question **2** concludes this section well.

- 4** Pandemics: this can be a homework activity, or group work. Define the word *pandemic*. Students can *either* research the examples in the text (Black Death 1347–53 in Europe when one third of the population died; 20th-century Spanish flu event) *or* research more recent pandemics (SARS and swine flu). The websites listed in **Further reading and weblinks** for this lesson are a useful resource here.
- 5** HIV/AIDS: allow students to discuss this condition. Whichever country you live in, they will have some knowledge of it. Students can list answers to these questions:
- What type of disease is HIV/AIDS?
 - How does it pass between people?
 - What are its symptoms and results? (Students should know that the virus itself rarely kills, but it destroys the immune system and people contract other illnesses and infections from which they die.)

Now investigate question **3** (using graph **E**) supports this section. It is useful to draw a best-fit line to show the trend. This should not be horizontal, but have a gradient from top left to bottom right, i.e. countries with a higher rate of HIV/AIDS have a lower fertility rate. Leave this topic on a positive note by looking at photo **D** on Student Book p. 15 (photo **1.13** from the downloadable resources), and the ABC prevention system.

- 6** 'Do you feel lucky?': students produce a rating for your country, on the chances of young people surviving to the age they are now. Which of the problems mentioned in the Student Book are relevant in the country where you live? They should identify the different risks that young people face in your country, and produce a score from 1 to 5, with 1 being a dangerous place to live and 5 being very safe.

Give extra support with graph interpretation.

Give extra challenge by encouraging research into the detail of a larger number of relevant diseases.

Plenary suggestions

Ask students which of the diseases discussed in this lesson affect (to a greater degree) each of LEDCs and MEDCs (all are found in LEDCs; only HIV/AIDS to any degree in both LEDCs and MEDCs).

Now investigate question **1** can be used here if time, or for a homework activity to develop skills.

Further skills homework: use table **C** to present a discussion on the impact of HIV/AIDS on population growth in Botswana.

Skills notes	Students have the opportunity to interpret data from graphs and tables, and to summarise a sequence of events using a cycle diagram.
Assessment suggestions	Assess students' discussion of the situation in Botswana.

1.1 (7)

Anti-natalist population policies

Assessment objectives

- Candidates should understand the possible ways in which governments deliberately reduce the population growth rate.
- Candidates should be able to use case studies to illustrate different government policies and their level of success.

0460/2217 syllabus

1.1 Population dynamics

- Describe and evaluate population policies
- Understand the impacts of social, economic and other factors (including government policies) on birth and death rates

Differentiated learning outcomes

- **All students must** understand that some governments want to control their country's population growth rate and that there are different ways of approaching this (Grade E/D).
- **Most students should** understand the details of the Chinese one-child policy and consider the successes and problems it has brought (Grade C/B).
- **Some students could** analyse the advantages and disadvantages of the Chinese one-child policy (Grade A/A*).

Resources

- **Student Book:** pp. 16–18
- **Worksheet:**
1.8 Kerala: case study of smaller families in an LEDC
- **Photographs:** None
- **Further reading and weblinks:**
en.wikipedia.org/wiki/One-child_policy
en.wikipedia.org/wiki/Two-child_policy
www.bbc.co.uk/news/world-asia-china-25533339

Key concepts

- Some countries make the decision to control their population growth, but do so in various ways, sometimes by law and sometimes by democratic means.

Starter suggestions

Place students in small groups to discuss:

- why governments might want to reduce their population growth rate
- how they might do this.

Bring the class back together to consider their ideas.

Ask whether anyone knows of any country where this has occurred – they are likely to respond with China, leading into the main body of this lesson.

Main lesson activities

- 1 Read the text in the Student Book and the suggested websites above. Some wider reading is needed here, by students and/or by the teacher, to illustrate the ways in which people were forced to abide by the policy, e.g. late abortions, pay cuts etc. This will provide more balance in judging the policy. Students can summarise the policy by finding answers to the following questions:
 - Why was the one-child policy needed in China?
 - How were people encouraged to obey the policy?
 - How were people who did not want to obey the rules pressurised into doing so?
 - What are the results of the policy for both individuals and for the country as a whole?
 - What is likely to happen to the policy in the near future?

- 2 The benefits and penalties of the one-child policy: use diagrams **A** and **B** to help students see both sides of this important policy, which affects 2 in 11 people in the world (as stated in the **Fantastic fact** on p. 16). Students should list the points on both sides and draw their own conclusion on how persuasive this policy is. If you were a young person living in China in 1980, would you consider having a second child? Give reasons for your answer.

Students should discuss the advantages and disadvantages of the one-child policy.

- 3 Optional activity: produce a short play which dramatises a discussion between two Chinese parents. One of them is keen to have a second child, but the other wants to follow the one-child policy. Think through what the policy means for families. The traditional 'family tree' is changed completely, for example:

- No one in the class would have brothers and sisters.
- No one would have any aunts or uncles.
- There would be a problem for men in finding a partner due to gender imbalance (more young men than young women – 117:100 M:F).

If you have any mainland Chinese students, the discussion and short play can be especially interesting.

- 4 Use table **D** to compare China's population change 1970–2010 with that in Asia and the world as a whole.
- 5 How has China updated the one-child policy? Read the text and ask for students' reactions to these updates.

One of the major reasons for this change of approach is the threat of a rapidly ageing population and too few working adults to support the future elderly. Ask students to explain the nature of the problem, using the 4-2-1 idea in the text (a family will consist of two parents, four grandparents but only one child/grandchild – this is an economically impossible situation).

- 6 A contrasting case study – Kerala: use **Worksheet 1.8** to teach students about a different approach to anti-natalist policy.

Homework assignment	Answer Now investigate question 2a . Read the suggested weblinks, and then answer Now investigate question 2b .
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Give extra support by encouraging weaker students to understand the positive and negative aspects of the one-child policy.

Give extra challenge by discussing the similarities and differences between the communist policy in China and the democratic one in Kerala. This is best done in the plenary session.

Plenary suggestions

Make a comparison of the two case studies considered during this lesson, China and Kerala.

Skills notes	Tasks in this lesson enable interpretation of various diagrams and construction of a timeline.
Assessment suggestions	<p>Now investigate question 1, the timeline: check students' ability to summarise the one-child policy.</p> <p>Now investigate question 2b: assess students' evaluation of the long-term effects of China's population control policies.</p>

1.1 (8)

Pro-natalist population policies

Assessment objective

- Candidates should understand that some countries – usually those that have experienced natural decrease – wish to increase their population growth once again.

0460/2217 syllabus

1.1 Population dynamics

- Describe and evaluate population policies
- Understand the impacts of social, economic and other factors (including government policies) on birth and death rates

Differentiated learning outcomes

- **All students must** know the difference between pro-natalist and anti-natalist policies (Grade E/D).
- **Most students should** be able to state the key points of both anti-natalist and pro-natalist policies (Grade C/B).
- **Some students could** know the detail of how and why some countries are following pro-natalist policies (Grade A/A*).

Resources

- **Student Book:** pp. 18-20
- **Worksheets:** None
- **Photographs:** None
- **Further reading and weblinks:**
<https://data.gov.sg>

Key concepts

- Those European countries that have moved into Stage 5 of economic development often wish to grow once again for economic reasons.

Starter suggestions

Use the **Fantastic fact** on p. 18 of the Student Book regarding Western Europe. Ask students to interpret this. Tell them that some countries in this region are still growing – for example the UK – and ask what that says about those which are in a state of natural decrease (their birth rate must be very low).

Check the current birth rate and death rate of such countries (for example Germany, Sweden, Czech Republic, Greece).

We have studied anti-natalist policies. What do we mean by a ‘pro-natalist’ policy?

Main lesson activities

- 1 Ask the question, ‘Why would a country whose death rate is greater than its birth rate want to increase its birth rate?’ Answers should be: to maintain population size; so there are enough people to fill the jobs and to care for the elderly, etc.
- 2 Together read the first paragraph in the Student Book and look at the data in table **A** to support (or correct) the answers just given. Ask why it matters that Europe’s fertility rate is significantly lower than the global average. This could be positive (this region is not growing) or negative (it lacks workers).
- 3 A pro-natalist policy example – France: the Student Book introduces the policies that operate in France to encourage larger families. Here are some additional facts about the French policy:
 - three years of paid parental leave around the birth of a child – this can be used by either mother or father
 - free day care until a child is three years old
 - full-time school, funded by the government, now starts from age three
 - the number of children a woman has affects her age of retirement: the larger the family, the earlier the retirement.

Students should answer **Now investigate** question 1 to assess the French system, taking in the points in the text and as above.

- 4 Use **Now investigate** question 2. This supports your discussion on Europe's fertility rate and gives skills practice. The graph could be drawn as a compound bar graph.
- 5 **Now investigate** question 2 allows students to make a comparison of France with other European countries, as well as giving practice at bar graph construction. When answering question 2c, students should pay particular attention to the example country (France).

Give extra support by using your own country as another example: does it have a clear anti-natalist or pro-natalist policy? Does it need such a policy?

Give extra challenge by directing students to look at Singapore data (<https://data.gov.sg>). That country offers a Baby Bonus to families. Students could make a brief presentation on their findings.

Plenary suggestions

Ask students at which stage of economic development are countries with a pro-natalist policy likely to be (Stage 5 is the most likely, but late Stage 4 is also possible).

Does the class think pro-natalist policies will move Stage 5 countries back to Stage 4?

Skills notes

Students have practice in drawing bar graphs, including compound graphs.

Assessment suggestions

Now investigate question 3 allows students to assess more aspects of the French pro-natalist policy.

1.2(1)

Why, where and how do people move around?

Assessment objectives

- Candidates should be able to demonstrate knowledge and understanding of processes, spatial patterns and interactions contributing to the development of economic, social and political environments.
- Candidates should be able to recognise the role of decision making as affected by different human contexts, values and perceptions.

0460/2217 syllabus

1.2 Migration

- Explain and give reasons for population migration
- Understand internal movements such as rural-urban migration, as well as international migrations, both voluntary and involuntary

Differentiated learning outcomes

- **All students must** understand that people sometimes move from one area to another and be able to give reasons why migration takes place in their local area (Grade E/D).
- **Most students should** be able to define different kinds of migration and describe some of the reasons for migration within an example country (Grade C/B).
- **Some students could** complete detailed descriptions and explanations of internal migration, making full and proper use of examples (Grade A/A*).

Resources

- **Student Book:** pp. 21–23
- **Worksheets:**
1.9 Migration: push and pull factors
1.10 Experiences of moving to the big city
- **Photographs:** None
- **Further reading and weblinks:**
www.citymayors.com/statistics/urban_growth1.html lists the world's fastest growing cities – mainly as a result of internal migration

Key concepts

- Migration is the movement of people from one place to another.
- There are many different reasons why people migrate.
- Migration takes place both from rural to urban and urban to rural areas.

Starter suggestions

Begin the lesson by introducing the concept of migration using the opening paragraph on the spread.

Ask students the following questions as part of a class discussion:

- How many have moved to different places in their lives and why?
- What kinds of migration have they been involved in (examples could be rural to urban, urban to rural, international)?

Collate answers on why students have moved, as an introduction to the next section.

Main lesson activities

- 1 Working as a class, draw up a list from the experiences of the whole class detailing migration movements within your country. These can include movements by themselves, other members of their family, friends and any other people they know of, including celebrities, sports people, etc. Mark the information on a large-scale map of your country.

- 2 Read through the section on 'The bright lights of the big city' and migration push and pull factors. In pairs or groups, students should use **Worksheet 1.9** to draw up a list of the 'push' and 'pull' factors that would cause migration (both inward and outward) in their home town or region.
- 3 **Worksheet 1.10** shows an area that internal migrants may want to move into. Students should draw a talking head (or find a picture) of a migrant who may want to move here and write a speech bubble describing their experiences.
- 4 Students can reflect on the most popular places to live in their own country. What are the reasons why these places are so popular? Are they all urban areas or are their advantages in moving to the countryside?
- 5 Read through the section on counter-urbanisation. Use this as a basis for a class discussion on whether this kind of migration is happening in the students' own country. They should be able to identify examples of cities that are depopulating and rural areas that are gaining more people (and the reasons why).

Extension activity

Students could use the internet to find out about Ravenstein and Lee's theories of migration. How do these extend what is provided in the Student Book?

Give extra support by concentrating on the local area and getting students to think of examples of services, jobs, etc. that are special in the place where they live.

Give extra challenge by asking students to think further about the effects of migration to cities. What consequences will the pressure of services have for individuals, services and the city authorities that are trying to cope?

Plenary suggestions

Draw a spider diagram to bring together all the different strands surrounding migration. Place the title 'Migration' in the centre and add separate headings for the reasons for migration (both push and pull factors), directions of migration (rural to urban and urban to rural) and any effects of migration that students can think of.

Use **Now investigate** question 4b as a discussion prompt, and ask students whether they would prefer to live in an urban or a rural area, and why. This could be written up as a homework exercise.

Assessment suggestions

Now investigate questions 1 and 2 present a good opportunity for students to display factual knowledge on migration. They also ensure that key words and phrases are fully understood.

1.2(2)

Moving from one country to another

Assessment objectives

- Candidates should be able to demonstrate knowledge and understanding of human actions, the importance of scale and the changes that occur through time.
- Candidates should be able to analyse and interpret geographical data using annotated maps.
- Candidates should be able to recognise the role of decision making as affected by different human contexts, values and perceptions.

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1.2 Migration

- Demonstrate an understanding of the impacts of migration
- Understand that positive and negative impacts should be considered, on the destination and origin of the migrants, and the migrants themselves

Topic link: for more on the impacts of climate change see Topic 3.7 pp. 213–34.

Differentiated learning outcomes

- **All students must** understand that people move from one country to another, even when they don't want to, and give basic reasons why this may take place (Grade E/D).
- **Most students should** be able to define key terms related to international migration, including forced and voluntary migrations, and describe some of the issues associated with migration in relation to a case study country (Grade C/B).
- **Some students could** complete detailed descriptions and explanations of international migration, making full and proper use of case studies (Grade A/A*).

Resources

- **Student Book:** pp. 23–6
- **Worksheets:**
1.11 Refugees and other types of international migration
1.12 Migration case study: Senegal
- **Photographs:** None
- **Further reading and weblinks:**
Up-to-date news on the global refugee situation at:
www.unhcr.org/uk/ and
www.guardian.co.uk/world/refugees

Key concepts

- Migration occurs on a large scale between different countries.
- Much international migration is forced rather than voluntary.
- International migration causes both problems and benefits for many countries.

Starter suggestions

Use the opening paragraph in the Student Book to introduce the concept of international migration.

Give students five minutes to discuss in pairs what immigration occurs in their own country and where immigrants come from.

Collate answers from pairs to draw up a list of places where migrants come from.

Discuss with students why these migrations occur.

Remember that the discussion may need to be handled sensitively if there are certain groups of immigrants within the class.

Main lesson activities

- 1 Find out which countries members of staff in your school have lived in, and mark them on a world map. This should provide a good example of voluntary migration. Some staff could be developed as 'pen portraits': can the students identify the member of staff when they are told where they have lived? Students could use proportional flow lines on the maps (as outlined in Section 4 on p. 257 of Student Book) to highlight where the largest number of staff migrants come from.

- 2 Read through the section in the Student Book on forced migration. Students could use the internet to find examples of refugee movements around the world and the causes behind them. The information could then be used to complete the table on **Worksheet 1.11**.
- 3 The case study section on Senegal has a good deal of information on the causes, benefits and problems of international migration. Students should use this information to annotate the map of Senegal on **Worksheet 1.12**.
- 4 Working in pairs or groups, students should come up with two lists showing the problems and benefits of international migration for the country of destination. These lists can then be used to feed into the plenary discussion below.
- 5 **Topic link** 3.7 p. 223 to sections on climate change: rising sea levels may be a future source of refugees from low-lying coastal areas. Students can use appropriate maps to identify the areas that are likely to produce these 'climate refugees' and to suggest what issues will be caused if such migration occurs.

Give extra support by directing students to use a simpler atlas or online help, or by initiating group work to help them identify individual countries.

Give extra challenge by getting students to collect news articles, or reports from the internet, about migration movements around the world. This material can be used to write a short report on the current state of global migration.

Plenary suggestions

Question 2 in the **Now investigate** section on p. 25 can be used to gauge students' views on migration and to empathise with migrants from other countries.

Ask how students feel about immigration. What are the problems and benefits caused by international migration? These could include the effects on the economy, job opportunities and culture.

Finish off with an online search to identify how your country's newspapers deal with the issue of immigration – this could be followed up or used as a homework exercise.

Skills notes

Flow lines are a very clear way to illustrate information about migration. They are even more useful if drawn as proportional lines. There are more details in Section 4 of the Student Book, p. 257.

Assessment suggestions

Detailed knowledge of the Senegal case study can be assessed using the annotated maps suggested in the main lesson activities above.

1.3(1)

Why are there more older or younger people where you live?

Assessment objectives

- Candidates should know how to draw and interpret an age/sex pyramid.
- Candidates should understand how a country's population structure may change as it becomes more economically developed.
- Candidates should know that the life expectancies of males and females are different.

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1.3 Population structure

- Identify and give reasons for and implications of different types of population structure

Topic link: there is more detail on the changing stages of economic development in Topic 3.1 on p. 139 of the Student Book.

Differentiated learning outcomes

- **All students must** understand how an age/sex pyramid 'works', be able to draw and interpret them at a basic level (Grade E/D).
- **Most students should** be able to recognise youthful and ageing populations by pyramid shape (Grade C/B).
- **Some students could** compare countries effectively in terms of both age and gender structure, plus use pyramids to predict likely future growth/decline patterns (Grade A/A*).

Resources

- **Student Book:** pp. 27–28
- **Worksheets:**
1.13 What does an age/sex pyramid tell us?
1.14 Annotating and understanding age/sex pyramids
- **Photographs:** None
- **Further reading and weblinks:**
Sources of pyramid diagrams:
<https://www.census.gov/data-tools/demo/idb/informationGateway.php>
Choose 'Population Pyramid Graph' in the 'Select Report' section, choose a country and 'Submit' – you can find your own country data this way.

Key concepts

Age/sex pyramids are a useful tool for:

- identifying age structure and gender patterns
- predicting future population growth/decline/zero growth and therefore helping governments in their strategies and planning for the future.

Starter suggestions

Read the first paragraph in the Student Book together. Ask students the question it poses regarding the number of elderly versus young people in your community. Ask them who is likely to be at home, or indoors at work, where they may be less visible in society. This idea can be supplemented by the fieldwork suggestion in the main lesson activities below.

Main lesson activities

- 1 What is a *census*? (A national survey, taken every 10 years, funded by the government and/or the UN, to gather data on the characteristics of the population of a country.) When was the last census in your country? For most countries it's in the year ending with zero. (In the UK it takes place in the year ending with a number one – except for 1941 which was in the Second World War when a census was not seen as a priority.)

- 2 If you have the opportunity, students could conduct a small piece of fieldwork, assessing the people who pass by in different streets/areas of your village/town/city. Categorise people's ages into the usual age groups: 0–4 years, 5–9, 10–14 and so on. The best way to record the count is to use a tally chart. The class can do this in groups, and the totals and percentages then calculated from their combined results. Ask the students how the day and time of the survey might have affected the results of their survey (or a hypothetical one).
- 3 Identify the questions that need to be asked to understand the age/ gender patterns for a particular country. Why does a government need this information? (Provision of schools and health care, care for the elderly and the very young). How does the census assist government in this respect? (Refer to **Now investigate** question 3.) Which age groups pay taxes? A country needs enough people of working age to earn and pay taxes to support the very young, the elderly and the poor/unemployed. Discuss the points raised above – students need to understand all these situations in the context of their own country and of others.
- 4 Age/sex pyramids: refer to graphs **A** and **B**. Explain the structure of a pyramid: horizontal and vertical axes, width of the bars in the various age groups, etc. Students compare the shapes of graphs **A** and **B** and explain what they mean (Germany a rich MEDC, Haiti a poor LEDC).
 - What is represented by the width of the bars?
 - In any given age group, is there a difference between male and female bars? (See **Fantastic fact** and use **Now investigate** question 1.)
 - **Now investigate** question 4: pyramid construction using data from the table.
 - Students try **Worksheet 1.13** for reinforcement of pyramid labelling.
 - Students use the internet to find the age/sex pyramid for your country. Use the weblinks above. Does it fit with the pattern found in your school? Aim to explain the result (**Now investigate** question 2).

Homework exercises

Now investigate question 5 and **Worksheet 1.14**.

Give extra support by helping weaker students with pyramid construction and interpretation.

Give extra challenge with this extension exercise: Use the internet to investigate the census in your country. What type of question is asked? What other information does your government need to know in order to help it manage the country?

Plenary suggestions

Summarise the key points of age/sex pyramid construction and meaning.

Skills notes

Students practise basic data collection, and question their methods, validity, and the impact of time of day on quality of results; they learn how to construct and interpret age/sex pyramids.

Assessment suggestions

Worksheets 1.13 and **1.14** provide opportunities for assessment by both teacher and student.

1.3(2)

Changing stages of economic development

Assessment objectives

- Candidates should be able to describe age/sex pyramids and relate them to the different stages of economic development

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1.3 Population structure

- Explain the structure of age/sex pyramids of countries at different levels of economic development

Differentiated learning outcomes

- All students must** be able to recognise the main characteristics of an age/sex pyramid and understand what type of country it represents (Grade E/D).
- Most students should** be able to draw a population pyramid from given age/sex data, and know how to read a pyramid to obtain data about the country's population structure. They should understand how detailed information about a country's population structure can help with that country's future planning (Grade C/B).
- Some students could** use age/sex pyramids to investigate a country's population structure, and know how and why the differently shaped pyramids are linked to the different stages of economic development (Grade A/A*).

Resources

- Student Book:** pp. 29–31
- Worksheets:**
1.15 Which stage of economic development?
- Photographs:** None
- Further reading and weblinks:**
For pyramid research:
<https://www.census.gov/data-tools/demo/idb/informationGateway.php>
For population change and links to levels of economic development:
www.geographyalltheway.com

Key concepts

- Each stage of economic development has a typically shaped population pyramid from which it can be identified.
- Pyramids are a useful tool for any country to analyse and plan for the future.

Starter suggestions

Together read the first paragraph on page 29 in the Student Book. Students could identify the five stages of economic development and population change, and say something about the characteristics of each.

Use the **Fantastic fact** that there are no longer any *countries* in Stage 1 and ask students to explain why this is so (medical services at some level are now available in all countries, so death rate decreases). Refer to map C (Student Book p. 30) to identify those peoples who are in Stage 1, and note why (these groups are so remote that knowledge from the outside world barely reaches them).

Main lesson activities

- Study the remote communities pyramid (Stage 1) and those for Burkina Faso, Mexico, Australia and Japan (Stages 2, 3, 4 and 5) in diagrams **A** and **B**. In groups, or as a whole class, students should discuss the general differences in the pyramid shapes and how they change over time. Students should write a summary of the changes, especially at the base and the apex of each pyramid.
- Location of countries at different stages of economic development: students use **Worksheet 1.15** and a copy of the world map available from the downloadable resources. They will also need to refer to an atlas. This could be used as a homework exercise.

- 3 Activity based on your country: The population of any country changes over time and this is reflected in the age/sex pyramids. Use the website address above to search for two pyramids for your country dated 50 years apart, e.g. 2000 and 2050 or 1975 and 2025, or similar dates depending on when your censuses were recorded. Students should:
 - (a) describe the shapes of each of the two pyramids, using these key terms: *base, apex, concave/straight/convex sides*
 - (b) note the major differences between the two pyramids
 - (c) explain what has happened over the 50-year (or similar) period of time in terms of birth rate, death rate and life expectancy
 - (d) What has your government done to influence the population? For example, has it tried to raise/lower the birth rate or death rate? What should your government do in the future to manage population growth?
- 4 **Further research:** use the internet to find and print out a pyramid for your country or a neighbouring one. Each student needs their own copy. In pairs, annotate the pyramid to show the key characteristics of the age and gender structures. Students should compare their ideas with those of other pairs. They can refer here back to their earlier work on **Worksheet 1.14**. This could be an extension activity or extra homework assignment.
- 5 Read the text on p.30 of the Student Book on Japan's population situation.
 - (a) Define the term 'ageing population'.
 - (b) Answer the **Now investigate** question 1.
 - (c) Discuss: what are the social and economic advantages of having more older people in a population? (e.g. In Japan they tend to be well off and spend money on tourism and leisure. They may help with childcare for working parents.) Also, what are the advantages of a youthful population? (e.g. A large workforce when these young people reach adulthood, which then helps the economy to grow.) You could choose another suitable country.

Give extra support by helping those less able students in using an atlas to locate countries; reinforce what the shape of a pyramid tells us.

Give extra challenge for the most able students in main lesson activity 3 by asking them to find additional age/sex pyramids for their country showing different stages.

Plenary suggestions

Summarise the key characteristics of your own country's age/sex pyramid. Ask students whether their earlier observations of people's age categories in the street (previous lesson) fits in with the pattern shown in your national diagram.

Skills notes	Students have practice in the construction of age/sex pyramids, comparing and interpreting age/sex pyramids, using an atlas, and using and interpreting the links between population change and economic development.
Assessment suggestions	Main lesson activity 3 covers many aspects of economic development, age/sex pyramids and the links between these. If students complete it individually in class or for homework, it will provide a clear measure of the level of their understanding.

1.4(1)

Why do some people have more neighbours than others?

Assessment objectives

- Candidates must know how people are distributed around the Earth's surface.
- Candidates should understand why some places are more densely populated than others.
- Candidates should understand the problems of people living in very densely and sparsely populated areas.

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1.4 Population density and distribution

- Describe the factors influencing the density and distribution of population

Differentiated learning outcomes

- **All students must** know how people are distributed around the Earth's surface and know why some places are more densely populated than others (Grade F/E).
- **Most students should** know about the problems of people living in very densely and sparsely populated areas and understand where their own home area lies within the continuum (Grade C/B).
- **Some students could** apply the factors in this spread to their home area (Grade A/A*).

Resources

- **Student Book:** pp. 32–3
- **Worksheets:**
 - 1.16 Densely populated urban places
 - 1.17 Rating your own home
- **Photographs:**
 - 1.14 A densely populated city
 - 1.15 A sparsely populated rural area
 - 1.16 Hot desert
 - 1.17 Dense forest
 - 1.18 Mountainous region
 - 1.19 Polar region: Antarctica
- **Further reading and weblinks:** www.worldmapper.org

Key concepts

- World population is very unevenly distributed.
- The main reasons for this are environmental and resource availability.

Starter suggestions

Begin with photos **A** and **B** in the Student Book (photos **1.14** and **1.15** from the downloadable resources), showing the contrast between very densely packed urban areas and very sparsely peopled rural areas. Ask for students' reactions to the contrasts shown. Compare/contrast these with your local home area. The response will clearly depend on the nature of the area where you live.

The **Now investigate** activity **1** (Student Book p. 33) will help continue this initial discussion.

Use the Worldmapper website > Animations > Land area to Population to show students how unevenly distributed world population really is.

Main lesson activities

- 1 Make sure that the students know the five key definitions: *population distribution*, *population density*, *densely populated*, *sparsely populated*, *uninhabited*.
- 2 Describing and explaining world population distribution/density: world map **C** is a choropleth showing population distribution and density. (A choropleth map is a shaded map – the darker the shading, the higher the value.)
 - (a) Look at the world as a whole. State where the highest and lowest values are found. Name places and quote data from the map to make a really good description. Which continents/countries are the most/least densely populated countries?

- (b) Try to explain why these areas are especially densely or sparsely populated. Your atlas will help you here. Look at relief, climate and vegetation maps to see whether areas are likely to be attractive to people or not.
- 3 Factors affecting population density: this can be explored using photos **D** to **G** in the Student Book (photos **1.16–1.19** from the downloadable resources). They represent four entirely different environments, all of which are difficult environments to some extent. Allow students five minutes to look carefully at each photo. Ask them which of these environments they think is the most difficult to live in, and which the least difficult. There are no right or wrong answers, but students should be encouraged to justify their opinions.
 - 4 Use **Worksheet 1.16** to explore the attractions and problems of more densely settled urban environments.
 - 5 Apply what students have already learned regarding the advantages/disadvantages of various locations across the world to their home area using **Worksheet 1.17**.
 - 6 Use **Now investigate** questions 3 and 4 as follow-up homework to reinforce the lesson's key ideas.

Give extra support by using **Worksheet 1.17** to help students understand the idea of the various factors affecting the attractiveness/unattractiveness (pull/push) of an area for people trying to make a living there.

Give extra challenge by encouraging students to look at other environments in the same way, anywhere in the world, familiar to the students or unfamiliar. This will stretch their ability to apply ideas to particular global environments.

Plenary suggestions

What variations are there in population density within your home area? Discuss and note these down. This relates the material used in the lesson to the students' own direct experience.

Skills notes	Students develop their skills in internet use, by interpreting the Worldmapper animation to see the misfit between land area and population size in many countries across the world. They also understand the idea of a continuum and of scoring an area based on various criteria. Map construction.
Assessment suggestions	Now investigate questions 3 and 4 (suggested as homework) reinforce much of the lesson's work.

Assessment objectives

- Candidates should understand clearly the difference between the definitions of population distribution and population density.
- Candidates should know the issues faced by people living in a densely populated area.

0460/2217 syllabus**1.4 Population density and distribution**

- Describe the factors influencing the density and distribution of population
- Explain the physical, economic, social and political factors which result in an area of high population density

Topic links: For more on population and resources and over-population see Topic 1.1 pp. 2–15; on migration Topic 1.2 pp. 21–6; on the site and situation of settlements see Topic 1.5 pp. 39–44 and Topic 1.6 pp. 50–63.

Differentiated learning outcomes

- **All students must** know the difference between *densely populated* and *over-populated*. They should be able to annotate a photo to point out the characteristics of a densely populated area (Grade E/D).
- **Most students should** understand the factors leading to an area being densely populated, and that some factors are physical whilst others are human. They should know the issues arising in a densely populated area (Grade C/B).
- **Some students could** apply the points made in the case studies in the Student Book to their own country, and use these in new examples given to them (Grade A/A*).

Resources

- **Student Book:** pp. 34–5
- **Worksheet:** 1.18 Annotating photographs
- **Photographs:**
 - 1.20–1.21 Views of different parts of Singapore
 - 1.22 Lagos Island, Nigeria
 - 1.23 Sousse, Tunisia
 - 1.24 An area of densely populated coastline
 - 1.25 The Nile Valley in Egypt
 - 1.26 The port of Singapore
- **Further reading and weblinks:**

These sites support the homework exercise on Singapore and provide more photos of the city:

http://en.wikipedia.org/wiki/Economy_of_Singapore

http://en.wikipedia.org/wiki/History_of_Singapore

Key concepts

- Half the world's population lives in densely populated urban areas, usually by their own choice.
- Several factors can lead to high-density populations.
- There are different degrees of population density across a city.

Starter suggestions

Ask students to identify the key differences between *population distribution* and *population density*. They should write down clear definitions.

Use the **Fantastic fact** to show how much of the world lives in more densely populated areas. Reflect on this in view of your home area's density characteristics – is it densely or sparsely populated, or somewhere in between?

Pose the question, 'Is a densely populated area necessarily over-populated?' Make use of photos **1.20–1.23** from the downloadable resources. Allow students to make points but do not draw any conclusions yet. This will be revisited later in the lesson.

Main lesson activities

- 1 Densely populated areas develop because of the features that attract people to live there:
 - Physical: water supply, ease of transport, good soil, flat land for building on, mineral or other resources available, comfortable climate with enough rainfall and sufficiently high temperatures for agricultural production.
 - Human: people with initiative to begin businesses and make them flourish, capital (money) available to invest and develop new enterprises/companies, to set up health and education facilities, opportunities for leisure and tourism.

Read the section of text on p. 34 of the Student Book. Students must decide whether the ideas listed can be categorised as physical or human resources.

Create two large spider diagrams, one with 'Physical resources' at the centre and the other 'Human characteristics'. From each centre draw legs to link to these categories – flat/gently sloping land, fertile soil, climate, fossil fuels, mineral deposits, coastal location, fresh water (rivers) – putting each on the appropriate 'leg'. From each of these draw more legs: explain why that feature is likely to attract people to settle there. This should provide a good summary of all the factors involved.

- 2 Using photos A, B and C on pp. 34–5 (photos 1.24–1.26 from the downloadable resources), students should analyse their features likely to attract people to live and work there.
- 3 Students answer **Now investigate** questions 1a and 1b (p. 35). These relate to what they have just completed above to your home location, and allows them to think more widely.
- 4 Case study – Singapore: read the section on Singapore which begins to explain why it is so densely populated. Refer back to photos 1.20–1.21 of Singapore from the downloadable resources, and to photo C in Student Book p. 35 (photo 1.26). Students should list the attractions of Singapore, comparing their ideas.

Homework assignment	Students should carry out further research on the reasons for Singapore being so densely populated. Many of these are historical, while others are linked to its coastal location and resulting trade. See websites above as a starting point. Students should write two to three paragraphs to explain Singapore's high population density.
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- 5 Students should already understand the meaning of the instruction 'annotate'. Explain or reinforce this. Answer questions 2 and 3 in the main **Now investigate** section on p. 35.
- 6 Having considered a case study, now move on to a more global perspective with **Now investigate** question 4. Once again, this involves map construction.
- 7 Ask the question relating dense population to over-population: 'Is Singapore over-populated – that is, are there too many people for the resources the city has to offer?'

Homework activities	<ul style="list-style-type: none"> • Use Worksheet 1.18 to reinforce the skill of annotation needed for Now investigate question 2. • Research more photos from the internet and annotate them in the same way as in Worksheet 1.18.
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Give extra support by using **Worksheet 1.18** to teach the difference between simple labelling and detailed annotation.

Give extra challenge by exploring with the most able students the difference between dense population and over-population.

Plenary suggestions

This should have been quite a busy lesson – a quick summary of the ideas used should be sufficient.

Skills notes	A number of different skills are practised here: annotation, photo interpretation, atlas use, map construction, case study interpretation.
Assessment suggestions	<p>The homework exercise on Singapore would make a useful assessment. Assess students' skills in annotation from Worksheet 1.18 and their own choice of extra photos for annotation.</p> <p>The map constructed in Now investigate question 4 also offers opportunities for assessment.</p>

1.4(3)

Areas of low population density

Assessment objectives

- Candidates should understand the major influences on population distribution and density – physical, economic and other human factors.
- Candidates should know the issues faced by people living in a sparsely populated area.

0460/2217 syllabus

1.4 Population density and distribution

- Describe the factors influencing the density and distribution of population
- Explain the physical, economic, social and political factors which result in an area of low population density

Topic link: For more on population and resources, and under-population, see Topic 1.1 pp. 2–20 of the Student Book.

Differentiated learning outcomes

- **All students must** know the difference between *sparsely populated* and *under-populated*. They should be able to annotate a photo to point out the characteristics of a sparsely populated area (Grade E/D).
- **Most students should** understand the difference between population distribution and population density, the pattern of distribution of densely populated and sparsely populated areas in the world, and the factors leading to an area being sparsely populated; also that these factors are both physical and human. They should understand how desertification and soil degradation adversely affect farming communities (Grade C/B).
- **Some students could** understand the processes of deforestation and soil degradation, and be able to apply the points made in the case studies in the Student Book to their own country, and use these in new examples given to them (Grade A/A*).

Resources

- **Student Book:** pp. 36–8
- **Worksheets:** None
- **Photographs:** None
- **Further reading and weblinks:**
East African famine:
www.bbc.co.uk/news/world-africa-14248278
Crop production in Mali:
www.naweb.iaea.org/nafa/swmn/water-docs/Mali-Sorghum-water-crop-yield.pdf

Key concepts

- Sparse populations are often the result of physical factors.
- With appropriate technology, standard of living can be raised and food supply made more secure.

Starter suggestions

Remind students of the differences between densely populated and sparsely populated areas. Ask whether densely populated = over-populated (answer is *no*).

Read the first paragraph in the Student Book (p. 36) on population density in North Africa. Ask students whether they think sparsely populated always = under-populated (this is simply to get students thinking).

Main lesson activities

- 1 Use the world map you created in the previous lesson, showing the more densely populated parts of the world, and add the least densely populated areas. Use an atlas to help you here. Make sure the areas shaded are named.
- 2 Note that the Sahara and Sahel regions are classified as being sparsely populated. Students should label them on their world map. Identify the key differences in terms of climate and vegetation between desert (the Sahara) and semi-desert (the

Sahel). This can be done with reference to the climate graphs and map A, or equivalent data which can be found in an atlas.

- 3 Sparse population and under-population: read the text on the Sahel. Review the difference between the meanings of these terms. Students should make a clear note of these.
- 4 Sahel case study: discuss the processes involved in desertification. The text in the spread has some useful information, but it would be interesting to research some more. Make a list of the difficulties experienced by farmers in the Sahel region, clearly identifying the reasons for low population density in the Sahel. Students should use this material to write an explanation of why people are not attracted to live in this region (aim for two paragraphs). They may do this individually or in small groups/pairs. Ideas can be compared afterwards.
- 5 Search the internet for items on the East African famine of 2011 – and/or see weblink on the previous page. If you are working on this spread at a time when the Sahel is suffering from famine, the content is particularly pertinent.
- 6 **Now investigate** questions 1 and 2 make a supportive homework. Question 2 involves an adaptation of the written exercise in main lesson activity 4 above.

Homework assignment	<p>Research homework:</p> <ul style="list-style-type: none"> Find more news websites concerning any angle on the Sahel, its people, climate and economy. As a follow-up discuss the students' findings. Do some research online to discover how people in the Sahel have managed to overcome some of the problems of living in that region. A good start would be to investigate how farmers in Mali have managed to increase their crop yields (see weblink in Further reading and weblinks). Research which areas in the world are currently under threat of desertification.
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Give extra support by explaining the link between physical difficulties and people's experiences.

Give extra challenge by encouraging the most able students to research more challenging websites in terms of reading level and complexity of ideas.

Plenary suggestions

Summarise the key terms for the processes that make farming difficult in the Sahel: *deforestation* (due to reliance on fuelwood), *soil degradation*, *erosion*, *salinisation*, *leaching*, *desertification*. Students could quiz each other until they get the definitions completely accurate.

As a class, discuss the differences between your way of life and that of nomads and other farmers in the Sahel.

Discuss whether the Sahel is under-populated. Could it support more people if technology was available to make use of its resources?

Skills notes	In this lesson students develop their map and photo interpretation skills, and practise writing a reasoned answer.
Assessment suggestions	Quiz students on the key terms and place names in this lesson: Sahel, semi-desert, deforestation, soil degradation, salinisation, erosion, leaching, sparse population, under-population.

1.5(1)

Why do people live in the countryside?

Assessment objectives

- Candidates should be able to describe the patterns of rural settlement – dispersed, linear, nucleated.
- Candidates should understand which factors are important when deciding where to site a new village.
- Candidates need to know the factors that influence the growth or decline of rural settlements.
- Candidates should be able to explain what influences patterns of settlement in rural areas.

0460/2217 syllabus

1.5 Settlements and service provision

- Explain the patterns of settlement – dispersed, linear and nucleated
- Describe and explain the factors which may influence the sites, growth and functions of settlements
- Explain the influence of physical factors (including relief, soil, water supply) and other factors (including accessibility, resources)

Differentiated learning outcomes

- **All students must** understand the concept of site and the characteristics involved (Grade E/D).
- **Most students should** know how to apply these ideas to their own and other settlements (Grade B/C).
- **Some students could** apply these ideas to settlements they do not know personally (Grade A/A*).

Resources

- **Student Book:** pp. 39–40
- **Worksheets:** None
- **Photographs:**
1.27 A small village in a rural environment
- **Further reading and weblinks:** None

Key concepts

- Most settlements are old and have developed and changed over time in pattern, scale and function.
- A minority are recently planned and mostly built all at the same time.

Starter suggestions

Defining key terms: ask students what they think the word *settlement* means. Bring in the idea of scale and these terms: *isolated settlement*, *hamlet*, *village*, *town*, *city*, *conurbation*. This could be drawn as a flow diagram.

Explain that ‘rural settlement’ refers to all settlement up to and including small towns in a rural environment. However, note that in some countries meanings can vary. For example, in India ‘villages’ can have up to 30 000 people, but in the UK the upper limit is around 10 000.

Main lesson activities

- 1 Begin with your own home area – is it classed as rural or urban and why? Refer to its characteristics. Students can consider why they live where they do, as suggested in the Student Book.

The most common reasons are likely to be to do with earning a living, e.g. owning land, job opportunities. You can prompt your students with the following suggestions: services may be important, or the family may simply have lived there for generations.

In wealthier countries, the exact location may be to do with proximity to a certain school, the size of house that is needed/can be afforded. The location of work is likely to come out high on the list.

- 2 The concept of site: students need to know this definition: the *site* of a settlement is the actual land on which the settlement is built. (Think of it like this: if you picked up the buildings in the settlement, the site is the land underneath.) Students need to note down this definition.

When they describe site, students should think about:

- height
- gradient
- water supply
- resources.

It might be useful to test this concept by asking students to look at settlements in their local area and applying these criteria. Or use photo **B** in the Student Book (photo **1.27** from the downloadable resources) and ask students to identify the characteristics of its site. You might also consider how each settlement has grown from its original roots, and why, if you have the relevant data available. Students can practise this exercise using the Ordnance Survey map of part of St Lucia on p. 42.

- 3 Consider the town/city in which you live, or the one closest to you. As the teacher, you need to know/research how it began and its history of growth. Invite students to interpret any images of growth you have. Has it grown from a village/small town? Describe the ways in which this has happened.

Identify the ways in which one settlement (your own settlement or an adjacent one) is accessible to its surrounding area.

Use diagram **C** and **Now investigate** questions **1** and **2** to identify why your chosen settlement grew.

- 4 How can the characteristics of a landscape limit the potential for settlement establishment and development? Use **Now investigate** question **3**.
- 5 Most settlements develop gradually over time. Again using the St Lucia map on p. 42, ask students to find evidence that this has been the case. You could also refer to your own area and the way in which it has developed.
- 6 Some settlements, however, are new towns and villages. They have been deliberately planned and constructed more or less all at the same time. Either present an example of a new settlement to students, or ask them to research one.

Give extra support by guiding students on the factors affecting settlement development. All students need to note down the key factors.

Give extra challenge by asking students to apply the principles of site (positive and negative) to any settlements that they know well.

Plenary suggestions

Revise the definition of site. How does this help us explain the growth, development and present-day characteristics of our home settlement?

Skills notes	Students have practice in map interpretation, and the application of generic site characteristics to specific examples.
Assessment suggestions	A useful homework task: use an Ordnance Survey or equivalent map to identify the site characteristics of a particular settlement. Classify these characteristics into positive and negative in terms of growth, development and the well-being of residents.

1.5(2)

Rural settlements on Ordnance Survey maps

Assessment objectives

- Candidates should be aware of the three types of settlement pattern: dispersed, linear and nucleated.
- Candidates should be able to use an OS map to identify and explain settlement pattern.
- Candidates should understand the concept of site and how it affects settlement patterns.

0460/2217 syllabus

1.5 Settlements and service provision

- Explain the patterns of settlement – dispersed, linear and nucleated
- Explain the influence of physical factors (including relief, soil, water supply) and other factors (including accessibility, resources)
- Describe and explain the factors which may influence the sites, growth and functions of settlements

Topic link: See Topic 4.2 pp. 245–50 for more information on using maps

Differentiated learning outcomes

- **All students must** know the basic range of rural settlement shapes (Grade E/D).
- **Most students should** be able to identify these on an OS map (Grade C/B).
- **Some students could** interpret a satellite image, using it in a similar way to an OS map (Grade A/A*).

Resources

- **Student Book:** pp. 41–3
- **Worksheet:** 1.19 Settlement shape
- **Photographs:**
 - 1.28 An isolated, dispersed settlement (Capel Cefnywaen, Wales, UK)
 - 1.29 A linear settlement (Champlain, Quebec, Canada)
 - 1.30 A nucleated settlement (Cogolo in the Pejo valley, Trentino, Italy)
- **Further reading and weblinks:** www.nationsonline.org/oneworld/map/google_map_Castries.htm

Key concepts

- Site affects both the size and shape of settlements.
- OS maps allow geographers to understand the impact of site on settlement.

Starter suggestions

If your students live in a rural area, ask them to consider the size and, in particular, the shape of their settlements. If you are located in an urban area you can do this based on the OS map on p. 42 of the Student Book, or refer to a rural area that all your students know. Ask these questions:

- Are all rural settlements the same size? The answer is obviously *no*, leading on to the naming of different settlement sizes – the rural settlement hierarchy of: isolated house/farm, hamlet, village, small town.
- Do they all have the same pattern? Use the map, or examples that you know, to have a short discussion on the possible differences.

Main lesson activities

- 1 Continue working on identifying settlement patterns using photos **1.28–1.30** from the downloadable resources. These illustrate the three key settlement shapes: dispersed, linear, nucleated (see also table A in the Student Book).
- 2 St Lucia example: read the short text detail on St Lucia. Spend a few minutes on OS map revision (symbols, shading, grid references). Does the map extract support the text in showing that the majority (72%) of St Lucians are rural inhabitants?

Try to identify typical village patterns from the map. Students answer **Now investigate** questions **1a** and **1b** on specific villages.

- 3** Settlement site was discussed in the previous spread. Ask students to define it. One really good way to visualise it is that if you could pick up a settlement off the ground, the site would be the land you now see, i.e. the actual land on which a settlement is built. **Now investigate** question **2** allows students to use their knowledge of site applied to an OS map. This is a much more demanding skill.
- 4** Apart from new towns, all towns and cities today began as hamlets or villages. It is the advantages of the *site* that make people choose the location of their settlement, but it is the *situation* (the settlement's relation to its surroundings) that leads to its growth and development.

Some extra mapwork tasks:

- (a) Port Castries, St Lucia's capital, has close to 60 000 people – about one third of the total island population. Use the OS map to determine which of its site and situation characteristics have encouraged its foundation and growth. (Hint for weaker students: consider height, relief and shape of the coastline, communications with other parts of the island and outside of the island.) Internet research will give historical background on the town's development.
- (b) Use www.nationsonline.org/oneworld/map/google_map_Castries.htm to obtain a satellite image of Port Castries. Students should explain reasons for the shape and layout of the town (the built-up areas are quite scattered).

Give extra support by using **Worksheet 1.19** to reinforce settlement shape. Weaker students may need to refer back to diagram **C** on p. 40 of the Student Book to help them with **Now investigate** question **2**.

Give extra challenge by using the additional questions in main lesson activity **4**. These extend the mapwork further and introduce a satellite image.

Plenary suggestions

Summarise with students what they have discovered during this lesson regarding settlement patterns. Invite opinions on the usefulness of both OS maps and satellite images in this respect.

Skills notes	Students practise interpreting OS maps and using grid references. They also have opportunities to interpret photos and satellite images.
Assessment suggestions	The Now investigate questions present opportunities for assessment.

Assessment objectives

- Candidates should be able to describe sites of settlements and to identify reasons for settlement development, size and pattern in different environments.

0460/2217 syllabus**1.5 Settlements and service provision**

- Describe and explain the factors which may influence the sites, growth and functions of settlements

Differentiated learning outcomes

- All students must** know how to identify settlement patterns and site advantages on maps and locate them using the grid reference system (Grade E/D).
- Most students should** know how site factors affect settlement development (Grade C/B).
- Some students could** understand how a wide range of site and situation factors can both help and hinder settlement development, and know how to assess settlements according to the suitability of their individual locations (Grade A/A*).

Resources

- Student Book:** pp. 43–4
- Worksheet:**
1.20 Comparing sites
- Photographs:**
1.31 Farming by hand
1.32 A typical street scene in a rural town in the Tamil Nadu region of Southern India
- Further reading and weblinks:**
None

Key concepts

- Settlement patterns vary – site is often a factor in this.
- Different factors, including site and situation, affect the growth of a settlement.

Starter suggestions

To begin this lesson, use the introductory sentences in the Student Book concerning percentage of world population living in villages, and the **Fantastic fact**. Note that this figure of 37% living in villages and working on farms is a rapidly reducing portion of the global population. Also, China has the world's largest population, closely followed by India. Check current data for the year in which you are teaching this, so that students have the most accurate and recent data.

India is known as the 'country of 800 000 villages'. How does it compare with your own country? Allow students to make both local and global comparisons.

Main lesson activities

- 1 Illustrate the starter material with the Chembakolli example. Remember that case studies/examples have huge value in examinations in gaining marks, when correctly applied to a particular question.

Locate Chembakolli using map **A** in the Student Book. Note that Adivasi society has a simple organisation. The people grow basic crops and draw a large proportion of their resources directly from the forest in which they live. Students should read the example. Then conduct a short question-and-answer session to test whether or not they have absorbed the main facts.

In the discussion, encourage students to compare their lives and society with that of the Adivasi people (**Now investigate** question 1). Photo **B** on Student Book p. 43 (photo 1.31 from the downloadable resources) shows an Adivasi group, which will give your students a more complete image of these people and allow more worthwhile comparisons to be made.

- 2 The text shows that the Adivasi people are, in some ways, experiencing a little more of the outside world. Ask students to identify these recent developments.

Use photos **B** and **E** to help compare Gudalur and Chembakolli (photos **1.31** and **1.32** from the downloadable resources).

- 3** Graph C shows climate data for Chembakolli. This is a good opportunity to teach or revise the construction/interpretation of climate graphs. Note: emphasise that precipitation is always shown by shaded bars (blue, if in colour) and temperature by a solid line (red).

Take a few minutes to practise climate graph interpretation. Students should produce a written description of the patterns shown by both the temperature and precipitation sections of the graph, noting the months of the wet and the dry seasons (**Now investigate** question **2a**).

Compare Chembakolli's climate with your own (**Now investigate** question **2b**) and consider the problems that climate (in this case, the monsoon pattern) can cause for local people (**Now investigate** question **2c**).

Homework activities

Suggested homework activities:

- **Worksheet 1.20** provides extra practice in site characteristics.
- **Further research** as suggested on p. 44 of the Student Book: students look in detail at settlements in your local area.

Give extra support by giving students extra practice in identifying site characteristics using **Worksheet 1.20**.

Give extra challenge by comparing the patterns shown on a variety of climate graphs.

Plenary suggestions

Have a short discussion on the site and shape of Chembakolli. Is it likely to grow and develop further in the future? Is its site suitable for further development, or not?

Skills notes

Students have opportunities to interpret climate graphs and maps.

Assessment suggestions

Worksheet 1.20 provides an opportunity for assessment.

1.5(4)

The settlement hierarchy

Assessment objectives

- Candidates should understand the concept of a settlement hierarchy and recognise such patterns in individual countries.
- Candidates should be able to look back and apply the concept of hierarchy to locations they have already studied in the Student Book.

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1.5 Settlements and service provision

- Give reasons for the hierarchy of settlements and services

Topic links: For more on the functions of urban settlements see Topic 1.6 pp. 52–6.

Differentiated learning outcomes

- **All students must** understand the idea that a hierarchy places settlements in order (Grade E/D).
- **Most students should** understand the characteristics of a settlement hierarchy based on population size (Grade C/B).
- **Some students could** know the characteristics of hierarchies based on different types of service provision (Grade A/A*).

Resources

- **Student Book:** pp. 45–7
- **Worksheets:**
1.21 Settlement hierarchies
- **Photographs:** None
- **Further reading and weblinks:**
www3.sympatico.ca/truegrowth/demographics.htm
www.nationsonline.org/oneworld/bigcities.htm

Key concepts

- The settlement hierarchy helps geographers classify any size of settlement within an area/region/country.
- The number of megacities in the world is increasing rapidly – these are located primarily in LEDCs and NICs.

Starter suggestions

Read the first paragraph of text in the Student Book. Students should note the definitions of *settlement hierarchy* and *megacities*. Ask students about what they see as the definition of a city, given the references to Sweden and Romania.

In the UK, a *city* is any settlement with a castle, a cathedral or a university, or a population of over 250 000. This includes St Andrews in Scotland, with 16 870 (2011 census) people in its permanent population including some of the 7000 students at the university. Its famous ancient university, as well as an early cathedral and castle ruins, explain its city status. However, its population would otherwise classify it as a small town.

Main lesson activities

- 1 Teach the concept of hierarchy by referring to your school's staff hierarchy. The headteacher/principal is like the capital city, with lower layers of heads of department, subject teachers and then the students. Within a school, teachers might get promoted and move up the hierarchy. How do villages become towns, or towns become cities?
- 2 Settlement hierarchy: hierarchies can be based on population size or on function. Students need to know a definition of settlement *function* (what the settlement does and why it is there). Some settlements have one main function, such as port, capital city with government activities, market town, coastal resort, centre of education, commuter (dormitory) settlement, or mining village. Most settlements have more than one function – all provide a residential function and most have some retailing, in addition to other key functions. Ask your students to list the functions of their own settlement, the one in which your school is located (if different) plus another of a different size in your region/country. In this way you are already introducing the idea of levels in a hierarchy.

- 2 Referring to diagram **A**, consider the range of scale of settlements. Use the population sizes to help students understand the differences. Ask students to interpret the narrowing of the pyramid triangle (the larger the settlement, the fewer of them exists in one country/region).
- 3 Given the St Andrews example in the 'Starter suggestions' and the statistics of Croatia, Sweden and Romania, ask students which system for identifying cities they agree with. Ask them to give their reasons, and then compare them with those of others in the class.
- 4 Settlement hierarchies based on population size: ask students to think of examples at all stages of the settlement size hierarchy. Paris could be included: it classifies as a world city and as a megacity, if you include its wider urban area. Ask students to suggest world megacities and check their populations using www3.sympatico.ca/truegrowth/demographics.htm. Use **Now investigate** question 1 to apply hierarchy to your home settlement.
- 5 **Worksheet 1.21** provides useful questions to support this work on hierarchies. Use this worksheet to improve student understanding of the settlement hierarchy diagram. This considers settlement hierarchies based on population size. A key idea is that the great majority of the world's megacities are located in the poorer countries, i.e. in LEDCs and in NICs. Depending on time constraints, all or part of this worksheet may be completed as homework.
- 6 Settlement hierarchies based on function: read the second paragraph on p.45 and study table **B**. Functional hierarchies are based on service provision. Table **B** orders functions likely to be found in settlements from megacities down to isolated settlements, which effectively have no services at all. Megacities and conurbations often have several examples of a particular function like an international airport, while smaller cities may have only one. **Now investigate** question 2 supports this idea of functional hierarchy.
- 7 Example: Port Castries, St Lucia. Port Castries is an example of a settlement with several high-level functions, so it is much further up the settlement hierarchy than its population size suggests. It is a small town in terms of population (15 000) but, as the capital of the island, it has many functions. Use the text in the Student Book to explain why this is so.
- 8 Settlement hierarchies in less economically developed countries: LEDCs often have a *primate city* that is disproportionately larger than all other settlements in the country. Use graph **D** to illustrate this. Explain to students the idea of rank order and then illustrate the situation in your own country in a similar way.
- 9 **Now investigate** questions 3 and 4 represent a lengthy exercise, for which students will need teacher support. Ideally, these will make a supplementary lesson, supportive of the concepts here and practising a range of important skills.

Give extra support by helping some students with **Worksheet 1.21**, especially the later questions which are quite challenging. Working in mixed ability groups is a possible way of achieving this.

Give extra challenge by allowing the most independent students to tackle **Worksheet 1.21** in pairs or small groups.

Plenary suggestions

Consider the key points of this lesson, i.e. the two types of hierarchy and their application to any country/region.

Skills notes	Students have practice in interpreting tables, the pyramid diagram and graphs.
Assessment suggestions	The last few questions on Worksheet 1.21 can be set as a homework or individual class exercise and then assessed. Now investigate questions 1 to 4 also present opportunities for assessment.

1.5(5)

Service provision in an area

Assessment objectives

- Candidates should understand that people are more willing to travel longer distances to obtain certain goods and services than they are for others.
- Candidates should know that, as a rule, the more expensive the item, the more choice people want and the further they will travel to find this.

0460/2217 syllabus

1.5 Settlements and service provision

- Understand high-, middle- and low-order settlements and services, as well as sphere of influence and threshold population

Topic links: For more on the settlement hierarchy see pp. 45–6.

Differentiated learning outcomes

- **All students must** know that different sizes of settlements provide different shops and services (Grade E/D).
- **Most students should** know why different types of service provision often have different population thresholds (Grade C/B).
- **Some students could** know the key terms associated with urban settlement (Grade A/A*).

Resources

- **Student Book:** pp. 47–9
- **Worksheet:**
1.22 Spheres of influence
- **Photographs:**
1.33 Market stalls in Bangkok, Thailand
1.34 Shopping centre in Hong Kong
1.35 Union Street, Ryde, Isle of Wight
- **Further reading and weblinks:** None

Key concepts

- Application of the ideas of threshold population and sphere of influence/catchment area to particular locations.

Starter suggestions

Ask students about their shopping patterns and those of their parents. For instance, where would they buy particular items or services? Note the type of good/service suggested, whether it is needed rarely/often, whether its cost is high/low, and how far your students are prepared to go for it (they could estimate the distance in km) and to what size of settlement.

You should find a pattern: they go further for expensive things needed occasionally, and only a short distance for something cheaper and needed more often. Any size of settlement, from village upwards, can supply the basics, but expensive items are usually found only in towns and cities. Compare particular items like daily food, for which you would not go far, and luxury items for which you would want more choice and you would be prepared to go further to get that.

Photos 1.33 and 1.34 from the downloadable resources show different shopping locations. Ask students to identify the type of product/service they might buy in each of these.

Main lesson activities

- 1 Read the first paragraph in the Student Book. Consider the idea of demand, using the cake shop idea or something similar that your students relate to well. Explain to students the key definition of *threshold population*. Illustrate this using table A. Note down the definition. Add in extra examples of your own that are meaningful to your students. Google 'Sarlat market', and then click 'Images'. Sarlat is a market town in the Dordogne region of France. It serves the local population plus many tourists in the summer. Use the market stall photos and ask the students what size of threshold population is likely for each of these businesses.

- 2 Graph **B** shows population thresholds for a variety of services. Ask students to describe the pattern shown, then read the text on population threshold data. Many factors affect threshold population, such as community preferences and traditions, shown in the football kit example (prior to case study on p. 48). Ask your students to think of similar examples that apply to their home area.

Use **Now investigate** question 1 on 10 items bought by your family. This uses the students' own experience so it should help them understand the concept.
- 3 Specific businesses have their own threshold for establishing a store. For example, in the UK and Canada, the Marks & Spencer company considers a market of 50 000 people is the minimum for setting up a small department store. The wealth of the population in the area is also taken into account. Ask students to think of an equivalent business in their home area which considers not just the number of possible customers but also their wealth.
- 4 Use the Isle of Wight case study to teach the idea of *catchment area/sphere of influence*. The definition should be noted down. Students can learn about the characteristics of Ryde from photo **C** on p. 49 of the Student Book and also photo **1.35** from the downloadable resources. Graph **E** shows the number of businesses on the Isle of Wight by category. Ask students to write a description and explanation of the data on this graph and to relate it back to your previous discussions on your local area.
- 5 Students should work in small groups on **Now investigate** questions 2, 3 and 4. It would be useful if they present their thoughts to the rest of the class.
- 6 Use **Worksheet 1.22** as a support and assessment of students' understanding of this topic.

Give extra support by discussing other examples of particular goods or services and how far it would be reasonable to travel to obtain them.

Give extra challenge by asking students about the shape of spheres of influence. What affects their size and shape (for instance the travel network, landscape features)?

Plenary suggestions

The **Fantastic fact** (Student Book p. 47) states that the catchment area for the highest-quality jewellery sold in central London is the whole of the British Isles. In fact, it may be even greater, as London has many global tourists who come to Hatton Garden, the city's jewellery district, to shop. Ask students to think of other very high-order goods or services available in cities and to suggest where the customers come from. This will reinforce the ideas taught in the lesson.

Skills notes	Students have further practice in the interpretation of graph, map and photo.
Assessment suggestions	Worksheet 1.22 will test some of the ideas taught in this lesson.

1.6(1)

What kind of settlement do you live in?

Assessment objectives

- Candidates should know how settlements can be put in order of their size and importance.
- Candidates should understand how the size of a settlement and its sphere of influence are linked.
- Candidates should know that large urban areas have land use zones, which can serve different functions.
- Candidates should understand that growth depends on the nature of a settlement's site and situation.

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1.6 Urban settlements

- Describe and give reasons for the characteristics of, and changes in, land use in urban areas

Differentiated learning outcomes

- **All students must** know the main difference between site and situation (Grade E/D).
- **Most students should** know the key differences between site and situation and be able to apply them to a particular example (Grade C/B).
- **Some students could** understand the many advantages of the situation of a major urban area (Grade A/A*).

Resources

- **Student Book:** pp. 50–2
- **Worksheet:** None
- **Photographs:**
1.36 Aerial view of Paris
- **Further reading and weblinks:**
www.geography.learnontheinternet.co.uk/topics/urban.html
(follow the route to the case study of Rio de Janeiro as a South American city)

Key concepts

- Differences between site and situation.
- An appreciation of the type and scale of settlement in which the student lives.
- Reasons for the growth of a world city, represented by the example of Paris.

Starter suggestions

Refer back to previous lessons by asking students to recall the definition of *rural settlement* and to make a list of the differences between rural settlement and urban settlement.

Use the **Fantastic fact** regarding the Parisian population to show how dominant a city can be within a country – especially a capital city.

Download an aerial view of Paris and ask students to discuss the characteristics of a large world city such as this.

Main lesson activities

- 1 Refer to photos/text **A** and **B** in the Student Book to see how people in different situations see their own urban environments. Compare the locations and attitudes/perceptions of Pedro and Maria. Note that this exercise involves a comparison of young people from different social and economic backgrounds in urban settlements at varying scales.
- 2 What is the point of the speech bubbles comparing the contrasting situations regarding car sales/top showrooms for new cars as against second-hand vehicles? Ask students what they think these comments are showing them.
- 3 Explore the idea of how your students see the town/city in which they live. This is easier if you live in an urban area, but most students who are village-based know a local town/city and can use their imagination to make such a comparison possible.

- 4 Use **Now investigate** question 1 on p. 51 to get students to compare the settlement where they live with those of Pedro and Maria.
- 5 Ask students to consider why Maria says she wants to move to the city when she leaves school. In what ways might she gain and lose? Are your students in a similar situation?
- 6 Look back at the definition of *situation* used in Topic 1.5 (see **Main lesson activity 4** on p. 51 of this Teacher Guide). Students need to note and know this definition well. A settlement is more likely to grow if it is a route centre, at a confluence where valleys meet, is on a navigable river or on the coast. Ask students to relate these things to Paris, their home town/city, or another one they all know.
- 7 Paris: location and growth of a capital city.
 - (a) Read through the Paris example with your students. Ask them what they think were the main characteristics of the *site* and *situation* of Paris that encouraged its development.
 - (b) Answer **Now investigate** question 2, which extends these ideas on the *site* of Paris. Reference to map C and photo 1.36 from the downloadable resources will help here. Use the opportunity here to remind students of the value of an annotated map.
- 8 Use map E to answer **Now investigate** question 3 on the *situation* of Paris.
- 9 Homework: **Now investigate** question 4 helps students to apply to other urban locations the ideas taught in this lesson in the context of Paris.

Give extra support by asking weaker students to identify the site and situation of their own settlement, so that they understand the key differences.

Give extra challenge by asking students to apply this work to an urban settlement they do not know.

Plenary suggestions

Discuss the St Lucia map (Student Book p. 42) in preparation for the suggested homework, main lesson activity 9 above. Continue to emphasise the difference between *site* and *situation*.

Skills notes	Students interpret annotated sketch maps and develop their ability to draw these. They also develop the ability to comment on photos in the context of site and situation. There is opportunity for some graph interpretation.
Assessment suggestions	<p>Homework questions that could be used for assessment:</p> <ol style="list-style-type: none"> 1 In what ways does the <i>site</i> of Paris contribute to its success as a world city today? 2 In what ways does the <i>situation</i> of Paris contribute to its success as a world city today? <p>These will enable students to use the example, and show you that they can differentiate successfully between the concepts of site and situation.</p>

1.6(2)

How does urban land use change, and why?

Assessment objectives

- Candidates should know that an increasing proportion of the world's population live in urban areas.
- Candidates should understand that large urban settlements are made up of zones with different functions and that urban land use models can be used to understand these patterns.
- Candidates should understand the main functions and characteristics of each urban zone, and that these can change over time.
- Candidates should be able to explain how land use zones in LEDCs and MEDCs are both similar and different.

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1.6 Urban settlements

- Describe the land use zones including the Central Business District (CBD), residential areas, industrial areas, and the rural-urban fringe of urban areas in countries at different levels of economic development

Topic links: See Topic 1.7 pp. 66–8 for more on squatter settlements.

Differentiated learning outcomes

- **All students must** know how urban settlements are made up of different land use zones (Grade E/D).
- **Most students should** know how to use the Burgess and Hoyt land use models to evaluate zone patterns in urban settlements, using photos and other evidence (Grade C/B).
- **Some students could** apply the Burgess and Hoyt land use models to their own urban settlements and to others they may study (Grade A/A*).

Resources

- **Student Book:** pp. 52–4
- **Worksheets:**
 - 1.23 Using the Burgess land use model
 - 1.24 Hoyt's urban land use model
- **Photographs:** None
- **Further reading and weblinks:**
 - http://en.wikipedia.org/wiki/Concentric_zone_model
 - <https://people.hofstra.edu/geotrans/eng/ch6en/conc6en/burgess.html>
 - http://en.wikipedia.org/wiki/Sector_model
 - <http://geobytesgcse.blogspot.com/2007/02/urban-land-use-models.html>

Key concepts

- Urban areas can be divided into different land use zones which are located in particular parts of the town/city; there are four main land use zones.
- Transects show a cross-section through an urban area, showing the various land use zones.

Starter suggestions

Begin the lesson by introducing the term *urbanisation* – the process by which an increasing proportion of the world's population lives in cities. The **Fantastic fact** gives a figure for the proportion of the world's population living in urban areas in 2008.

Main lesson activities

- 1 Read the text in the Student Book on Keetan's view of his home city of Kolkata. Ask students to identify the different land use areas of the city based on this. Follow this with **Now investigate** question 1 to do a similar exercise on your own town/city (or the nearest town/city if you are in a rural area).
- 2 Two key land use models: use this opportunity to teach/revise the concept of a model in Geography. Students have already used the stages of economic development in this section, so they should understand that the purpose of a model is to simplify the real world with the aim of understanding basic patterns, and then bringing detail back into the picture in order to explain particular situations.

- (a) Burgess urban land use model (diagram **B**): Burgess designed this model in the 1920s, based on the real city of Chicago. Chicago did not, in fact, spread evenly in all directions due to landscape factors, but Burgess simplified it to a more universal pattern that could be applied to any town or city. Explaining this background theory to your students at an appropriate level will help them understand what a model is and why we use them in Geography.

Use **Worksheet 1.23** to help students understand the growth of a town/city in the style of the Burgess model.

- (b) Hoyt urban land use model (diagram **C**): this is a similar but contrasting urban land use model. It is based on the premise that major routes – roads, railways, canals, rivers – attract certain types of economic development (mainly industry) and repel others (middle to higher-class residential). Homer Hoyt was an American like Burgess, but he looked at city land use from a slightly different angle.

Read the text in the Student Book on the Hoyt model with your students. Identify the key characteristics that make this model different from the Burgess model. Consider your own home town/city (or nearest urban settlement).

Does it fit more with Hoyt's or Burgess's model, or with neither of these?

Worksheet 1.24 allows your students to work with the Hoyt urban land use model.

- 3** Recent changes in urban land use: read the text on changes in today's urban land use in the Student Book. Ask your students the following:
- (a) Identify the recent land use changes in your home/nearest urban area. In what ways have these altered the urban land use model for this settlement?
 - (a) Has this settlement had additional development on its edges – out-of-town retailing, for example – which have made the Burgess/Hoyt models less relevant to explaining its land use? Ask students to list these new developments.
- 4** Using transects: a transect is a cross-section, in this case (diagram **D**) drawn through a city and its different land use zones. Students should be encouraged to identify the land use zones across the city. How do these relate to the Burgess/Hoyt models?

Give extra support by simplifying models where necessary, to help weaker students understand the basic concept of a model as well as its possible applications.

Give extra challenge by using the question in main lesson activity **4** and encouraging students to research other urban land use models (e.g. the multiple nuclei model). Does this apply to your settlement or one you know well?

Plenary suggestions

Summarise the land use zones identified in this lesson.

Return to Keetan in Kolkata. Re-cap the land use zones mentioned in his account.

Skills notes	Students study diagrams showing geographical models, urban transects, and apply these to places in the real world.
Assessment suggestions	Use the Now investigate question 2 on p. 54 to test students' understanding of the general themes and content. Main lesson activity 4 will test the brightest students.

1.6(3)

Urban zones

Assessment objectives

- Candidates should know the key characteristics of the main urban land use zones.
- Candidates should understand the links between urban land use zones and maps, street plans and photos of equivalent areas.
- Candidates should be able to identify urban land use zones relevant to their own home area.

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1.6 Urban settlements

- Describe the land use zones including the Central Business District (CBD), residential areas, industrial areas and the rural–urban fringe of urban areas in countries at different levels of economic development

Differentiated learning outcomes

- **All students must** know the four main land use zones in an urban area, and their characteristics (Grade E/D).
- **Most students should** be able to recognise each of these four zones on photographs, maps and street plans (Grade C/B).
- **Some students could** recognise details of the different land use zones on local maps (Grade A/A*).

Resources

- **Student Book:** pp. 54–6
- **Worksheets:** None
- **Photograph:**
1.37 Part of the CBD in Shanghai, China
1.38 Suburban scene in an MEDC
- **Further reading and weblinks:** None

Key concepts

- There are four main types of urban zone: the CBD, the inner zone, the outer zone (suburbs) and the rural–urban fringe.
- CBDs have very similar characteristics whether they are located in MEDC or LEDC cities.

Starter suggestions

Refer back to the urban land use models in the previous lesson and ask students to list the key land use zones and their basic characteristics.

Main lesson activities

- 1 Use photo **A** on Student Book p. 54 (photo **1.37** from the downloadable resources) to link the CBD characteristics stated above to this real world image. Many of these buildings are high-rise. Answer these brief questions with your students:
 - (a) Why are so many buildings in the CBD high-rise? Can you distinguish between the older and newer buildings within the CBD on this photo by looking at the style and building materials involved? Explain how you know the differences.
 - (b) Research some more photos showing the CBDs of both MEDC cities and LEDC cities, and then answer these questions:
 - What are the differences between the CBDs of MEDCs and of LEDCs?
 - What are the similarities between these cities?
- 2 Together read the text in the Student Book on the CBD. Draw a basic spider diagram with 'CBD' at the centre. Students should copy this and then add as many 'legs' as necessary to show the variation in land use found in this central urban zone. Do not make the centre too large, to reflect the fact that the actual area of the CBD is remarkably small. Ask students to suggest why you have made it so small; this will act as a useful revision of material from the previous lesson. Use **Now investigate** question 1 to emphasise these ideas.

- 3 Use the photos to show students that not all CBD buildings are shops and offices; some are residential. Together read the text and find out which members of the class would choose to live in the CBD, why and in what type/s of accommodation.
- 4 Using maps of CBDs: to take the work a stage further, answer **Now investigate** question 2. This exercise will help students to see the links between photo and map interpretation.
- 5 Ask your students whether all the buildings in a CBD were built at the same time. The answer is *no* – in all urban zones they develop gradually over time. Older buildings become defunct as technology allows taller structures to be built. Refer to the photos (in the Student Book on pp. 54–56 and from the downloadable resources) to find evidence of this process.
- 6 Are CBDs in LEDCs the same as or different from those found in MEDCs? Photo D on Student Book p. 56 (photo 1.38 from the downloadable resources) will help here. The key point is that they do look very similar. In LEDCs enough technology and finance are available to build virtually identical urban zones. There are wealthy people to live there and companies to locate their offices there.

In that case, what do your students think are the key differences between richer and poorer world urban areas? They should read the text on the outer zones of cities and the rural–urban fringe. Then go back to their urban model diagrams and label these land use zones on those diagrams.

Draw up a table to show differences between cities in LEDCs and MEDCs. Use the land use zones from the urban models as headings.

- 7 Consider the inner and outer zones of the town/city when answering **Now investigate** question 3. The land use here is considerably different to the CBD. You might have time to consider why this is so.

Give extra support by helping students identify the key characteristics of the CBD and other particular urban land use zones.

Give extra challenge by encouraging research into rural–urban fringe land uses.

Plenary suggestions

Students need to relate the material covered in this lesson with the urban land use models in the previous lesson. Working as a class, or in small groups, a Burgess and/or Hoyt model could be annotated with the key characteristics of each land use zone in a city that the students know.

Skills notes	Students practise photo interpretation. There are also links here to map identification of different urban areas.
Assessment suggestions	Use the Now investigate questions as a homework exercise to assess students' understanding of the material covered in this lesson.

1.6(4)

The environmental impact of pollution

Assessment objectives

- Candidates should know that there are different types of pollution and how urbanisation increases the amount of pollution.

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1.6 Urban settlements

- Explain the problems of urban areas, their causes and possible solutions
- Understand different types of pollution (air, noise, water, visual), inequality, housing issues, traffic congestion, and conflicts over land use change

Differentiated learning outcomes

- All students must** know the basic types of pollution (Grade E/D).
- Most students should** understand a number of ways in which the natural environment is put at risk due to the impact of urbanisation (Grade C/B).
- Some students could** understand in detail how and why the natural environment is put at risk due to the impact of urbanisation (Grade A/A*).

Resources

- Student Book:** pp. 57–8
- Worksheets:**
 - 1.25 Types of pollution in cities
 - 1.26 Living with pollution – a problem, or not?
- Photographs:**
 - 1.39 Smog over Tel Aviv, Israel
 - 1.40 Eiffel Tower in Paris
 - 1.41 A wind turbine
 - 1.42 Polluted water
 - 1.43 Litter
 - 1.44 Air pollution
- Further reading and weblinks:**
 - www.time.com/time/specials/packages/completelist/0,29569,1661031,00.html

Key concepts

- There are four main categories of urban pollution, primarily caused by people.
- With care and planning, it is possible to limit people's pollution of their urban environment.

Starter suggestions

Decide with your students on a definition of pollution. Ask them what they think it is. They should aim to categorise it into different types. A standard definition of pollution is: 'The contamination of air, water or soil by substances that are harmful to living organisms. Pollution can occur naturally, for example through volcanic eruptions, or as the result of human activities.'

Note the term 'smog' and the source of the word: **smoke** and **fog** = **smog**. Refer to the photo **B** on p. 57 of the Student Book (photo **1.39** from the downloadable resources) so that students understand the appearance and potential impact of this type of air pollution.

Main lesson activities

- In their opinion, what categories of urban pollution are there (for this lesson use these four: air, water, visual, noise)? Ask students to identify examples from their own home area or from a town or city that they know, or simply from having read about cities or seen images on television or on the internet. For each idea offered to the discussion, place it into one of the four categories of pollution identified above. Identify the source of the pollution.

Students should use **Worksheet 1.25** and **Now investigate** question **1** to summarise their ideas and examples. They should keep the sheet to one side in case more detail can be added later on in this lesson.

- Use diagram **A** to recap on the different types of pollution.

- 3 Research the world's most polluted cities using the Time website (see above). Students should choose one of the locations on the website and identify the key types of pollution shown. Then, in groups, they should produce a guide for visitors to that city, identifying the places that should be avoided for health reasons.

Are there certain parts of the world that have more heavily polluted cities than others? Students should list these.

Add 'smog' to **Worksheet 1.25** if your class does not already have this category on the sheet. Consider the consequences of air pollution in terms of people's health: coughs, bronchitis, asthma, etc. Use students' own experience to elaborate here.

- 4 Ask students to think about the types of pollution in their home/school area. They can then:

- identify the pollution problems
- list the ways in which residents experience the various types of pollution.

Are there any obvious ways in which people in your area cope with/reduce the pollution problems?

- 5 Noise pollution: read the extract in **Worksheet 1.26**, written by a resident living close to Gatwick, one of London's main airports. Students should discuss the text in small groups and then produce written comments. Groups can compare their opinions.

Discuss with students diagram C in the Student Book, to help them identify different levels of noise.

- 6 Visual pollution: use photo 1.40 from the downloadable resources and the **Fantastic fact** to illustrate how people can perceive the same structure very differently. Referring to photo D in the Student Book (photo 1.41 from the downloadable resources), discuss students' opinions of the visual impact of a wind turbine. Note that these can also be noisy. Students should answer **Now investigate** questions 2a and 2b.
- 7 Water pollution: discuss photo 1.42 from the downloadable resources. Do students know any local examples of water pollution? This ties in with answering **Now investigate** question 1 for homework.
- 8 Read the text on the Mercer Survey, which is a way of assessing how 'green' or pollution-free a city is. Can students think of any other environmental criteria that it would be useful to measure?

Give extra support by reinforcing the skills needed for **Now investigate** question 1 (set as homework) and by confirming the four categories of urban pollution listed above.

Give extra challenge by asking students to research the Mercer Survey.

Plenary suggestions

Return to **Worksheet 1.25**. Add any more forms of pollution students can think of. Using photos 1.39 and 1.41–1.44 from the downloadable resources, discuss in detail what aspects of pollution are being illustrated and link them to the relevant section of the worksheet. This creates a summary of the types of pollution covered in this lesson.

Skills notes	Students have further practice in photo interpretation, and in the construction of a table, sketch map or annotated photos, according to student choice in Now investigate question 1.
Assessment suggestions	Students can be assessed on their research on the different types of pollution illustrated on diagram A. Now investigate question 1 should test students' overall understanding of the material on pollution presented in this lesson.

1.6(5)

The effects of rapid urban growth on the rural–urban fringe

Assessment objectives

- Candidates must understand what is meant by 'urban sprawl', and its consequences for the rural–urban fringe.
- Candidates should know the types of development that are most likely to occur at the rural–urban fringe.
- Candidates should understand the ways in which development can be limited in the rural–urban fringe.

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1.6 Urban settlements

- Understand the effects of change in land use and rapid growth in an urban area, including the effects of urban sprawl

Topic links: See Topic 1.2 p. 22–3 for information on counter-urbanisation, and Topic 3.7 pp. 220–6 for more on environmental issues.

Differentiated learning outcomes

- **All students must** be familiar with a range of land uses that are typical of the rural–urban fringe (Grade E/D).
- **Most students should** know how rural–urban sprawl can be controlled (Grade C/B).
- **Some students could** understand the detail of land use conflicts in the rural–urban fringe (Grade A/A*).

Resources

- **Student Book:** pp. 59–61
- **Worksheet:**
1.27 Activities in the rural–urban fringe: extension exercise
- **Photograph:** 1.45 Modern retail park
- **Further reading and weblinks:**
On green belts:
www.cpre.org.uk
http://en.wikipedia.org/wiki/Green_belt
On new towns:
http://en.wikipedia.org/wiki/New_town

Key concepts

- Urban areas can have a significant impact on their surrounding environment.
- The rural–urban fringe contains land useful for large developments in industry, retailing and leisure activities, yet much is still used as farmland.
- Some land uses in the rural–urban fringe cause conflict with each other.

Starter suggestions

Begin with key definitions: *rural–urban fringe*, *urban sprawl*, *mobility*, *counter-urbanisation*, *green belt*. These are all terms that will be needed during this lesson. Students may be able to recall some of them from previous study.

Main lesson activities

- 1 In any town or city, the rural–urban fringe is the area where land is most likely to be available for new developments, in particular for activities that need a lot of land. There is increasing demand from leisure activities. Read the first paragraph in the Student Book to find out why.

Students answer **Now investigate** question **1a**, the OS map exercise on Mauritius, to identify some rural–urban fringe land uses. They could then add two columns to their table to record the following for each of the land uses:

- whether the land use serves urban residents, those in the rural area, or both
- whether the land use is for leisure.

Students then complete question **1b** (colour-coding), to further classify land use.

Students can apply what they have learned to their own home area by answering **Now investigate** question 2. The same categories of who benefits, and the colour-coding, could be applied here. This might be best carried out as a whole class activity, to allow students to interact and exchange ideas.

- 2 Example of land use in the rural-urban fringe – retail parks: use the annotated photo A on p. 59 (photo 1.45 from the downloadable resources) to discuss the advantages that this area has for retail development. Think of the requirements of both the large retailing companies and of potential customers. Make a list. Ask your students whether this location fulfils all or most of these needs.
- 3 Controlling urban sprawl: read the text in the Student Book and ask students to identify ways in which the rural-urban fringe can be protected from development, for example by creating a green belt or establishing new towns at a distance from the city in order to attract people elsewhere. Divide students into two groups, one to research green belts and the other new towns. Some websites are suggested above.
- 4 Conflict in the rural-urban fringe: not all land uses work well together. Read the text to discover some areas of conflict. Students could write a paragraph to answer each of the following:

Farmers and visitors to the countryside often clash – why?

Local people are usually against quarrying in their area – why? Are there any advantages to having quarrying in the rural-urban fringe? (**Now investigate** question 4).
- 5 Students use **Worksheet 1.27** to consider the changes that occur across the rural-urban fringe, from the city into the really rural area.
- 6 In many LEDC cities, urban sprawl results from shanty town development and new heavy industry. How do these developments affect the rural-urban fringe of these LEDC cities? Students could choose a particular LEDC city for further investigation as an extension exercise.

Give extra support by revising mapwork skills for those who find this difficult.

Give extra challenge by asking students to compare directly the rural-urban fringe developments of any two towns/cities, for example St Louis in Mauritius and Port Castries in St Lucia, or your home area and an area known to your students.

Plenary suggestions

Now investigate question 3 will serve as a revision of several points made during this lesson.

Skills notes	Students have practice in their map skills, using annotated photos, and table construction.
Assessment suggestions	Now investigate question 1b, as proposed for main lesson activity 1, provides opportunity for assessment.

1.6(6)

Urban change

Assessment objectives

- Candidates should understand that today's cities came from small settlements but have changed radically over time to evolve into global cities.
- Candidates should understand that regeneration of poorer urban areas can be a bi-product of large scale projects, such as the Olympic Games.
- Candidates should understand the nature of urban redevelopment.

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1.6 Urban settlements

- Describe and give reasons for the characteristics of, and changes in, land use in urban areas
- Understand the effects of change in land use and rapid growth in an urban area, including the effects of urban sprawl
- **Topic links:** For more on site and situation see Topic 1.5 pp. 39–42 and on the environmental impact of urbanisation see Topic 1.6 pp. 57–60.

Differentiated learning outcomes

- **All students must** be able to understand, from map and photo evidence, how a city grows (Grade E/D).
- **Most students should** know how London began and developed and is likely to develop into the future (Grade C/B).
- **Some students could** conduct research on how regeneration projects will have long-term effects on parts of East London (Grade A/A*).

Resources

- **Student Book:** pp. 61–3
- **Worksheets:** None
- **Photographs:**
 - 1.46 London's East End
 - 1.47 Westminster, London
 - 1.48 London Docklands today
 - 1.49 London Olympic Park
- **Further reading and weblinks:**
 - http://en.wikipedia.org/wiki/List_of_Olympic_Games_host_cities
 - www.thoughtco.com/olympic-game-cities-1434453

Key concepts

- Today's cities have developed and changed through time.
- Great events, such as the Olympic Games, can be used to regenerate poorer urban areas.

Starter suggestions

Begin with the **Fantastic fact** that London was the largest city in the world in 1900. Today it is far from being the largest city, having been overtaken by other cities in both LEDCs and MEDCs. Research London's present population and compare it with those of other major world cities. This shows that London has changed dramatically in just over a century.

Main lesson activities

- 1 Study map A, which shows London as it was much further back in time, to its original site as Roman Londinium, which was primarily due to its being the lowest bridging point of the River Thames at that time. Ask students what is meant by the term 'lowest bridging point' and why it is important in terms of settlement development.

Ask students to describe the site of London and to explain the advantages and disadvantages this site held for these early settlers.

- 2 Use photos **B** and **C**, showing the East End of London and Westminster (photos **1.46** and **1.47** from the downloadable resources). Ask students to produce a written description and comparison of each area. This is an opportunity to emphasise key command words – *describe, explain, compare, contrast*, etc.
- 3 Students should read the text on the development of London, then answer **Now investigate** question 1.
- 4 London's Olympic development – the sustainability of the future East End: London Docklands was redeveloped from the 1980s onwards into an extension of the 'City' of London (the financial district – photo **D** on p. 62 of the Student Book, and photo **1.48** from the downloadable resources). In many ways this was successful, but housing and employment for local people was not fully catered for in this project. One major aim of the Olympics was to change the Lea Valley, the area just east of Docklands, into an area with new buildings and opportunities. Study photo **1.49** of the Olympic Park. Ask students for their reactions and how they think London's development would be affected.

Research Activity: to investigate the changes the Olympic Park made to London.

Homework exercise	Students use the text and map E to answer Now investigate question 2.
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Give extra support by using map **E** to review annotation skills.

Give extra challenge by asking students to research previous Olympic city venues to see how the Olympic developments altered the city. Barcelona (1992) and Beijing (2008) are suggestions. Other cities are possible. Look at the websites in **Further reading and weblinks** for all the cities and their dates to give you a start. These events both stimulated economic growth and improved recreational facilities for the local population.

Plenary suggestions

Ask students whether they know of any large-scale projects in their own country linked to urban redevelopment, or in any other country.

Create a list, perhaps in small groups, to have as a revision tool when learning urban regeneration.

Skills notes	Students have practice in skills of description, annotation of sketch maps and of photos, and in summarising a short text.
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Assessment suggestions	<p>Students can be assessed on the homework research exercise (main lesson activity 4). They should begin with the text and map E showing changes to the London Docklands area and the Olympic Village.</p> <p>Students could research the growth of a city other than London in the same way. The following headings could be used:</p> <ul style="list-style-type: none"> • Original site • Reasons for growth • Changes in land use today • Possible future changes.
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1.7(1)

What problems are caused when cities grow?

Assessment objectives

- Candidates should know that traffic congestion is now a global urban problem.
- Candidates should learn what strategies are available for reducing traffic congestion.

0460/2217 syllabus

1.7 Urbanisation

- Identify and suggest reasons for rapid urban growth
- Describe the impacts of urban growth, along with possible solutions to reduce the negative impacts

Topic link: For more information on the effects of pollution in cities see Topic 1.6 pp. 57–8.

Differentiated learning outcomes

- **All students must** know a limited range of reasons why traffic congestion occurs (Grade E/D).
- **Most students should** know the main causes and times of traffic congestion, and a number of strategies for reducing traffic congestion (Grade C/B).
- **Some students could** know a wide range of strategies for reducing traffic congestion (Grade A/A*).

Resources

- **Student Book:** pp. 64–6
- **Worksheet:**
1.28 Solving traffic congestion
- **Photographs:**
1.50 Traffic in Los Angeles, USA
1.51 Traffic jam in Darjeeling, India
1.52 Section of the Metro Monorail in Sydney, Australia
- **Further reading and weblinks:** None

Key concepts

- All cities in the world suffer from traffic congestion.
- Traffic congestion is worst at the times when people are travelling to and from work (commuting).
- There are many ways of tackling traffic congestion, mostly through making public transport services more frequent and more affordable.

Starter suggestions

Ask students to identify any traffic problems in your home area or in other settlements with which they are familiar. Ask them why they personally travel and then widen the question out to include family members, friends and so on.

Read the first paragraph on p. 64 about why people travel. This states that the main reason is travelling to work/school/college and should coincide with the comments made in this introductory conversation.

Main lesson activities

- 1 Commuting as the main cause of traffic congestion: ask students to what extent there is a rush hour in their neighbourhood, then aim to identify the key busy times. (If students live in a rural area, they can still answer these questions based on their knowledge of a town or city known to them.) Use photos **1.50** and **1.51** from the downloadable resources to illustrate just how bad traffic jams can be.
- 2 Use diagram **A** to list other reasons for travel that may lead to congestion. Overall, travel to work/school/college is likely to come out as the top reason.
- 3 Graph **B** shows the changing volume of road traffic on a typical work day. It should reinforce your discussion to date. Use the graph to identify the busiest times of the day, as asked in **Now investigate** question **1** on p. 65. Students could

use this opportunity to write a description of the data shown in the graph, not forgetting to quote figures from the diagram.

- 4 Use the text on the changing volume of road traffic on a typical work day to make a list together, or in small groups, of the reasons for rush hours. Students should compare lists with each other to ensure that everyone has the most comprehensive list possible.

The most common reason for traffic congestion is the dramatic rise in car ownership, especially in LEDC cities. As the standard of living rises, people have greater disposable income and are therefore more likely to be able to afford a car. As the economy expands, there are more vans, lorries/trucks on the road as well. Graph C illustrates this for India, today classed as an NIC (Newly Industrialised Country) with a rapidly expanding middle-class population. Students should answer **Now investigate** question 4.

- 5 Discuss with students their experience of traffic congestion. What are the consequences of congestion in terms of people's time, stress levels and the environment? Can students think of any personal examples to illustrate here?
- 6 Solving traffic congestion: refer to photo D on p. 65 (photo 1.52 from the downloadable resources) showing a public transport system. Students should note down the possible solutions suggested in the text, and research extra information on one particular example. For instance, many cities have congestion charging – London, Singapore and Oslo, for example. They should research one city and write a few lines on its method. The **Fantastic fact** idea on p. 65 can be included in the list.

Give extra support with graph and photo interpretation.

Give extra challenge by asking students to identify likely locations on the map where traffic congestion may occur; and by encouraging extra research in sustainability using the website address above.

Plenary suggestions

A short summary of this lesson can be done by completing **Worksheet 1.28**.

Skills notes	Students have practice in graph description and interpretation, data collection (recording by tally chart and interpreting this primary data), and in using map symbols and general map reading.
Assessment suggestions	<p>Now investigate question 2: it will take a week to collect the necessary data and then a little time for the write-up.</p> <p>Now investigate question 4 allows students to write a longer answer on the basis of their own data interpretation and understanding of the text.</p>

1.7(2)

Squatter settlements

Assessment objectives

- Candidates should understand that many cities grow so rapidly they cannot meet people's needs.
- Candidates should know that squatter settlements are a major feature of most large cities in less economically developed countries.
- Candidates should understand that, while moving to a squatter settlement can be very difficult, it can bring upward mobility to some migrants or to their children.

0460/2217 syllabus

1.7 Urbanisation

- Identify and suggest reasons for rapid urban growth
- Understand the physical, economic and social factors which result in rural depopulation and the movement of people to major cities
- Explain the effects of urbanisation on the people and natural environment and the characteristics of squatter settlements

Topic links: For more information on push–pull factors in migration see Topic 1.2 pp. 21–2; on land use zones in cities see Topic 1.6 pp. 52–6.

Differentiated learning outcomes

- **All students must** be able to describe a squatter settlement and its buildings and understand some reasons why people migrate there (Grade E/D).
- **Most students should** be able to differentiate between the negative and positive aspects of living in such a settlement (Grade C/B).
- **Some students could** research other squatter settlements and be able to compare them (Grade A/A*).

Resources

- **Student Book:** pp. 66–8
- **Worksheet:**
1.29 Rural–urban migration crisis!
- **Photographs:**
1.53 A squatter settlement in Mumbai, India
1.54 Kibera, Nairobi
1.55 A favela in São Paulo, Brazil
- **Further reading and weblinks:**
www.coolgeography.co.uk/GCSE/AQA/Changing%20Urban/Shanties/Squatter%20settlements.htm
www.slideshare.net/tudorgeog/case-study-of-a-squatter-settlement-kibera-nairobi-6439924
www.bbc.co.uk/schools/gcsebitesize/geography/urban_environments/urbanisation_ledcs_rev3.shtml

Key concepts

- Squatter settlements have both negative and positive aspects for the people who live in them and for the city as a whole.
- One in seven people in the world live in some sort of slum settlement.

Starter suggestions

Read the first paragraph on p. 66 together as a class. Refer to photo **B** on Student Book p. 67 (photo **1.53** from the downloadable resources), and photos **1.54** and **1.55** from the downloadable resources, so that students get a clear image of exactly what such an area looks like. Use map **A**, of Mumbai, to demonstrate just how extensive squatter settlements can be.

Main lesson activities

- 1 Ask students to think about the high population densities found in the shanty towns. A figure of 30 000 per km² is quoted. Look up the overall densities of some cities in less economically developed countries and compare them with this figure.

- 2 Why do people migrate from rural areas to urban squatter settlements? It may seem that they are not getting a very good deal. There are two sets of reasons why people decide to make such a move. Economic problems at home in the countryside leave them in severe poverty (push factors), and they are attracted by news of opportunities in the cities (pull factors). Students could list the push and pull factors involved, which will help them understand these people's decisions.
- 3 Read the text on p.66 on challenges facing new migrants in the city: getting a job and finding somewhere to live. Ask students for their reactions to these people's situation. They should work through the first exercise on **Worksheet 1.29**, which shows the negative side of people's experience. Answer **Now investigate** question 1a.
- 4 Mumbai case study: read this section in the Student Book, and go online using the coolgeography website listed above. Search and follow links to find images of Dharavi, in Mumbai. Students should list the problems they can observe in the text and on the website, considering environmental, social and economic issues. They should then contrast that list with positive aspects of living in a squatter settlement. How might moving to such a settlement improve people's chances in life? (**Now investigate** question 1b). This ties in with the second exercise on **Worksheet 1.29**.

Students should decide whether they think, on balance, that the negative aspects of living in a squatter settlement outweigh the advantages.

Give extra support by asking students to annotate a photo of Dharavi or other squatter settlement to highlight the advantages and disadvantages of living there.

Give extra challenge by asking students to research a case study of a particular squatter settlement other than Dharavi, perhaps one in South America.

Plenary suggestions

This lesson has contrasted the advantages and disadvantages of living in a squatter settlement. Students have had plenty of opportunity to consider and evaluate these. Ask them to write a short paragraph to summarise their feelings on the prospect of having to live in such a location.

Recap on the key terms in this lesson: *informal sector, formal sector, favelas/barriadas/bustees/bidonvilles*.

Skills notes	Students have practice in photo and diagram interpretation and annotation. They should also develop empathy – putting oneself in the position of others and assessing their reactions.
Assessment suggestions	<p>Students can be assessed on their ability to describe the scale and distribution of squatter settlements in Mumbai, using the case study map; and on their answers to Now investigate questions 2 and 3.</p> <p>They can conduct research on 'favela tourism', a new development in some cities. Tourists can visit squatter settlements, such as Khayelitsha in South Africa, and even stay there to get a taste of what life is like. Use the Nomvuyos website www.nomvuyos-tours.co.za/township_info.shtml.</p> <p>In some Brazilian cities, squatter settlements were being cleared in the run-up to the 2014 World Cup, so that visitors did not have to look at these slums. Students should write about their reactions to this policy. This work could take the form of a newspaper article.</p>

1.7(3)

Ways of upgrading residential areas

Assessment objectives

- Candidates should be able to explain how housing can be upgraded by renovation and redevelopment.
- Candidates should be able to compare different examples and their characteristics in terms of environmental, social and economic criteria.

0460/2217 syllabus

1.7 Urbanisation

- Describe the impacts of urban growth on both rural and urban areas, along with possible solutions to reduce the negative impacts
- Suggest strategies to reduce the negative impacts of urbanisation

Differentiated learning outcomes

- **All students must** know that there are different strategies by which squatter settlements can be improved (Grade E/D).
- **Most students should** know the difference between renovation and redevelopment – strategies to improve poorer urban areas (Grade C/B).
- **Some students could** know a wide range of ways of renovating and redeveloping urban communities (Grade A/A*).

Resources

- **Student Book:** pp. 68–70
- **Worksheets:** None
- **Photographs:**
 - 1.56 A self-help scheme in Roçinha, Rio de Janeiro
 - 1.57 High-rise flats in 6th of October City
 - 1.58 Low-quality terraced housing in Harlem, New York
 - 1.59 A 'new town' area in Singapore
- **Further reading and weblinks:** None

Key concepts

- Self-help schemes aim to create a community, improve people's standard of living and upgrade services.
- Site and service schemes are more ambitious: they are based on a whole new development, with a higher level of services provided.

Starter suggestions

Use photos **A** and **B** on Student Book p. 69 (photos **1.56** and **1.57** from the downloadable resources) to encourage students to make comparisons between these two urban areas.

Answer **Now investigate** question 1.

Main lesson activities

- 1 Ask students to list the problems being faced by families living in squatter settlements in poorer world cities. This is revision from the previous lesson.
- 2 Comparing improved areas in LEDC cities: read the examples on Roçinha in Rio de Janeiro, Brazil (a self-help scheme) and 6th of October City, Egypt (a site and service scheme). Students should prepare a table of similarities and differences between the two types of improvement. Note the **Fantastic fact** on p. 70 about Cairo.

Now investigate question 2 would fit well here to reinforce the LEDC example material.

- 3 If you live in an LEDC, identify a squatter settlement that is in need of improvement. Students should follow the instructions in **Further research** on p. 70 of the Student Book, including the location map and annotated photos.

They should then decide what type of improvements would most benefit this settlement – a self-help or site and service scheme – giving reasons for this decision and making suggestions for the necessary improvements.

- 4 Improving poorer areas in MEDC cities: new towns have been built in many MEDCs to relieve population pressure in cities, and today this is sometimes carried out in LEDC cities too. 10th of Ramadan City, being built entirely from new, could be classified as a new town. In the UK during the 1950s and 1960s, many new towns were constructed around London, Glasgow and Edinburgh to relieve urban areas cramped and poor-quality housing. Crawley and Harlow (near London) are examples.

Read the text on pp. 69–70 and look carefully at the detail in photos C and D (photos 1.58 and 1.59 from the downloadable resources).

Ask students to identify any similarities and differences they can see between these MEDC developments and the previously discussed LEDC changes.

Extension activity	Students could conduct further research on another MEDC city's solutions to housing problems.
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Give extra support by asking weaker students to make clear lists of the characteristics of each type of improvement scheme, for comparison and to make the key points easier to learn.

Give extra challenge by asking brighter students to research similar schemes in other cities and to write a two-to-four paragraph section on their findings and any further comparisons they are able to identify. They could also consider ways in which these recent developments are or are not environmentally sustainable.

Plenary suggestions

Ask students to think of any other ways in which people in squatter settlements might be helped to improve their lives. Consider the practicalities and economic soundness of their suggestions.

Skills notes	Students have practice in photo interpretation and in summarising and evaluating material.
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Assessment suggestions	Now investigate question 4 will engage students in many aspects of squatter settlement and slum district change in both LEDCs and MEDCs. It will act as an excellent summary of the material in this lesson.
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1.7(4)

More sustainable cities

Assessment objectives

- Candidates should understand the concept of a sustainable city and know the ways in which it avoids pollution.

0460/2217 syllabus

1.7 Urbanisation

- Suggest strategies to reduce the negative impacts of urbanisation

Topic link: For more on sustainable development see Topic 3.7 pp. 227–34.

Differentiated learning outcomes

- **All students must** know some strategies for making cities more sustainable (Grade E/D).
- **Most students should** know the details of at least one example of a sustainable city (Grade C/B).
- **Some students could** understand how the four strategies for sustainability interact with each other (Grade A/A*).

Resources

- **Student Book:** pp. 70–2
- **Worksheet:**
1.30 Four strategies for sustainability
- **Photographs:**
1.60 A three-section bus and ‘tube’ bus stop
1.61 A park in the centre of Curitiba
- **Further reading and weblinks:**
<http://reimaginerpe.org/node/344>

Key concepts

- Some cities have clear strategies to limit the pollution emitted and thereby to reduce the impacts of urbanisation on the environment.
- Public transport and green spaces are two key strategies in making a city more ‘green’.

Starter suggestions

Ask students for their ideas on the meaning of the word ‘sustainable’. Make sure this is placed in the context of urban areas.

Read the final paragraph of text on p. 70 of the Student Book and use this to complete the simple diagram on **Worksheet 1.30**.

Main lesson activities

- 1 Read the section of text on the development of Curitiba, Brazil (pp. 71–2), and the progress of its green policies. Students could summarise this historical information in their own words or in a flow diagram.
- 2 For each of the four actions taken to make Curitiba greener in the 1970s, ask students to explain likely reasons for these policies. For example, establishing bus-only lanes makes buses faster than other vehicles, encouraging people out of their cars and onto the public transport system (p. 72).
- 3 Read together the section of text about the Bus Rapid Transit system under the side-heading ‘In the 1990s’, and ask students what is meant by a mass transit system – refer to photo C on p. 72 of the Student Book (photo 1.60 from the downloadable resources).

Use a search engine to research further into this public transport network. Ask the following questions:

- What are the advantages and disadvantages of this system?
 - Would your students choose it over car travel to work, college or school? They should try to give their reasons.
- 4 Photo **B** on p. 72 of the Student Book (photo **1.61** from the downloadable resources) shows a planned green area, typical of several in Curitiba. The city government has actively promoted such areas and continues to do so. Students should answer the following:
- What are the characteristics of the green areas in Curitiba?
 - What are the main uses to which they will be put by the population of the city?
 - Are there any disadvantages of having these green urban zones?

Note the **Fantastic fact** on p. 72 about sheep being used to control the grass in the parks rather than lawn-mowing equipment!

Extension activity

Consider how the green policies in Curitiba might be used in:

- your home town or city
- a town/city you know well, or in the city you have chosen when answering **Now investigate** question 2 (below). This will create a case study on sustainable cities.

In each case students should ask the questions:

- What strategies have been used to improve the environment?
- What plans are there to make the city greener in the future?

Give extra support by encouraging students to think of suitable annotations for several photos in the Student Book and on the websites recommended for this lesson. (This is an extension of the plenary activity.)

Give extra challenge by asking students to answer **Now investigate** question 2. This will require personal research. Other possible cities are Beijing, Los Angeles and Kuala Lumpur. You could also refer to the website https://wikipedia.org/wiki/List_of_most_polluted_cities_by_particulate_matter_concentration which gives a list of the world's most polluted cities.

Plenary suggestions

Choose any photo of 'green' Curitiba and ask students to think of suitable annotations to highlight pollution control methods.

Skills notes

Students have practice in designing a flow diagram, and photo annotation.

Assessment suggestions

Using the material in the Student Book on Curitiba, students should answer **Now investigate** question 1 and write an account of all the ways in which Curitiba's city government has managed to fulfil each of the four strategies listed at the top of p. 71 and on **Worksheet 1.30**.

2.1 (1)

Why does where you live make a difference?

Assessment objectives

- Candidates should be able to demonstrate knowledge and understanding of processes contributing to the development of physical environments.
- Candidates should be able to recognise the changes that occur through time in places and landscapes.

0460/2217 syllabus

2.1 Earthquakes and Volcanoes

- Describe the main types and features of volcanoes and earthquakes
- Identify types of volcanoes (including strato-volcanoes [composite core] and shield volcanoes)
- Understand features of volcanoes (including crater, vent, magma chamber)

Differentiated learning outcomes

- **All students must** have a basic knowledge of the structure of the Earth and the theory of plate tectonics (Grade E/D).
- **Most students should** be able to describe the characteristics of the different layers of the Earth and be able to identify the tectonic plate on which their country is found (Grade C/B).
- **Some students could** have a detailed understanding of the different plate names, the characteristics of the plates and the effect of plate boundaries on the formation of fold mountains (Grade A/A*).

Resources

- **Student Book:** pp. 73–5
- **Worksheets:**
2.1 The structure of the Earth
2.2 Creating a supercontinent
- **Photographs:** None
- **Further reading and weblinks:**
News footage of the Montserrat eruption:
www.bbc.co.uk/scotland/education/int/geog/envhaz/volcanoes/impact/index.shtml?ram.name=news
<http://astronomy.uconn.edu/lectures/TheEarthTimelineToiletPaperLesson.pdf>
<http://deeptime.info/>

Key concepts

- The Earth is made up of a number of different layers.
- The topmost layer is known as the crust and is divided into different plates.
- The movement of these plates is responsible for earthquakes and volcanic activity.

Starter suggestions

Begin the lesson by either showing a picture or a video clip of a volcanic eruption (see website suggested above) – Montserrat would link in well with the case study in the Student Book.

Ask students to write down five words to describe their feelings when looking at the volcano. Students should then pair up and share their words, picking five they agree on as the best descriptions. Two pairs should come together and repeat the exercise.

Each group of four should write a 25-word paragraph describing their feelings about the volcano. These should be read to the class and discussed.

Main lesson activities

- 1 Talk students through the geological history of the Earth. Outline that the Earth is very, very old. Geological time will be difficult for some students to understand. Explanations can be made easier using the toilet paper timeline (<http://astronomy.uconn.edu/lectures/TheEarthTimelineToiletPaperLesson.pdf>) or the history of the Earth in one hour (<http://deeptime.info/>).

- 2 Students should complete an annotated diagram showing details of the structure of the Earth (**Now investigate** question 1 on p. 75 of the Student Book). This can be done using the template on **Worksheet 2.1**.
- 3 **Worksheet 2.2** includes a map of the continents. The continents should be cut up into separate pieces, and India separated from the rest of Asia. Students should try to fit the pieces together to make the one supercontinent Pangaea. Discuss how this fits with the theory of plate tectonics outlined in the Student Book.
- 4 Ask students to suggest why the continents do not fit together perfectly. Some may be able explain that the continental shelf is now often covered by the ocean that surrounds the current landmass.
- 5 Students should now feel more confident about completing **Now investigate** question 2. This can be extended by asking students to identify major mountain ranges closest to where they live, and to investigate (using the internet) the rate at which they are growing.
- 6 Using plasticine or papier mache or whatever materials you may have available, get students to make a model of one of the two main types of volcano. They should label their models to show the main features.

Give extra support by allowing students to use an atlas to identify the names of continents and for hints about the supercontinent of Pangaea.

Give extra challenge by getting students to think further about geological time and major geological events in the past (using the internet), or to describe a 'Journey to the Centre of the Earth' as a homework extension essay.

Plenary suggestions

You could use the session as a brief investigation into geological time, to emphasise the effects that plate tectonics have had on our landscapes.

What is the oldest thing that students know of in your local area? Are there any particularly old rocks or mountains? Use the internet to find out about the oldest rocks, fossils, etc. found in your country.

Assessment suggestions

Drawing an annotated diagram of the structure of the Earth, or identifying the names of the tectonic plates on a blank map, provides assessment opportunities.

2.1 (2)

Plate boundaries

Assessment objectives

- Candidates should be able to demonstrate knowledge and understanding of processes contributing to the development of physical environments.
- Candidates should be able to recognise the changes that occur through time in places and landscapes.

0460/2217 syllabus

2.1 Earthquakes and Volcanoes

- Describe and explain the distribution of earthquakes and volcanoes
- Describe the global pattern of plates, their structure, and an awareness of plate movements and their effects – constructive/divergent, destructive/convergent and conservative plate boundaries

Differentiated learning outcomes

- **All students must** know that earthquakes occur because of processes operating at plate boundaries (Grade E/D).
- **Most students should** be able to describe the processes operating at two different kinds of plate boundary (Grade C/B).
- **Some students could** have a detailed understanding of the processes operating at the three most common types of plate margin and know how seismic activity is measured (Grade A/A*).

Resources

- **Student Book:** pp. 75–6
- **Worksheets:**
2.3 The world's greatest earthquakes
2.4 Activity at plate margins
- **Photographs:** None
- **Further reading and weblinks:**
Recent earthquakes:
www.iris.edu/seismon/
Videos and other information:
<https://video.nationalgeographic.com/video/101-videos/earthquake-101>

Key concepts

- The Earth's plates are constantly in motion.
- A number of different processes are operating at the edges where the plates meet.
- It is possible to measure an earthquake but not to predict when it will occur.

Starter suggestions

Revise the structure of the Earth (see the previous lesson). Give the class 60 seconds to draw a diagram of the structure of the Earth showing the four main layers and their names. Swap diagrams to be marked by a partner.

Show a map of the world's tectonic plates with no names. Ask for volunteers to name the seven main plates – this can be done as an individual exercise or could be done quickly in groups with photocopied sheets of the plates.

Ask if anyone can remember why the plates move. Get students to spend two minutes discussing with their partner what will happen at the boundaries where plates meet.

Main lesson activities

- 1 Ask students to examine (or show them) the map of recent earthquake activity found at www.iris.edu/seismon/. They should identify any recent earthquakes near to where they live and find out how strong these earthquakes were. Could these earthquakes be felt? If not, can the students find out why not?
- 2 **Worksheet 2.3** shows a map of the world's plate boundaries. Using an atlas or the internet, students should locate 10 major earthquakes and mark them on the map.

The map can then be annotated with further details, such as date, numbers of deaths/casualties, information about damage caused etc.

- 3 Read in the Student Book the descriptions of the three different types of plate margin. In pairs or groups, students should test each other on what is happening at the different plate margins. They can then use what they have learned to identify, on **Worksheet 2.4**, the different types of margin, and annotate the diagrams with more information.
- 4 Using an atlas or information in the Student Book, students should be able to answer the questions on their own plate boundary in **Now investigate** question 3 on p. 77 of the Student Book.
- 5 Students should read through the section on seismic activity and complete **Now investigate** question 4. This knowledge can then be used as a basis for in-depth research into the way seismic activity is detected:
 - (a) Students should use the internet to find a diagram of a seismometer and make an annotated copy.
 - (b) They should investigate the Richter Scale, discuss what it means and make a list of the world's top 10 earthquakes by magnitude.

Either of these last two tasks would make good opportunities for homework assignments.

Give extra support by allowing groups to work in pairs or groups of mixed ability to complete the more technical challenges.

Give extra challenge by encouraging students to go further with their internet research. They should search sites with no reference to Wikipedia. Challenge them to access information on earthquake distribution from university websites.

Plenary suggestions

Check for understanding of the measurement of the Richter Scale by asking students to explain to a partner how it works (i.e. logarithmically). Ask for a volunteer with a particularly good explanation to present it to the class.

Show the plate tectonic map used at the start of the lesson and check understanding of plate margins by asking for volunteers to identify different types of activity at the margins on the map.

You could also ask why it is difficult to predict when an earthquake will occur.

Assessment suggestions

Assessment can be made by collecting and analysing the worksheets used in main lesson activities 2 and 3 above, or by using the homework suggestions given for activity 5 above.

2.1 (3)

Earthquake – Japan 2011

Assessment objectives

- Candidates should be able to analyse and interpret geographical data.
- Candidates should be able to select and show understanding of techniques for collecting, organising and presenting data.

0460/2217 syllabus

2.1 Earthquakes and Volcanoes

- Describe the causes of earthquakes and their effects on people and the environment
- Understand features of earthquakes (including epicentre, focus, intensity)
- Explain what can be done to reduce the impact of earthquakes

Differentiated learning outcomes

- **All students must** be aware of the earthquake and tsunami that happened in Japan in March 2011 (Grade E/D).
- **Most students should** be able to give some details of the causes, effects and aid response to the disaster in Japan (Grade C/B).
- **Some students could** have a detailed understanding of the Japanese earthquake – its causes, effects, the aid response and the way in which Japan tries to cope with its location in an area of major tectonic activity (Grade A/A*).

Resources

- **Student Book:** pp. 77–9
- **Worksheets:**
2.5 Earthquake-proof building
2.6 Earthquake survival kit
- **Photographs:** none
- **Further reading and weblinks:**
News reports on the Japanese earthquake (see also text below):
www.bbc.co.uk/news/world-asia-pacific-12711226
www.guardian.co.uk/world/blog/2011/mar/11/japan-earthquake

Key concepts

- Japan is located in an area of major tectonic activity.
- There can be many different effects of an earthquake including, in some countries, the risk of tsunami.
- Some countries have developed complex preparation and response mechanisms to help cope with natural disasters.

Starter suggestions

Ask students for their memories of the Japanese earthquake and tsunami. Write any details on the board to be referred to at various points during the lesson.

Show the class some of the maps (www.bbc.co.uk/news/world-asia-pacific-12709598) and video clips from the BBC website. There are excellent opportunities for them to see the effects of the earthquake (www.bbc.co.uk/news/world-asia-pacific-12722105) and tsunami (www.bbc.co.uk/news/world-asia-pacific-12725646).

Main lesson activities

- 1 Read the background to the Japanese earthquake case study in the Student Book on p. 77 and then complete activities **2** and **3** below. These are designed to get students thinking about the level of preparedness in Japan before the earthquake struck.
- 2 Use the template on **Worksheet 2.5** to design an earthquake-proof building. This can be any design that students can come up with, but it should be possible to build it with materials that are currently available, and it should be practical to live in (i.e. no flying houses or ones made out of jelly).

- 3 **Worksheet 2.6** has some ideas of what Japanese people would include in an earthquake survival kit. Students should first identify the pieces of equipment shown and explain why they would be important (e.g. a radio, preferably a battery or self-powered one, to keep up to date with news reports). They can then add extra bits of kit with further explanations.
- 4 You should explain to students, using images and video clips from the websites listed, why the earthquake caused a tsunami. This can also be done using the Student Book. Students can then research the tsunami further either by themselves or in groups.
- 5 Read through the section of text on p. 79 describing how Japan used the internet to help coordinate relief efforts inside the country. Students can then use a blank template to create a social media page for relatives to get in touch with each other following the disaster.

Give extra support by prompting students with suggestions for the design of their earthquake-proof house, or for items to include in their survival kits.

Give extra challenge by asking students to research the long-term effects of the Japanese earthquake, including implications for the country's economy and its infrastructure and the emotional effects on the people who suffered loss of family and property.

Plenary suggestions

Ask students to consider what would happen to their home town if an earthquake struck. Ask them questions such as:

- Would there be a tsunami?
- Which buildings would suffer the most damage and why?
- Where would be the safest places to shelter?
- Would there be any kind of long-term damage or effects?

If there is time, you could take this further and get students to identify, on a map of the town, vulnerable and safe areas.

Assessment suggestions

The assessment should relate to a major case study report under the title 'Japan 2011 – a case study of an earthquake'. This should answer questions such as why the earthquake occurred, and should describe the effects on people and on the landscape.

2.1 (4)

Why live next to a volcano?

Assessment objectives

- Candidates should be able to demonstrate knowledge and understanding of the interrelationships between people's activities and their environment.
- Candidates should be able to make judgements that demonstrate an awareness of the contrasting opportunities for people living in different places.

0460/2217 syllabus

2.1 Earthquakes and Volcanoes

- Describe the causes of volcanic eruptions and their effects on people and the environment
- Demonstrate an understanding that volcanoes present hazards and offer opportunities for people and the environment
- Explain what can be done to reduce the impact of volcanoes

Differentiated learning outcomes

- **All students must** know that people live near volcanoes because of the economic opportunities they provide (Grade E/D).
- **Most students should** be able to give at least two examples of the ways in which people can benefit by living near volcanoes (Grade C/B).
- **Some students could** have a detailed understanding of the economic opportunities (and dangers) found in volcanic landscapes, with reference to a comprehensive case study (Grade A/A*).

Resources

- **Student Book:** pp. 79–81
- **Worksheets:**
2.7 Volcano vacation!
2.8 Effects of the Soufriere Hills eruption on the Caribbean island of Montserrat
- **Photographs:** None
- **Further reading and weblinks:**
A full case study of the Soufriere Hills eruption:
www.bbc.co.uk/scotland/education/int/geog/envhaz/flash/volcanoes/index.shtml

Key concepts

- Volcanic eruptions can cause widespread destruction on a local scale.
- Volcanic landscapes offer a number of different economic opportunities to those people who choose to live nearby.
- The Soufriere Hills eruption had a huge impact on the people of Montserrat.

Starter suggestions

Check student knowledge of recent volcanic eruptions. Can they think of examples from the last few years (especially any local volcanoes)?

Given the destruction caused by volcanoes, ask students to think of reasons why people would choose to live near them. They should write down as many reasons as they can and then compare their list with a partner's.

Brainstorm the ideas from the class and write them down on the board as a reminder during the following activities.

Main lesson activities

- 1 Compare the student list collected in the starter with the first paragraphs in the Student Book. Use the information to answer **Now investigate** question 1.
- 2 Tourism is one economic opportunity offered by volcanic landscapes, as people come to view the volcano (and, possibly, the damage it has caused). Students should use the template in **Worksheet 2.7** to produce a poster advertising a volcanic landscape to potential tourists. They need to think about the kind of activities they could offer (e.g. lava walks, volcano viewing) to make the area attractive to visitors.

- 3 Students should read through the case study information about the Soufriere Hills eruption and, if possible, carry out further research on the internet. In groups (maximum four students) they then need to prepare a script for a TV news report from the scene of the eruption. This should include a news reporter setting the scene, and interviews with various eyewitnesses and victims. The reports should then be performed in front of the class.
- 4 Using **Worksheet 2.8**, students should compile a table of the positive and negative effects of the Soufriere Hills eruption. This can be done using the information from the Student Book. Students could also add information to the table while watching the performances from activity 3 above.

Homework exercise

Now investigate question 3 provides an excellent opportunity for students to produce a piece of creative writing that can be used to assess their understanding of the effects of volcanic eruptions on people.

Give extra support by adding information to the worksheets before copying/handing out to students; that will give them prompts to help them complete the activities.

Give extra challenge by asking students to explain in detail the background to the eruption on Montserrat, naming the plates involved and the type of plate margin, and describing the position of the island in relation to tectonic activity across the region.

Plenary suggestions

Discuss the benefits and problems of living near a volcano. Ask students who would like to live near a volcano, and ask them to justify their answer. What would they do to survive?

You could also ask students to quickly prepare an evacuation plan for what the local council would do if the volcano erupted. How would people be warned of possible evacuation? How would the evacuation take place? Where would people go and how would the authorities reduce panic?

Skills notes

The pages in the Student Book include a map of pyroclastic flows on Montserrat of a type that may be new to students. Details of how to interpret different kinds of map can be found in the Student Book in Topics 4.1 to 4.3.

Assessment suggestions

You could assess the homework exercise outlined above.

2.2(1)

What's the story of your river?

Assessment objectives

- Candidates should be able to demonstrate knowledge and understanding of processes contributing to the development of physical environments.
- Candidates should be able to recognise the changes that occur through time in places and landscapes.

0460/2217 syllabus

2.2 Rivers

- Explain the main hydrological characteristics and processes which operate within rivers and drainage basins
- Understand the characteristics of rivers (including width, depth, speed of flow) and drainage basins (including watershed, tributary, confluence)
- Identify processes which operate in a drainage basin (including interception, infiltration, throughflow, groundwater flow, evaporation, overland flow)
- Demonstrate an understanding of the work of a river in eroding, transporting and depositing

Differentiated learning outcomes

- **All students must** have a basic knowledge of the processes taking place within a river (Grade E/D).
- **Most students should** be able to name some of the processes of erosion, transportation and deposition and explain how they occur (Grade C/B).
- **Some students could** have a detailed understanding of all the processes taking place within a river and a knowledge of how these may vary along a river's long profile (Grade A/A*).

Resources

- **Student Book:** pp. 82–4
- **Worksheets:**
2.9 The long profile of river
2.10 Processes of river erosion
- **Photographs:** None
- **Further reading and weblinks:**
River facts (biased towards the USA):
www.rivers.gov/waterfacts.php

Key concepts

- Rivers, whatever their size, are constantly changing.
- There are many different processes – of erosion, transportation and deposition – taking place in a river and its drainage basin.
- The importance of these processes varies along the length of the river.

Starter suggestions

How many of the world's major rivers do students know about? On the board, brainstorm a list from names given by the class.

Ask students decide which they think are the 10 longest rivers and get them to write them down in order. They can compare their answers with those on the river facts website (address above). Remember to point out that there is some debate about whether the Amazon or the Nile is the longest river in the world.

How many rivers in their own country can students name? Brainstorm again and see if they know which ones are the longest.

Main lesson activities

- 1 Using an atlas, students should find the source and the mouth of the rivers Amazon and Nile. They may need help because there are many tributaries, but they should be able to identify the Amazon's source in southern Peru. They should identify the Nile as having two distinct sources, one in Uganda and the other in Ethiopia.

- 2 Still using the atlas (or perhaps larger-scale maps), students should draw a sketch map of the rivers in their own country. They should include names of the rivers, major towns, and perhaps shading for the high ground where the rivers have their source. Which do they think is the most important river in their country? Ask them to identify it and write a sentence explaining why it is the most important.
- 3 Alternatively, look at **Now investigate** question 2 on p. 84 of the Student Book and ask students to make a sketch of the long profile of their local river or of the most important river in the country. They should include details of major towns and cities and landmarks. **Worksheet 2.9** can be used by students who need extra help.
- 4 Read through the sections in the Student Book on river and drainage basin processes. Students should make a list of all the key words they find in the text, including the names of all the different processes of erosion, transportation and deposition. They should then be given five minutes to learn what the key words mean. Finally, in pairs, they should take it in turn to test each other on the definitions.
- 5 **Worksheet 2.10** shows an example of how to illustrate hydraulic action using an image. Students should complete the worksheet by making sketches for the remaining three processes of river erosion (corrosion, corrasion and attrition).

Give extra support by letting students use **Worksheet 2.9** to complete main lesson activity 3.

Give extra challenge by asking further questions of students completing atlas work in main lesson activity 1. For example: How many countries does the river Amazon pass through? What is the name of the city where the Nile divides into two?

Plenary suggestions

Use the plenary to draw the lesson together by looking at a river's long profile and discussing the processes operating in each of the different sections.

Ask students to identify the three sections – upper, middle and lower – on their long profiles. Question them on where they think the processes of erosion, transportation and deposition are most likely to take place, in order to get them thinking in advance about the content of the next lesson which introduces the river's course.

What factors will influence river processes along the river's course? This question could be considered by students as a homework exercise.

Assessment suggestions

No items are specifically designed here for assessment, but **Now investigate** questions 1 and 3 could be used to check understanding.

2.2(2)

River features (1)

Assessment objectives

- Candidates should be able to demonstrate knowledge and understanding of processes contributing to the development of physical environments.
- Candidates should be able to analyse and interpret, organise and present geographical data.

0460/2217 syllabus

2.2 Rivers

- Describe and explain the formation of the landforms associated with the work of a river
- Understand forms of river valleys – long profile and shape in cross section, waterfalls, potholes, meanders, oxbow lakes, deltas, levées and flood plains

Differentiated learning outcomes

- **All students must** have a basic knowledge of one of the common features found in each course of a river (Grade E/D).
- **Most students should** be able to describe a variety of river features and explain how they were formed (Grade C/B).
- **Some students could** have a detailed understanding of how the various river processes influence the development of different features at different stages along a river's course (Grade A/A*).

Resources

- **Student Book:** pp. 84–6
- **Worksheet:**
2.11 Identifying river features from grid references on maps
- **Photographs:**
Images of waterfalls, meanders and oxbow lakes from:
www.slideshare.net/whiskeyhj/river-changes-and-landforms
<https://slidegur.com/doc/3065001/river-studies---geointeractive>
- **Further reading and weblinks:**
Diagrams, video clips of river features:
www.bbc.co.uk/bitesize/standard/geography/rivers/river_forming/revision/1/

Key concepts

- Rivers are divided into three different courses – upper, middle and lower.
- Different processes operate in different parts of the river.
- These processes create a number of very distinct landscape features.

Starter suggestions

Begin with a revision exercise to see how much students can remember about river processes – erosion, transportation and deposition.

Divide the class into groups of three and tell students to assign themselves a number 1, 2 or 3. Send number 2s and 3s out of the classroom.

Tell number 1s they have three minutes to start a spider diagram showing details of all the river processes they studied in the previous lesson. When time is up, send them out and invite in number 2s for two minutes, then repeat for number 3s.

Get the whole group back in and give them two minutes to add any missing detail, then have groups compare their diagrams for five minutes to judge how complete they are.

Main lesson activities

- 1 Split the class in two, with half studying the sections in the Student Book on features in the upper course, and half studying features in the middle course. Students from the different groups should then pair up and act as teacher and pupil, telling their partner about the formation of the features they studied.

- 2 Give the class large-scale maps of a section of their own country (or any other country you may have sufficient maps for). Students need to find at least one river, trace its course and identify features of the upper and middle courses including: V-shaped valleys, waterfalls, tributaries, meanders, oxbow lakes. They should be encouraged to give proper grid references for the features they find.
- 3 After identifying 10 different features, they should write the grid references for these in the table on **Worksheet 2.11**. They should then swap their own worksheet with another member of the class and see if they can identify the features from the grid references.
- 4 Show images of waterfalls, meanders and oxbow lakes. These can either be displayed on the board or handed out as individual pictures. Students should make field sketches from the images, labelling the individual features and including details of the processes that have caused their formation.

Homework/ extension exercise

Ask students to research a famous waterfall of their choice, looking at its formation and history. They could either write a report or present their findings to the class in the next lesson.

Give extra support by providing students with clues to what they should be including in their spider diagram in the starter exercise.

Give extra challenge by ensuring that students include adequate detail about the processes involved in landscape formation when drawing diagrams showing river features.

Plenary suggestions

The plenary session could be used to discuss the different shapes of a river in its upper and middle courses, and the influence that rock type has on different features.

This can be done with reference to **Now investigate** questions 1 and 3. Students might answer by sketching diagrams or through a classroom discussion.

Students could then finish the lesson by completing the two questions.

Skills notes

This lesson helps students practise a number of important geographical skills including drawing field sketches and annotated diagrams, identifying features from maps and reading map grid references.

2.2(3)

River features (2)

Assessment objectives

- Candidates should be able to demonstrate knowledge and understanding of processes contributing to the development of physical environments.
- Candidates should be able to analyse and interpret, organise and present geographical data.

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2.2 Rivers

- Describe and explain the formation of the landforms associated with the work of a river
- Understand forms of river valleys – long profile and shape in cross section, waterfalls, potholes, meanders, oxbow lakes, deltas, levées and flood plains
- Demonstrate an understanding that rivers present hazards and offer opportunities for people

Differentiated learning outcomes

- **All students must** have a basic knowledge of one of the common features found in the lower course of the river (Grade E/D).
- **Most students should** be able to describe a variety of river features from the lower course and explain how they were formed (Grade C/B).
- **Some students could** have a detailed understanding of how the various river processes influence the development of features in the lower course and be able to relate this knowledge to a global case study (Grade A/A*).

Resources

- **Student Book:** pp. 86–9
- **Worksheets:**
2.12 River features Keyword Bingo
2.13 River deltas around the world
- **Photographs:**
2.1 Satellite image of the Mekong delta
2.2 Rice farming in the Mekong delta
2.3 Hydro-electric power on the Nam Tha river, Laos
- **Further reading and weblinks:**
More detail on the river features found in the lower course can be found at:
www.bbc.co.uk/schools/gcsebitesize/geography/water_rivers/river_landforms_rev3.shtml

Key concepts

- Deposition is the dominant process in the lower course.
- This deposition leads to very distinctive river features.
- The lower course of the river often provides a number of economic opportunities.

Starter suggestions

Re-cap the main learning that has taken place so far in the rivers theme.

You could do this as an informal test on keywords, giving definitions of processes involved in river landscape formation and asking for the names of features found in the upper and middle courses.

This could also be done as Keyword Bingo using **Worksheet 2.12**. Make up descriptions for the various keywords shown on the grid and tell students to cross them out when they identify the keyword from your description. In theory, because everyone has the same bingo card, they should all shout 'BINGO' at the same time.

Main lesson activities

- 1 Students should read through the section in the Student Book on flood plain formation. They can then draw a cross-section diagram showing the formation of a flood plain and add detailed labels. The diagram should include details of the build-up of alluvium and the formation of levees.

- 2 Give the class large-scale maps of a section of their own country (or any other country you may have sufficient maps for). Students need to find at least one river and identify its lower course. They should write a detailed description of what the flood plain is like and what happens to the river at its mouth (if it has one). Students should also look at the kinds of land use taking place on the flood plain and include information about this in their description.
- 3 Use the BBC website (address above) to show students three different types of river delta. The three types are also shown on **Worksheet 2.13**. Using the templates shown on the worksheet, and with reference to an atlas, students should try to find examples of the different types of delta from countries around the world.
- 4 Students should complete the questions in the **Now investigate** section on p. 89 of the Student Book. If possible, this could be done by getting out into the local area to look at the nearest river and completing the fieldwork suggestions.
- 5 Read through the case study on the Mekong delta in Vietnam. Students should draw a sketch map of the region in the centre of a large piece of paper (using the images in the Student Book, from an atlas or the internet). They should then annotate their sketch map with details of the course of the river, identifying any obvious physical features and adding information on the land use in the surrounding area.

Give extra support by pairing students up for the starter exercise, and providing a simplified image of the Mekong delta which they could copy for main lesson activity 5.

Give extra challenge by changing main lesson activity 5 to give students the opportunity to choose which river delta they would like to study, giving them responsibility for sourcing all the relevant images and information.

Plenary suggestions

Have a final round-up of all the things students have learned about river processes and river features. This could be done as a brief question-and-answer session, as an informal test, or by getting students to write the questions themselves to test their classmates.

Skills notes	This lesson helps students practise a number of important geographical skills including field sketching, drawing annotated diagrams and identifying features from maps and atlases.
Assessment suggestions	Both main lesson activities 1 and 5 provide opportunities for assessment of student work, knowledge and research capability (in activity 5).

2.2(4)

The world's great rivers

Assessment objectives

- Candidates should be able to demonstrate knowledge and understanding of the interrelationships between people's activities and the total environment.
- Candidates should be able to make judgements that demonstrate a concern for landscape, the environment and sustainable development.

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2.2 Rivers

- Demonstrate an understanding that rivers present hazards and offer opportunities for people
- Identify causes of hazards, including flooding and river erosion as well as opportunities of living on a flood plain, a delta or near a river
- Explain what can be done to manage the impact of river flooding

Topic link: For more detail on the causes and impacts of river flooding see Topic 2.5 on pp. 133–5.

Differentiated learning outcomes

- **All students must** have a basic knowledge of one of the world's major rivers (Grade E/D).
- **Most students should** be able to describe how some of the river processes they have studied are responsible for the formation of the Mississippi river landscape (Grade C/B).
- **Some students could** have a detailed understanding of the formation of the Mississippi river, the impact of human activity and the need for careful management of the river's drainage basin (Grade A/A*).

Resources

- **Student Book:** pp. 89–91
- **Worksheets:**
2.14 The Mighty Mississippi
2.15 Mississippi flood plain
- **Photographs:** None
- **Further reading and weblinks:**
National Geographic has a detailed guide to the Mississippi at:
<http://travel.nationalgeographic.com/travel/unit-ed-states/mississippi-guide/>

Key concepts

- River processes and landscape features are all found on the world's greatest rivers.
- Rivers need careful management to combat some of the effects of human activities.
- The Mississippi provides a good case study of a world-famous river.

Starter suggestions

Find a map of the United States of America in the atlas.

Students should look at the map closely and try to identify the five biggest rivers in the USA. They could also look for any common features (such as the direction in which the rivers flow and their source areas).

The lists they come up with should comprise the following: Missouri, Mississippi, Yukon, Rio Grande, St Lawrence (others mentioned may include the Colorado and the Arkansas).

Where do these rivers come from? Write the names of the five longest rivers on the board and see if students can find the sources using the atlas.

Main lesson activities

- 1 The Student Book lists some interesting facts about the Mississippi river (figure A). Challenge the students to find others, using the internet. They should not limit themselves to facts only about the river itself, but look for information about the people and animals that use it.

- 2 Using the blank map of the USA on **Worksheet 2.14** as a base, students should draw the course of the Mississippi river from source to mouth. They should then read through the details of the case study in the Student Book and, consulting an atlas, annotate their map with details of features along the river's course. They should also mark the major towns and cities – especially those further down the river that are particularly liable to flooding.
- 3 Ask students, working in groups, to consider the following questions, to be answered in a class discussion. They can use details from the Student Book and, if possible, from the internet, to help them think about their answers:
 - Which areas of the Mississippi are most likely to flood and why?
 - What kinds of human activity will be taking place on the flood plain?
 - Is it worth paying the money needed to keep putting prevention measures in place in order to stop the flooding?
- 4 Students can also look at the example of Hurricane Katrina in the Student Book (p. 132). Again working in groups, they can discuss the impact of the hurricane on the flooding of the Mississippi, and include points from their discussion in the plenary.

Notes for all these questions can be made on **Worksheet 2.15**.

Give extra support by thinking carefully about the make-up of the groups for the main lesson activities **3** and **4**.

Give extra challenge by asking students to draw a sketch map of the course of the Mississippi on blank paper, rather than supplying them with the worksheet template.

Plenary suggestions

Students should use their notes from the main lesson activities **3** and **4** to engage in a class discussion about flooding on the Mississippi river.

The discussion should concentrate on the impact of human activity and how careful management can be used to reduce the effects of severe flooding.

Skills notes	This lesson helps students practise a number of important geographical skills including field sketching and research techniques using the internet.
Assessment suggestions	Students could be given time at home to complete a detailed case study project on the Mississippi and, especially, on either the impact of human activity or the flooding caused by Hurricane Katrina. They could include the map they completed for main lesson activity 2 .

2.3(1)

How and why is your coastline changing?

Assessment objectives

- Candidates should understand the types of waves and the components of waves, swash and backwash.
- Candidates should understand the erosional processes of wave action: corrasion (abrasion), hydraulic action, corrosion (solution) and attrition.
- Candidates should be able to describe the landforms associated with these processes.

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2.3 Coasts

- Demonstrate an understanding of the work of the sea and wind in eroding, transporting and depositing

Topic links: There is more information relating to earthquakes and tsunamis in Topic 2.1 pp. 77–9, and to processes of erosion in Topic 2.2 pp. 82–4.

Differentiated learning outcomes

- **All students must** use annotated diagrams to represent coastal processes and landforms (Grade E/D).
- **Most students should** know a range of coastal landforms and how they were formed (Grade C/B).
- **Some students could** have a wide-ranging knowledge of process and landform (Grade A/A*).

Resources

- **Student Book:** pp. 92–4
- **Worksheet:**
2.16 Weathering and erosion of a headland
- **Photographs:**
2.4–2.7 Coastal scenes
2.8 The Foreland, Dorset
- **Further reading and weblinks:**
None

Key concepts

- The size and power of waves is controlled by the strength of the wind, the length of time it has been blowing and the length of the fetch.
- Waves can be either destructive or constructive.
- The coastline is affected by both erosion and weathering processes.

Starter suggestions

Ask students to think of coastlines with which they are familiar. This could be in their home country or elsewhere. They should consider what makes these areas distinctive in terms of both physical and human geography. Aim to get a range of answers.

Main lesson activities

- 1 Photo exercise: study the four photos **A** on p. 92 of the Student Book (photos **2.4–2.7** from the downloadable resources). Ask students to identify the key differences between these.
- 2 Teach students about the formation of waves. The text gives the main facts; use key terms like swash and backwash, friction, toppling over, breaking, perpendicular. Students could draw a simple diagram of a wave to show its main characteristics: wave height, wavelength, wave front, crest and trough. Make sure students understand that waves are simply the movement of energy through the water, that the water does not move forward out at sea, but just moves up and down as the wave passes. The water only moves forward as the wave approaches the beach and the wave depth becomes greater than the water depth.
- 3 Defining fetch: map **B** on p. 93 of the Student Book shows the longest fetches affecting the different coastlines of the British Isles, depending on the wind direction. Using an atlas, ask students to identify the longest fetch for the British Isles. Waves approaching the south-western coasts of Ireland, Wales and England have the whole of the width of the Atlantic over which to travel and build up. This

is why Cornwall, the most south-westerly county in England, is famous for its surfing tourism.

Ask students to find a map in the atlas showing their own country (or the nearest country with a coastline) to try to identify the fetch for different wind directions.

- 4 Constructive and destructive waves: use diagram C to teach the key facts about constructive and destructive waves. Read the text in the Student Book and ask students to explain what is happening in the diagram.

Students should read the text on this topic which links to constructive and destructive waves and the actions of these. Ask students to write down the definitions of attrition, corrasion (abrasion), corrosion (solution) and hydraulic action. These are already defined in Topic 2.2 on p. 83 in the Student Book. Conclude clearly that constructive waves are associated with deposition (they build up beaches) and that destructive waves are associated with erosion (they destroy beaches).

- 5 Use **Worksheet 2.16** and photo 2.8 from the downloadable resources to give students further practice in the skill of sketching from a photo and accurately labelling a diagram. You could display this photo first and discuss the following questions with the whole class:

- (a) What types of weathering are taking place on this headland?
- (b) What are the differences between the impacts of weathering and those of erosion on this headland?

Give extra support by using **Now investigate** question 2 to place the coast in context for weaker students.

Give extra challenge by asking students to research other headlands around the world.

Plenary suggestions

Bring students back to the coastline/s first discussed at the start of the lesson. Summarise their features in the light of the content of this lesson.

They could complete **Now investigate** question 5 associated with the four photos A in small groups to allow some discussion. Each group can then bring its ideas back to the class as a whole.

Use the text to list briefly the factors that cause changes along coastlines.

Skills notes	Students have practice in interpreting and explaining diagrams, sketching from a photo and annotating photos and diagrams.
Assessment suggestions	Now investigate questions 4–5 provide opportunities for assessment. An alternative is to draw a series of annotated sketches to tell the story of how the processes of weathering, erosion and deposition take place. They should draw their sketches without direct reference to diagrams in the Student Book, or any previous diagrams they may have drawn.

2.3(2)

Coastal erosion

Assessment objectives

- Candidates should be able to describe and explain the processes of coastal erosion.
- Candidates should be able to draw annotated diagrams to illustrate each process and its associated landforms.
- Candidates should be able to use case studies to provide examples of each coastal process and its associated landforms.

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2.3 Coasts

- Demonstrate an understanding of the work of the sea and wind in eroding, transporting and depositing
- Describe and explain the formation of the landforms associated with these processes
- Describe cliffs, wave-cut platforms, caves, arches, stacks, bay and headland coastlines

Differentiated learning outcomes

- **All students must** know a range of erosive processes and the consequent landforms (Grade E/D).
- **Most students should** be able to study an annotated diagram and work out the order of events and processes happening (Grade C/B).
- **Some students could** identify landforms of erosion and know which are the relevant processes in their formation (Grade A/A*).

Resources

- **Student Book:** pp. 94–6
- **Worksheets:** None
- **Photographs:**
2.8 The Foreland, Dorset
2.9 Coastal slumping at Holderness
Photos of the following contrasting coastal locations can be found on Google images by putting in the key names: e.g. West Cliff, Burton Bradstock, Dorset; East Cliff, Burton Bradstock, Dorset; Morecambe Bay, Lancashire; the West Sands, St Andrews, Fife; Beachy Head, East Sussex.
- **Further reading and weblinks:**
<http://parkweb.vic.gov.au/explore/parks/port-campbell-national-park>
www.lonelyplanet.com/australia/victoria/port-campbell-national-park

Search Google using these key words: 'Burton Bradstock 2014' and 'Birling Gap cliffs 2014'

Key concepts

- There are four categories of coastal erosion: abrasion, attrition, hydraulic action and solution. These processes operate together to erode a coastline.
- Features typical of an eroded coastline are cliffs, wave-cut notches, wave-cut platforms, caves, arches, stacks and stumps.

Starter suggestions

Ask students what factors they think might have affected the shape and landforms of a coastline well known to them, or one they can see clearly in a photo. Suitable photos are photos 2.8 and 2.9 from the downloadable resources. Further images are suggested above from Google Images (note that 'Burton Bradstock beach' shows both vertical sandstone cliff photos, i.e. West Cliff, and very gentle clay cliffs, i.e. East Cliff). Can students identify any relevant processes?

List the factors suggested by the students. This leads into main lesson activity 1.

Main lesson activities

- 1 Compare the factors suggested by the students with the factors in the Student Book on p. 94. How many did they manage from this list? The key points should be noted.

2 Development of bays and headlands: use diagram **A** on p. 94 to think about why bays and headlands form. Ask students to write a clear description of exactly what this diagram shows (note: this is a description only – no explanation is needed yet). Then ask students to offer explanations, the key one here being the alternate bands of more and less resistant rock types.

3 Cliff retreat and the formation of wave-cut notches and wave-cut platforms: refer again to photo **2.9** and the researched photo of East Cliff, Burton Bradstock, Dorset (showing cliffs formed in soft rock), then to their researched photos of Beachy Head, East Sussex, and of West Cliff, Burton Bradstock, Dorset. Ask students to identify the key differences and to suggest the reasons for these differences. Use the suggested key words in Google or another search engine.

Diagram **B** shows the forces at work in eroding the cliff line and creating the wave-cut notch and wave-cut platform. Ask students to explain the processes shown in the diagram, getting the stages in the right order. They should make clear notes on the order of events here, or they could number the processes on their own copy of the diagram.

Ask students to decide whether cliff lines of soft rock, or those of harder rock, are eroded more quickly and why. Use the **Fantastic fact** to illustrate just how fast a soft rock cliff line really can retreat.

4 Slumping and lines of weakness within a cliff line: look again at the Holderness and East Cliff, Burton Bradstock photos. Direct students to identify the process of cliff slumping from the evidence for these soft rock cliff lines.

Look again at the photo of West Cliff, Burton Bradstock. There are clear cracks within the cliff. These are lines of weakness (faults). The sea finds it easier to erode along these lines and they are often the starting point for caves. Ask students to interpret what they see in the photo in this context. Refer back to the 2014 winter storm photos above, to show that even harder rocks can collapse dramatically. This will lead the lesson on to diagram **C** on p. 95.

5 Erosion of a headland: use diagram **C** to help students work out the processes affecting a headland, from cave formation at weak points (cracks and fault lines) through arches, stacks and stumps. Ask students to write down a clear order of events to go with their own copy of this diagram.

6 Example of coastal erosion on the Australian coast: read the text on Port Campbell National Park. Students should try to link each named location to the feature of which it is an example.

Give extra support by practising annotation of photos and diagrams so that students easily recognise the different landforms.

Give extra challenge by encouraging students to research the Port Campbell National Park coastline further, as suggested in the Student Book. Two websites are suggested above as a starting point.

Plenary suggestions

Use photos **D** and add the labels, working together as a class or in groups.

Skills notes	Students have practice in the interpretation of photos and diagrams.
Assessment suggestions	The Now investigate questions offer opportunities for assessment.

2.3(3)

Coastal transportation and deposition

Assessment objectives

- Candidates should be able to describe and explain the processes of coastal transportation and deposition.
- Candidates should be able to draw annotated diagrams to illustrate each process and its associated landforms.
- Candidates should be able to use case studies to provide examples of each coastal process and landform.

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2.3 Coasts

- Demonstrate an understanding of the work of the sea and wind in eroding, transporting and depositing
- Describe and explain the formation of the landforms associated with these processes
- Describe beaches, spits, and coastal sand dunes

Differentiated learning outcomes

- **All students must** be able to annotate photos and diagrams with basic information and have a simple understanding of the formation of some coastal deposition features (Grade E/D).
- **Most students should** be able to use longer, more detailed annotations and should know the order of events in the formation of key deposition features (Grade C/B).
- **Some students could** have a detailed knowledge of a wide range of coastal deposition features (Grade A/A*).

Resources

- **Student Book:** pp. 96–8
- **Worksheets:**
2.17 How do groynes control longshore drift?
2.18a) and b) Salt marsh development behind bars and spits
- **Photographs:** Images of the following locations can be found on Google images by putting in the key names: Slapton Sands, Devon, UK (a bar); Chesil Beach linking to the Isle of Portland, Dorset, UK (a tombolo)
- **Further reading and weblinks:**
www.chesilbeach.org
http://en.wikipedia.org/wiki/Slapton_Ley
This website offers useful revision on coastal processes and landforms:
www.bbc.co.uk/schools/gcsebitesize/geography/coasts/

Key concepts

- Longshore drift is the most important means of beach deposits being transported along the shore.
- This process leads to a number of coastal deposition features: spits, bars, lagoons, tombolos.

Starter suggestions

Revise transportation of beach material up and down the beach (swash and backwash) from pp. 93 in the Student Book. **Now investigate** question 1 supports this activity.

Main lesson activities

- 1 Take the starter suggestion a stage further by teaching the transportation process of longshore drift. The labelling on diagram A on p. 97 shows the order of events clearly. Students should have their own copy of this figure on which they can write down the sequence of pebble movements and understand the reasons for these.
- 2 How can we recognise where longshore drift is happening? Ask students to identify one method from the Student Book (e.g. the presence of groynes – see photo B). The way groynes work can be further explored using **Worksheet 2.17**.

- 3 Spit formation: teach the details of how longshore drift can form spits: where the angle of the coastline changes, or where there is an estuary. Photo **D** on p. 98 will help here.

Ask students to work in small groups and to do the following:

- Write the order of events in the formation of a spit.
- Decide what factors limit spit development.
- Decide why spits often have a hook on their end.

Students should research a photo of another spit, draw a field sketch from this and label/annotate it appropriately. This could be a homework activity.

- 4 Bars and tombolos: these features could be thought of as being a stage further on from spits. In the case of a bar, the spit develops right across a bay and links the two headlands at either side. The lagoon formed can be understood by using diagram **E** on p. 98 of the Student Book. A tombolo is similar, except that the spit attaches to an offshore island.

Ask students to go onto Google images and search for 'Slapton Ley' and 'Chesil Beach tombolo'. There are plenty of useful photos of Slapton Sands and Chesil Beach, both located on the south coast of England. These will help students to visualise these landforms really clearly. Note that a road has been built across the causeway of Chesil Beach, for use by people who live on the Isle of Portland. This tombolo is now a much more permanent feature. **Now investigate** question 2 is useful here.

- 5 **Worksheet 2.18** is a way of teaching about salt marsh development behind spits and bars. A sketch of each situation is included, with a list of annotations. Arrows are already drawn in the correct positions. Students need to match the annotations to arrows and work out the order of events in the process.

Extension activity

As an extension activity for homework, students could research the salt-tolerant plants that thrive on a salt marsh, and the wildlife living in its ecosystem.

Give extra support by providing the labels for students to complete the diagram on **Worksheet 2.17**. Move students into pairs or groups to work on **Worksheet 2.18** so that stronger students support the weaker ones, especially for the order of events questions.

Use the BBC Bitesize website (address above) as revision for all students – it is especially helpful for weaker members of the class.

Give extra challenge by removing the labels provided on **Worksheet 2.18**. Ask students to make up similar questions based on other coastal landforms.

Plenary suggestions

Test key words introduced in the lesson, such as landform names; also *halophyte*, *groynes*, *marram grass*.

Ask students to find named examples of landforms on pp. 96–8.

Skills notes

Students have practice in photo interpretation, drawing a field sketch from a photo, annotation, and sequencing information.

Assessment suggestions

Now investigate question 3 tests students' work on **Worksheet 2.18**. Question 4 tests annotation skills.

2.3(4)

A coastline of deposition

Assessment objectives

- Candidates should be able to use case studies to provide examples of each process and landform of deposition.
- Candidates should be able to use maps to identify and describe landforms and to predict the likely processes operating in a certain area.

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2.3 Coasts

- Describe and explain the formation of the landforms associated with deposition

Differentiated learning outcomes

- **All students must** use maps to identify simple coastal landforms (Grade E/D).
- **Most students should** be able to identify a range of coastal landforms on maps (Grade C/B).
- **Some students could** link the various landforms on this map exercise together (Grade A/A*).

Resources

- **Student Book:** pp. 99–100
- **Worksheets:** None
- **Photographs:**
2.10 Omara Spit, North Island, New Zealand
- **Further reading and weblinks:**
www.satelliteview.co
(select New Zealand/Auckland/PEN - peninsula)

Key concepts

- Landforms can be identified using map sources.
- There are key differences between landforms of erosion and of deposition.

Starter suggestions

Revise the map skills that are needed in this lesson: basic map reading skills (see Topic 4.1 pp. 236–7 in the Student Book) and drawing sketch maps based on part of a map.

Main lesson activities

- 1 Ask students to study the map **B** on p. 100 and to identify features of the physical landscape, land use and settlement. This area of North Island, New Zealand, could be located using an atlas to give this work a broader context.

The website address above gives images/maps of Omara Spit that will give greater depth to this study.

- 2 Now refer to photo **A** on p. 99 the Student Book (photo **2.10** from the downloadable resources). Ask students to use both the photo and map **B** as a basis to describe the landscape and characteristics of this depositional landform in as much detail as they can. This would be best done as individuals or in pairs. Students' work could be read out in class and classmates asked to give a mark or grade for each other's efforts. It is always good for students to assess the work of others as it gives an insight into their own level and rate of progress.

- 3 Questions on the map are set out in the **Now investigate** section. Everyone should try question **1** on their own and compare answers.

Question **2** would be best completed as a small group or whole class exercise as students may manage to find more than five possible answers. The quality of the evidence also needs to be assessed.

Questions **3**, **4** and **5** could be done in class, but in planning this lesson, bear in mind that they would also make a useful test exercise for the end of the coastline topic within the Landforms and landscape processes section of the syllabus.

Question 6 makes a useful supplementary case study exercise and could be done on any scale in class, depending on your computer access.

Give extra support by using this lesson as an opportunity for mapwork revision for those who find this type of work difficult.

Give extra challenge by encouraging students to link what can be seen on map B, photo A, and the map and satellite image on the website suggested above.

Plenary suggestions

It is possible to link the physical and human characteristics of Omara Spit together using the visual materials in this lesson plan. Encourage students to think about what land uses they can identify and to suggest reasons for these activities being in this location.

Skills notes	
	Students have practice in mapwork and in interpreting a satellite image.
Assessment suggestions	Any of the written questions in the Now investigate section can be assessed.

2.3(5)

Coral reefs and mangrove swamps

Assessment objectives

- Candidates should be able to describe the conditions required for the development of coral reefs and mangrove swamps.
- Candidates should be able to describe the appearance of the three main types of reef and of mangrove vegetation.

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2.3 Coasts

- Describe the coral reefs and mangrove swamps and the conditions required for their development

Topic link: see Topic 3.4 on pp. 181–8 for more information on tourism in coastal regions.

Differentiated learning outcomes

- **All students must** know there are three types of coral reef and recognise some of their differences and know what a mangrove looks like (Grade E/D).
- **Most students should** be able to describe conditions for the formation of a coral reef and recognise and describe the three main types of reef and a typical mangrove swamp (Grade C/B).
- **Some students could** describe and explain the conditions required for the formation of a coral reef and recognise the difference between fringing reefs, barrier reefs and atolls; they should be able to explain the formation of each type of reef. In addition, different types of mangroves should be recognised (Grade A/A*).

Resources

- **Student Book:** pp. 101–3
- **Worksheet:**
2.19 Types of coral reef
2.20 Why are coral reefs so important?
- **Photographs:**
2.11 A healthy coral reef
2.12 The polyps that create coral
2.13 Fringing reef
2.14 Barrier reef
2.15 Atoll
2.16 Red mangrove
2.17 White mangrove
- **Further reading and weblinks:**
<http://coral.org/coral-reefs-101/why-care-about-reefs/>
www.arkive.org
www.photolib.noaa.gov/reef
<http://ocean.si.edu/corals-and-coral-reefs>
www.learningfromthesea.yolasite.com
www.bbc.co.uk/nature/habitats/
<http://oceanservice.noaa.gov/facts/>

Key concepts

- Coral reefs are unique and valuable ecosystems that provide safe coastal zones and economic activities.
- Coral reefs are under threat from certain human activities.
- Mangrove swamps anchor coastal sand and sediment, help soil to accumulate and provide shelter and food for many marine species.

Starter suggestions

Ask students what they think a coral reef is. The way in which you phrase this will depend on where you are in the world and therefore whether students will have any direct experience of reefs. They could look at the first paragraph of text in the Student Book to help them. This refers to the economic value of coral reefs and you could tie this in with the **Fantastic fact**, which places a monetary value on them.

Main lesson activities

- 1 Defining the term 'coral'. Use the definition in the Student Book to differentiate between the tiny marine organisms and the reef structures they create. The photos **A** on p. 101 are useful here (photos **2.11** and **2.12** from the downloadable resources). Students should note the material of which the reef structure is built (calcium carbonate) and the function of algae (giving colour to the reef).

- 2 What are the ideal environmental conditions in which coral reefs develop? Students should use the text to make a list of these as in **Now investigate** question 1. The distribution map **B** could be useful as a reference here, but can be explored more thoroughly in the next lesson activity.
- 3 The global distribution map **B** on p. 101 can be used here for extra practice in describing distributions. At the same time it will help you teach students where the coral reefs at risk are located.
- 4 For each of the three basic types of coral reef – fringing reef, barrier reef and atoll – students should note down a description of appearance and any other key characteristics. The text in the Student Book, with photos **C** (photos 2.13 to 2.15 in the downloadable resources), will help them to do this. Students could compare notes and descriptions, and in this way the weaker students can be helped by the more able ones. **Worksheet 2.19** helps students to understand fringing reefs.

Now investigate question 2 is a useful focus for this part of the lesson.
- 5 The main threats to coral reefs: reefs provide protected coastline areas and so attract economic activities including tourism, as stated in **Worksheet 2.20**. Students could make a basic list of the threats to reefs using the worksheet and then research these further, perhaps in groups, later comparing notes. This might also be used as a homework activity with ideas and examples being brought back to a subsequent lesson.
- 6 **Extension activity:** further research on the species that thrive in coral reefs and the impact of human activity, e.g. tourism, can be pursued as a homework activity (see the websites above).
- 7 Read the text on p. 102 in the Student Book on the characteristics of mangrove swamps and the conditions for their growth. Photo **D** on p. 102 (photo 2.16 from the downloadable resources) will help here. Discuss in groups to determine the five key characteristics of mangroves which make them a unique ecosystem. In what ways are mangroves especially useful to people?

Give extra support by revising the key differences between the three types of coral reef.

Give extra challenge by encouraging students to link the list of environmental conditions that encourage coral growth with the characteristics of the locations of coral development on the world map (this ties in with main lesson activity 3).

Plenary suggestions

Test students quickly on key terms relating to coral reefs and mangroves.

Students should decide whether they think coral reefs are doomed.

Skills notes	Students have practice in describing distribution, and in the interpretation of photos and distribution on a world map.
Assessment suggestions	Now investigate question 3 serves as a useful exercise on threats to both coral reefs and mangroves. It uses some of the material from the lesson and extends it.

2.3 (6)

A world famous coastline

Assessment objective

- Candidates should be able to use a case study to illustrate their understanding of coral reef ecosystems.

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2.3 Coasts

- Demonstrate an understanding that coasts present hazards and offer opportunities for people
- Identify hazards including coastal erosion and tropical storms
- Outline the opportunities presented by an area of coastline, the hazards associated with it, and their management

Differentiated learning outcomes

- All students must** have some knowledge of one coral reef case study (Grade E/D).
- Most students should** be able to recall specific information about one coral reef area (Grade C/B).
- Some students could** have detailed case study knowledge of at least one coral reef region (Grade A/A*).

Resources

- Student Book:** pp. 103–5
- Worksheet:** 2.21 Case study of an atoll
- Photographs:** None
- Further reading and weblinks:**
A good general site with images:
http://en.wikipedia.org/wiki/Great_Barrier_Reef
A very good site on natural history and tourism opportunities with video clip:
www.greatbarrierreef.org
Search for Great Barrier Reef at:
www.nationalgeographic.com
<http://en.wikipedia.org/wiki/Aldabra>
 (for **Worksheet 2.21**)

Key concepts

- Coral reefs vary greatly in scale.
- Some reefs are the focus of huge tourist interest.
- Coral reefs are threatened by both physical and human impacts.
- It is possible to protect coral reefs, although this is not easy.

Starter suggestions

Ask students to Google 'Great Barrier Reef' images to see what they can find in terms of photos of coral and wildlife. Read the first paragraph of the case study in the Student Book text. The class should discuss their findings from these sources.

Main lesson activities

- Use **Now investigate** question 1. Students should research photos/diagrams of healthy and bleached corals, aiming to discover the different characteristics and appearance of each and the ways of improving coral growth. Create the display if you have time and space.
- Threats to the Great Barrier Reef:
 - Climate change/rising sea temperature
 - Pollution and declining water quality
 - Effects of nutrient pollution
 - Overfishing

- (e) Shipping
- (f) Tourism
- (g) Climate, e.g. tropical storms and changing sea levels

For each of these, use the Student Book text to expand students' knowledge of each issue. Extra internet research is possible: look at the suggested websites above which refer to the Great Barrier Reef to discover more.

A class discussion at the end of this activity would bring ideas together effectively.

- 3 Use **Worksheets 2.21a) and b)**. Answer the questions posed and use it as a lead into **Now investigate** question 2, creating a short brochure for tourists visiting a coral reef. If necessary, explain to them what is meant by a Code of Good Practice.
- 4 Make sure that students have a good set of notes on the characteristics, threats and management of Australia's Great Barrier Reef.

Give extra support by discussing the Great Barrier Reef in class so that students understand its characteristics and importance.

Give extra challenge by asking students to research a fringing reef case study in the same way as the atoll has been covered in **Worksheet 2.21**.

Plenary suggestions

In groups, ask students to summarise the key characteristics and status of the Australian Great Barrier Reef.

Skills notes	Students have practice in photo interpretation, internet research and the creation of a case study.
Assessment suggestions	Now investigate question 3 provides a useful assessment of the issues students have looked at in this lesson.

2.4(1)

What is the weather like where you are today?

Assessment objectives

- Candidates should be able to define the differences between the terms 'weather' and 'climate'.
- Candidates should be able to describe the distribution of the world's main climate zones.
- Candidates should be aware of the impact of weather on their own lives.

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2.4 Weather

- Use and interpret graphs and other diagrams showing weather and climate data
- **Topic links:** see Topic 2.5 p. 116 and p. 119 for more practice in describing distribution on a map; see Topic 4.3 for information on the construction of climate graphs.

Differentiated learning outcomes

- **All students must** know the basic differences between 'weather' and 'climate' and be able to identify world climates using the global distribution map (Grade E/D).
- **Most students should** know the differences between 'weather' and 'climate' and be able to describe the pattern of climate types around the world (Grade C/B).
- **Some students could** state clearly the differences between 'weather' and 'climate', and describe the distribution of the Earth's major climate regions with or without a world map to help them (Grade A/A*).

Resources

- **Student Book:** pp. 106–8
- **Worksheet:**
2.22 What decisions are influenced by the weather?
- **Photographs:**
2.18 Wind
2.19 The effects of drought
2.20 Torrential rain
2.21 Snowscape
- **Further reading and weblinks:**
www.weatherspark.com

Key concepts

- Weather is something that affects our daily lives and livelihoods.
- Climate varies hugely across the world.

Starter suggestions

The weather is something we all experience, observe and can record daily. Ask students how the weather affects their lives and what decisions they have to make from day to day. Depending on where you live, answers will vary. Question 1 in the **Now investigate** section on p. 107 gives some useful questions to direct this discussion.

If you are in a temperate zone of the world with variable weather patterns there will be more impact on students' lives than if you are in a location where weather changes little from day to day. As well as discussing your own local situation, choose a very different region of the world for comparison, e.g. a monsoon region if you live in a temperate one, or the other way round.

Worksheet 2.22 allows students to put themselves in the place of other people who need to make decisions based on the weather. It could be completed at this point in the lesson, or set as homework.

Notice the extremes of weather listed in the **Fantastic fact**.

Main lesson activities

- 1 Define the terms 'weather' and 'climate'. The text in the Student Book tells you a little about both weather and climate but you will need to explore this in more detail with students. It would be useful for them to know that climate data is

collected over a period of a minimum of 30 years in order to be considered as giving a reliable picture of expected weather over the whole year.

- 2 Use photos **A** on p. 106 (photos **2.18** to **2.21** from the downloadable resources). Students should answer the first part of **Now investigate** question **2**; if this is done in small groups, the discussion and exchange of ideas should produce good answers. Come together as a class and use the groups' ideas as a basis for discussion in preparation for each student writing an individual answer for **Now investigate** questions **3** and **4**.
- 3 Use map **B** on p. 107, showing the distribution of the world's main climates and some climate graphs. You may need to explain how to interpret (or understand) a climate graph for students to be able to answer this set of questions (see Topics 4.2 pp. 245–7 and 4.3 p. 261), but, if they have already had experience of these, you could quickly revise them. Ask the class how they would go about writing a description of a distribution on a world map, and make sure each student understands how to approach this. Question **1** in the **Now investigate** questions on p. 107 has a useful hint here. Students are then in a position to answer questions **1** and **2**.
- 4 The research idea in **Further research** on p. 107 would make a useful homework. If students enter 'extreme weather' into Google or another search engine, they will find the most up-to-date weather events.

Give extra support by looking back at any previous work done by students on map distribution description and climate graph construction or interpretation.

Give extra challenge by giving the more able students some rather less obvious climate graphs to interpret.

Plenary suggestions

Reinforce the definitions of weather and climate and the importance of the differences between them.

Skills notes	Students have practice in describing map distributions, interpreting climate graphs and in photo interpretation.
Assessment suggestions	Questions 1 and 2 in the Now investigate questions on p. 107 test the most difficult aspects of the material dealt with in this lesson and therefore make a valuable assessment.

2.4(2)

How can you investigate the weather?

Assessment objectives

- Candidates should be able to name and recognise the equipment used in a weather station.
- Candidates should be able to describe the appropriate method of measuring each element of the weather.
- Candidates should know how to record and display weather data appropriately and use and interpret graphs and other diagrams showing weather data.

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2.4 Weather

- Describe how weather data is collected
- Describe and explain the characteristics, siting and use made of a Stevenson screen
- Identify a rain gauge, maximum–minimum thermometer, sunshine recorder, barometer, anemometer and wind vane, which can be used for weather observations

Topic link: see Topic 4.3 pp. 251–2 for information on drawing a climate graph.

Differentiated learning outcomes

- **All students must** know the purpose of a Stevenson screen and have some idea of its use and site (Grade E/D).
- **Most students should** be able to sketch and label a Stevenson screen and each item of weather recording equipment, and describe and give reasons for the use and siting of each item (Grade C/B).
- **Some students could** draw annotated diagrams of a Stevenson screen and each weather recording instrument, and describe and explain where it should be sited, and why (Grade A/A*).

Resources

- **Student Book:** pp. 108–10
- **Worksheets:** None
- **Photographs:** None
- **Further reading and weblinks:** www.metoffice.gov.uk/public/weather

Key concepts

- Measuring weather data is essential to help us understand the climate of a region.
- The location of each piece of measuring equipment is very important in order to take accurate readings.
- The Stevenson screen is a key piece of equipment.

Think carefully about the timing of teaching this topic. It is a perfect opportunity for learning outside the classroom. If there is any chance to go outside and experience the weather, then teachers should do so. Try to purchase some of the weather equipment that is mentioned in the Student Book but, if your budget does not stretch to that, you can make some of your own. A plastic bottle can be turned into a rain gauge, for example. You might be able to time this topic to highlight the changeability of the weather, depending on where you are teaching.

Starter suggestions

Ask students to think about the weather they are experiencing today, especially temperature. The introductory paragraph in the Student Book provides some suggestions for discussion.

Main lesson activities

- 1 Read about measuring temperature on pp. 108–9 including diagram B. **Now investigate** question 1 allows students to teach each other and so enhance their own understanding.

- 2 Extend beyond temperature and think about other aspects of weather:
 - What other types of weather can we measure?
 - What other types of weather measuring equipment have students heard of or used?
- 3 The weather station: state clearly that many instruments used for recording the weather are kept outdoors inside a special box called a Stevenson screen. Refer to the **Fantastic fact** about the origin of the Stevenson screen. Look at photos **A** on p. 109, showing the equipment kept inside and close to the Stevenson screen. Discuss the characteristics of each piece of equipment shown in terms of its appearance, its purpose and its location.
- 4 What is the purpose of the Stevenson screen? List its characteristics using both photos and the text in the Student Book. Each characteristic has a very particular purpose; students need to note these down.
- 5 Location of the Stevenson screen: answer **Now investigate** question 2 to revise the purpose of the screen and to think about the best location sites. It is important that students can justify their chosen location within the school grounds.
- 6 Various items of equipment for measuring weather (photos **A**): to make a useful summary of these instruments and how they are used, students could make a table with the following headings:
 - Name of instrument
 - Appearance of equipment
 - Location in which equipment is ideally placed (there is a link to **Now investigate** question 3 here)
 - How the equipment is operated (see also **Homework/Extension** activity below)
 - How the data collected is recorded and represented.

Homework/ extension activity

Diagram **B** on p. 109 is annotated to show how the equipment, in this case a maximum–minimum thermometer, is used. Students could choose other items of measuring equipment and produce their own similar annotated diagrams.

Give extra support by adapting the type of data collected and the equipment used to the context of your own school/home area.

Give extra challenge by guiding students through the process of setting up a weather station (if your school does not have one yet) and of operating it over a period of time. Students could take turns in recording readings over a period of time.

Plenary suggestions

As you run through the lesson, note down quick questions on each of the topics that can be asked as a plenary session just to remind students of each aspect of the work.

Skills notes

Students have practice in the interpretation of diagrams and photos, in annotating diagrams and designing summary tables, and in constructing climate graphs.

Assessment suggestions

- 1 Draw an annotated diagram of a Stevenson screen to highlight its characteristics and the purpose of each.
 - 2 **Now investigate** question 2 revises the important aspects of locating a Stevenson screen.
- Assessment suggestions 1 and 2 above both practise the skill of producing annotated diagrams.

2.4(3)

More complex weather measurements

Assessment objectives

- Candidates should be able to describe the appropriate method of measuring each element of the weather.
- Candidates should know how to record and display weather data appropriately.
- Candidates should be able to make calculations using information from these instruments.
- Candidates should be able to use and interpret graphs and other diagrams showing weather data.

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2.4 Weather

- Make calculations using information from weather instruments
- Identify a wet-and-dry bulb thermometer (hygrometer) and simple digital instruments, which can be used for weather observations

Topic link: see Topic 4.3 pp. 251–2 and 255–6 for information on presenting different weather records as maps and graphs.

Differentiated learning outcomes

- **All students must** be able to measure and record weather data (Grade E/D).
- **Most students should** be able to record weather data and make calculations using such data; they should be able to read data from graphs and other diagrams (Grade C/B).
- **Some students could** represent, use and interpret weather data in graph or other diagrams and make calculations (Grade A/A*).

Resources

- **Student Book:** pp. 110–12
- **Worksheets:** None
- **Photographs:** None
- **Further reading and weblinks:**
www.metoffice.gov.uk/public/weather
www.nhc.noaa.gov/aboutsshws.php
http://en.wikipedia.org/wiki/Wind_rose

Key concepts

- There are different methods of measuring relative humidity, air pressure, wind direction and speed.
- Digital methods of weather recording are used more today than traditional mechanical ones.

Starter suggestions

This lesson is a continuation of the previous one, but it introduces some more complex measuring equipment: hygrometer, barometer, wind vane, anemometer and digital equipment. To introduce each of these, ask students to define some of the features being measured: relative humidity (or just ask them what we mean by humidity), air pressure, and wind speed and direction.

Main lesson activities

Wherever possible during this lesson, show students actual pieces of recording equipment and how to use them. Fieldwork is the best way to demonstrate and understand the use of weather instruments. This is a good opportunity to emphasise the importance of fieldwork.

- 1 **Relative humidity:** teach students what relative humidity is and its importance in our perception of weather. Diagram A on p. 111 shows how the wet and dry bulb thermometer (a hygrometer) works, and the text in the Student Book helps to explain the process to students. If you have one at school, students should practise using it.
- 2 **Atmospheric pressure:** students may well know the definition of air pressure from Science lessons. Because humans are designed to exist in the Earth's pressure environment, we almost forget it's there. For those who find it a difficult idea, you could describe it as a balloon trying to rise but a person keeping it down with their hand. We would 'float' were it not for the influence of air pressure on us. What happens in a space capsule without gravity and air pressure?

Air pressure is not constant throughout the world, as explained in diagram **B** on p. 111. Explain that differences in air pressure are essential to weather patterns. You could use a simple convection current diagram to show how warmed air rises, creating lower pressure. Later, when it cools and sinks, pressure rises.

Introduce the barometer. Note that there are different types of barometer (mercury and aneroid).

- 3** Measuring the characteristics of wind: follow the direct link from variations in air pressure to the occurrence of wind – wind is simply the movement of air from higher pressure areas to lower pressure areas. Explore with students the variations in wind in your own local climate – strong winds may be unusual, or you may live in a hurricane zone!

Ask students what they think we can measure about the wind. Encourage them to identify both speed and direction. Ask students whether wind direction varies much in your own climate and if that affects the type of weather experienced.

Refer to the **Fantastic fact** on p. 112 and compare the Barrow Island statistic with the strongest likely gust in your own area or with the Saffir–Simpson scale (used to categorise the strength of hurricanes according to wind speed). You should either have researched wind speeds for your own area in preparation for this or you could ask students to do so during the lesson or as preparation. Have a copy of the Saffir–Simpson scale to hand (see the website in **Further reading and weblinks**).

Measuring wind direction: students may well have seen a wind vane. If not, draw a simple diagram and ask students how they think it works and how accurate it is.

Measuring wind speed: students are less likely to have seen an anemometer. Again, ask students to work out its operation and accuracy from what they see. Remember that anemometers can be linked to digital recording equipment.

The Beaufort scale is an old way of assessing wind speed. Discuss diagram **C** so that students understand how it operates. What they do think of its degree of accuracy?

- 4** Drawing a wind rose: a wind rose is useful for showing both wind speed and direction. Teach students how to construct a simple one from the data in **Now investigate** question **4** (Topic 4.3 p. 255 in the Student Book will help you here). You can also Google ‘wind rose images’ for a variety of styles of diagram.
- 5** Digital equipment: today modern meteorologists use digital equipment whenever possible. Discuss with students the likely reasons why (e.g. greater accuracy, continuity and comparability). Refer to photo **D**, the digital weather station. Students should write a list of the similarities and differences between this and the more traditional weather station studied in the previous lesson.

Give extra support in the wind rose construction by mixing more able and less able students in small groups.

Give extra challenge by encouraging students to research and interpret weather data.

Plenary suggestions

Students should decide whether they, as meteorologists, would prefer to work with traditional or digital equipment. They should give clear reasons for their decision.

Skills notes	Students have practice in the interpretation of photos and diagrams, and in the construction of a wind rose.
Assessment suggestions	Now investigate questions 1 , 2 and 3 provide opportunities for assessment of students’ work on recording the weather.

Assessment objectives

- Candidates should be able to explain how clouds form and recognise the main cloud types.
- Candidates should be able to estimate the amount of cloud cover in oktas.

0460/2217 syllabus**2.4 Weather**

- Identify types and measure amounts of cloud

Differentiated learning outcomes

- **All students must** be able to recognise and describe some basic types of cloud and be able to estimate full and partial cloud cover (Grade E/D).
- **Most students should** be able to recognise and describe different types of cloud and estimate cloud cover (Grade C/B).
- **Some students could** recognise and describe the main and other types of cloud and estimate and record accurately the extent of cloud cover (Grade A/A*).

Resources

- **Student Book:** pp. 113–14
- **Worksheet:**
2.23 Recognising cloud types
- **Photographs:** None
- **Further reading and weblinks:**
<http://cloudappreciationsociety.org/>
<http://cloudappreciationsociety.org/gallery>

Key concepts

- The three basic cloud types are cirrus, stratus and cumulus.
- Cloud cover is estimated in number of oktas (eighths of the sky covered).
- One key characteristic of cloud type is height above the ground.

Starter suggestions

Start by asking students what they think clouds are. They are likely to know that clouds are made of water vapour, but not necessarily that they may also be made of ice crystals.

Main lesson activities

- 1 Teach students the processes of cloud formation. The text in the Student Book gives you a start. Define key terms like 'condensation'. Explain in detail how some clouds lead to rain. The Student Book gives you a start here, but you will need to add more detail.
- 2 The three main types of cloud: students need to be able to define 'cirrus', 'stratus' and 'cumulus' types. **Worksheet 2.23** can help students at this stage to link cloud appearance/characteristics and type. It is a simple exercise and mostly geared to weaker students.
- 3 Estimating cloud cover: diagram **B** on p. 114 shows the cloud cover symbols; the system needs to be explained to students. They should note down these symbols and test each other so that they recognise them quickly and easily. Practise using the photos **C** in the Student Book/on **Worksheet 2.23**.

Unless you are teaching this lesson on a completely cloudless day, ask students to estimate the number of oktas of cloud cover they can see in the sky. This may involve going outside to get a full view of the sky. Ask them to write down their answer on paper and not to discuss it with others. Back in the classroom, take in the answers and assess the level of agreement; report back to your students and comment on that and their degree of accuracy. Point out that, of all the weather

recording methods discussed in this lesson and the two previous ones, this is the least accurate. This is because it is subjective rather than objective.

- 4 Students could produce a guide to help them to recognise different types of cloud. This guide will help them to link cloud types and the different types of weather associated with them.

Extension activity

Organise a competition to judge the best cloud photo taken by a student. Students should include the type of cloud and a description of the cloud shown in their photo.

Create an area of the departmental website, if you have one, where they can be displayed as a gallery. Otherwise, students could print them out and create a wall or board display. It might be placed somewhere where the whole school can appreciate it.

Give extra support by using **Worksheet 2.23** to help students recognise cloud types.

Give extra challenge by encouraging students to research a wider range of cloud types, e.g. altocumulus, altostratus, cirrocumulus, cirrostratus, nimbostratus and stratocumulus. Website suggestions can be found above. Notice not only the shape and colour of the clouds but also their typical heights above the ground surface. The students should be able to answer **Now investigate** question 4. This is best done in pairs or small groups to allow for discussion and reasoning.

Also, students could carry out online research into the Cloud Appreciation Society, as suggested in the Student Book. The website address is listed above.

Plenary suggestions

Finish this lesson with a reference to the **Fantastic fact** on cloud height.

Skills notes

Students have practice in interpreting photos and diagrams, using cloud cover symbols and assessing cloud cover.

Assessment suggestions

Now investigate questions 1 and 2 provide opportunities for assessment.

2.5(1)

How does climate affect natural vegetation?

Assessment objectives

- Candidates should be able to place their local climate in a global context.
- Candidates should be able to describe the main climate characteristics of the tropical rainforest.
- Candidates should be able to describe and give reasons for the global distribution of tropical rainforests.

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2.5 Climate and natural vegetation

- Describe and explain the characteristics of equatorial climate
- Understand climate graphs and climate characteristics of the equatorial climate, including temperature (mean temperature of the hottest month, mean temperature of the coolest month, annual range) and precipitation (the amount and seasonal distribution)
- Identify factors influencing the characteristics of the equatorial climate (including latitude, pressure systems, winds, distance from the sea, altitude and ocean currents)

Differentiated learning outcomes

- **All students must** know where some rainforest regions are located and know some of the climate's characteristics (Grade E/D).
- **Most students should** be able to describe the global distribution of rainforest regions, naming and locating key examples. They should also describe and give reasons for equatorial climate patterns and be able to use a climate graph (Grade C/B).
- **Some students could** describe the global distribution of rainforests with reference to latitude and continental locations (Grade A/A*).

Resources

- **Student Book:** pp. 115–17
- **Worksheets:**
2.24 What aspects of the environment affect natural vegetation?
2.25 The diurnal rainfall pattern in the rainforest
- **Photographs:** None
- **Further reading and weblinks:**
An ideal website for all rainforest topics:
<http://kids.mongabay.com>
The following is ideal for extra background for teachers on all rainforest topics:
http://kids.mongabay.com/lesson_plans/handout.html

Key concepts

- Climate, vegetation, soils and bedrock are closely linked.
- Rainforest climate occurs in a continuous band between about 5 degrees north and south of the Equator except when mountainous areas alter the climate by reducing temperature.

Starter suggestions

Explore your own climate with students to create a context for the main part of this lesson and the next two lessons on tropical rainforests. See top of Student Book p. 115.

Identify your climate in a broad sense. Ask students to categorise it as cold, temperate or tropical. You may need to explain the term 'temperate'. Consider the following:

- mean temperature
- variability of temperature
- total rainfall/precipitation
- seasonality of rainfall/precipitation
- reliability of rainfall/precipitation

In a previous lesson you have already discussed the impact of your local weather on people's daily lives and decision-making.

Main lesson activities

- 1 Introduce the links between climate and vegetation. Plants need heat and water, which are directly related to climate. In addition, they need light, which is a

function of your location on the Earth's surface and therefore has some link to climate. Mineral nutrient inputs come from the soil which is partly affected by climate in terms of types and rates of weathering. For example, tropical soils are often around 30 metres deep, as high temperatures and abundant rainfall lead to rapid chemical weathering of the bedrock.

- 2 **Worksheet 2.24** shows the possible links between climate, soils, bedrock and vegetation. Lines have been drawn to show where there are links. Ask students to add the arrowheads to show the direction of the impact, e.g. climate affecting soils, as explained above. Students must write at least one reason for each decision.
- 3 Apply the discussion above, and students' ideas in response to **Worksheet 2.24**, to your home climate and vegetation. Answer **Now investigate** question 1 on p. 117 on whether your local vegetation has had to adapt to your climate. This has to be true in all situations but the degree to which this is the case will vary.
- 4 The extent of tropical rainforest climate: map **A** shows an almost continuous band of this climatic/vegetation zone. Ask students to write a description of the distribution (**Now investigate** question 2, Student Book p. 117). Then take this question a stage further by asking students to explain this pattern. It is important that students understand the key differences between description and explanation. Students should now aim to explain the reasons for the gap/s in this climatic zone. Students need to refer (perhaps using an atlas) to the location of key mountains, and they should read the text on altitude to discover why higher ground precludes a true tropical climate. The **Fantastic fact** is also relevant here.
- 5 Characteristics of a tropical rainforest climate: students need to understand the factors affecting this climate. Start by using graph **B** and diagram **C** on p. 116; discuss the climate pattern shown, both in terms of temperature and rainfall. Students need to record the key facts about the climate:
 - low annual temperature range
 - higher diurnal temperature range
 - high annual rainfall total
 - diurnal pattern of rainfall – **Worksheet 2.25** and diagram C will help here
 - no obvious seasons
 - high humidity levels
 - light winds.
- 6 Explanations for the location of the rainforest climate: ask students to work in groups. Each group should prepare one short presentation on one factor affecting the rainforest climate (choose between: latitude and insolation; altitude; atmospheric pressure).
- 7 Homework questions: **Now investigate** questions 3–5 on p. 117 (as an assessment).
 - **Give extra support** by illustrating the operation of convection currents within your own classroom.
 - **Give extra challenge** by encouraging students to research into natural vegetation changes with altitude.

Plenary suggestions

Refer to some chosen images on the Mongabay website (see **Further reading and weblinks** above) and ask students to interpret these in the context of what they have learned in this lesson.

Skills notes	<ul style="list-style-type: none"> • Students have practice in the construction of a flow diagram (Worksheet 2.24), interpretation of a world map and a diagram, and in labelling diagrams (Worksheet 2.25).
Assessment suggestions	<ul style="list-style-type: none"> • Now investigate questions 3, 4 and 5 provide opportunities for assessment. Question 4 in particular allows students to work out processes from a diagram.

2.5(2)

Tropical rainforest vegetation

Assessment objectives

- Candidates should know the key characteristics of rainforest vegetation.
- Candidates should be able to describe how rainforest vegetation has adapted to local conditions.
- Candidates should understand how the rainforest ecosystem operates.
- Candidates should know the effects of deforestation and ways in which people exploit and abuse the rainforest.

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2.5 Climate and natural vegetation

- Describe and explain the characteristics of tropical rainforest ecosystems
- Explain the relationship in this ecosystem of natural vegetation, soil, wildlife and climate

Differentiated learning outcomes

- **All students must** know some adaptations of rainforest plants to their climate (Grade E/D).
- **Most students should** describe how and why plants adapt to rainforest conditions, quoting some named examples and locations (Grade C/B).
- **Some students could** describe in detail the key characteristics of the equatorial climate (with or without a climate graph to help), and show a detailed understanding of the processes leading to the development of rainforests; they should be able to describe and explain the interrelationships between climate and vegetation with reference to named locations and plants (Grade A/A*).

Resources

- **Student Book:** pp. 117–19
- **Worksheet:**
2.26 Rainforest plant adaptations
- **Photographs:**
2.22 Tropical rainforest in the Loboc River, Bohol
- **Further reading and weblinks:**
*These two websites are for use with **Worksheet 2.26** or for general student interest and research:*
www.rainforest-alliance.org/kids/species-profiles
<http://mbgnet.net/sets/rforest/plants/adapt.htm>
This website can be used to research deforestation:
www.rain-tree.com/facts.htm

Key concepts

- Rainforests represent one of the most important world ecosystems.
- Rainforests have the greatest biodiversity of all the world's ecosystems.
- Rainforest is a particularly fragile ecosystem, easily damaged by people.

Starter suggestions

Ask students what they know about ecosystems – for example a definition, the components, and so on. They could try to link the idea to the rainforest and your own local ecosystem.

What is included in an ecosystem? Aim for a list including plants, animals, insects, bacteria. Some students may realise that the non-living environment is also a part of the whole ecosystem – soils, rock and climate.

We say that animals live in a 'habitat'. Ask students to define this term.

Main lesson activities

- 1 The terms discussed above are found in context in diagram A on p. 117 Also read the first paragraph in the Student Book text. Students should look at these together and work out/discuss the interactions and flows found in the rainforest ecosystem. Students need to make their own copy of diagram A.

- 2 Use photo C on p. 118 (photo 2.22 from the downloadable resources) to remind students of the appearance of a tropical rainforest. Perhaps the key characteristic of rainforest vegetation is that every process goes on simultaneously – new leaf growth and leaf drop happen together, and flowering and fruiting can occur side by side on the same tree. Students can learn about this by working through **Worksheet 2.26**. This can involve some internet research, but, depending on the timing of your lesson, the research aspect could easily be left as an extension activity, as homework or as support for weaker students.
- 3 Biodiversity in the rainforest: students should read the section in the Student Book on this subject. It is useful to refer back to map A on p. 116 as a reminder of the very small area (only 6 per cent) of the Earth's surface that is covered by tropical rainforest. The most important point here is that, despite this, these regions have the greatest biodiversity in the world and people derive more raw materials from rainforests than from any other ecosystem (the mbgnet website from **Further reading and weblinks** is helpful here).

Students need to note the definition of 'biodiversity' and they should know some of the uses to which rainforest plants can be put. The statistic of there being 50 per cent of the Earth's species in just this 6 per cent of the area makes this point strongly.
- 4 Nutrient recycling in the rainforest: students should study diagram B on p. 118. You should teach the idea of nutrient recycling: introduce the idea of nutrient stores, i.e. the nutrients in the system are stored in the biomass (the vegetation itself plus the animal and insect populations), the litter (the accumulation of dead material on the ground surface) and the soil. The nutrients pass through these in order. Students need either a clearly labelled diagram to illustrate the processes here, or a clear written description.
- 5 Rainforest soils: despite their thickness and the vibrancy of the ecosystem as a whole, rainforest soils are very poor and fragile, as the nutrient recycling discussed above has shown. This contradiction needs to be understood by students. Discuss the nature of the soil in diagram D.
- 6 Homework suggestion: **Now investigate** questions 1 and 2 on p. 119 could form an assessment. Note that question 2c involves research into the effects of deforestation. The rain-tree website above gives a clear summary.

Give extra support by directing students to the websites above. These are produced for students to broaden and deepen their knowledge and understanding.

Give extra challenge by asking students to think about how their own actions and use of products and raw materials may be having an impact on the sustainability of rainforests today.

Plenary suggestions

Review the material covered in this lesson by asking a variety of definitions and quick questions.

Skills notes	Students have practice in interpreting diagrams and conducting internet research.
Assessment suggestions	Now investigate questions 1 and 2 on p. 119 provide opportunities for assessment.

2.5(3)

A tropical rainforest environment

Assessment objectives

- Candidates should be able to describe and explain the characteristic features of Borneo's rainforest system.
- Candidates should know why the climate and other aspects of the environment of Borneo leads to the development of a rainforest ecosystem.
- Candidates should be able to list reasons why people exploit and abuse the rainforests.

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2.5 Climate and natural vegetation

- Describe and explain the characteristics of the tropical rainforest ecosystem
- Describe the causes and effects of deforestation of the tropical rainforest
- Identify effects on the natural environment (both locally and globally) along with effects on people

Topic link: for more information on how people are damaging the natural environment, see Topic 3.7 pp. 225–6.

Differentiated learning outcomes

- **All students must** use a case study to illustrate the links between climate, vegetation and wildlife in a rainforest (Grade E/D).
- **Most students should** be able to list the main economic activities in a named rainforest area and state ways in which these impact on the ecosystem (Grade C/B).
- **Some students could** understand the details of the economic value of rainforest case study and the environmental impact of economic activity there (Grade A/A*).

Resources

- **Student Book:** pp. 119–21
- **Worksheets:** None
- **Photographs:**
Photo 2.23 A baby orangutan
Google Images – submit 'Borneo rainforest ecosystem' to get a range of super photos of the rainforest
- **Further reading and weblinks:**
www.mongabay.com/borneo.html
The following are about the plight of the orangutan:
www.savetheorangutan.org
www.treehugger.com/natural-sciences/palm-oil-plantations-orphan-baby-orangutans-leave-them-nowhere-to-call-home.html

Key concepts

- Rainforests around the world are decreasing rapidly due to human exploitation.
- Borneo's ecosystem includes some of the most threatened species in the world.
- Borneo is a large and important rainforest region but with an increasing amount of exploitation, and further demands are increasing the rate of deforestation.

Starter suggestions

Begin with the **Fantastic fact** as it places the importance of Borneo in context. Discuss students' reactions.

This leads on to the first paragraph in the Student Book concerning global decrease in rainforest area.

Main lesson activities

- 1 First locate Borneo on a world map/in the atlas.

Study map **A** on p. 120 of the Student Book and note the details shown. Consider the location details that lead to this being a rainforest environment, e.g. latitude.

- 2 Referring to graph **B**, ask students to note down the characteristics of this climate (e.g. temperature in general, temperature range, total rainfall, distribution of rainfall, degree of seasonality) which support a rainforest ecosystem. The list in the Student Book text helps you here.

Students could try to explain the rainfall pattern (shift of the wind belts, monsoon air flows). This is an exercise for more able students, or students working in small

mixed ability groups where the more able can encourage and assist the less able.

Now investigate questions **1a**, **1b** and **1c** help cover this work.

- 3** Students should read the text on why Borneo's rainforests are very special and list the key points. Ask students why these important fauna are worth preserving – they may, of course, not agree!
- 4** Use photo C (photo **2.23** from the downloadable resources), showing an orangutan. Many students are likely to have heard of these creatures and perhaps have read more about them or have seen them on television. The orangutan is a primate and so has links to us as humans. Does this closeness influence the way in which students react to the potential/likely destruction of their habitat? This would make an interesting short debate. Groups could take one of the two sides to this argument and present it to the class as a preliminary to more general class discussion. The 'Save the orangutan' website could complement this activity.
- 5** Ask students to make a list of the development pressures on the rainforest in Borneo. The text helps here with some starter suggestions. These can be further investigated on Google or another search engine. The website addresses above will also help here. Students should think about the rainforest products they personally use – this was considered in a previous lesson, but is useful to re-visit here.
- 6** Group work: pose the following questions to mixed ability groups of students:
 - Do you think Borneo's rainforest should be exploited?
 - Is the damage worth the benefits gained? Think about the benefits and the problems. People in Borneo need to be able to make a living.
 - Is the damage too much to cope with? Will future generations lose too much?

The list of development pressures made in main lesson activity **5** and **Now investigate** questions **2** and **3** will be useful in this activity.
- 7** Protecting the rainforest: read the last paragraph p.120 in the Student Book on National Parks as a tool for protecting the rainforest. Research to find more details on National Parks in Borneo's rainforest. The websites listed above will help with research into the operation and success of Borneo's National Parks. Students should create a National Park case study involving one Park or more than one.

Give extra support by setting **Now investigate** question **1a**, which gives further practice in describing a climate graph. This skill could be practised with other climate data and used for comparison.

Give extra challenge by encouraging independent research into ecotourism.

Plenary suggestions

As a class, summarise the situation currently experienced by the rainforests – exploitation versus conservation. Take a classroom vote of support for each side of this debate.

Skills notes	Students have practice in internet research, map interpretation, description and interpretation of a climate graph, and construction of a line graph.
Assessment suggestions	Now investigate questions 1a and 1b , 2 and 3 provide useful assessment. This is a good case study of the interrelationships between the natural environment and human activities. Assessment could focus on the causes and impacts of deforestation in Borneo, management and conservation measures.

2.5(4)

How do living things survive in hot deserts?

Assessment objectives

- Candidates should be able to describe and give reasons for the main climate characteristics of hot desert areas.
- Candidates should be able to describe and give reasons for the global distribution of hot deserts.

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2.5 Climate and natural vegetation

- Describe and explain the characteristics of hot desert climates
- Understand climate graphs and climate characteristics of the hot desert climate, including temperature (mean temperature of the hottest month, mean temperature of the coolest month, annual range) and precipitation (the amount and seasonal distribution)
- Identify factors influencing the characteristics of the hot desert climate (including latitude, pressure systems, winds, distance from the sea, altitude and ocean currents)

Differentiated learning outcomes

- **All students must** be able to describe a map showing the global distribution of hot deserts, and know some of the characteristics of its climate (Grade E/D).
- **Most students should** be able to describe the global distribution of hot deserts by naming and locating the main examples, and describe and give reasons for the type of climate found there (Grade C/B).
- **Some students could** describe the global distribution of hot deserts, referring to latitude and continental locations thoroughly, and describe the key characteristics of the hot desert climate (Grade A/A*).

Resources

- **Student Book:** pp. 121–3
- **Worksheet:** 2.27 Animal adaptations in the hot desert
- **Photographs:** None
- **Further reading and weblinks:** http://en.wikipedia.org/wiki/File:D%C3%BCne_S-Schlag_Sossusvlei.JPG

Key concepts

- Hot deserts are mainly located between 5 and 20 degrees north and south of the Equator.
- There are several reasons for the formation of hot deserts – not always the same combination in each location.
- People and wildlife are able to adapt to living in these harsh conditions.

Starter suggestions

Ask students about their own experience and knowledge of hot deserts. The amount of feedback you get will vary according to your home location and student access to television programmes. Use the photo on the Wikipedia website listed above showing a huge sand dune. Students should be aware that not all deserts have a sandy surface ('erg'); indeed, the majority do not. You can put key words such as 'erg', 'hammada' and 'reg desert' into Google or another search engine to find photos of other types of desert surface. (Note: you must include the word 'desert' with 'erg' and 'reg' – otherwise it will not show you what you are searching for.)

Main lesson activities

- 1 Begin by using map A on p. 122 of the Student Book, showing the global distribution of hot deserts. Remind students how they should write a description of a map, including using latitude, naming continents and using compass directions. Ask them to answer **Now investigate** question 2. It is ideal if each student produces their own description and then some are read out in class for

comparison. It is best not to allow students to read the text in the Student Book before completing this exercise, as it gives them too much help and reduces the challenge of writing a good description on their own. After this exercise they should read the text; it will help them judge their own performance.

- 2 Climate in hot deserts: read the text in the Student Book on this topic. Students should note the definition of a desert and remember the key rainfall figure of 250 mm per annum. You should point out that not all deserts are hot, but that they can also be cool or cold. Refer to the **Fantastic fact** about the longest known drought period in the Atacama Desert, Chile.
- 3 Factors leading to a hot desert climate: the main ones dealt with in the Student Book are:
 - the dryness of prevailing winds
 - high atmospheric pressure and the movement of the pressure belts (it is quite a difficult concept that may need a good deal of reinforcing)
 - lack of cloud cover
 - the rainshadow effect (map **A** and diagram **D** are helpful here)
 - location of a cold ocean current offshore.

Divide the class into groups, each taking one of the above factors. Students can access some information from these pages of the Student Book, and further research will give them a fuller picture of the processes at work. If each group produces a set of notes on their topic, copies can be made so that everyone has notes on all the factors listed above.

Students can add examples of deserts affected by each factor, as suggested in **Now investigate** question 5.

- 4 Diurnal range: define 'diurnal range' (refer to diagram **C** and see also the definition on Student Book p. 116) and read the detail in the text. Ask students to list the problems for plants, wildlife and people living in the desert that result from a diurnal range of up to 50°C. In small groups they should consider how such problems might be overcome, especially by people and animals. **Worksheet 2.27** helps students to think about animal adaptations. (Adaptation by plants is covered in the next lesson.) Students can then bring their ideas back to the class as a whole.

Give extra support by helping weaker students with diagram construction in **Now investigate** question 5 mentioned in main lesson activity 3.

Give extra challenge by asking students to teach their factor to the other members of the class.

Plenary suggestions

Summarise the following points in a question-and-answer session:

- the definition of a desert
- the types of desert surface
- the factors leading to the formation of a desert.

Skills notes	Students have practice in description of a map distribution, description and interpretation of a climate graph, diagram construction and annotation of a diagram.
Assessment suggestions	Now investigate questions 1, 3 and 4 provide opportunities for assessment.

2.5(5)

Hot desert vegetation

Assessment objectives

- Candidates should be able to describe the adaptations made by some plants to their hot desert environment.
- Candidates should be able to explain the reasons for these adaptations.

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2.5 Climate and natural vegetation

- Describe and explain the characteristics of hot desert ecosystems
- Explain the relationship in this ecosystem of natural vegetation, soil, wildlife and climate

Differentiated learning outcomes

- **All students must** know some adaptations of hot desert plants to the climate (Grade E/D).
- **Most students should** be able to describe how and why plants adapt to desert conditions, naming some examples and locations (Grade C/B).
- **Some students could** show a detailed understanding of how hot deserts develop and explain the interrelationships between climate and vegetation, using named locations and plants (Grade A/A*).

Resources

- **Student Book:** pp. 124–5
- **Worksheet:**
2.28 Oases and artesian wells
- **Photograph:**
2.24 A desert oasis
- **Further reading and weblinks:**
These websites show you some hot desert plants. Further searching will reveal other images – submit 'hot desert plants' under Google Images:
www.blueplanetbiomes.org/desert_plant_page.htm
<https://saharadesertproject1.weebly.com/plants.html>
http://en.wikipedia.org/wiki/Siwa_Oasis
(for use with **Worksheet 2.28a) and b)**)

Key concepts

- Plant and animal life in hot deserts is greatly limited by environmental factors.
- Plants and animals survive by adapting to the limitations of their environment.
- Water sources do exist in the desert at oases and underground.

Starter suggestions

Use the websites above to look at some desert plants.

Ask students for their responses to the two questions below. Do not read the text in the Student Book at this stage; see what ideas are put forward by students.

- What are the limitations for plants in a hot desert? (This is primarily directed at the climatic issues.)
- What are the likely characteristics of desert plants?

Main lesson activities

- 1 Now read the relevant section of text and see how close to being correct students were. Some of the key words, such as *infiltration*, *surface runoff* and *evapotranspiration*, are defined for students in the Glossary. Students should make a list of the limitations to plant growth in hot deserts and write a short explanation of each. Alternatively this could be done as a spider diagram, as suggested in **Now investigate** question 1 on p. 125. Make sure there is detail in the annotations. Whichever method is chosen, remember to include total rainfall, frequency of rainfall, depth of the water table and soil salinity (all discussed later in the Student Book text).

- 2 Refer to diagram **A** on p. 124, the desert soil profile. Discuss the characteristics of this profile with students. Make sure they understand that a profile is a vertical cross-section. Ask students to write a description of the profile and its main characteristics.
- 3 Oases, where the water table lies close to the surface, have much more vegetation and can sometimes be used for food production. Students can study photo **B** on p. 124 (photo **2.24** from the downloadable resources) and also research photos and descriptions of oases.

Worksheet 2.28 explains more about oases and how artesian wells work. These are both useful water supplies for desert populations.

- 4 Particular plant adaptations: the Student Book discusses a number of ways in which plants adapt to hot desert conditions. Students could make a summary table with the following headings:
 - Name of plant
 - Reason for adaptation, e.g. storing water, surviving drought
 - Details of the adaptation

Don't forget to include the tumbleweed plant in the **Fantastic fact**, and the creosote bush. The diagrams and photos on pp. 124–5 of the Student Book will help students here.

Extension activity

Students should research the best adaptations of particular plants and animals in the desert. Have a class discussion in which each student has to explain why they think their choice is the best. The whole class could vote for the most interesting/unusual/efficient adaptation.

Give extra support by explaining key terms carefully.

Give extra challenge by encouraging further research into insect populations in hot deserts – some are surprisingly successful at adapting to this environment.

Plenary suggestions

Answer **Now investigate** question 2 on p. 125 to summarise ways in which plants adapt themselves to be able to store more water.

Skills notes

Students have practice in photo interpretation, in the construction of a table, the description of a soil profile diagram, and internet research.

Assessment suggestions

Now investigate question 4 on p. 125 of the Student Book provides a suitable activity for assessment.

2.5(6)

Life in the hot desert

Assessment objectives

- Candidates should be able to describe and explain the main features of the Namib Desert.
- Candidates should be able to explain the ways in which people living in the Namib Desert make a living and the impacts caused to the environment.

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2.5 Climate and natural vegetation

- Describe and explain the characteristics of hot desert ecosystems
- Explain the relationship in this ecosystem of natural vegetation, soil, wildlife and climate

Topic links: there is more on how people live in difficult environments in Topic 3.7 pp. 213–9, and on how people can damage the environment in Topic 3.7 pp. 220–6.

Differentiated learning outcomes

- **All students must** know some economic activities of hot deserts and be able to name some human impacts on the ecosystem (Grade E/D).
- **Most students should** be able to list the economic activities in a named desert region and describe how these affect its ecosystem (Grade C/B).
- **Some students could** describe the economic value of hot deserts and the environmental impact of human activity (Grade A/A*).

Resources

- **Student Book:** pp. 126–8
- **Worksheets:** None
- **Photographs:** 2.25–2.27 Plant adaptations in the Namib desert
- **Further reading and weblinks:**
This is a 2.5 minute video on the Namib by well-known naturalist David Attenborough:
www.youtube.com/watch?v=iMCY9WMnzaw
This is a short video of the desert beetle:
www.greatestplaces.org/book_pages/namib2.htm
More detail on the Namib region for those with a good level of English:
www.namibian.org/travel/namibia/namib-naukluft.htm
<http://www.google.com/earth/>

Key concepts

- The Namib Desert exists because it is in a rainshadow and is affected by a cold offshore ocean current.
- Whilst its desert climate limits the economic possibilities in Namibia (the Namib Desert), it does contain many mineral resources, and its wildlife and landscape offer tourism opportunities, if managed very carefully.

Starter suggestions

Revisit the key facts learned about hot desert climate, vegetation and wildlife in the previous two lessons. Each desert is different. This case study investigates the Namib Desert in south-west Africa. Later in this lesson plan, further research is suggested into other hot desert regions.

Watch the short YouTube video on the Namib Desert narrated by the famous British naturalist David Attenborough. It includes some spectacular photography.

Main lesson activities

- 1 Study map **A** on p. 126 of the Student Book and the satellite image **B**. Discuss their main features. Refer to the **Fantastic fact** to show how outstanding the landforms in the Namib Desert can be.

- 2 Read the description of the Namib Desert in the Student Book text. Then use Google Earth to identify the landscapes mentioned. You can find images for different parts of the desert and, based on the textbook description, students could say which part of the Namib they think each image is from, justifying their choice.
- 3 Climate in the Namib Desert: students have already summarised what they know about hot desert climate at the start of this lesson, so now you can move on to study the particular details of the Namib Desert's climate. The factors affecting climate are the Drakensburg Mountains which create a rainshadow area, and the position of the cold Benguela Current off the coast. Refer to diagram D on p. 128 and map A on p. 126 to help here. You will have to teach the mechanisms of the rainshadow effect and the consequences of an offshore cold current if students have not met these ideas before. If they have done so, then a reminder should be all that is necessary.
- 4 Plant and animal adaptations: the Namib Desert has some unique plants and wildlife, with their own, interesting climatic adaptations. Explore these using the photos C on p. 127 of the Student Book (photos 2.25 to 2.27 from the downloadable resources). This information could be added to the table created in the previous lesson.

Watch the very short Greatestplaces video on the desert beetle (address above). This shows an unusual adaptation to acquire water.
- 5 Human activity in the desert: there is more to the Namib economically than the short video watched earlier might suggest. Students could re-draw the table on p. 128 but add an extra column to show the benefits of each economic activity. Use the text to add a little more detail to the table. Use the Namibian travel website (address in **Further reading and weblinks**) to explore further the benefits and issues of tourism.
- 6 Homework exercise: students could choose another hot desert region of the world and research its climate, vegetation and economic activities, as suggested in **Further research** in the Student Book.

Give extra support by discussing the table as students construct it.

Give extra challenge by encouraging extra research: research stories of desert survival against the odds. Students should try to discover what it was that some people did that made the difference.

Plenary suggestions

Ask students for their opinion on which of the images of the Namib Desert used during this lesson was their favourite, and why.

Skills notes	Students have practice in map interpretation, photo interpretation, constructing an annotated diagram, and internet research.
Assessment suggestions	Now investigate questions 1, 2 and 3 on p. 128 provide opportunities for assessment.

2.5(7)

When does a natural hazard become a disaster?

Assessment objectives

- Candidates should know some of the main hazards presented by the natural environment.
- Candidates should understand the links between human activities and the natural environment.

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2.5 Climate and natural vegetation

- Describe the effects of natural hazards on the environment (both locally and globally) along with the effects on people

Differentiated learning outcomes

- **All students must** know that natural hazards can affect people and their property (Grade E/D).
- **Most students should** be able to illustrate the impact of hazards on people by using case studies (Grade C/B).
- **Some students could** understand the link between human activity and the increase in hazard risks (Grade A/A*).

Resources

- **Student Book:** pp. 128–30
- **Worksheet:** 2.29 Primary and secondary hazard impacts
- **Photographs:** None
- **Further reading and weblinks:** None

Key concepts

- A natural hazard is only a disaster if people and their property and livelihoods are damaged.
- People in LEDCs suffer more from the consequences of hazard events than do people in MEDCs; this is a consequence of wealth and preparedness.

Starter suggestions

Together read 'Fermin's experience' in figure A on p. 128. Ask students to respond to this material. They should aim to put themselves in Fermin's place (geographical empathy). Student responses here will depend very much on where in the world you live. For example, if you are located in a natural hazard region of any kind, students will probably have had experience of such events and they will, therefore, react differently from students from a calmer part of the globe.

Main lesson activities

- 1 'Natural hazards are a fact of life.' This is a quote from the text on p. 129 of the Student Book. Ask students for their opinion on this quotation.
- 2 Discuss as a class the different types of natural hazard, and their causes (for example, if people live close to a plate boundary, they are likely to experience volcanoes and/or earthquakes). Photos B will suggest different situations. Students could make a table to summarise the following:
 - Type of hazard: geological; hydrological, climate and weather events – as explained in the Student Book text.
 - Cause of the disaster: remember that the obvious cause is not always the main cause. As explained in the Student Book text, the results of a hazard event can be far more devastating than the event itself: poor-quality buildings cause deaths, whereas high-quality ones generally protect people in an earthquake situation. For example, the Japanese tsunami of 2011 caused more devastation than the powerful earthquake that led to it.

- Discuss with students the differences between the initial hazard and what follows – in other words, primary and secondary impacts. The Student Book text will help here. Completing **Worksheet 2.29** will give students practice in differentiating primary and secondary impacts and will allow debate over those consequences that can be classified as either primary or secondary.
 - Example location/s in the world.
 - Degree of seriousness of hazard (a scale of 1 to 10 could be agreed for this). If your students have previously studied earthquakes, you could refer to the Richter and Mercalli scales here. Students can still devise their own.
- 3** Students could research examples of secondary hazard events:
- The Japanese tsunami, March 2011
 - Wildfires and bushfires in Australia (caused by global warming and El Niño/La Niña events), 2009, 2011
 - Lahars such as the Armero disaster in Colombia, 1985
 - Avalanches in the Alps
 - Flooding after Hurricane Katrina, 2005 (see next lesson)
- 4** The link between wealth (more and less economically developed countries) and vulnerability to hazards: read the text in the Student Book on this subject and consider diagram C on p. 130, showing aspects of preparation for disasters.

Discuss the meaning of the three Ps, i.e. Prediction, Protection, Preparation. Which hazards might be predicted? Volcanoes can be monitored more effectively than earthquakes. How can people protect their buildings and themselves, e.g. in a flood; an earthquake? How can people prepare for life in the wake of a hazard event?

Students should answer **Now investigate** question 3 but you could divide the class by ability as follows:

- Less able students should compile a general leaflet on preparing for a hazard event.
- More able students could differentiate between poorer and richer countries, creating different leaflets for each, according to their perception of people's needs in the contrasting situations.

Give extra support with the concept of 'vulnerability'.

Give extra challenge by applying the concept of primary and secondary consequences of a hazard event to case studies of a variety of types of event.

Plenary suggestions

Tell students about the worst natural disaster of the last 100 years, which was the 1931 flood event in China in which 2.5 million people died. Ask students to compare this with other hazard events discussed in this lesson.

Skills notes	Students have practice in constructing a table, and in the interpretation of photos and diagrams.
Assessment suggestions	Now investigate questions 1 and 2 in the Student Book provide opportunities for assessment.

2.5(8)

Tropical storms

Assessment objectives

- Candidates should understand the links between the natural environment and human activities.
- Candidates should be able to describe the effects of natural hazards on people's lives.
- Candidates should be able to illustrate the impact of natural hazards using an example: Hurricane Katrina, August 2005.

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2.5 Climate and natural vegetation

- Describe the effects of natural hazards on the environment (both locally and globally) along with the effects on people

Differentiated learning outcomes

- **All students must** understand that natural hazards can affect people across the world (Grade E/D).
- **Most students should** be able to describe and explain how and why a tropical storm can affect people's lives (Grade C/B).
- **Some students could** give examples to demonstrate a breadth of understanding of tropical storm impacts (Grade A/A*).

Resources

- **Student Book:** pp. 131–3
- **Worksheets:** None
- **Photographs:** 2.28 Satellite image of Hurricane Katrina
See the websites below for useful images
- **Further reading and weblinks:**
Hurricane/tropical storm names for 2017 onwards:
www.nhc.noaa.gov/aboutnames.shtml
An explanation of the Saffir–Simpson scale:
www.nhc.noaa.gov/aboutsshws.php
An animated track of Hurricane Katrina:
news.bbc.co.uk/1/shared/spl/hi/americas/05/katrina/html

Key concepts

- Physical hazards like tropical storms can have a huge impact on human lives and economies.
- More economically developed areas can suffer more severely in this respect than people often think – they include many poorer citizens who cannot afford insurance and so are vulnerable. The city of Kobe in Japan (earthquake 1995) is still completing recovery 20 years later.

Starter suggestions

Ask students what they already know about severe tropical storms. (They are also known as 'cyclones' in the Indian Ocean region and as 'typhoons' in eastern Asia – 'hurricane' is the term used in the Americas, including the Caribbean region.)

Use the **Fantastic fact** to explain how tropical storms and hurricanes are named. They follow a 6-year cycle after which names are reused. Tell students that names are 'retired' – that is, they are never used again after a particularly large-scale event (there will never be another H. Katrina, for example). H. is the common abbreviation for 'hurricane' in an event name.

Can students find their own names in the lists on the NOAA website above?

Main lesson activities

- 1 Where do tropical storms happen? Use map **A** to identify the global locations of tropical storms. Areas affected by tropical storms, directions in which storms travel, frequency and season of storms are all shown.

Answer **Now investigate** questions **1a** and **b** on p. 133. Once students have identified that all tropical storms travel westwards but curve slightly away from the Equator, add in an extra question **c**: What makes tropical storms travel in this general direction? (Answer: The spin of the Earth, or the Coriolis effect.)

Look at the BBC website bbc.co.uk/1/shared/spl/hi/americas/05/katrina/html showing the tracking of H. Katrina. Does its pattern fit with the one shown on the maps **A** and **D**?

- 2 Ask students to check the date of H. Katrina in the Student Book (p. 132) and to see whether it fits with the Caribbean/USA hurricane season. Look at pp. 134–5 of the Student Book, which uses the example of Cyclone Aila, which hit Bangladesh in 2009. Again, check whether its date fits in with the hurricane season for the Indian Ocean shown on map A.
- 3 What are the factors leading to a tropical storm event? Hurricanes are seasonal because certain weather circumstances are needed (refer to the Student Book text near the top of p. 131). Ask students to list the key factors as they answer **Now investigate** question 2 on p. 133.
- 4 Impacts of tropical storms fall into three main categories (refer to diagram B):
 - Strong winds: tropical storm wind speed is recorded using the Saffir–Simpson scale (see **Further reading and weblinks**). Work through this scale and discuss with pupils the likely impact of each level.
 - Heavy rainfall: due to the huge evaporation of sea water in warm conditions.
 - Storm surges: this means a rise in sea level and therefore coastal flooding. Make sure students understand why this happens (low air pressure allows sea levels to rise, plus water in the warmer seas expand).

Divide the class into small working groups. Allocate one of these bullet points to each group for further research. The text in the Student Book gives them a start, with key words to put into a search engine. Information should then be exchanged between groups so that all students have comprehensive notes.

- 5 Example: H. Katrina. What does a hurricane look like from space? Display the satellite photo C (photo 2.28 from the downloadable resources) as an introduction to this example. H. Katrina was probably the most thoroughly reported tropical storm, not only because it hit the city of New Orleans in the south-eastern USA very hard, but also because of the limited response and rescue achieved by the American authorities. The situation was perceived by some as a scandal, so this makes an ideal example showing how wealthier countries do not always manage the clean-up operation very well.

List the key impacts of H. Katrina as it hit the city of New Orleans.

Students should write a detailed example of H. Katrina, either individually or in groups, dividing the workload by topic between them. Use the suggested websites plus the students' own research. Key ideas include:

- the giving way of the existing flood defences
- the crisis at the Superbowl
- the significant proportion of the city's population who were made homeless
- the large out-migration from the city – some people never returned
- the fact that, even today (at time of writing in 2014) some work remains to be done to re-house all of New Orleans' citizens in good accommodation. Those without insurance were, of course, hit worst.

Give extra support by mixing students by ability in the group activities, or by grouping by ability and spending your time encouraging the weaker students.

Give extra challenge by allowing the better students to spark off each others' ideas to achieve a really detailed example.

Plenary suggestions

Ask students the following question: To what extent has New Orleans been successful in coping with H. Katrina and its impacts on the population?

Skills notes	Students have practice in map and photo interpretation, and in internet research.
Assessment suggestions	Now investigate question 4 on p. 133 is a useful assessment activity.

2.5(9)

Flooding in Bangladesh

Assessment objectives

- Candidates should understand the links between the natural environment and human activities.
- Candidates should be able to describe the effects of at least two natural hazards on people's lives, including possible benefits.
- Candidates should be able to illustrate the impact of natural hazards by using an example: Cyclone Aila, May 2009.

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2.5 Climate and natural vegetation

- Describe the effects of natural hazards on the environment (both locally and globally) along with the effects on people

Differentiated learning outcomes

- **All students must** know some facts about flooding in an LEDC (Grade E/D).
- **Most students should** be able to use an example of a flood event to illustrate the problems caused (Grade C/B).
- **Some students could** write a detailed comparison of hazard events, comparing and contrasting the impacts experienced in LEDCs and MEDCs (Grade A/A*).

Resources

- **Student Book:** pp. 133–5
- **Worksheet:** 2.30 The monsoon climate in Bangladesh
- **Photographs:** 2.29 The effects of Cyclone Aila
- **Further reading and weblinks:**
A website about Cherrapunji, the wettest place in the world:
www.extremescience.com/wettest.htm
Websites to help with researching Cyclone Aila:
http://en.wikipedia.org/wiki/Cyclone_Aila
<http://news.bbc.co.uk/1/hi/8069458.stm>
www.youtube.com/watch?v=_322J43O79Y

Key concepts

- Hazards such as flash flooding have a variety of causes – some are natural, while others are caused by people's activities.
- LEDCs are usually less prepared for hazards on this scale than are MEDCs, so they suffer to a much greater extent.

Starter suggestions

Discuss map A and the characteristics of the country. Locate Bangladesh using an atlas. Ask students to identify some likely similarities/contrasts between your home country and Bangladesh. The population density of Bangladesh is particularly high (1128 people/km², as quoted by the Student Book p. 133). Make a comparison between this figure and the population density in your own country.

Main lesson activities

- 1 Define the term 'flash floods'. Ask students what this means for areas and people affected by this type of event.
- 2 What are the causes of Bangladesh's flood events? Read the Student Book text on p. 133–4. Consider the following:
 - Monsoon rains – rainfall in the upper river basin converges lower down.
 - Storm surges linked to tropical cyclones – these move onshore from the Bay of Bengal, primarily affecting the low-lying coastal plains. Refer back to map A to identify these different regions.

Students begin to answer **Now investigate** question 1. They should draw the sketch map to show the flood-risk parts of Bangladesh. Annotations to show the main causes of flooding can be added at this stage, but the rest of the question is best answered later (main lesson activity 7).

- 3 **Worksheet 2.30** gives climate data for Bangladesh and shows clearly how flooding is inevitable in most monsoon seasons. As students work through the questions they construct a climate graph, which gives extra practice, and they are asked to interpret the patterns produced. Climate graph construction and interpretation is found in Topic 4.3 pp. 251–4 (construction) and pp. 260–2 (interpretation) in the Student Book.
 - 4 Investigate the consequences of flooding from monsoon rainfall and tropical cyclones. Remember that the monsoon is an annual event which is crucial for water supply. It can fail, bringing water shortages; it can bring too much rainfall, leading to serious flooding. Diagram **B** in the Student Book, showing the main causes of flooding in Bangladesh, and the text are useful starting points for this research, and the website addresses above take student research further. The BBC website has a useful video clip.
 - 5 Divide the class into small working groups. Undertake some quick research on key words used in the Student Book text. A definition should be written for each term listed below. This will help all students, especially those with lower ability or whose English is more limited.
 - Evacuated
 - Storm surge
 - Devastated
 - Submerged
 - River embankments
 - Homeless
 - Contaminated
 - Water-borne diseases
 - Cholera
 - Refugees
 - Overseas aid organisations
- Compare definitions between groups and agree the best in each case.
- 6 Consider the effects of Cyclone Aila: this piece of work can be undertaken on a variety of scales. It could simply be a classroom discussion if you are short of time, with students making a list of the consequences of this hazard event, as in **Now investigate** question 2. Or students could prepare a display using photos **C** on p. 134 (available as photo **2.29** from the downloadable resources), the textual detail and the websites above.
 - 7 Flooding in Bangladesh has many causes. Answer **Now investigate** question 3 to give student research more direction here.
 - 8 What are the benefits of living in a flood-prone area? At this stage in the lesson, students might be surprised to discover that there are any benefits. Discuss and list the benefits of alluvium in agriculture.
 - 9 The **Further research** suggestion in the Student Book ties in with Topic 3.2 on p. 164. This would make a strongly contrasting example.

Give extra support by mixing the abilities in groups for main lesson activity 5.

Give extra challenge by setting research on flood prediction and protection. Remember that more economically developed countries have much better technology for these difficult tasks than do less economically developed countries. How can this situation be solved?

Plenary suggestions

Briefly summarise the causes of flash flooding in Bangladesh by asking students to make a bullet point list together.

Skills notes	Students have practice in the construction of a sketch map and a climate graph, and in internet research.
Assessment suggestions	Students can go back to Now investigate question 1 on p. 135 and complete the map to show the results of flooding on richer and poorer people. A written comparison of the impacts of Cyclone Aila in Bangladesh (a poorer country), and of H. Katrina in the USA (a wealthier country) will be a useful assessment.

3.1(1)

Quality of life

Assessment objectives

- Candidates should be able to understand relative wealth and poverty within and between countries.
- Candidates should understand the differences between the meaning of Human Development Index and Quality of Life Index, and know how they are calculated.

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3.1 Development

- Use a variety of indicators to assess the level of development of a country
- Understand indicators of development - including GNP per capita, literacy, life expectancy, and composite indices, e.g. Human Development Index (HDI)

Differentiated learning outcomes

- All students must have a basic understanding of the differences in people's lives when in wealth and poverty. They must know what data is used to calculate the Human Development Index and Quality of Life Index (Grade E/D).
- Most students should understand the variation in wealth and poverty within all countries (Grade C/B).
- Some students could have a detailed understanding of a range of countries with respect to the indexes under study (Grade A/A*).

Resources

- **Student Book:** pp. 136–7
- **Worksheets:**
3.1 How do we calculate HDI?
3.2 Quality of Life Index
- **Photographs:**
3.1 A shanty town in Mumbai, India
3.2 A residential area in an MEDC
- **Further reading and weblinks:**
<http://nationranking.wordpress.com>
www.businessinsider.com/oecd-better-life-index-2011-5

Key concepts

- Poverty is often a product of the population explosion.
- All countries show considerable variations in wealth and poverty.
- People's ideas about their quality of life (their perception of it), whilst subjective, are very important.

Starter suggestions

Revise the terms *over-population* and *under-population*, and what the problems are of each. Refer back to photos 1.5–1.6 used in lesson 1.1(4), asking students to recall which environments link to over-population and under-population.

Invite students to suggest what might be a better population/resource balance (introducing the idea of *optimum population*).

Main lesson activities

- 1 Read the first section of text in the Student Book as a class, ensuring that students understand the key points. They are now able to define *optimum population*. Discuss the concept of *poverty line*. Why do we call it a 'line'?
- 2 Use **Now investigate** questions 1 and 2 (Student Book p. 137) and photos A and D to clarify the differences in quality of life between those in poverty and those who are better off. (Additional images are available from the downloadable resources: photos 3.1 and 3.2.)
- 3 What images do the students have of different countries in terms of their wealth? Do they make assumptions that everyone in an MEDC is quite well off or even wealthy? Equally, do they think people in an LEDC are all relatively poor? Use the **Fantastic fact** on the USA to clarify this point.

- 4 Ask students, without looking at diagram **B**, whether they think they have ‘a good life’, and why/why not. In pairs they can write down how their lives compare with those of others who are poorer and wealthier than them in their own country, and elsewhere in the world. Conclusions can then be brought back to the class as a whole. Then go to **Now investigate** question 3 – students can now check diagram **B** to see whether they have been asking the right questions.
- 5 Human Development Index: **Worksheet 3.1** shows a spider diagram with HDI at the centre. Students should fill in each contributing data set (adult literacy, life expectancy and GDP per capita) around the centre. They need to understand clearly what each of these three terms means. They should write a definition of each beside it on their own copy of the worksheet.
- 6 Quality of Life Index: consider the differences in the way this is calculated compared with the Human Development Index. What extra factors are included and what has been omitted? (A key difference is that people’s own opinions come into the Quality of Life score.)
- 7 Consider the countries shown in table **C** (countries with highest and lowest qualities of life). Are students surprised at the countries included in these rankings? Encourage them to give reasons. Aim to analyse what characteristics of particular countries make their citizens satisfied or dissatisfied with their lives – for example, the political situation in Zimbabwe is the main reason for its very low Quality of Life score.
- 8 Homework suggestions:
 - (a) Students can work individually on the tasks on **Worksheet 3.2**.
 - (b) They can research the Quality of Life Index values for a wider range of countries. Are any of these surprising? Why?
- 9 Where does your country lie in the list? Do students think this is a fair position? They should support their conclusion with reasons, and compare their own opinion with those of their classmates.
- 10 Choose a country from www.businessinsider.com/oecd-better-life-index-2011-5. Students should compile a list of reasons for its high position in the Quality of Life Index listing. Do the countries in this list have anything in common in terms of location, population size, and so on?

Give extra support by explaining GDP carefully – it is not an easy concept for weaker students – and highlight the differences between the Human Development Index and Quality of Life Index.

Give extra challenge by using main lesson activity **8(b)** above to stretch the brightest students.

Plenary suggestions

In a question-and-answer session, revise the key terms that have been used in this topic.

Skills notes

Students revise their skills in photo interpretation, and are introduced to the concept of indexes (Human Development Index and Quality of Life Index).

3.1 (2)

Development

Assessment objectives

- Candidates should understand there are differences in development between countries, and that the development gap between countries is increasing.
- Candidates should understand how we can measure development.

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3.1 Development

- Identify and explain inequalities between and within countries
- Understand indicators of development – including GNP per capita, literacy, life expectancy, and composite indices, e.g. Human Development Index (HDI)

Differentiated learning outcomes

- **All students must** know some of the possible development measures and know some of the simpler links between them; they should know the names of some countries at each level (Grade E/D).
- **Most students should** know a broader range of indicators and why some of them correlate closely; they should be able to identify several countries at each level (Grade C/B).
- **Some students could** be able to explain why some countries/regions within a country are much more developed than others (Grade A/A*).

Resources

- **Student Book:** pp. 138–40
- **Worksheets:** None
- **Photographs:** None
- **Further reading and weblinks:**
For a list of global HDI data plus maps:
http://en.wikipedia.org/wiki/List_of_countries_by_Human_Development_Index
For a long list of development indicators:
<http://wdi.worldbank.org/tables>
For a comparison of the top and bottom countries (Norway and Niger):
www.un.org/apps/news/story.asp?NewsID=44372

Key concepts

- Development is measured using both economic and social indicators.
- Countries improve their level of development over time but at varying rates.
- There are inequalities in levels of development, not just between countries but also within them.

Starter suggestions

Read the first two paragraphs on p. 138 on GNP and wider indicators of development. Do your students already know a definition of GNP/GDP? If yes, ask them to write it from memory. You could use mini-whiteboards or just rough paper. Then they can compare their definitions and correct/improve with each other. However, if this is a new concept to your students, then explain it to them and allow them to make a note of it. Explain the difference between GNP and GDP.

GNP is an economic indicator and has been used for a long time. Why might it not be enough to give a full picture of a country's development?

How else might we measure development? Hold a short group discussion, feeding back to the class as an introduction to social indicators and their value.

Main lesson activities

- 1 How have countries developed over time? Use diagram A to compare indicators in 1962 and 2012, a period of 50 years. Ask students whether countries tend to be high/low on all statistics or whether there are variations.

2 Read the two paragraphs on pp. 138–9 on the Human Development Index. Make it clear to students that the three indicators that make up the HDI are: life expectancy at birth; level of education, including both literacy rate and years spent in school; income adjusted for purchasing power. Discuss why each of these is important.

3 Note that the maximum HDI is 1, also the highest and lowest figure from table B, and from the three websites suggested above. Note that the news story identifies Norway and Niger, not Norway and Mali as in the table on p. 138, showing that statistics do vary over time.

Use table B, the paragraph in the middle of p. 139 and the website links to discuss the four groupings of countries. Ask students to decide on why such groupings are useful, finally linking this discussion to diagram C.

Now investigate question 1 extends this idea so could usefully be undertaken at this stage.

4 What other indicators of development are there? Use the World Bank website to investigate further. This could be used as an extension exercise.

5 Why are there such great inequalities between countries? This is a very difficult question, even for adults to answer. Diagram D makes a wide range of suggestions. In groups, ask students to comment on each of the bubbles on the spider legs. Note that in the History one, there were differing levels of development input by colonial administrators into the colonies. Some were given their independence with education and health care services already in place, whilst others were much more neglected. Aim to show students that not all countries had an identical experience. Emphasise in particular the Geography bubble.

6 Inequality between regions within a country: map E shows aspects of inequality within the UK. Use **Now investigate** question 3, i.e. students should describe the distribution patterns on each of the maps and note any correlations between them (e.g. life expectancy and income seem to show a positive correlation).

7 Homework exercise: ask students to investigate the UN Millennium Development Goals (diagram G). Why were they needed? How likely are they to be successful in developing the poorest countries?

Give extra support by helping the weaker students recognise the correlations between data sets in map, table and graph form.

Give extra challenge by asking brighter students to extrapolate ideas discussed and patterns identified to a wider range of countries; country data can be found on the websites suggested. Also, ask them to discuss why the indicators that make up HDI were the ones chosen.

Plenary suggestions

Ask students how their home country/region fares in terms of GNP, HDI and other indicators. How might their country, and others they might be familiar with, help themselves to improve?

Skills notes	Graph, table and map interpretation: both description of patterns and explanation of these. Identifying links between data sets.
Assessment suggestions	Main lesson activity 7 could be used as an assessment, as could Now investigate question 4. The more able students could consider the quality of life of poorer people in a wealthier country such as the UK.

3.1 (3)

Classifying industry

Assessment objectives

- Candidates should be able to demonstrate knowledge and understanding of human actions contributing to the development of economic environments.
- Candidates should be able to make judgements that demonstrate an awareness of the contrasting opportunities and constraints of people living in different places and under different physical and human conditions.

0460/2217 syllabus

3.1 Development

- Classify production into different sectors and give illustrations of each
- Identify primary, secondary, tertiary and quaternary sectors

Differentiated learning outcomes

- **All students must** have a basic knowledge of the four different types of industry (Grade E/D).
- **Most students should** be able to classify different jobs into specific industrial classifications (Grade C/B).
- **Some students could** have a detailed understanding of industrial classification, be able to define the characteristics of different types of industry and say why each type has different benefits for a country (Grade A/A*).

Resources

- **Student Book:** pp. 141–2
- **Worksheets:**
3.3 Classifying local industry
3.4 The geographically-skilled employee
- **Photographs:**
3.3 Miners
3.4 Workers in a computer factory
3.5 Workers in a call centre

Key concepts

- There are four main types of industry – primary, secondary, tertiary and quaternary.
- Different jobs are associated with different industrial classifications.
- Different jobs require different skills – many of which can be gained through studying geography.

Starter suggestions

Use the starter activity to introduce classification to the students.

Pick a topic that can be classified into different categories, for example types of sport (one using your hands, one using your feet, bats, rackets etc.) or foods as in the previous theme (carbohydrates, proteins, vegetables etc.).

Ask students to make a list of all the examples they can think of and then try to put them into three or four different categories.

Explain that this is called classification and that the same process can be used when discussing industry and job types.

Main lesson activities

- 1 Display the three photographs **A**, **B** and **C** from pp. 141–2 of the Student Book (photos 3.3 to 3.5 from the downloadable resources). Ask students to describe the nature of the jobs illustrated. You could ask prompting questions such as: Does this job involve making anything? Does it involve providing a service directly to other people? Are the people working with raw materials? Lead the discussion towards different ways of classifying jobs.
- 2 Next have students read through the four different classifications of industry in the Student Book. They should write down definitions of the four different types and give at least two examples of each – one general and one they would find in the local area.

- 3 Students may already be thinking of jobs they may do when they leave school. Use local newspapers and other sources (radio advertisements, for example) to produce a list of local companies that are recruiting right now. They should then try to fit the available jobs into the four main classifications (using **Worksheet 3.3**). Which of the four categories seems to be providing most of the jobs in the local area? (You could compare this with the answers to the activities in the Student Book.)
- 4 Have a look at the job advertisements again. What are the skills being asked for by local employers? Are some skills asked for more often than others?
- 5 Get students to think about how geography can help to develop these skills. They can refer to the rest of the Student Book to determine the skills they need to do well in IGCSE/O Level Geography. Now they should use **Worksheet 3.4** to annotate the outline of the person with the qualities that they think employers want and the skills that studying geography can help develop.
- 6 Internet exercise: use Google Earth, Google Maps or another internet mapping program to 'go job hunting' in your local (probably the nearest town) where most industries are found. What can you find out about these companies? What do they do? Which of them have their headquarters in other countries?

Give extra support by having students complete the classification activities in the **Now investigate** section of the Student Book, before attempting those using the local newspapers listed above.

Give extra challenge by finding out what transnational companies are and which of the companies in main lesson activity 6 are TNCs.

Plenary suggestions

After looking at the various opportunities available, do students think the particular job they really want to do will be possible in your local area?

If not, where will they have to go in order to find the job they would like to do?

Get students to think about the difficulties this may pose and the opportunities that it may open up for them (whether staying in the local area or moving away).

Skills notes

The main lesson activities allow students to develop classification skills and, in the internet exercise, to gain experience of using geographical information systems at a very basic level.

Assessment objectives

- Candidates should be able to make judgements that demonstrate an awareness of the contrasting opportunities and constraints of people living in different places and under different physical and human conditions.
- Candidates should be able to analyse and interpret geographical data, recognise patterns, select and use techniques for organising and presenting the data.

0460/2217 syllabus**3.1 Development**

- Describe and explain how the proportions in each sector vary according to the level of development
- Understand indicators of development and employment structure to compare countries at different levels of economic development and over time

Differentiated learning outcomes

- **All students must** have an idea of the skills that can be used to present geographical data (Grade E/D).
- **Most students should** be able to describe both the formal and informal employment sectors and use some geographical skills to present data on industrial development (Grade C/B).
- **Some students could** have a detailed understanding of the causes and effects of different types of employment and a complete knowledge of how industrial development data can be displayed using different geographical techniques (Grade A/A*).

Resources

- **Student Book:** pp. 143–5
- **Worksheets:**
3.5 Industrial development pie charts
3.6 Industrial development divided bar graphs
3.7 Industrial development triangular graph
- **Photograph:**
3.6 Working in the informal sector
- **Further reading and weblinks:**
Tutorials on how to draw graphs and charts using Microsoft Excel can be found at:
<https://support.office.com/en-US/Excel>
(Click on Excel training)

Key concepts

- Industrial development means different industries become increasingly important over time.
- Many people, especially in LEDCs, are employed in the informal sector.
- Industrial development data can be displayed using a number of different geographical techniques.

Starter suggestions

The following starter activity should be set up as a previous homework exercise.

Ask students to talk to older family members to find out their opinions on how employment in the local area has changed over, say, the last 50 years.

They should ask what their parents and grandparents remember about the jobs available when they were young. They could also ask about informal jobs such as street sellers – were these as widespread when they were young?

This leads in to the first activity below, on industrial change.

Main lesson activities

- 1 Ask students to read through the opening paragraphs in the Student Book on how industrial development and employment structures change over time. They should analyse the flow diagram A on p. 143 and use it to explain, in three or four paragraphs, the process of industrial development (including examples of specific countries from the Student Book).

- 2 Students should use the information in table C to draw a multiple bar graph showing the percentage of people employed in different industries for a range of countries. They will need to take care with this as a lot of information needs to be included on the graph. Further information on how to draw a multiple bar graph can be found in Section 4 of the Student Book.
- 3 Students should read through the information about the informal sector in the Student Book. You could display photo D from p. 143 of the Student Book (photo 3.6 from the downloadable resources). In groups, get them to discuss the following questions and to note down the answers for a later discussion:
 - What informal jobs do you see people doing in your local area?
 - How much would you expect to earn if you did those sorts of jobs?
 - What are the main differences between the informal and formal sectors and what are the problems for people working in the informal sector?
- 4 Using the templates on **Worksheets 3.5, 3.6 and 3.7** students should complete the activities on display techniques in the Student Book, drawing pie charts, divided bar graphs and perhaps triangular graphs.
- 5 Students should look at all their completed worksheets and carry out **Now investigate** task 4 on p. 145 of the Student Book, describing the positive and negative aspects of the three different display techniques they have used.

Give extra support by asking students to draw the multiple bar graph in main lesson activity 2 using data for only three or four countries, rather than the full nine.

Give extra challenge by getting students to complete some of the geographical display techniques using computer software – the tutorial listed above shows how some of these can be done using Microsoft Excel.

Plenary suggestions

The plenary session provides an excellent opportunity to discuss aspects of citizenship in relation to perceptions of street traders and informal workers.

Ask groups to feed back their answers to the questions posed in main lesson activity 3 above to the whole class.

Discuss how students feel about the informal workers in their community and try to develop a sense of understanding for those who may have less opportunity in their lives.

Skills notes	The main lesson activities allow students to develop a very wide range of geographical display skills.
Assessment suggestions	Any of the worksheets can be used to assess how well students are getting on with developing their geographical skills (and main lesson activity 5 gives a written guide to how good their interpretation skills are).

3.1 (5)

Changes over time – Newly Industrialised Countries

Assessment objectives

- Candidates should be able to demonstrate knowledge and understanding of the changes that occur through time in places, landscapes and spatial distribution.
- Candidates should be able to recognise the role of decision making within a geographical context as affected by the choices available to decision makers and the influences and constraints within which they operate.

0460/2217 syllabus

3.1 Development

- Understand indicators of development and employment structure to compare countries at different levels of economic development and over time

Differentiated learning outcomes

- **All students must** have a basic knowledge of how industrial development takes place in NICs (Grade E/D).
- **Most students should** be able to describe the location of a number of NICs and some of the reasons behind their rapid industrial growth (Grade C/B).
- **Some students could** have a wide-ranging knowledge of the characteristics of different NICs and a detailed understanding of industrial development, in respect of a specific NIC (Grade A/A*).

Resources

- **Student Book:** pp. 145–7
- **Worksheets:**
3.8 Newly industrialised countries (NICs)
3.9 Top 10 Brazil _____ facts
- **Photograph:**
3.7 Unequal housing in Paraisopolis, Brazil
- **Further reading and weblinks:**
A short PowerPoint introduction to NICs can be found at:
www.slideshare.net/mhsgeography/newly-industrialised-countries-presentation

Key concepts

- Some LEDCs have economies that are expanding very rapidly.
- If the growth of these LEDCs is due to expansion of secondary industries then they are known as Newly Industrialised Countries.
- These NICs are spread across different continents and have often developed in different ways.

Starter suggestions

Ask students to think of a list of 10 LEDCs, preferably in their own region.

They should look at their list and consider if some of the countries are significantly wealthier than others (they could do this by looking at the World Bank list of GDP for individual countries at <http://data.worldbank.org/indicator/NY.GDP.MKTP.CD>).

Why do the students think some of these countries may be richer than others? Ask them to consider their answers further after reading the introductory sections on NICs in the Student Book.

Main lesson activities

- 1 Using an atlas (or the internet), students should locate the NICs listed in the opening paragraphs of the Student Book and then mark them on the blank world map on **Worksheet 3.8**. They should annotate the map with the common characteristics of NICs copied from the Student Book. If there are other NICs not mentioned in the Student Book, those should be added to the map too.

- 2 To complete the information on Brazil as an NIC, make sure students answer questions 2 and 3 in the **Now investigate** section of the Student Book.
- 3 Display photo **B** from p. 146 of the Student Book (photo 3.7 from the downloadable resources). This picture shows an extreme example of the different lifestyles of the rich and poor in Brazil. Students should write a one-page essay from the point of view of a person on either side of the divide looking over at the other side – for example, what would a rich Brazilian think of his country's poor people? Alternatively, students could write an essay considering both points of view.
- 4 Have a look at an alternative Brazil, different from the one described in the Student Book. Perhaps the country is most famous either for the wildlife of the Amazon forest or for its football. Students should use different sources to find a list of the top 10 facts about either of these subjects. The facts can be filled in on **Worksheet 3.9**, and then five more facts can be added by students asking others in the class what they have managed to find out.
- 5 Internet research exercise: using the example of Brazil as a basis for the type of investigation needed, students can research and complete a brief project on another NIC of their choice. They should look at the reasons for economic growth and the benefits and problems it is bringing. This could also be set as a homework exercise.

Give extra support by getting students to work in pairs or groups to compile their lists of top 10 facts in main lesson activity 2.

Give extra challenge by ensuring that students include a high level of detail in their main lesson activity 5, including appropriate illustrations and, perhaps, an annotated map.

Plenary suggestions

Finish the theme on industrial activity by asking students if their attitudes to the world of work have changed over the last four lessons.

Are they clearer in what they need to do to enter a competitive job market?

They should also consider what other information they will need before deciding or embarking on their future career or job choice.

Assessment suggestions

If set as a homework exercise, main lesson activity 5 provides a good example for assessment.

Assessment objectives

- Candidates should understand the concept of globalisation and the reasons why it occurs.
- Candidates should realise that globalisation has both positive and negative effects on different people.

0460/2217 syllabus**3.1 Development**

- Describe and explain the process of globalisation, and consider its impacts
- Understand the role of technology and transnational corporations in globalisation, along with economic factors which give rise to globalisation
- Explain the impacts of globalisation at a local, national and global scale

Differentiated learning outcomes

- **All students must** know the names and nature of business of some of the top global TNCs, and understand the basic idea that a single TNC company operates in several countries for various aspects of its business (Grade E/D).
- **Most students should** be able to explain when and why globalisation has occurred and how this process affects them directly (Grade C/B).
- **Some students could** discuss the balance between the positive and negative impacts of TNC-style business (Grade A/A*).

Resources

- **Student Book:** pp. 147–50
- **Worksheets:** None
- **Photographs:**
3.8 BP Oil refinery, Kwinana, Australia
3.9 HSBC Tower, 8 Canada Square, City of London
3.10 Proportional diagram: Number of Wal-Mart stores worldwide
- **Further reading and weblinks:**
List of largest global companies:
http://en.wikipedia.org/wiki/List_of_largest_companies_by_revenue
On the development of BP globally:
www.pstiel.de/fileadmin/pstiel.de/Download/english_globalisation.pdf

Key concepts

- Globalisation has happened in recent decades and remarkably quickly.
- Transnational corporations (TNCs) operate all over the world, with the headquarters usually being in MEDCs or NICs, but many of the production units in LEDCs because labour there is cheaper; the market is often the whole world.

Starter suggestions

Ask students to look at the labels on their clothes and other belongings (e.g. pencil cases, tablets, laptops, where their books were printed) to see how many countries have been involved in the production of these. Also, do not forget that the raw materials that were used to make these items may well have come from several locations around the world. In this way, you can illustrate the meaning of 'globalisation'.

Another idea is to refer to this IGCSE/O Level course; it has been written for, and is used by, students in many countries. Your school is just one example.

Main lesson activities

- 1 Read together the first paragraph on p. 147. Students should try to write their own succinct definition of globalisation – something suitable for a glossary or geographical dictionary.
- 2 Interpret map A, showing global internet use:
(a) What type of map is this?

(Answer: a choropleth, i.e. shaded, map showing value by depth of colour.)
Why is this style of data presentation used on this occasion?

- (b) Ask students to describe and explain the pattern of internet use on the map. They should emphasise the link between level of development and internet use; your brighter students may realise that levels of use could be considered as remarkably high even in the poorest countries – there is a clear link here to potential development, which your most able students might see.
- (c) What is the link between internet use and globalisation?
- 3** In small groups, create a diagram to illustrate the causes of globalisation (a spider diagram would be ideal, but students should also have the opportunity to devise something more original). The text on p. 148 forms a start here.
- 4** Explain to your students what a transnational corporation is. The text refers to McDonald's, which they will all be familiar with.

Study table **B** and decide how many of these companies students have heard of and in what context. What do your students notice about this table? (The most likely answer is the dominance of oil and gas companies).
- 5** Link this to the Wikipedia website above, a list of the world's top companies. The table on the website gives more information, including nationality of company, city where headquarters is located, nature of business. Again, ask students what they notice. (TNCs are based in MEDCs or NICs; again, importance of oil and gas; growing importance of China, an NIC, with three in the top 10 companies). Refer to diagram **C** to reinforce these ideas.
- 6** Use photos **3.8**, **3.9** and **3.10** from the downloadable resources:
 - (a) What does HSBC stand for? (Hong Kong and Shanghai Banking Corporation.) Why is the London location significant?
 - (b) Ask students to react to the photo of the BP refinery in Kwinana (large-scale, British-owned, Australian location).
 - (c) Identify Wal-Mart's business and location. Describe its growth since 1962 and its place in a globalised economy.
- 7** Ask students to identify the most important positive and negative effects on economic development using the list on p. 149. Pose the question whether the advantages tend to be for national economies, but the disadvantages tend to be for individual workers?
- 8** Homework activity: Use the **Now investigate** questions to allow students to review the whole lesson and react to the material in their own way. Question 2 links to the Wikipedia website above.

Give extra support by linking students' own experience of TNCs in their everyday lives to the material in this spread.

Give extra challenge by asking your more able students to read the internet article on BP's growth (P. Stiel), and then use it to comment on the positives and negatives of such a large global company.

Plenary suggestions

Use the **Fantastic fact** and photo **D**. How do they reflect the positive and negative impacts of TNCs?

Skills notes	This section includes opportunities for interpretation of a choropleth map, proportional circles.
Assessment suggestions	The Now investigate questions should assess the extent to which students have understood the issues in this topic.

3.1 (7)

Nike – a transnational corporation

Assessment objectives

- Candidates should understand the importance of TNCs in the world economy, especially in terms of a source of employment in LEDCs/NICs.
- Candidates should be able to use Nike as a case study in examination answers.

0460/2217 syllabus

3.1 Development

- Case study of a transnational corporation and its global links

Differentiated learning outcomes

- **All students must** know the name 'Nike', the nature of its business and the locations of a few of its manufacturing centres and markets (Grade E/D).
- **Most students should** know some reasons behind Nike's location policy (Grade C/B).
- **Some students could** suggest how a TNC like Nike might behave in the future in terms of location, energy use, waste and water use (Grade A/A*).

Resources

- **Student Book:** pp. 150–2
- **Worksheets:** None
- **Photographs:**
3.11 Nike factory in Vietnam
- **Further reading and weblinks:**
For more information on Nike Inc:
http://en.wikipedia.org/wiki/Nike_Inc

Key concepts

- Nike is a case study of a large TNC with global connections.
- A company like Nike is prepared to move its locations to minimise its costs and maximise its profits.

Starter suggestions

Use the **Fantastic fact** that 'Nike' was the Greek goddess of victory. Ask your students why the sports equipment company would choose such a name.

Ask your students to look at photo **A** on p.150 and photo **3.11** from the downloadable resources, both of Nike factories. What do they think about the two photos?

- What is being made?
- How many of your students own Nike trainers or other items?
- How do the working conditions seem to you and your students?
Good/adequate/poor?

Main lesson activities

- Ask the students, if they were setting up their own factory, what factors would they take into account? (Suggestions: raw materials, cost and location, labour force, skills and cost, market, etc.) Link this to the statement at the end of the first paragraph in the Student Book p. 150, 'In 2017 Nike had 620 factories in 42 countries employing over one million workers.' Read the rest of the case study text on pp. 150–2.
- Answer **Now investigate** question 1 in map **B**, showing the distribution of countries containing Nike factories. Consider the LEDC/NIC/MEDC balance of these countries. (In fact, all of these groups are involved, showing that Nike does not always just go for cheap labour, but also manufactures close to its markets.)

Ask students, in small groups, to study table **C**. Is it possible to put the countries into groups? (Suggestion: East Asia, South/Central America, Indian Subcontinent, USA.)

- 3** As a class, use the bullet point list on p. 151, to expand the information on map **B**. Which countries have cheap labour? Which countries are likely to produce cheap raw materials, and why? Consider the balance between manufacturing and market: an LEDC might be chosen as a manufacturing base due to very cheap labour even though the people there are generally too poor to afford the products. On the other hand, it may be worth employing more expensive labour in an NIC or MEDC because that places the product within its market area (e.g. USA or China).

Students could research the ideas of free trade groups and of government incentive schemes. **Now investigate** question **2** could act as a summary here for students' notes/files.

- 4** If your students have already studied China's demography and the one-child policy, recap on this quickly, i.e. China's population grew quickly but is already ageing. The story of Nike's location in China in the early days, but now moving into South East Asia for cheaper labour, illustrates the location behaviour of TNCs.

Put students into pairs. Ask one of each pair to read the 'Nike in China' text at the top of p. 151. The other student must not look at this. The first student then teaches the other about why Nike has moved some factory locations to Vietnam and Indonesia. They should understand that the cost of transporting goods back to China is less than the amount saved in labour costs.

- 5** Still in pairs, students should use diagram **D**, the symbols, and try to interpret the meanings of these. This could become a 'pair-share' exercise, where two pairs join together and discuss their ideas, then progress to a larger group. By then, all should have heard the ideas of several other students.

- 6** Individual exercise (which could be for homework): **Now investigate** question **3**, which pulls together the last section on Nike's problems and solutions.

Give extra support by pairing weaker and stronger students so that the more able supports the less able.

Give extra challenge by encouraging students to think like business people in terms of location and market.

Plenary suggestions

Ask students to write down what they consider to be the most important factor in Nike's location policy and justify their decision.

Skills notes	Students have practice in map distribution description and reading a table.
Assessment suggestions	Use any or all of the Now investigate questions here.

3.2(1)

What do farmers grow in your local area?

Assessment objectives

- Candidates should be able to demonstrate knowledge and understanding of processes, including human actions, contributing to the development of economic landscapes.
- Candidates should be able to use geographical data to recognise patterns, deduce relationships and organise and present information.

0460/2217 syllabus

3.2 Food Production

- Describe and explain the main features of an agricultural system: inputs, processes and outputs
- Understand farming types: commercial and subsistence; arable, pastoral and mixed; intensive and extensive

Differentiated learning outcomes

- **All students must** have a basic knowledge of a number of different types of farming (Grade E/D).
- **Most students should** be able to name the different components of the agricultural system and the basic classifications of different types of farming (Grade C/B).
- **Some students could** have a detailed understanding of the component parts of agricultural systems and relate this knowledge to different types of farming from around the world (Grade A/A*).

Resources

- **Student Book:** pp. 153–5
- **Worksheets:**
3.10 A local agricultural system
3.11 Interview with a farmer
- **Photographs:** None
- **Further reading and weblinks:** None

Key concepts

- There are many different types of farming.
- Farming types are classified according to a number of different factors.
- Agricultural systems have inputs, processes and outputs.

Starter suggestions

Discuss with the students what they already know about farming.

Ask them to come up with 10 words associated with agriculture – these can include the machinery used, crops grown or anything else that comes to mind.

Brainstorm a selection of the words, write them on the board and then group them into different categories. Explain that this exercise is called classification and that students will return to these groupings when farming types are looked at later on in the lesson.

Main lesson activities

- 1 Talk about the farming that takes place in your local area. What do students know about the activities taking place? You could make use of some local knowledge if there is anybody in the class who lives on a farm.

Try to differentiate between different types of farming. Are there commercial activities and people growing crops on small areas of land? Encourage students to build up a mental picture of their local farming landscape.

- 2 Give students large-scale maps of the local area. Ask them if different farming types and individual farms can be identified from the maps. In many countries farms will be named on the maps (especially if they are large scale) but smaller farms may be lost.

Fieldwork option 1	Interviewing a farmer Find local farmers who are willing to help students in their investigations and then either invite them in to school or, preferably, organise a visit to their farm. Students should prepare an interview sheet as a class or homework exercise before talking to the farmers.
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Fieldwork option 2	Crop analysis Take students to a local market or farmers' market and get them to list the produce that is available to buy. They should concentrate on the crops and foodstuff that have been grown or produced locally and find out where it comes from. As a follow-up this could be marked on a map of the area when back in the classroom.
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- 3 Read through the information in the Student Book on the different types of farming (pp. 153–4). Using the information gathered so far in the activities above, get students to classify the types of farming taking place in your local area.
- 4 Go through the information on agricultural systems in the Student Book (p. 154) and make sure all students understand the concepts of inputs, processes and outputs.

Now concentrate on one type of farming found in the local area and tell students to construct a systems diagram illustrating how it works, using the template on **Worksheet 3.10**.

Give extra support by providing a standard format question sheet that could be used for interviewing farmers (**Worksheet 3.11**).

Give extra challenge by asking students to find out why certain farmers are growing certain crops in specific areas. Ask searching questions about how profitable the farms are (without causing offence!).

Plenary suggestions

Ask students to imagine they will become farmers (some may) and to think about what they would like to grow and why.

Pick a few volunteers at random to explain their choices to the class. Ask questions about how hard a job they think it is and whether they would be able to make any money from their chosen farming type.

Skills notes	The main lesson activities use a number of geographical skills including drawing systems diagrams and analysing maps. Fieldwork opportunities include conducting interviews – for more details see the relevant fieldwork investigation information on pp. 269–71 of the Student Book.
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3.2(2)

Inputs to the farming system

Assessment objectives

- Candidates should be able to demonstrate knowledge and understanding of processes, including human actions, contributing to the development of physical and economic landscapes.
- Candidates should be able to use and apply geographical knowledge and understanding to maps.

0460/2217 syllabus

3.2 Food Production

- Describe the influence of natural inputs (relief, climate and soil) and human inputs (economic and social) on agricultural land use, including their combined influences on the scale of production, methods of organisation and the products of agricultural systems

Topic link: a basic introduction to the environmental risks and benefits of agriculture is followed up later on in Topic 3.7 on pp. 213–34.

Differentiated learning outcomes

- **All students must** have a basic knowledge of the human and natural inputs involved in the farming system (Grade E/D).
- **Most students should** be able to relate a number of different human and natural inputs to different types of farming around the world (Grade C/B).
- **Some students could** have a detailed understanding of human and natural inputs and how they influence the development of agricultural systems in different parts of the world (Grade A/A*).

Resources

- **Student Book:** pp. 155–7
- **Worksheets:**
3.12 Farming in different climates
3.13 Human inputs in farming
- **Photographs:**
3.12 Terraced hillsides in China
3.13 Picking olives in Al Walaja
3.14 Mechanised farming techniques
- **Further reading and weblinks:**
All sorts of information on different types of farms can be found at:
www.farm-direct.co.uk/farming/

Key concepts

- There are both human and natural inputs to the farming system.
- These inputs are very varied and their importance differs in different parts of the world.
- Different agricultural systems have grown in different places around the world to take advantage of the inputs available on a local scale.

Starter suggestions

Recap the farming system.

Ask for a volunteer to come and draw a basic systems diagram template on the board. Pick a farming type and ask for students to come and fill in any part of the systems diagram they can.

Outline the importance of the inputs and point out this is what usually limits the types of agriculture taking place in a specific area – this leads in to the following lesson concentrating on natural and human inputs to the farming system.

Main lesson activities

- 1 Read through the information in the Student Book on natural inputs to the farming system (p. 155). Climate is often the most important factor. Ask students, in groups, to consider the following climates (ideally by showing them climate graphs):

- tropical rainforest
- hot desert
- temperate (with mild temperatures and average rainfall).

Using **Worksheet 3.12**, students should answer the questions on what types of farming could be carried out in each of the areas listed, what difficulties farmers could be presented with and how they could overcome these difficulties.

- 2 To get an idea of relief, students could look at maps of the local area and identify areas (if there are any) of particularly difficult relief. They should look for high altitude, hilly or mountainous areas, steep-sided valleys, and north- and south-facing slopes. Photo **A** on p. 156 of the Student Book (photo **3.12** from the downloadable resources) helps as a focus here. Is relief a limiting factor on farming in the local area?
- 3 Ask students to read through the information on human inputs in the Student Book. You could display photos **B** and **C** on p. 156 of the Student Book (photos **3.13** and **3.14** from the downloadable resources) to highlight the contrast between farming methods that use very different levels of human input. Then ask students to rank their top five human inputs in order of importance on **Worksheet 3.13**. They should justify the reasons for their ranking and then compare it, and their reasons, with a partner.
- 4 The Student Book shows a map of world farming types. Students should try to work out which is the world's most widespread farming type. The map has no details of the different types of crop that may be grown within the different farming types. Do they have any ideas what types of crop are grown in different places?
- 5 Students can interpret atlas maps by describing the distribution of the different farming types shown (see **Now investigate 2**, p. 157).

Give extra support by ensuring groups have a cross-section of students working at a number of different levels.

Give extra challenge by having students answer main lesson activity 4 above – this requires a high level of general knowledge and should be challenging for most students.

Plenary suggestions

Discuss what students believe are the main influences on farming.

Students should have understood that climate is, perhaps, the most important factor but should be able to bring in other important aspects.

They should also be able to recognise that, if conditions are good enough for a number of different farming types to be carried out, the decision as to what to grow may come down to the personal preference of the individual farmer.

Skills notes	Some of the main lesson activities can involve map interpretation at a number of different scales, both large and small.
Assessment suggestions	Main lesson activity 5 above provides an excellent opportunity to assess how well students can describe distributions shown on maps.

3.2(3)

Commercial farming systems

Assessment objectives

- Candidates should be able to demonstrate knowledge and understanding of processes, including human actions, contributing to the development of physical and economic landscapes.
- Candidates should be able to recognise the role of decision making as affected by human and physical contexts, choices, influences and constraints.

0460/2217 syllabus

3.2 Food Production

- Understand commercial farming
- Describe the influence of natural inputs (relief, climate and soil) and human inputs (economic and social) on agricultural land use, including their combined influences on the scale of production, methods of organisation and the products of agricultural systems

Topic link: the environmental effects of commercial agriculture are covered in Topic 3.7 on pp.213–34.

Differentiated learning outcomes

- **All students must** have a basic knowledge of how large-scale commercial farming operates (Grade E/D).
- **Most students should** be able to relate the main features of large-scale commercial agriculture to a specific case study example (Grade C/B).
- **Some students could** have a detailed understanding of how a wide number of human and natural inputs have influenced the development of large-scale commercial agriculture, particularly plantation agriculture in Malaysia (Grade A/A*).

Resources

- **Student Book:** pp. 157–60
- **Worksheet:**
3.14 Case study: Plantation agriculture in Sarawak, Malaysia
- **Photograph:**
3.15 A palm oil plantation in Malaysia
- **Further reading and weblinks:**
A slideshow discussing the commercial agriculture sector in Malaysia can be found at:
www.slideshare.net/ranzcdadavao/overview-of-agriculture-sector-in-malaysia-presentation

Key concepts

- Commercial farming is carried out to make a profit.
- Agribusinesses, sometimes owned by multinational corporations, are often in charge of the development of commercial farming.
- Plantation agriculture in Malaysia provides a good case study of how commercial farming operates.

Starter suggestions

Tell students that this lesson will be about extensive commercial agriculture.

Based on what they have learned so far, ask students to explain what this term means. What kinds of farming do they think will be studied in this lesson?

Main lesson activities

- 1 Students should read through the first section on commercial farming in the Student Book, and all the explanations and examples. Ask them to describe extensive commercial farming, in a one-paragraph summary. They should include some examples of crops grown, the areas where it takes place and some key words (such as cash crops and monoculture).
- 2 Many parts of the world have large areas given over to commercial agriculture. In groups, students should brainstorm the advantages (money, employment, global trade connections, etc.) and disadvantages (reliance on one type of crop,

environmental damage) that such commercial agriculture may bring. They should write down the advantages and disadvantages as two separate lists, and then discuss whether the advantages of such activities outweigh the disadvantages.

- 3 Find Malaysia in an atlas. Using either the atlas or the internet, students should find brief details about the population, industry, climate and environment and use them to annotate the map on **Worksheet 3.14**. They should then add case study information (from the atlas, the internet and the Student Book) on plantation agriculture in the country. Display photo **B** on p. 159 of the Student Book (photo **3.15** from the downloadable resources) to illustrate a typical Malaysian palm oil plantation.

Homework project

Students should read through the information on plantation agriculture in Malaysia in the Student Book. As a homework exercise they should then try to find a similar amount of information on a different kind of extensive commercial farming from another part of the world. This can then be written up (and illustrated) as a case study project.

- 4 As an alternative students could complete a case study on an example of commercial farming in the region where they live. See **Now investigate** question 1 on p. 160 for more details.

Give extra support by allowing students to complete the case study project on Malaysian plantation agriculture rather than asking them to find a completely new case study.

Give extra challenge by asking students to include fieldwork techniques such as surveying farms or interviewing farmers, to complete the case study of a local example of commercial agriculture (as outlined in main lesson activity 4 above).

Plenary suggestions

Look at the list of cash crops in the Student Book (above the case study on p. 158). Do students know if any of these are grown in their own country?

If so, where are they grown and what are the characteristics (climate, relief, soils, infrastructure) of these areas? If none of these crops is grown, what alternatives are grown on a large scale?

Brainstorm the answers from students, writing them on the board, and discuss the advantages and disadvantages of developing a cash crop economy.

Skills notes

The main lesson activities include work on geographical display techniques, practical fieldwork activities and questions that require research.

Assessment suggestions

The homework project on a case study example of extensive commercial agriculture, either in the local area or somewhere else in the world, should provide a good object for assessment.

3.2(4)

Subsistence farming systems

Assessment objectives

- Candidates should be able to demonstrate knowledge and understanding of processes, including human actions, contributing to the development of physical and economic landscapes.
- Candidates should be able to recognise the role of decision making as affected by human and physical contexts, choices, influences and constraints.

0460/2217 syllabus

3.2 Food Production

- Understand subsistence farming
- Describe the influence of natural inputs (relief, climate and soil) and human inputs (economic and social) on agricultural land use, including their combined influences on the scale of production, methods of organisation and the products of agricultural systems

Differentiated learning outcomes

- **All students must** have a basic knowledge of how small-scale subsistence farming operates (Grade E/D).
- **Most students should** be able to relate the main features of small-scale subsistence agriculture to a specific case study example (Grade C/B).
- **Some students could** have a detailed understanding of how a wide number of human and natural inputs have influenced the development of small-scale subsistence agriculture, particularly rice farming in Bangladesh (Grade A/A*).

Resources

- **Student Book:** pp. 160–2
- **Worksheets:**
3.15 Commercial v subsistence farming
3.16 The rice farming landscape
- **Photographs:**
3.16 The rice farming landscape
- **Further reading and weblinks:**
The United Nations has details of different rice farming systems at:
www.fao.org
Search for 'sustainable rice farming'

Key concepts

- Subsistence farming is carried out to feed the farmer and his family.
- Many communities around the world still practise subsistence farming.
- Intensive rice cultivation, in Bangladesh and throughout Southeast Asia, is the most widespread form of subsistence farming.

Starter suggestions

Tell students that this lesson will be about small-scale, intensive subsistence agriculture.

Based on what they have learned so far, ask students to explain what these terms mean. What do they think will be the main characteristics of intensive subsistence agriculture? What kinds of farming do they think will be studied in this lesson?

Main lesson activities

- 1 Students should read through the first section on subsistence farming in the Student Book, and all the explanations and examples. In groups they should then consider the main differences between intensive subsistence farming and extensive commercial farming. They should use their discussion to complete the table on **Worksheet 3.15**.
- 2 Internet research: students should find out about shifting cultivation in the Amazon, its characteristics and the people who still farm in this way. Watch the video footage showing uncontacted tribes at www.uncontactedtribes.org/brazilfootage.

What kinds of threats to their existence do these people face?

- 3 Ask students to read through the case study information on rice farming in the Student Book (pp. 161–2). Display photo **B** on p. 162 (photo **3.16** from the downloadable resources) to show the features of the rice farming landscape. Referring back to the information on farming systems, tell them to construct a systems diagram (including inputs, processes and outputs) for the rice farming system.
- 4 **Worksheet 3.16** shows an image of a typical rice farming area. Annotate the image to show the distinctive characteristics of this kind of landscape.
- 5 Build up a case study profile of a country where intensive subsistence agriculture is used (see **Now investigate** question 4 on p. 162). Concentrate on using the information on Bangladesh from the Student Book. Students could include their own sketch map of the Bangladesh map as part of their profile.
- 6 Students should try to think what life would be like as a subsistence farmer – either growing rice in Bangladesh, or shifting cultivation in the Amazon or the Congo basin. They should write a short essay describing what their life is like and the difficulties and successes they experience on a daily basis.

Give extra support by giving a number of key words to students to help them be focused in their internet searches.

Give extra challenge by getting students to choose a country other than Bangladesh for their case study profile in main lesson activity 5 above.

Plenary suggestions

Go back to main lesson activity 1 above and the comparison between commercial and subsistence farming. Do both types of farming exist in your country?

Ask students to think about which type of farming has the biggest benefits for the country as a whole. They should not just be thinking about economic benefits (which belong to commercial farming) but also about issues such as sense of community and the fact that subsistence farms will be helping to feed people and will still be owned by local people.

Skills notes

The main lesson activities include using geographical display techniques, including construction of systems diagrams and annotation of photographs.

Assessment suggestions

The imaginative writing essay gives a chance to test more than just formal knowledge of subsistence agriculture, including literacy, assessment of values and understanding of the difficulties faced by farmers.

3.2(5)

Why are there food shortages in some parts of the world?

Assessment objectives

- Candidates should be able to demonstrate knowledge and understanding of the interrelationships between people's activities and the total environment, and an ability to seek explanations for them.
- Candidates should be able to make judgements that demonstrate an awareness of the contrasting opportunities and constraints of people living in different places and under different physical and human conditions.

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3.2 Food production

- Recognise the causes and effects of food shortages and describe possible solutions to this problem
- Identify natural problems which cause food shortages (including drought, floods, tropical storms, pests) along with economic and political factors (including low capital investment, poor distribution/transport difficulties, wars)

Topic link: more on the environmental effects of agriculture can be found in Topic 3.7 on pp. 213–34.

Differentiated learning outcomes

- **All students must** have a basic knowledge that some areas of the world have more food available than others (Grade E/D).
- **Most students should** be able to explain some of the reasons why food shortages occur in certain parts of the world (Grade C/B).
- **Some students could** have a detailed understanding of the many different reasons behind food shortages and be able to relate this knowledge to a recent example (Grade A/A*).

Resources

- **Student Book:** pp. 163–5
- **Worksheets:**
3.17 What have you eaten in the last 24 hours?
3.18 Food shortages in your country
- **Photographs:**
Pictures of the 2011 famine in East Africa, from websites such as:
www.theatlantic.com/infocus/2011/07/famine-in-east-africa/100115/
- **Further reading and weblinks:**
Information on the 2011 food shortage crisis in the horn of Africa can be found at:
www.bbc.co.uk/news/world-africa-14248278
www.guardian.co.uk/global-development/famine

Key concepts

- Some parts of the world have much more food available than others.
- There are many different reasons for food shortages around the world.
- These reasons can depend on physical geography and human and political factors.

Starter suggestions

Ask students to list on **Worksheet 3.17** the meals they have had in the last 24 hours, and what foods they ate. They need to remember all the various snacks too.

Do they think they needed all the food they ate? Ask them how they would have felt if they had missed one of these meals or a few of the snacks.

Tell them to keep their list for one of the activities later in the lesson.

Main lesson activities

- 1 Internet exercise: get students to examine the graph at www.fas.org/irp/cia/product/globaltrends2015/375781.gif, showing world grain production over the last 40 years. Ask them to find out (using the internet) what the world population increase has been over the same period. They can now calculate the average grain total per person both for 40 years ago and for today. How has this changed (if at all)? Discuss what this should mean for the amount of food people have available to eat each day.
- 2 Complete **Now investigate** question 1 on p. 165, describing the pattern of global food supply. Students should use an atlas and try to name individual countries as examples in their answers.
- 3 Refer back to the lists of food that students have eaten over the last 24 hours. Now go online and find a 'calorie counter' or a website showing the number of calories in certain types of food. Ask students to try to work out how many calories they have eaten over the last day. How do the figures compare with the global average (3000 calories) and the average minimum needed to survive (2500 calories)?
- 4 Get students to look at the list of causes of food shortages shown in the Student Book (p. 164). Do any of these factors occur in their own country? (They can analyse this using the checklist on **Worksheet 3.18**.) If so, has this led to wide variations in the amount of food available? If not, why hasn't it led to food shortages?

Homework project	The early part of 2011 saw a huge shortage of food in the Horn of Africa. Students should complete an exercise looking at the causes behind the disaster and the effects it had on the countries and the individual people involved.
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Give extra support by providing students with calculators to make it easier for them to work out their 24-hour calorie count.

Give extra challenge by removing the atlas from main lesson activity 2 – students must rely on their general knowledge of the location of different countries.

Plenary suggestions

As a lead-in to the homework exercise, ask students what they remember about the 2011 famine in East Africa. Show pictures to prompt their memory and direct them to the websites where they can find more information.

Skills notes	The main lesson activities allow students to interpret geographical data shown on both maps and graphs.
Assessment suggestions	Assess understanding of how food shortages can turn into major disasters, by marking the homework projects on the Horn of Africa.

3.2(6)

The health effects of a shortage of food

Assessment objectives

- Candidates should be able to demonstrate knowledge and understanding of the inter-relationships between people's activities and the total environment and an ability to seek explanations for them.
- Candidates should be able to demonstrate knowledge and understanding of human actions contributing to the development of physical, economic and cultural environments.

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3.2 Food production

- Recognise the causes and effects of food shortages and describe possible solutions to this problem
- Identify the negative effects of food shortages, but also the effects of food shortages in encouraging food aid and measures to increase output

Differentiated learning outcomes

- **All students must** have a basic knowledge of the effects of food shortages and some ways to tackle the problem (Grade E/D).
- **Most students should** be able to explain why a lack of food causes diseases in humans and know a variety of ways in which food shortage problems can be tackled (Grade C/B).
- **Some students could** have a detailed understanding of the diseases caused by a lack of food and be able to explain exactly how the problems of food shortages can be addressed using both complex science and basic technology (Grade A/A*).

Resources

- **Student Book:** pp. 165–7
- **Worksheets:**
3.19 The effects of disease caused by food shortages
3.20 Solutions to the problem of food shortages
- **Photographs:** none
- **Further reading and weblinks:**
Further details of the green revolution can be found at:
www.geography.learnontheinternet.co.uk/topics/greenrev.html
www.thoughtco.com/green-revolution-overview-1434948

Key concepts

- A shortage of food can cause a number of different diseases.
- Scientists have devised various ways to tackle the problems of food shortages.
- These methods bring both benefits and problems of their own.

Starter suggestions

How do students feel if they do not have enough food to eat?

Ask students to consider different types of food. Do they know, for instance, why they need the different food groups – proteins, carbohydrates, fruit and vegetables?

See if they can come up with a basic meal that involves all of these groups. Which of the groups do the class feel they lack most in a daily diet?

Main lesson activities

- 1 Following the starter activity, ask students to read through the sections in the Student Book that describe diseases that can result from a lack of food (p. 165). They should try to learn the names of the various diseases. Give them five minutes to learn them and then, in pairs, they can test each other. One partner names the disease and the other has to say what its effects are.
- 2 Use the information at the end of the first section to draw a flow chart showing how disease can progress and then lead to a decline in agricultural productivity and other effects. Start with the sentence 'Malnutrition means people cannot work because of poor health' and move on from there using the template started on

Worksheet 3.19. Encourage students to add their own arrows and boxes in the space left at the bottom of the worksheet.

- 3** Ask students to read through the information on the Green Revolution. They should then design their own 'miracle plant', saying what advantages it has for people (and perhaps the environment). They could also outline some of the problems in trying to grow their miracle crop.
- 4** Use the internet to find examples of appropriate or intermediate technology. Students should be able to find at least three examples, and then write a paragraph describing how each one works and why it is a solution to the problem of food shortages.
- 5** After reading through the three solutions to food shortages outlined in the Student Book, students should summarise the benefits of each, in a paragraph on **Worksheet 3.20**.

Extension activity

Download and read through the document entitled 'Green Revolution: Curse or Blessing?' at www.ifpri.org/publication/green-revolution. Students should summarise the article and give their own opinions as to whether the Green Revolution has brought more benefits or problems.

Give extra support by providing students with pictures showing the diseases that are caused by a lack of food, to help them keep a mental image of the symptoms.

Give extra challenge by encouraging those students who are able enough to complete main lesson activity 5 – this involves reading a high-level article which should provide a challenge to many students.

Plenary suggestions

Discuss the various solutions used to try to overcome the problems of food shortages.

Which do students think is the best? They should divide into three groups, each group studying *either* the Green Revolution, *or* GM crops *or* intermediate technology. Give each group five minutes to come up with an argument for why their solution is best.

Each group presents its arguments to the whole class. All groups then judge which group gives the best reasons.

Assessment suggestions

Assessing the paragraphs on the worksheets completed for main lesson activity 4 will give a good indication of the level of understanding displayed by the students.

Assessment objectives

- Candidates should be able to demonstrate knowledge and understanding of human actions contributing to the development of physical, economic and cultural environments.
- Candidates should be able to make judgements that demonstrate an appreciation of the attitudes, values and beliefs of others in economic, political and social issues that have a geographical dimension.

0460/2217 syllabus**3.2 Food production**

- Recognise the causes and effects of food shortages and describe possible solutions to this problem
- Identify the economic and political factors causing food shortages

Differentiated learning outcomes

- **All students must** have a basic knowledge of how governments can deal with food shortages (Grade E/D).
- **Most students should** be able to explain some of the reasons why food shortages occur in LEDCs and how governments have tried to tackle the problem (Grade C/B).
- **Some students could** have a detailed understanding of the politics behind food shortages in LEDCs and the responsibilities governments have in solving the problems (with reference to a specific case study) (Grade A/A*).

Resources

- **Student Book:** pp. 168–71
- **Worksheets:**
3.21 Bolivia factfile
3.22 Letter to the President
- **Photograph:**
3.17 Christian Medina, miner, Bolivia
- **Further reading and weblinks:**
You can search for more information on food shortages in Bolivia using the key words mentioned in the Student Book.

Key concepts

- Governments often have a role to play in causing food shortages.
- Governments can take action to ensure their people receive enough food.
- Food shortages can lead to civil unrest, demonstrations and riots.

Starter suggestions

Ask students why governments often have a role in creating food shortages.

Brainstorm ideas about what governments can do to prevent food shortages taking place (then get students to check their answers against the first paragraphs of the Student Book).

Finish by discussing why governments may not be able to ensure a secure food supply. How do they think people in their country would react if there wasn't enough food to eat?

Main lesson activities

- 1 Using the information in the opening paragraphs of the Student Book, students should write short notes explaining how governments can prevent food shortages and why some may not be able to.
- 2 The case study on food shortages in Bolivia shows that there have been huge price rises in certain basic products over a short period of time. Ask students to talk to adults in their family to find out if the situation is the same in their country. They should be able to gather opinions on food price rises and could also ask their family members what they think of the price rises and how they are able to cope.

- 3 **Worksheet 3.21** can be used to construct a factfile about Bolivia. Students should gather information from an atlas and the Student Book to add details to the blank map of the major cities and landmarks. They can also add some details about the people. They can then find out and add other facts using either an atlas or the internet.
- 4 Christian Medina, the miner protesting in Bolivia, is obviously worried about the effects that food shortages will have on his family (see photo A on p. 163 – also in the downloadable resources as photo 3.17). Read what he thinks about the situation and then, using the template on **Worksheet 3.22**, write a letter from Christian to the president of Bolivia in which he explains his situation and asks for help.

Internet extension activity

Ask students to find examples of civil unrest (problems such as riots and demonstrations) caused by food shortages in other countries around the world. They should try to find out the reasons for the shortages of food in these countries. Are the reasons similar to or different from those that caused the demonstrations in Bolivia?

Give extra support by showing students the pictures of riots caused by food shortages in Bolivia and asking them to describe how those involved may be feeling before they complete the letter-writing exercise in main lesson activity 4.

Give extra challenge by ensuring that students complete the internet extension activity above – this could be done as an exercise to practise internet research techniques at home.

Plenary suggestions

Based on the readings in this chapter, discuss the problem of civil unrest caused by food shortages around the world. What do students think can be done to help?

What about the future? Do students think things will get better or worse? Ask them to explain their answers.

Assessment suggestions

A simple assessment could look at the letters written in main lesson activity 4. The exercise completed for the internet extension activity above could provide an assessment opportunity for higher-ability students.

3.3(1)

What do you want to be when you start work?

Assessment objectives

- Candidates should be able to demonstrate knowledge and understanding of human actions contributing to the development of economic environments.
- Candidates should be able to make judgements that demonstrate an awareness of the contrasting opportunities and constraints of people living in different places and under different physical and human conditions.

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3.3 Industry

- Demonstrate an understanding of an industrial system: inputs, processes and outputs (products and waste)

Differentiated learning outcomes

- **All students must** have a basic knowledge of the wide variety of jobs available (Grade E/D).
- **Most students should** be able to describe the skills that are needed to do a number of different jobs (Grade C/B).
- **Some students could** have a detailed understanding of the skills needed to succeed in the workplace and be able to give opinions on future developments in employment opportunities (Grade A/A*).

Resources

- **Student Book:** pp. 171–3
- **Worksheet:**
3.23 The world of work
- **Photographs:**
3.18 Agricultural worker
3.19 Doctor
3.20 Teacher
3.21 Computer technician
- **Further reading and weblinks:**
None

Key concepts

- There are a wide variety of jobs available for students when they leave education.
- The jobs available require very different types of skills.
- Many jobs of the future may not have been invented yet.

Starter suggestions

Ask students to think of the three jobs they would like to do more than anything else in the world.

Get them to write the jobs on a large piece of paper (or several pieces of paper) at the back of the classroom.

Tell the students that we will return to their 'jobs most wanted' later in the lesson.

Main lesson activities

- 1 Get students to look at the four photos in figure A on p. 171 of the Student Book, of people working (photos 3.18 to 3.21 from the downloadable resources). Working in pairs and using **Worksheet 3.23**, they should identify each of the jobs shown (as described in the **Now investigate** question 1 on p. 173). They should then discuss with their partner the good points and bad points about each of the jobs and write down their thoughts. Finally they should compare their good and bad points with another pair.
- 2 The Student Book includes a number of 'talking heads' on pp. 172–3, describing a wide variety of jobs. Students should pick two members of their family and carry out a similar exercise, writing down what their family members do and what they might think of their jobs.

Homework extension	This activity could be extended over a homework session with students interviewing their family members to get their real thoughts on what they think of their jobs.
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- 3 Discuss the jobs shown in the Student Book and ask students what skills they think would be needed for them to be able to do the jobs. Now ask students to return to the 'jobs most wanted' board and to pick three (or five) jobs they would want to do (but not the ones they themselves wrote down). They now need to decide what skills they would need to do the job. Finally they should find somebody else in the class who has picked the same job and compare what they have written.
- 4 Ask students to decide on their one ideal job. They should now write a letter of application explaining to an employer why they should be given the job they want most in the world.
- 5 The Student Book mentions that 'the job you may do may not have been invented yet'. What do students think is meant by this? Give them examples, such as mobile phone apps designer, or hydrogen-powered car engineer, which did not exist 20 years ago. Now ask them to write down descriptions of two jobs that haven't been invented yet but which might be around in 20 years' time (and the skills needed to do them).

Give extra support by providing students with lists of jobs from the local paper so they have help when thinking of available jobs and the skills needed to do them.

Give extra challenge by having students find out the names of companies holding their ideal job, before completing the application letter in main lesson activity 4.

Plenary suggestions

Talk to students about your own experiences in the job market and get a couple of other teachers to come in and do the same – especially if they have had other jobs outside of teaching.

Prepare the students for life by explaining how you got your job, the skills you needed and what you had to do to apply (detailing, perhaps, interviews and selection procedures).

Skills notes	The main lesson activities allow students to develop some skills for life by thinking about the jobs they may want in the future, the skills needed to do them and how to apply for them.
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3.3(2)

What things are made in my local area?

Assessment objectives

- Candidates should be able to demonstrate knowledge and understanding of human actions contributing to the development of economic environments.
- Candidates should be able to make judgements that demonstrate an awareness of the contrasting opportunities and constraints of people living in different places and under different physical and human conditions.

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3.3 Industry

- Demonstrate an understanding of an industrial system: inputs, processes and outputs (products and waste)
- Identify industry types: manufacturing, processing, assembly and high-technology industry
- Explain the influence of factors including land, labour, raw materials, fuel and power, transport, markets and political factors

Differentiated learning outcomes

- **All students must** have a basic knowledge of secondary industry and industrial location (Grade E/D).
- **Most students should** be able to describe how secondary industry operates and have knowledge of a number of factors affecting industrial location (Grade C/B).
- **Some students could** have a detailed understanding of how the industrial system operates with respect to secondary industry and be able to explain how a wide range of factors affect industrial location with reference to specific industries (Grade A/A*).

Resources

- **Student Book:** pp. 173–7
- **Worksheet:**
3.24 Industrial location diamond ranking
- **Photographs:**
3.22 Large-scale manufacturing
3.23 Small-scale manufacturing
- **Further reading and weblinks:**
Some revision pages of industry characteristics including location can be found at:
www.bbc.co.uk/schools/gcsebitesize/geography/economic_change/characteristics_industry_rev4.shtml

Key concepts

- Secondary industry is involved with the manufacture of products.
- As a country develops, its secondary industry increases in importance.
- There is a wide range of factors influencing industrial location.

Starter suggestions

Manufacturing industry is all about making things. This can be on either a very large or a very small scale, as illustrated in the photos in figure A on p. 173 of the Student Book (photos 3.22 and 3.23 from the downloadable resources).

Students need to imagine they are the workforce in a factory. What can they already make without any further training?

Can any students cook? Have some helped build furniture at home? Do any have part-time jobs or help in the family business?

Consider the answers from the class and decide if you would employ any of the students on the basis of the skills they have. Which skills are the most useful?

Main lesson activities

- 1 Ask students to name as many manufacturing industries as they can that have factories in the local area. You could identify a number of these local manufacturing companies in advance of the lesson, to enable you to support students with some of the tasks that follow. Contact one or more of these companies and ask if they are willing to come into school to talk about their business.
- 2 Using any local business as a case study example, draw a systems diagram to show how the secondary industrial system operates (as outlined in **Now investigate** question 3 on p. 175 of the Student Book).
- 3 Read through the sections on industrial location. In groups, and using the template on **Worksheet 3.24**, complete a 'diamond ranking' showing the importance of the various factors listed – the most important at the top and the least important at the bottom. You could write the statements down and cut them out so you can move them around in a diamond shape on the desk as discussion progresses.
- 4 Looking back to examples of industries in the local area, decide on the location factors that will have brought (or kept) the industry in your town or city. Again, this exercise can be enhanced by getting speakers in from the industry to talk to students in class.
- 5 Role-playing exercise: the decisions and actions involved in the manufacturing process can be modelled using a 'trading game'. Some of these are commercial products but there are examples available online which explore the difficulties of making a living from manufacturing in some parts of the world.
Try **Trading Trainers** at
https://cafod.org.uk/content/download/854/6774/version/8/file/secondary_fairtrade_trading-trainers_activity.pdf
as an example.

Give extra support by writing down in advance the 'diamond ranking' factors influencing industrial location, and cutting them out so that students can move them around.

Give extra challenge by asking students to fully justify their reasons for their 'diamond ranking' of industrial location factors.

Plenary suggestions

To help students understand more about the opportunities available in the manufacturing industry and to increase their ambitions for when they leave school, try to find information on the destinations of former students and the sort of jobs they now do.

If possible, ask some of the former students to come in to school for a question-and-answer session with your current students.

Skills notes

The role-playing games provide excellent opportunities for developing high-level thinking skills and encouraging students to cooperate and share skills.

3.3(3)

Manufacturing industries

Assessment objectives

- Candidates should be able to demonstrate knowledge and understanding of the changes that occur through time in places and spatial distribution.
- Candidates should be able to recognise the role of decision making within a geographical context as affected by the increasing level of global interdependence.

0460/2217 syllabus

3.3 Industry

- Describe and explain the factors influencing the distribution and location of manufacturing industries
- Explain their combined influences on the location, scale of production, methods of organisation and the products of the system
- Identify industrial zones and/or factories with respect to locational and siting factors

Topic link: the environmental impacts, problems and benefits of high-technology industry are outlined in Topic 3.7 pp. 220–6.

Differentiated learning outcomes

- **All students must** have a basic knowledge of why secondary industry locates in a certain place (Grade E/D).
- **Most students should** be able to describe why specific examples of secondary industry are located in different countries (Grade C/B).
- **Some students could** have a detailed understanding of how secondary industries operate at a number of different scales, with reference to specific examples of industries and the countries in which they operate (Grade A/A*).

Resources

- **Student Book:** pp. 175–8
- **Worksheets:**
3.25 Factors influencing the location of the iron and steel industry
3.26 Textile industry case study
- **Photographs:**
3.24 Making steel in India
3.25 Small-scale textile industry in Bangladesh
- **Further reading and weblinks:**
An overview of the world textile trade is available at:
www.teonline.com/industry-overview.html

Key concepts

- The location factors affecting secondary industry have changed over time.
- The textiles and clothing industry is one of the biggest secondary (manufacturing) industries in the world.
- Industrial development is increasingly taking place on a local scale in many countries.

Starter suggestions

Revise the factors that affect the location of manufacturing industries.

Brainstorm with input from the class and write the location factors they come up with on the board. How many of these factors are applicable to the local area? What kinds of industry have grown up to take advantage of these location factors?

Explain that the following lesson will look in more detail at how location factors affect specific industries and how they change over time.

Main lesson activities

- 1 Read through the first few paragraphs on manufacturing industries in the Student Book. Concentrate particularly on the location factors affecting iron and steel industries. Display photo **A** from p. 176 of the Student Book (photo **3.24** from the downloadable resources). Now use the information to annotate the picture on **Worksheet 3.25**.

- 2 The Student Book has a detailed case study on the textile and clothing industry. Use the information to write a one-page report on the history and development of the global textile industry, concentrating on location factors and the shift in production from MEDCs to LEDCs.

Extension activity

Some students could also include details of future trends in the textile industry by looking at the website listed in **Resources**.

- 3 How does your town market itself as a location for business? Try to find examples of advertising literature from your town's chamber of commerce or equivalent organisation. See if your students can do better by producing a marketing campaign with posters and brochures, or using new technologies such as podcasts or internet adverts.
- 4 The case study looks at the textile and clothing industry in Bangladesh and includes a few details of how this started as small-scale manufacturing in rural areas. Display photo 3.25 from the downloadable resources showing some of this home-grown textile production. Can students think of any examples of similar small-scale manufacturing in their own country? What kinds of products are local people making? Where are they selling these products?
- 5 There are many more examples of small-scale manufacturing industries around the world on independent business websites such as www.kiva.org – an organisation that offers small loans to people around the world who have good business ideas. Have a look at the website and find five examples of businesses that you would like to support. You could even try to get your students to fundraise: pick a small business to support and make a donation to help them.

Give extra support by giving students **Worksheet 3.26** – a writing frame to enable them to complete main lesson activity 2 above.

Give extra challenge by asking students to find other examples of small-scale entrepreneurial websites from around the world.

Plenary suggestions

Revisit some of the discussions in earlier themes that looked at how employment opportunities in the students' local area had changed over time.

Get hold of some old maps of the area and look at the industries that used to be located around the town or local area. If this is not possible, invite senior members of the community into school to talk to students about the changes.

Use the session to show that industrial location is a dynamic process and that companies locating in the local area are changing all the time.

Assessment suggestions

The case study report in main lesson activity 2 provides a good opportunity for assessment of knowledge, understanding and interpretation.

Assessment objectives

- Candidates should be able to demonstrate knowledge and understanding of human actions contributing to the development of economic environments.
- Candidates should be able to recognise the role of decision making within a geographical context as affected by the increasing level of global interdependence.

0460/2217 syllabus**3.3 Industry**

- Describe and explain the factors influencing the distribution and location of high-technology industries
- Explain their combined influences on the location, scale of production, methods of organisation and the products of the system
- Identify industrial zones and/or factories with respect to locational and siting factors

Topic link: the environmental impacts, problems and benefits of high-technology industry are outlined in Topic 3.7 pp. 220–6.

Differentiated learning outcomes

- **All students must** have a basic knowledge of how high-technology industries operate (Grade E/D).
- **Most students should** be able to describe the global distribution and some of the location factors for high-technology industries and science parks (Grade C/B).
- **Some students could** have a detailed understanding of the industrial system as it relates to high-technology industries and the associated location factors with reference to specific case studies from around the world (Grade A/A*).

Resources

- **Student Book:** pp. 178–80
- **Worksheets:**
3.27 Odd One Out: Industry (question sheet)
3.28 Odd One Out: Industry (word grid)
- **Photographs:**
3.26 Biopolis, Singapore
3.27 Hsinchu Science Park, Taiwan
- **Further reading and weblinks:**
More details on the science park of Biopolis in Singapore at:
<https://en.wikipedia.org/wiki/Biopolis>

Key concepts

- High-technology industries have specific location factors that lead to them being termed 'footloose'.
- High-technology industries often locate near each other in science parks.
- Most science parks are in MEDCs but there is an increasing number in LEDCs.

Starter suggestions

What do we mean by high-technology industries? What kinds of things do they make?

Ask students to check their pockets and bags for anything they may consider high-tech, e.g. phones, iPods (some may also have laptops or tablets).

Look around the classroom – what else can we add to the list? Take account of products including PCs, projectors, DVD players etc.

Main lesson activities

- 1 Have students consider the products identified in the starter session. What are the common characteristics of these items? Students should be able to say they are mainly small in size with a lot of even smaller, complex parts. They should then answer the following questions (perhaps in pairs):

- Given their size, what location factor previously identified for manufacturing industries will no longer be important?
- Where, then, will the high-technology industries that make them want to locate?

Finish this activity by having students write down their own definition of 'footloose' in relation to industrial location.

- 2 Students should read through the section in the Student Book on the global distribution of high-technology companies. In pairs they should decide what would attract them to an area if they wanted to work for a footloose industry. Using an atlas they should then try to identify three areas or countries where they could find these attractions.
- 3 Students should read through the sections on science parks and the location factors behind them. Display and discuss photos **D** and **E** on p. 179 of the Student Book (photo **3.26** and **3.27** from the downloadable resources). In groups, on a large piece of paper, they should design their own science park where these location factors are met. They need to pay some attention to transport links and landscaping, for instance. They could have a look at www.cambridge-science-park.com for some ideas from a specific example.
- 4 Internet exercise: students should try to find out more details of one science park in either Asia, South America or Africa. They should research the companies located in their chosen park and the location factors that make it attractive to global businesses.
- 5 Students should answer question **3** in the **Now investigate** section on science parks in your own country (Student Book p. 180). Are there any already established and, if not, what could your government do to encourage companies or universities to build them?

Give extra support by letting students read the opening few paragraphs in the Student Book before answering main lesson activity **1** above.

Give extra challenge by asking students to find an example other than those featured in the Student Book to research for their case study in main lesson activity **4**.

Plenary suggestions

Revise the whole industry theme using the Odd One Out exercise on **Worksheets 3.27** and **3.28**. Students need to pick the three words listed on **Worksheet 3.27** from the grid on **Worksheets 3.28**, write them down and decide which is the odd one out.

Remember: there may be more than one correct answer. The most important thing is for them to justify why they have chosen their particular odd one out.

Extension activity	Students can make their own Odd One Out number lists and question their classmates.
Assessment suggestions	The Odd One Out exercise in the plenary can be formalised (or set as homework) to be used for assessment; or the detailed case study in main lesson activity 4 can be checked for a deeper appreciation of students' knowledge and understanding.

3.4(1)

Where do tourists go on holiday?

Assessment objectives

- Candidates should be able to make judgements that demonstrate an awareness of the contrasting opportunities and constraints of people living in different places.
- Candidates should be able to recognise the role of decision making within a geographical context as affected by the increasing level of global interdependence.

0460/2217 syllabus

3.4 Tourism

- Describe and explain the growth of tourism in relation to the main attractions of the physical and human landscape

Differentiated learning outcomes

- **All students must** have a basic knowledge of the growth of global tourism (Grade E/D).
- **Most students should** be able to describe some of the reasons behind the massive recent growth in global tourism (Grade C/B).
- **Some students could** have a detailed understanding of the growth of global tourism, the many different kinds of holidays that are available and how the nature of tourism is changing (Grade A/A*).

Resources

- **Student Book:** pp. 181–3
- **Worksheets:**
3.29 Postcard from an ideal holiday
3.30 The worst holiday in the world
- **Photographs:** None
- **Further reading and weblinks:** None

Key concepts

- Many countries develop their tourist industry as a way to boost their economy.
- Global tourism has increased massively over the past 50 years.
- There have been big changes recently in the characteristics of tourists and the holidays they are taking.

Starter suggestions

Do many people come to visit your local area?

In groups, have students make a list of all the tourist attractions that people may want to come and see in their local area. This could include anything from swimming pools to major theme parks.

Why else would people want to come and visit? Think about the weather, local food and local people, and how these may influence visitors to your country or region.

Main lesson activities

- 1 Following on from the starter activity, ask students to complete the **Now investigate** question 1 on p. 183 of the Student Book. They should devise a holiday for Jean-Claude and his family, remembering that it has to appeal to all the family members.
- 2 Ask students, if they could go on holiday anywhere in the world, where they would like to go and why. What would they do when they got there? They should imagine they are on their ideal holiday and, using the template on **Worksheet 3.29**, send a postcard to one of their friends. They can draw a picture (or find a photo) to illustrate the front of the postcard and then write their message saying what a great time they are having.
- 3 Where would you not want to go on holiday? In groups or pairs, students discuss some places that would be the worst tourist destinations, starting locally and then widening to a global scale. The reasons might be to do with the weather, or the environment, or even the presence of a particular building. It could also be related

to the economic, political or social environment in the country or location. Students write down their thoughts on **Worksheet 3.30**.

- 4 Internet exercise: the Student Book includes a list of speciality tours that are available in different countries. Students should choose one example and find out more about it using the internet and then write a brief report on what activities take place, the places where they happen and how much it all costs.

Extension: students can look for examples of other types of speciality tourism, not just those listed in the book.

- 5 In groups, students try to decide what are the top 10 tourist attractions in the world in terms of visitor numbers (the Student Book already states that Times Square in New York is number one). Answers can be compared with the top 50 shown at <http://coolrain44.wordpress.com/2009/08/25/50-most-popular-tourist-attractions-in-the-world/>.

Give extra support by letting students use the internet or, perhaps, some guidebooks to your own country, to help them complete main lesson activity 1.

Give extra challenge by having students consider the future trends in global tourism (there are brief indications to these in the Student Book) – they could add this information to their answers to question 2 in the **Now investigate** section on p. 183 of the Student Book.

Plenary suggestions

Link back to Topic 3.4 and ask students to produce a list of jobs related to tourism.

Which of these would be most 'rewarding' in financial terms? What other benefits would there be in taking on these jobs?

Ask students to vote on which of them they would be happy to have as a career.

Assessment suggestions

Either of questions 2 or 3 in the **Now investigate** section on p. 183 of the Student Book provide good opportunities for assessing knowledge and understanding, while question 4 tests research skills. Main lesson activity 2 above also gives more creative students the chance to produce excellent work.

Assessment objectives

- Candidates should be able to make judgements that demonstrate an awareness of the contrasting opportunities and constraints of people living in different places.
- Candidates should be able to recognise the role of decision making within a geographical context as affected by the increasing level of global interdependence.

0460/2217 syllabus**3.4 Tourism**

- Describe and explain the growth of tourism in relation to the main attractions of the physical and human landscape
- Evaluate the benefits and disadvantages of tourism to receiving areas

Differentiated learning outcomes

- **All students must** have a basic knowledge of the importance of global tourism (Grade E/D).
- **Most students should** be able to describe some of the benefits that tourism can bring, especially in relation to a case study from an MEDC (Grade C/B).
- **Some students could** have a detailed understanding of the benefits and disadvantages brought by global tourism, especially with respect to a case study from an MEDC (Grade A/A*).

Resources

- **Student Book:** pp. 183–6
- **Worksheets:**
3.31 The benefits and problems of global tourism
3.32 The world's top tourist destinations
- **Photographs:** None
- **Further reading and weblinks:**
The latest trends in world tourism are reported by the World Tourism Organisation at:
<http://mkt.unwto.org/publication/unwto-tourism-highlights-2013-edition>

Key concepts

- Tourism can bring considerable economic (and other) benefits to a country.
- There are also some negative effects associated with the tourist industry.
- Countries that rely on tourism continually have to try to attract tourists because of increased global competition.

Starter suggestions

Ask students to think about the advantages that tourism can bring to an area.

They should make a list of all the ones they can think of, including economic benefits, improvements to roads, etc., and other infrastructural changes.

Can they also think of disadvantages that a tourist industry may bring?

Main lesson activities

- 1 Students should read through the opening paragraphs in the Student Book outlining (mainly) the benefits that tourism can bring to a country. They should then summarise the information using the mindmap on **Worksheet 3.31**. Working with a partner they should add information on the disadvantages of tourism from what they have read and the work they completed in the starter exercise.
- 2 Using the information in table A on p. 184 of the Student Book, and the template on **Worksheet 3.32**, students should display the information on visitor numbers as a pie chart.

Extension: can students think of any other ways to display the information? Refer to Section 4 of the Student Book for some other examples.

- 3 Read through the case study information on France. The country has many cultural sites that are known throughout the world. Produce a guide to the local cultural sites that you think visitors to your home town, region or country would find unmissable while on holiday.
- 4 France is often viewed as a 'must see' tourist destination. www.100placestovisit.com has a list of 100 other destinations. How many of these have you actually seen? As a class, discuss whether books and lists like this can lead to places becoming damaged and less popular.
- 5 Many of the sites in France have been given special protection by UNESCO, as World Heritage Sites. There are hundreds more around the world shown on the list at <http://whc.unesco.org/en/list>. Investigate the interactive map on the website and see how many World Heritage Sites there are in France and in other MEDCs.
- 6 Working in pairs, students should suggest local places that might fit the criteria for listing as a World Heritage Site, and write a proposal to UNESCO asking for their place to be added to the list.

Give extra support by providing students with the data from table **A** already worked out as percentages, to enable them to complete their pie charts.

Give extra challenge by getting students to read the report from the World Tourism Organisation describing the trends in global tourism. Then ask them to summarise the information shown, in a one-page report (as a possible homework exercise).

Plenary suggestions

On balance, do students think that the global tourism industry does more harm than good?

Take each of the following points in turn and ask the students for opinions:

- What is the damage to the local environment caused by tourism?
- Why does tourism lead to jealousy and crime in some countries?
- What effects will tourism have on global climate change?

Explain to students that some of these negative effects are made worse when tourism is developed in LEDCs – as shown in the next lesson.

Skills notes

The lesson and the activities in the Student Book include a number of ways in which students can practise important geographical display skills, such as drawing bar graphs and pie charts.

Assessment objectives

- Candidates should be able to make judgements that demonstrate an awareness of the contrasting opportunities and constraints of people living in different places.
- Candidates should be able to analyse and interpret geographical data and use and apply geographical knowledge and understanding to maps.

0460/2217 syllabus**3.4 Tourism**

- Evaluate the benefits and disadvantages of tourism to receiving areas
- Demonstrate an understanding that careful management of tourism is required in order for it to be sustainable

Topic link: the environmental risks and benefits associated with tourism are discussed in Topic 3.7 on pp. 227–34.

Differentiated learning outcomes

- **All students must** have a basic knowledge of the importance of tourism to the economy of LEDCs (Grade E/D).
- **Most students should** be able to describe some of the benefits and problems that tourism can bring, especially in relation to a case study from an LEDC (Grade C/B).
- **Some students could** have a detailed understanding of the over-reliance that some LEDCs have on tourism (with respect to a specific case study) and knowledge of the effects that changes in trends in tourism can bring (Grade A/A*).

Resources

- **Student Book:** pp. 186–8
- **Worksheets:**
3.33 My Kenyan holiday
3.34 Nairobi climate graph
- **Photographs:**
Pictures of tourist sites in Kenya from the Kenyan tourist board website (see below)
- **Further reading and weblinks:**
The official Kenyan tourist board site is:
<http://ktb.go.ke>

Key concepts

- LEDCs often rely on tourism more than MEDCs do.
- Trends in international tourism mean that a popular country can quickly fall out of favour.
- Kenya is a good case study example of an LEDC with changing tourist patterns.

Starter suggestions

Referring back to the previous lesson, think again about the advantages and disadvantages that tourism can bring to MEDCs (perhaps this could have been set as a homework exercise at the end of the last lesson).

Ask students to list the advantages and disadvantages in a table and discuss them as a class exercise.

Tell students to keep the lists for activities later in the lesson.

Main lesson activities

- 1 Students should use an atlas to find famous tourist attractions, places and things to do in LEDCs. This exercise could be enhanced by getting students to use the internet to look for World Heritage Sites, famous beaches, safari parks and other sites. They can work in pairs or groups to come up with a top 10 of the world's best attractions in LEDCs. Take the top three from each group and vote on the 'Best LEDC holiday experience in the world'.

- 2 Students should read through the opening paragraphs in the Student Book on the advantages and disadvantages of tourism for LEDCs. They should then use this information to complete the table they created in the starter exercise, perhaps including the examples from LEDCs in a different colour.
- 3 Look at some pictures of Kenya or the tourist attractions shown on the tourist board website. Using an atlas and the information in the Student Book, students should devise a week or fortnight's holiday in Kenya for their family, and annotate the map on **Worksheet 3.33** with their route and itinerary.
- 4 Students can practise drawing a climate graph for the Kenyan capital of Nairobi using the information and template on **Worksheet 3.34**. Students can then compare their graph with the climate graph F for Mombasa on Student book p. 188 and discuss the differences in the climate that might make Mombasa a more popular choice for a holiday.
- 5 In the Student Book, Jean-Claude Benoix (p. 181) has a lot to say on holidays and tourism. Ask students how they think a Kenyan teenager of similar age would think about visitors travelling to Kenya. They should write down some quotes showing the thoughts of a young Kenyan, giving both negative and positive ideas.

Extension activity

What is the 'great migration'? Students should find out details of this spectacular wildlife event and explain it to their classmates.

Give extra support by adding the data for the first three months of the year to **Worksheet 3.34** before photocopying it for students.

Give extra challenge by asking students to add more detail to their Kenyan holiday worksheets, including important information for tourists such as exchange rates, the cost of flights and how long they take, the possibility of car hire, etc.

Plenary suggestions

Based on the readings and exercises completed in this theme, would students like to see the further development of tourism in their own country?

What would the specific advantages and disadvantages of any further development be? Students should be able to think of actual examples where effects would be felt – both good and bad.

Skills notes

The lesson provides a good opportunity for annotating maps and for practice in drawing climate graphs.

Assessment suggestions

Assessment of skills development can be made using either of the two examples in the **Skills notes** above.

Assessment objectives

- Candidates should be able to demonstrate knowledge and understanding of the wide range of processes contributing to the development of economic environments and their associated effects on the landscape.
- Candidates should be able to analyse and interpret geographical data and select and use techniques for organising and presenting data.

0460/2217 syllabus**3.5 Energy**

- Describe the importance of non-renewable fossil fuels, renewable energy supplies, nuclear power and fuelwood; globally and in different countries at different levels of development

Topic link: The increase in global population that has led to increased energy consumption is covered in Topic 1.1 pp. 2–5.

Differentiated learning outcomes

- **All students must** have a basic knowledge of global energy consumption (Grade E/D).
- **Most students should** be able to describe some of the ways in which energy is generated and how it is used around the world (Grade C/B).
- **Some students could** have a detailed understanding of the reasons behind differing levels of energy consumption around the world and how this has changed over time (Grade A/A*).

Resources

- **Student Book:** pp. 189–91
- **Worksheets:**
3.35 Worldwide energy use
3.36 Global energy sources
- **Photographs:** None
- **Further reading and weblinks:** None

Key concepts

- Huge amounts of energy are needed each day in order to power the modern world.
- Different countries use vastly different amounts of energy.
- Global consumption of energy has changed over the last 200 years.

Starter suggestions

What do we use energy for?

Students should make a list of everything they have used so far today that needs energy. A selection of these things should be brainstormed onto the board.

Now discuss where this energy comes from. Do students know how their energy is produced and what methods (e.g. coal, solar) are used to produce it?

Main lesson activities

- 1 Students should read through the statements by 'talking heads' in the Student Book. Ask them to consider which one they are most like in terms of their family's energy usage. In pairs they should discuss which of the talking heads it would be better for more of us to be like. Which of them would be bad news for the world if more of us were like them?
- 2 Ask students to introduce a *talking head version* of themselves, like those in the Student Book. They should identify the main ways that they use energy in the house and write a brief description of their family's energy use. How would they rate themselves on a scale of 1 to 10, with 1 being very energy efficient and 10 being very energy wasteful?
- 3 Ask students to complete activity 1 in the **Now investigate** section at the bottom of p. 190 of the Student Book, using the table on **Worksheet 3.35**. They can then add details from their own life (activity 2a) in the second half of the table. Finally, they

should write a few sentences to answer question **2b**, showing which of the things they use that perhaps they could do without.

- 4** Graph **B** in the Student Book p. 190 shows changes in global energy consumption over the last few hundred years. Using the graph and the information in the text, students should write a detailed description of the changes shown. Remind students to include details of specific fuel types in their answer.
- 5** Question **4** in the **Now investigate** section on p. 191 asks students to draw a pie graph to display the data shown in table **C**. After completing this, students can use the internet to research the energy sources used in their own country, and the percentage of each different energy type. They can then use the information to complete the divided bar graph on **Worksheet 3.36**.

Give extra support by showing students pictures of everyday items that use energy, to provide them with some visual stimulus before attempting main lesson activity **1**.

Give extra challenge by asking students to complete both parts of main lesson activity **5**. They should then decide which of these graphic methods they think is best, and why.

Plenary suggestions

Ask students, in groups, to create a list of countries that they think use the most energy in the world. They can check their lists against the table at http://en.wikipedia.org/wiki/World_energy_consumption

Now ask them to consider the biggest users of energy *per person*. Have their ideas changed? Why? Again, they can check their ideas against their original list.

After they have looked at both sets of data, ask students to decide which of the countries is really doing the most harm to the environment.

Assessment suggestions

The written work in main lesson activity **4** is a good test of students' ability to describe and explain trends from graphs. Main lesson activity **5** gives them a chance to show how well they understand geographical presentation techniques.

3.5(2)

Fossil fuels – making the world work

Assessment objectives

- Candidates should be able to demonstrate knowledge and understanding of the wide range of processes contributing to the development of economic environments, and their associated effects on the landscape.
- Candidates should be able to demonstrate knowledge and understanding of the interrelationships between people's activities and the total environment, and an ability to seek explanations for them.

0460/2217 syllabus

3.5 Energy

- Describe the importance of non-renewable fossil fuels globally and in different countries at different levels of development
- Identify non-renewable fossil fuels including coal, oil and natural gas

Differentiated learning outcomes

- **All students must** have a basic knowledge of the importance of fossil fuels in global energy consumption (Grade E/D).
- **Most students should** be able to describe the different types of fossil fuels and their importance in bringing about energy security (Grade C/B).
- **Some students could** have a detailed understanding of the different types of fossil fuels and their contribution to energy security with specific references to their use in a case study country (Grade A/A*).

Resources

- **Student Book:** pp. 191–3
- **Worksheet:**
3.37 The formation of fossil fuels
- **Photographs:**
Google images search for Fossil fuels China
- **Further reading and weblinks:**
Reports on fossil fuel use in China:
www.bbc.co.uk/worldservice/learning/english/language/wordsinthenews/2010/07/100723_witn_china_energy_page.shtml
www.washingtontimes.com/news/2009/sep/17/study-warns-of-shocking-fossil-fuel-use/

Key concepts

- Fossil fuels are by far the world's most significant sources of energy.
- Energy security comes when a country is self-sufficient in its energy production.
- China is one of the world's biggest consumers of fossil fuels.

Starter suggestions

What are fossil fuels? Ask students to write down the three main types of fossil fuels. Did anyone get them all correct? As they are called fossils, can any students guess how long ago they were formed?

See if anyone can describe how fossil fuels were formed. Provide an explanation by having them explore the link below:

www.coaleducation.org/q&a/how_coal_formed.htm

Main lesson activities

- 1 Once students have completed the starter they should draw a series of sketches to show how fossil fuels are formed, using the template on **Worksheet 3.37**. They can explore the internet for further information before filling in their pictures.

Internet exercise: use the internet to find out 'fantastic fossil fuel facts' such as:

- Which country has the most coal/oil/gas?
- Where are the world's largest coal and oilfields?
- Which country sells the most oil overseas?

– and any other facts you think would be good to feed back to the class.

- 2 Do you have any coal mines or oil and gas fields in the local area or your country as a whole? Get students to investigate them further (perhaps marking their location on a map). In groups, they should discuss the positive and negative effects that these businesses have. If possible, invite somebody from one of the companies involved in to school to speak to the students about them.
- 3 Read through the information on energy security in the Student Book and then students should answer question 2 in the **Now investigate** section on p. 193. They should concentrate on the problems of dependence for countries that do not have adequate supplies of their own.
- 4 The Student Book has reports from China of some of the problems brought by its increasing energy demands. In groups, and using the Student Book as a starter, make two lists showing the benefits and problems of fossil fuel use. These can then be used as discussion points in the plenary session.

Give extra support by letting students read and listen to the Chinese coal reports on the BBC website listed, to help them improve their vocabulary before attempting the tasks.

Give extra challenge by having students relate their investigations into local fossil fuel exploitation for main lesson activity 3, to map B on p. 191 of the Student Book, which shows global movements.

Plenary suggestions

Discuss the significance of fossil fuels for your own country and for the world as a whole. Ask students questions such as:

- On a local level, is your country's energy secure? Is this due to fossil fuels?
- What benefits does the exploitation of fossil fuels bring for those countries that have them?

You could also use this session to look at some of the negative aspects of fossil fuel use. You could discuss some of the potential environmental problems in China. It may also be useful to introduce the impact of fossil fuels on global climate change.

Assessment suggestions

The Student Book has some good questions in the **Now investigate** sections that will test ability to describe and explain patterns from maps, and ensure that students have a good basic case study knowledge.

Assessment objectives

- Candidates should be able to demonstrate knowledge and understanding of the interrelationships between people's activities and the total environment, and an ability to seek explanations for them.
- Candidates should be able to reason and make judgements that demonstrate a sensitivity to, and a concern for, landscape, the environment and the need for sustainable development.

0460/2217 syllabus**3.5 Energy**

- Describe the importance of fuelwood globally and in different countries at different levels of development

Differentiated learning outcomes

- **All students must** have a basic knowledge of the importance of fuelwood for many people in LEDCs (Grade E/D).
- **Most students should** be able to describe the importance of fuelwood and some of the environmental problems that come from its collection (Grade C/B).
- **Some students could** have a detailed understanding of the fuelwood crisis and the environmental damage that collection of fuelwood causes with respect to a specific country (Grade A/A*).

Resources

- **Student Book:** pp. 193–5
- **Worksheets:**
3.38 The problems with fuelwood collection
3.39 Factfile: reducing fuelwood use with more efficient stoves
- **Photographs:**
3.28 Deforestation for fuelwood use
- **Further reading and weblinks:**
A short video on the fuelwood crisis in India can be watched at:
www.youtube.com/watch?v=UjJHrpx4bUE

Key concepts

- Fuelwood is the most important source of energy for billions of people in LEDCs.
- Collection of fuelwood causes environmental and social problems.
- Deforestation for fuelwood collection is an increasing problem.

Starter suggestions

Show students photo **A** from p. 193 of the Student Book, of deforestation (photo **3.28** from the downloadable resources).

Explain that this is a typical scene in some areas of the world and especially in parts of Africa south of the Sahara.

What do they think is happening in the scene? Why have the trees been cut down?

Tell them that the reason for such deforestation is because people use the trees as fuelwood. What do they think this means?

Ask students to read through the first few paragraphs in the Student Book, which explain what is going on in photos **A** and **B**.

Main lesson activities

- 1 Go out into your school grounds and, in groups, send students foraging for wood. Explain that they need to get enough to cook a meal, but *must only collect what is lying on the ground*. They will need around four good-sized logs, or something of similar volume.

Students are likely to come back with very little wood. Discuss what their options would be once the foraged wood supplies are exhausted. If they have to cut wood from living trees, what impact will that have?

- 2 Read through the sections in the Student Book on the problems that fuelwood collection can cause. Students should add this information as labels around the picture shown on **Worksheet 3.38**.
- 3 One way to reduce the amount of wood that is being used for fuel is to design, and make available, more efficient stoves. Advantages include the fact that they produce less smoke and reduce the impact of that smoke on people's health, particularly for women. Research one of the stove types from the following list and use the information to complete the factfile on **Worksheet 3.39**.
 - Darfur stove:
www.stovesonline.co.uk/darfur-stove.html
 - Chulha stove:
www.geography.org.uk/cpdevents/onlinecpd/geographyoffood/cookingupastorm
 - Toyola stove:
<http://energy-access.gnesd.org/cases/35-toyola-efficient-charcoal-cook-stoves.html>
- 4 Get students to re-present the data shown in either diagram C or graph D using one of the other geographical display techniques they have studied (they should refer to Section 4 of the Student Book).
- 5 **Internet exercise:** the Student Book has a detailed example of fuelwood problems in West Bengal, India. Using the internet, research the fuelwood crisis in a country in Africa shown on graph D of the Student Book and complete a one-page report on the country chosen. Information on Burkina Faso, for instance, can be found at http://solarcooking.wikia.com/wiki/Burkina_Faso

Give extra support by directing students towards the countries of the Sahel (south of the Sahara) for their chosen example in main lesson activity 5 above.

Give extra challenge by asking students to read through all the data on different types of stoves listed in main lesson activity 3 above. Then challenge them to design their own ideal stove using bits from all three.

Plenary suggestions

Use question 2 in the **Now investigate** section on p. 195 to provide discussion points for the plenary session. Read through Rashid's story in the Student Book and then get students to consider the following questions:

- Why does Rashid feel forced into selling fuelwood when he knows it is wrong?
- What do you think will happen if he stops?
- What would you do in his situation?
- What could be done to help people in Rashid's situation cut down on their fuelwood consumption?

Assessment suggestions

The exercise in activity 5 above should provide a good example to assess students' research skills and their ability to interpret information.

Skills notes

Students can practise their geographical skills through main lesson activity 4 above.

Assessment objectives

- Candidates should be able to demonstrate knowledge and understanding of the interrelationships between people's activities and the total environment, and an ability to seek explanations for them.
- Candidates should be able to reason and make judgements that demonstrate a sensitivity to, and a concern for, landscape, the environment and the need for sustainable development.

0460/2217 syllabus**3.5 Energy**

- Describe the importance of renewable energy supplies globally and in different countries at different levels of development
- Identify renewable energy supplies including geothermal, wind, HEP, wave and tidal power, solar power and biofuels
- Evaluate the benefits and disadvantages of renewable energy sources

Topic link: A detailed example of the global use of hydro-electric power – a major source of renewable energy – can be found in Topic 3.5 on pp. 202–3.

Differentiated learning outcomes

- **All students must** have a basic knowledge of some of the different types of renewable energies (Grade E/D).
- **Most students should** be able to describe the importance of renewable energies in helping to provide alternative, sustainable energy sources (Grade C/B).
- **Some students could** have a detailed understanding of how the different types of renewable energies work and the ways they can reduce the worldwide dependence on fossil fuels (Grade A/A*).

Resources

- **Student Book:** pp. 195–7
- **Worksheet:**
3.40 The advantages and disadvantages of renewable energies
- **Photographs:**
3.29 An offshore wind farm
3.30 A hydro-electric power plant
3.31 A solar farm in Spain
3.32 A home-based biogas plant in India
- **Further reading and weblinks:**
Up-to-date news on global progress in the use of renewable energy can be found at:
www.guardian.co.uk/environment/renewableenergy

Key concepts

- Renewable energy can help reduce the global dependence on fossil fuels.
- There are many different types of renewable energy available.
- Use of renewable energies can help combat global climate change.

Starter suggestions

Ask students what they already know about renewable energy.

In groups they should try to come up with a definition of renewable energy and think of as many examples as they can. You could display photos **D**, **E**, **F** and **G** when these forms of renewable energy are mentioned (photos 3.29 to 3.32 from the downloadable resources).

Groups should merge to refine their definitions and then share them with the class. Compare definitions with the one given in the opening paragraphs in the Student Book.

Main lesson activities

- 1 Read through the information in the Student Book about the various kinds of renewable energies available. Which ones would be most suitable in your local area? Get students to head out into the school grounds with a map or sketch map to find the areas that are sunniest, windiest etc. where renewable energy systems could be installed. These should be marked on their map.
- 2 Using the internet (or local suppliers), students should find out more about the costs of installing renewable energy sources in the areas they found in main lesson activity 1. Would any of these make economic sense? How much money could be saved? If the amount is significant, perhaps you could start a campaign to get the school to use more renewable energy.
- 3 Look further afield and, on a map of your country, mark the areas where renewable energy stations could be best located. Again students should look for the sunniest and windiest areas, but this time they can also include sources of geothermal power or running water.
- 4 Look at graph **A** in the Student Book. Worldwide, which is the most important source of renewable energy? Students should try to think of reasons why this is and explain their reasoning to other members of the class.
- 5 Students should fill in the table on **Worksheet 3.40** showing the advantages, and any disadvantages they can think of, for the different types of renewable energy featured in the Student Book.
- 6 Diagram **C** on p. 196 shows how geothermal energy works. Students should write a couple of paragraphs to explain the diagram in words. Look back to Topic 2.1 on earthquakes and volcanoes. Where in the world would you expect most geothermal energy to be produced? Students should search the internet to find out if their theories are correct.

Give extra support by filling in some parts of **Worksheet 3.40** before photocopying it for students to complete.

Give extra challenge by asking students to think carefully, as part of main lesson activity 5 above, about the places where geothermal energy could be used, before letting them use the internet to find the answers.

Plenary suggestions

Do students think renewable energies could be the answer to the world's dependence on fossil fuels? You could use this session to debate the issues surrounding this question.

What advantages do fossil fuels have over the renewable energies featured in this lesson? What barriers are there to an increase in our use of these sustainable technologies?

Ask students if they would like to see more renewable energy used in their own country and, if so, what they can do to make it happen.

Skills notes

Classification and the sorting of information from different sources such as books and the internet is an important skill that is practised through a number of the activities in this lesson.

Assessment objectives

- Candidates should be able to demonstrate knowledge and understanding of the wide range of processes contributing to the development of economic environments, and their associated effects on the landscape.
- Candidates should be able to demonstrate knowledge and understanding of the interrelationships between people's activities and the total environment, and an ability to seek explanations for them.

0460/2217 syllabus**3.5 Energy**

- Describe the importance of non-renewable fossil fuels globally and in different countries at different levels of development
- Identify non-renewable fossil fuels including coal, oil and natural gas

Differentiated learning outcomes

- **All students must** have a basic knowledge of the importance of fossil fuels in generating electricity (Grade E/D).
- **Most students should** be able to describe the importance of thermal power stations in relation to the global distribution and consumption of electricity (Grade C/B).
- **Some students could** have a detailed understanding of how thermal power stations generate electricity from fossil fuels, where they are located and their importance in the context of global production of electricity (Grade A/A*).

Resources

- **Student Book:** pp. 198–9
- **Worksheets:**
3.41 Energy sources revision quiz
3.42 Household electrical appliance audit
- **Photographs:** None
- **Further reading and weblinks:**
Text, pictures and videos illustrating the importance of fossil fuels in electricity production can be found at:
www.darvill.clara.net/altenerg/fossil.htm

Key concepts

- Most of the world's electricity is produced in power stations using fossil fuels.
- There are huge variations in the global consumption of electricity.
- Power stations using different fossil fuels have quite different location requirements.

Starter suggestions

Use the starter session to revise the previous section on energy sources.

Have a quick quiz on energy sources using the questions on **Worksheet 3.41**.

Get students to peer mark without the answers, giving constructive feedback, before sharing the answers with the class. Answers are:

- 1 Oil/gas/coal
- 2 88 per cent
- 3 Solar energy
- 4 Population growth/increased number of electrical gadgets
- 5 China
- 6 Saudi Arabia
- 7 When a country produces enough energy to meet its own needs
- 8 Mining deaths/coal seam fires/air pollution
- 9 2.4 billion
- 10 Personal safety of women/desertification/soil erosion/respiratory diseases
- 11 Renewable energies
- 12 Geothermal
- 13 Wind/wave/HEP/solar/biofuel.

Main lesson activities

- 1 Ask students how much electricity they use in a typical day. Get them to keep a diary of what electrical appliances they switch on and for how long. Would it be possible for them to live for a day without switching anything on?

Homework extension

Some modern houses are fitted with meters that monitor usage of individual devices. Ask students to try to live for a week where, each day, they use *less* energy than the previous day. At the end of the week, hold a plenary where students explain how they got on.

- 2 Ask students to carry out an audit of their house and to count all the appliances that are plugged in. Try to reduce that by 10% without anyone noticing (using **Worksheet 3.42** if necessary). Which of these appliances could be unplugged when they were not in use (remind students that even something that is switched off or on 'standby' may still be consuming energy)?
- 3 Repeat main lesson activity 2 at your school. Students (in groups) should try to find out which school subjects seem to be the most 'energy-intensive' (these can then be 'named and shamed'). After carrying out the audit, groups should write a report to the school principal or head teacher to suggest why it is important to reduce energy. This should include information on the impact on the school's finances and on larger-scale problems such as global climate change and countrywide energy security.
- 4 After reading the information on electricity generation in the Student Book, small groups of students should 'act out' the formation of electricity, playing the part of different stages (from exploitation onwards), or equipment that is involved. Each student needs to have a specific role in the process. What would happen if any of them stopped doing what they were doing?
- 5 Choose two of the different types of fossil fuel power stations and make a list comparing and contrasting the location factors needed for their sites.

Give extra support by pairing students who may have difficulties, with others who can help them, for the main lesson activities being carried out for homework.

Give extra challenge by encouraging students to try to put a financial value on the electricity-saving activities carried out above, perhaps investigating the cost of electricity further using the internet or help from home.

Plenary suggestions

You could return here to the energy-saving activities students have tried to carry out at home.

Did they find it difficult to go without certain pieces of equipment? Did anyone notice when they turned certain things off? How did the same activity work out in school?

Ask students to consider the benefits that could result from such simple energy-saving techniques – for their families, their country and the whole world.

Assessment suggestions

Groups could be videoed carrying out main lesson activity 4, and students could produce a voiceover explaining what is going on. If groups of students did this, there could be an assessment of which video had the best explanation.

Skills notes

Analysis of distribution maps can be practised using the questions in the **Now investigate** section on p. 199 of the Student Book.

3.5(6)

Where to put a nuclear power station?

Assessment objectives

- Candidates should be able to demonstrate knowledge and understanding of the interrelationships between people's activities and the total environment, and an ability to seek explanations for them.
- Candidates should be able to recognise the role of decision making as affected by the physical and human contexts in which decisions are made, and the values and perceptions of groups or individuals.

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3.5 Energy

- Describe the importance of nuclear power globally and in different countries at different levels of development
- Evaluate the benefits and disadvantages of nuclear power

Topic link: For information on the problems caused by earthquakes at the Fukushima nuclear station see the relevant section in Topic 2.1 on pp. 78–9.

Differentiated learning outcomes

- **All students must** have a basic knowledge of the importance of nuclear power (Grade E/D).
- **Most students should** be able to describe the importance of nuclear power stations, their location factors and their dangers (Grade C/B).
- **Some students could** have a detailed understanding of the nuclear power industry, the reasons why nuclear power stations are located in certain areas and their dangers (with respect to a specific case study) (Grade A/A*).

Resources

- **Student Book:** pp. 200–2
- **Worksheet:**
3.43 Nuclear power station location
- **Photographs:**
Pictures of the Fukushima power station from the web, e.g.:
<http://cryptome.org/eyeball/daiichi-npp/daiichi-photos.htm>
- **Further reading and weblinks:**
In-depth reports on the Chernobyl nuclear disaster can be found at:
<http://news.bbc.co.uk/1/shared/spl/hi/guides/456900/456957/html/nn1page1.stm> and
http://news.nationalgeographic.com/news/2006/04/0426_060426_chernobyl.html

Key concepts

- Nuclear power is an important non-renewable source of electricity.
- Nuclear power stations have some very specific location requirements.
- The threats from nuclear power stations are potentially catastrophic.

Starter suggestions

What do students know about nuclear power generation and nuclear power stations? Can they remember the news concerning the Fukushima power station in Japan following the tsunami in 2011?

Show the video at www.bbc.co.uk/news/world-asia-pacific-13055446 to remind pupils about the questions and problems posed by the Japan tsunami.

Main lesson activities

- 1 Ask students to read through the opening paragraphs in the Student Book. Now direct them to find out where uranium comes from (using the internet). They should find as many details as they can, including the world's biggest producers and the methods for getting it out of the ground.

- 2 The waste products from nuclear power stations are highly radioactive and need to be kept as far away from humans as possible. Where would students put nuclear waste to allow it to be stored safely for thousands of years? Students should locate their top three nuclear burial sites using an atlas.
- 3 Using the information in the Student Book, students should try to identify the best location for a nuclear power station in their own country. They should work in pairs, use an atlas and fill in the advantages and disadvantages of their particular sites in the table on **Worksheet 3.43**.
- 4 The nuclear reactors at Fukushima in Japan that are mentioned in the Student Book are likely to remain a problem for the next few *thousand* years. This long time scale is a particular problem with nuclear power. Try to find out the latest news on the reactors, and the progress that is being made to make the area safe for people to live in. Display photos such as those given in the weblinks (see **Resources** above). The BBC website www.bbc.co.uk/news/world-asia-pacific-12711226 is an excellent source of information.
- 5 The Chernobyl area is still at the centre of a 30-km exclusion zone after the 1986 accident at the nuclear power station there. Recently, however, there have been signs of recovery in the wildlife around the station.

Internet exercise: students can find out about the current state of the environment around the Chernobyl station and write an eyewitness newspaper report describing what they find out.
- 6 Students should look at the arguments presented in the Student Book for and against nuclear power. In groups they should decide whether they are for or against nuclear power, and prepare an argument for their decision to be discussed in the plenary session.

Give extra support by asking students to complete the activities on Fukushima after consulting the relevant parts of Topic 2.1 concerning the effects of earthquakes on Japan.

Give extra challenge by encouraging students to search the internet for their own information on Chernobyl rather than giving them the web addresses listed.

Plenary suggestions

Students should use this session to discuss the following question in line with their prepared argument for main lesson activity 5:

Do the arguments for nuclear power outweigh the dangers of the technology?

Skills notes

The activities listed here and in the Student Book give ample opportunity to practise map and atlas skills in relation to location factors affecting nuclear power stations.

Assessment objectives

- Candidates should be able to demonstrate knowledge and understanding of the wide range of processes contributing to the development of economic environments, and their associated effects on the landscape.
- Candidates should be able to reason and make judgements that demonstrate a sensitivity to, and a concern for, landscape, the environment and the need for sustainable development.

0460/2217 syllabus**3.5 Energy**

- Describe the importance of renewable energy supplies globally and in different countries at different levels of development
- Identify renewable energy supplies including HEP, wave and tidal power

Differentiated learning outcomes

- **All students must** have a basic knowledge of the use of hydro-electric power in generating electricity (Grade E/D).
- **Most students should** be able to describe the importance of hydro-electric power and how it can be used at a variety of different scales (Grade C/B).
- **Some students could** have a detailed understanding of how hydro-electric stations generate electricity, their specific location factors and their advantages and disadvantages (with reference to specific examples) (Grade A/A*).

Resources

- **Student Book:** pp. 202–4
- **Worksheets:**
3.44 The advantages and disadvantages of hydro-electric power
3.45 Factfile: the Pico Hydro system
- **Photographs:** *Pictures of the Three Gorges Dam, China, from the web, e.g.* http://news.bbc.co.uk/1/shared/spl/hi/pop_ups/06/asia_pac_three_gorges_dam/html/1.stm
- **Further reading and weblinks:**
Text, pictures and videos illustrating how hydro-electric power work are at: www.darvill.clara.net/altenerg/hydro.htm

Key concepts

- Hydro-electric power is the world's most widespread renewable energy source.
- HEP can generate electricity at both large and small scales.
- There are both advantages and disadvantages associated with HEP generation.

Starter suggestions

Based on their previous knowledge of how electricity is generated, how do students think hydro-electric power works? (They should have some idea about turbines being turned.)

What do they think are the advantages of this form of electricity? Can they think of any disadvantages?

Main lesson activities

- 1 Building on the feedback from the starter session, ask students to read through the opening paragraphs in the Student Book. Using their own ideas and those from the book, they should annotate the picture on **Worksheet 3.44** with the advantages and disadvantages of large-scale HEP stations.
- 2 Ask students to complete **Now investigate** question 1 on p. 204 of the Student Book, asking them to consider the location of any HEP stations in their own country. If there aren't any, students should use the atlas to identify potentially suitable areas where the location factors listed in the Student Book can be found. Can they think of any reasons why these areas have not been exploited yet?

- 3 Show students pictures of The Three Gorges Dam on the Yangtse River in China – one of the world’s most controversial hydro-electric power projects (see weblink in the **Resources** for this lesson). In groups, students should research the history and present situation on the building of the dam, and draw a poster to show the information they have found. They should look into the history of flooding on the river as well as the need for increasing electricity as reasons behind the dam’s construction.

Homework extension

Students could follow up their work on the Three Gorges Dam by looking in more depth specifically at the controversy behind the project, and prepare a case study report for assessment.

- 4 Students can use the information on the Pico Hydro system to complete the factfile on **Worksheet 3.45**.
- 5 What plans are in place in the students’ own country to replace non-renewable energy sources with more renewable ones? Search the government website if possible for energy policy, and get students to give their country a score between 1 and 10, with 1 being poor and 10 being excellent.

Give extra support by giving students specific examples of HEP stations to research for their homework exercise (such as those in the Amazon or Malaysia), and giving them specific criteria for its assessment.

Give extra challenge by encouraging students to find a different type of small-scale HEP system, to complete the factfile in main lesson activity 4.

Plenary suggestions

Discuss whether hydro-electric power generation is really as environmentally friendly as it first seems.

Students should be able to weigh up the advantages and disadvantages of the technology and, as a class, you can come to a decision based on the work completed.

Small-scale HEP seems to be an excellent way of generating electricity – are there any disadvantages that students can think of or is this, perhaps, the way forward for renewable energy?

Assessment suggestions

The homework exercise outlined above provides an excellent opportunity for assessment.

Skills notes

Analysis of climate graphs, maps and other geographical display techniques is included in the **Now investigate** section on p. 204 of the Student Book.

3.6(1)

How can water supplies be managed?

Assessment objectives

- Candidates should understand how people get the water they need.
- Candidates should understand the extremes in water supplies available in different parts of the world.
- Candidates should be able to explain what causes water shortages.

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3.6 Water

- Describe methods of water supply and the proportions of water used for agriculture, domestic and industrial purposes in countries at different levels of economic development

Differentiated learning outcomes

- **All students must** be able to compare simple data on different levels of water use (Grade E/D).
- **Most students should** be able to relate the case study situation and other examples presented in the Student Book and the websites to their own situation (Grade C/B).
- **Some students could** draw up a plan to make water use in a particular example more sustainable (Grade A/A*).

Resources

- **Student Book:** pp. 205–7
- **Worksheet:**
3.46 Does rainfall affect water supply?
- **Photographs:**
3.33 Agriculture in north America
3.34 Agriculture in central Africa
- **Further reading and weblinks:**
www.wateruseitwisely.com
<https://extension.arizona.edu/sites/extension.arizona.edu/files/pubs/az1610.pdf>
www.africaheartwoodproject.org
www.cherwell.gov.uk (*Search for eco towns*)
<http://en.wikipedia.org/wiki/Eco-towns>

Key concepts

- There is a huge variation in the amount of water people use per day in different parts of the world.
- In some countries, or regions within countries, there is over-use of water resources and supplies are threatened.

Starter suggestions

Introduce students to the idea of keeping a water diary, as suggested in **Now investigate** activity 1 on p. 206 of the Student Book. Discuss with students whether they think they use a lot of water or a little and how they might compare with richer/poorer countries and with richer/poorer people in their own country. This can be addressed after they have completed their diaries, as an extension exercise.

Main lesson activities

- 1 Students should read the contents of the speech bubbles in figures A and B on p. 205 of the Student Book, comparing the water availability and use of water by people of their age in the USA and Ghana. Note that the situations have been chosen to be as contrasting as possible: MEDC/LEDC; temperate/tropical climates; urban or well-serviced rural/remote rural. Photos 3.33 and 3.34 from the downloadable resources support the comparisons here.

Ask students for their opinions on the contrasts in water use for the two characters – there is a notable discrepancy between levels of use. Students can quote figures from the text to illustrate this. Each student should separately draw two spider diagrams, as suggested in **Now investigate** question 4a on p. 207, and then follow these up by answering questions 4b and 4c.

- 2 **Worksheet 3.46** provides students with rainfall graphs to explore differences in the amount of water available.
- 3 Particular water use levels: the Student Book quotes data on how much water it takes to produce certain items. Consider these together. Ask students why it takes so much more water to produce 1 kg of beef than 1 kg of wheat. What is the water actually used for? On p. 206 there is a bullet point list to illustrate water usage. Do these figures shock your students? If 10 litres of water is needed to produce one page in their Student Book, how much water is used in the production of each book?
- 4 Places with a water deficit need to learn to use water more sparingly.
 - <https://extension.arizona.edu/sites/extension.arizona.edu/files/pubs/az1610.pdf> gives details on how Arizona, a state in the south-western desert region of the USA, uses its limited water resources unsustainably. Students can pick out the key problems and consider what sustainable use would mean.
 - www.wateruseitwisely.com/100-ways-to-conserve/ lists 100 ways to use water more sustainably and some are quite amusing, but many people in MEDCs would not want to give up the kitchen and laundry machinery, as suggested!
 - www.africaheartwoodproject.org gives a case study of water supply improvement projects in Ghana. Students could compare what has been achieved here for people with Yawo's situation in the speech bubble. What might Mary-Lou's region of the USA learn from this sustainable water supply project?

Homework	<p>Students should answer Now investigate questions 2 and 3 on pp. 206–7. This provides a useful overview of the material in the lesson, and gives skills practice in using data tables. Once again, it encourages students to think about sustainability of water use.</p> <p>How do students think they could save water? Ask and see what ideas are put forward.</p>
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Extension activity	<p>Return to students' water diaries, once completed, and ask them to assess whether they truly are efficient in their water usage habits or not. How do they think their own usage compares with the situations in the USA and in Ghana (Mary-Lou and Yawo)? Students should write a detailed comparison of at least two paragraphs.</p>
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Give extra support by talking through the data in table D, as there is quite a lot material here.

Give extra challenge by asking students to research how ecotowns and villages make better use of water resources.

Plenary suggestions

Return to www.wateruseitwisely.com. Ask students to choose which suggestions they think would be most effective in improving their own family's water efficiency.

Skills notes	Students have practice in using data tables and constructing proportional circles.
Assessment suggestions	Now investigate questions 2 and 3 on pp. 206–7, provided as suggested for homework, are an opportunity for assessment.

3.6(2)

Meeting the demand for water

Assessment objectives

- Candidates should know that not everyone in the world today has enough water or clean water.
- Candidates should understand that clean water is a precious resource, which has to be looked after now and in the future to allow everyone to have a reasonable supply.

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3.6 Water

- Identify methods of water supply (including reservoirs/dams, wells and bore holes, desalination)
- Explain why there are water shortages in some areas and demonstrate that careful management is required to ensure future supplies

Differentiated learning outcomes

- **All students must** use maps to show the differences between rainfall levels and access to water supply (Grade E/D).
- **Most students should** know the main ways by which we access clean water supplies and ways in which these might be improved (Grade C/B).
- **Some students could** know about the interrelationships between climate characteristics and the availability and use of river water (Grade A/A*).

Resources

- **Student Book:** pp. 207–9
- **Worksheet:**
3.47 Water transfer schemes
- **Photographs:**
3.35 The Aral Sea
- **Further reading and weblinks:**
none

Key concepts

- The world's demand for water is rising rapidly.
- The problem is not always a lack of water, but access to clean water.
- There are many ways in which people could improve access to, and storage of, clean water. This can be done at both higher and lower levels of technology.

Starter suggestions

Read the text in the Student Book p. 207 and discuss as a class the general demand situation currently in the world and the likely trends into the future. What do students feel, given that they, as the younger generation, are likely to be most affected if water use is not sustainably managed?

Refer to the **Fantastic fact** (p. 208) to illustrate the dramatic daily rise in water demand globally.

Main lesson activities

- 1 (a) Water transfer is the moving of water by pipeline or canal network, usually over a considerable distance. Use **Worksheet 3.47** to consider the implications of such a system.
- (b) Making the most of the resources we have:
 - (i) Lakes and rivers – students should answer the following short questions:
 - Does your home settlement get its water from a lake or a river?
 - How does the water get to your home?
 - Is the water cleaned and treated to make it completely safe before it gets to your house?
 - Is there a water pollution problem in your area? If so, what impact might this have on your water supply?

Display photo C from the Student Book (photo 3.35 from the downloadable resources), showing the devastation of the Aral Sea (it is called a 'sea' but it is really a lake). This water source has been ruined. Students should describe the damage they see in the photo.

Do they think this damage can be repaired and the Aral Sea used again as a reliable water source? Extension work suggested below will allow students to test their ideas expressed here.

- (ii) Aquifers – first define what is meant by an aquifer.
Read the text in the Student Book and then list the advantages and disadvantages of using aquifers as a clean water source.
- (iii) Sea water – some desert countries built desalination plants some decades ago to remove the salt from sea water. Identify at least one advantage and one disadvantage of this method. Students could prepare a case study of desalination, for example in Saudi Arabia, Dubai or other Gulf States, or in California.
- (iv) Rainwater – a large proportion of rainwater is wasted. People could not and should not use all of it – ecosystems need it to function and crops and livestock need it to grow. But we could catch a great deal more with some careful planning – often, only low-level technology is needed. This technology could be applied and used in both LEDCs and MEDCs. Students should write two paragraphs, one to contrast large-scale and small-scale water harvesting, and the other to point out any advantages and disadvantages of such schemes. See figure A on p. 210 for a small-scale example of rainwater harvesting in Burkina Faso.

- 2 Ask students to answer **Now investigate** question 1 on p. 209, followed by a comparison of their ideas.
- 3 Students should work on **Now investigate** question 2, completing the table. Collaborative work in groups should help them to produce more detailed answers.
- 4 **Now investigate** question 3 presents an opportunity to remind students of how to write a good description of patterns on a map. In this question, three map descriptions are needed. Students should write the first of these, say of that on map A on p. 207 of the Student Book, and compare their work with other members of the class. This exercise can then continue as a homework and assessment: students write the two remaining map descriptions and answer question 3b.

Give extra support by giving pupils information on how the water supply system operates in your area.

Give extra challenge by setting extra research for students to undertake, perhaps in groups, on rainwater harvesting. If each group writes up its findings, copies of each piece of research can be shared amongst class members for their personal files.

Plenary suggestions

Discuss the idea that, even with all the methods of using water more efficiently, the only way to make sure everyone has an adequate clean supply is to reduce the demand per person.

Skills notes	Students develop skills of map interpretation and annotation.
Assessment suggestions	Now investigate question 2 is appropriate for assessment, as discussed above. The research work suggested for 'extra challenge' (above) could be assessed on a group basis.

3.6(3)

Water supply issues

Assessment objectives

- Candidates should understand the issues around the provision of clean water.
- Candidates should understand the importance of both large-scale and small-scale improvements in water supply in different contexts.

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3.6 Water

- Explain why there are water shortages in some areas and demonstrate that careful management is required to ensure future supplies
- Understand the impact of lack of access to clean water on local people and the potential for economic development

Differentiated learning outcomes

- **All students must** be able to describe the ways in which they use water (Grade E/D).
- **Most students should** know about people's conflicting viewpoints on the use of the river Nile (Grade C/B).
- **Some students could** suggest ideas for future improvements to their own water supply or that of other people (Grade A/A*).

Resources

- **Student Book:** pp. 209–12
- **Worksheets:** None
- **Photographs:**
 - 3.36 Aswan High Dam and Lake Nasser
 - 3.37 Map of Egypt
 - 3.38 Satellite image of Egypt
 - 3.39 WaterAid project in Uganda
- **Further reading and weblinks:**

Programmes on providing people with clean water:
www.wateraid.org
www.oxfam.org.uk

Key concepts

- Water supply can be improved on a small scale in remote areas with the use of appropriate technology.
- As population increases in a region, the scale of water projects becomes greater and more complex.
- Water supply is likely to be a cause of human tension both today and in the future.

Starter suggestions

Refer back to the students' water-use diaries – work based on p. 206. Look at the **Now investigate** question 1 on p. 212 and work out the number of times a day you use water and what you use it for. Ask students whether their families only use water for essentials or whether they always have as much as they want. Are they ever short of water for essentials? Do they have more than they need?

Main lesson activities

- 1 Together read Sawadogo's story in figure A. Ask students how her situation compares with theirs. List the advantages for people in Burkina Faso (and elsewhere) of having safe, clean water supplies. Ask students what level of technology was probably involved in developing the water pumping system for Sawadogo's settlement – high, medium or low?
- 2 Students should add this small-scale example on rainwater harvesting to their existing notes on methods of using water efficiently.
- 3 Case study: water supply in northern India

The extent of this important aquifer is shown on map B. Students should study the map, read about the demands upon the aquifer, then work through these activities:

- (a) What will the water in the Rajasthan aquifer be used for?
- (b) Why will demand for water increase in the future? (Hint: in addition to the comments in the text, remember that India has a growing population and that rural-to-urban migration continues.)

4 Example: competition for water in the Nile Basin

For this section students will need to refer to figures **C**, **D** and **E**. To give context, display the map and satellite image of Egypt (photos **3.37** and **3.38** from the downloadable resources) showing the contrast between the Nile region and the desert region. The Nile river system is like the lifeblood of the region – without the rivers, it would be impossible for such a large population to be supported: 96 per cent of the Egyptian population lives on the 4 per cent of the country that is close to the Nile. This is a useful statistic for you to demonstrate to your students the essential nature of this water resource.

- (a) Students could describe the Nile valley's location in terms of the direction (south to north), the countries through which the river flows, and the nature of the landscape, as a starting point for study.
- (b) Students should answer **Now investigate** questions **2a** and **2b** on p. 212.
- (c) Answer **Now investigate** question **3**.
- (d) Students should consider the facts stated in the text regarding the characteristics of Egypt's population in relation to the water supply available from the river system. Is this likely to be a sustainable source of clean water for Egypt's population into the future?

5 Students could answer the following extra questions to take this example further. These could be used as an assessment exercise.

- (a) Find out more about the Aswan High Dam and Lake Nasser shown in photo **C** on p. 211 (photo **3.36** from the downloadable resources). How has the construction of this huge engineering project changed the lives of Egypt's population?
- (b) Explain why there are tensions between neighbouring countries over the use of the Nile's water. Read the caption for photo **C** on p. 211.

Give extra support by referring back to Topic 1.4 pp. 36–38 to help students better understand the difficult environment of the Sahel.

Give extra challenge by encouraging research into aid agencies that provide people with a clean and reliable water supply, such as WaterAid and Oxfam. Find out how they do this. Some websites are suggested above, and see photo **3.39** from the downloadable resources.

Plenary suggestions

Students could consider what might be done in their home area to improve their water supply. Are there any similarities with improvements referred to in this lesson's materials?

Skills notes	Students have practice in the skills of map interpretation, description of location, and description and comparison of climate graphs.
Assessment suggestions	Main lesson activity 5 is a suitable assessment exercise.

Assessment objectives

- Candidates should be able to describe how the natural environment affects where people live.
- Candidates should understand that all environments have positive and negative characteristics.
- Candidates should be able to assess their own environment in terms of its positive and negative attributes.

0460/2217 syllabus**3.7 Environmental risks of economic development**

- Understand threats to the natural environment including soil erosion, desertification, enhanced global warming and pollution (water, air, noise, visual)

Differentiated learning outcomes

- **All students must** understand that people choose where they live based on what the natural environment offers (Grade E/D).
- **Most students should** know the basic reasons why more people live in some natural environments than in others (Grade C/B).
- **Some students could** understand why different natural environments pose different problems and opportunities for people (Grade A/A*).

Resources

- **Student Book:** pp. 213–5
- **Worksheet:**
3.48 How challenging is your natural environment?
- **Photograph:**
3.40 A farming landscape in New Zealand
- **Further reading and weblinks:** None

Key concepts

- All natural environments provide both opportunities and challenges.
- People usually choose to settle in areas where the natural environment provides opportunities.
- People can adapt remarkably well to difficult environments, making much use of what might initially seem to be very limited resources.

Starter suggestions

Ask students to think about the relationship between people and the environment in which they live. Start by reading the text on p. 213 of the Student Book, and looking at photo A (photo 3.40 from the downloadable resources). Each student should write a short description of the photo and compare their results with other members of the class. Discuss together the characteristics of this landscape that students have chosen to highlight.

Next, think about more challenging environments and ask students to identify the contrasts. You could use the tropical rainforest and hot desert environments studies in Topic 2.5 of the Student Book. Pages 118–127 provide readily available photos for discussion.

Main lesson activities

- 1 Read **Now investigate** question 1 as an introduction to the activities in **Worksheet 3.48**. Students should work through the questions in the Worksheet. It can be answered by individual students and is also suitable for small group work. Teachers may wish to leave the last question on the sheet until later, as explained at the end of the activities on the Worksheet.
- 2 Finding a good place to live: New Zealand is an example of a good place to live. Most of its landscape offers opportunities for earning a living from activities like agriculture. Even its more difficult regions such as the mountains of the Southern Alps and the volcanically active parts of North Island encourage tourism and film-

making. (Landscapes in North and South Island were used as sets for the *Lord of the Rings* and *The Hobbit* film trilogies, and two films from *The Chronicles of Narnia*.)

Simplify things by going back to the most basic needs for people to make a living. Students should note down the points made in the list on p. 213 and discuss the importance of each one. Students should note down what the natural environment can provide to make a good place to live.

Problems posed by harsh environments: ask students whether a harsh environment always means that conditions are difficult. Refer to the **Fantastic fact** on p. 214 here to show that difficult environments can be overcome by people's ingenuity and technology.

Refer back to the difficult tropical rainforest and tropical desert environments considered in **Worksheet 3.48** and list the economic opportunities of such places. Photo C shows some of the tourist opportunities of a mountainous region.

Nevertheless, in some parts of the world, the difficulties of the environment are extreme. Students should discuss and note the key ideas put forward in diagram B on p. 214.

- 3** A balancing act: no region or area is perfect. All have positive and negative characteristics that offer opportunities and provide challenges. People will choose the best and aim to cope with the worst. The example of Bangladesh illustrates this well. Students have already learned about flood issues in Bangladesh in Topic 2.5 on pp. 133–5.

Give extra support by helping less able students to plan the assignment suggestion below. They need to have a reliable list of sources of information before they begin to think about the tourist opportunities.

Give extra challenge by asking students to consider which they think is the most challenging environment in the world, and why. Do not just accept Antarctica: make them think more broadly.

Plenary suggestions

Use the **Now investigate** questions 2 and 3 on p. 215 as a plenary session. You could cover these in a short class discussion.

Skills notes	Students have practice in photo interpretation and in collating information from a range of sources.
Assessment suggestion	List the ways in which tourism offers opportunities in areas that are otherwise very difficult to exploit to make a living. This exercise encourages students to gather information from a range of sources and is therefore quite challenging (see Give extra support above).

3.7(2)

Exploiting the natural environment: disaster!

Assessment objectives

- Candidates should understand the problems and opportunities presented by different natural environments.
- Candidates should be able to explain how people have tried to change their environment and the problems this may cause.
- Candidates should be able to demonstrate how people cope with the problems and take advantage of the opportunities by referring to case studies.

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3.7 Environmental risks of economic development

- Describe how economic activities may pose threats to the natural environment, locally and globally
- Understand threats to the natural environment including soil erosion, desertification, enhanced global warming and pollution (water, air, noise, visual)

Differentiated learning outcomes

- **All students must** understand that people can damage the natural environment (Grade E/D).
- **Most students should** know some of the effects of human activity on natural environments (Grade C/B).
- **Some students could** know the negative effects of human activity on the natural environment, illustrated by detailed case studies (Grade A/A*).

Resources

- **Student Book:** pp. 215–7
- **Worksheet:** 3.49 Effects on people and the environment
- **Photographs:** None
- **Further reading and weblinks:**
http://en.wikipedia.org/wiki/Aral_Sea
http://earthobservatory.nasa.gov/Features/WorldOfChange/aral_sea.php
The following site is good for background:
www.columbia.edu/~tmt2120/introduction.htm
www.dailymail.co.uk/news/article-1263516/How-Aral-Sea--half-size-England--dried-up.html
(Date of this article: 14 November 2011)

Key concepts

- Almost every environment offers something for people to live on, but fragile environments will suffer especially severely from over-exploitation.
- The Aral Sea is one of the most damaged landscapes on Earth, largely due to over-exploitation of resources by a population too large for available resources.
- Factors leading to the Aral Sea disaster were climatic, economic and a result of misguided government policy.

Starter suggestions

Discuss as a class what makes an environment fragile – that is, it is one that becomes damaged quickly and easily from human use or physical change. Consider things like limited vegetation cover, limited water supplies, difficult climate and resources that quickly become unsustainable if too much is exploited.

Main lesson activities

1 Case Study: The Aral Sea Disaster

Look at map A on p. 215 of the Student Book. Locate the Aral Sea using an atlas. Students could describe its location in terms of latitude, longitude, continent, country, relief, etc. Use the atlas to trace its water supply sources.

It was the world's fourth largest lake; ask students if that remains so. The Photos C and the Earth Observatory and Daily Mail websites listed above will help here as they show the size of the lake diminishing over time. Interpreting satellite photos is a useful skill for students (see Topic 4.4 pp. 263–4 in the Student Book).

The answer to the question above is clearly no, so follow on by encouraging students to make suggestions why that might be so. There should be no right or wrong answers at this stage – allow students to re-visit these original ideas later.

This is a good moment to answer **Now investigate** question 2 on p. 217 as it supports the detail of the shrinkage of the lake's area. Alternatively, it could be a useful skills homework question.

- 2 The climate of the Aral Sea region: note the key characteristic of the climate – aridity. Ask students to read the text in the Student Book and to study climate graph **B** on p. 216 to identify any climatic characteristics that lead to aridity. You could also introduce the ideas of:
 - continental climate (extreme temperatures)
 - distance from the sea (lack of rain-bearing winds)
 - very high temperatures leading to serious evapotranspiration
 - very low temperatures leading to dry air.
- 3 What caused the Aral Sea crisis? It is difficult to find physical factors as the system was previously in equilibrium, but you could allow students to make suggestions. Natural climate change (not human-induced global warming), in terms of both precipitation levels and temperature, is the main possibility here. The main issues are, of course, connected to:
 - human over-exploitation of the Aral Sea's resources
 - over-population – too many people trying to live off too few resources
 - diverting the water to other projects.
 Students should list the main factors involved.
- 4 The effects on people and the environment: the detail of this section could be displayed using a spider diagram. The frame is drawn on **Worksheet 3.49**. Ask students to suggest suitable words for the centre, e.g. 'crisis', 'disaster' or similar. In this diagram the arrows are pointing inwards towards the centre to represent the factors leading to the disaster. The arrows labelled 'People' and 'Environment' point inwards to the central word, with a further set of spider legs pointing to each of them. For example, 'Summers got hotter' and 'Winters got colder' points to 'Environment'. Students should draw and label as many other 'legs' as they think appropriate.

It is possible to explore the environmental issue of increased salinity further by describing graph **D** and answering **Now investigate** question 3.
- 5 Signs of recovery: students should note down the initiatives taken to try to reverse some of the damage done to the Aral Sea. Have a class discussion to assess the success of these measures.

Give extra support by working directly with students on the satellite photo interpretation if this is a new challenge for them.

Give extra challenge through **Now investigate** question 4, the extended piece of writing.

Plenary suggestions

Summarise the comments made in the class discussion. Ask students:

- Do you agree with the statement in the Student Book text made by Ban Ki-moon?
- What can people learn from this dreadful environmental event?

Skills notes	Students have practice in interpreting a climate graph, satellite photos and a graph, and in constructing a spider diagram based on detail in the text.
Assessment suggestions	Now investigate questions 1 and 4 provide opportunities for assessment.

3.7(3)

Exploiting the natural environment: success?

Assessment objectives

- Candidates should be able to explain how people have tried to use their natural environment without causing problems for the future.
- Candidates should be able to illustrate their points by referring to case studies.

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3.7 Environmental risks of economic development

- Describe how economic activities may pose threats to the natural environment, locally and globally
- Understand threats to the natural environment including soil erosion, desertification, enhanced global warming and pollution (water, air, noise, visual)

Differentiated learning outcomes

- **All students must** understand that it is possible to use the natural environment without causing damage (Grade E/D).
- **Most students should** know one case study of how humans have utilised a natural environment in a positive way (Grade C/B).
- **Some students could** know a range of positive effects of human activity on the natural environment, illustrated by detailed case studies (Grade A/A*).

Resources

- **Student Book:** pp. 217–9
- **Worksheet:**
3.50 Creating a new case study: tourism in a challenging environment – the Arctic
- **Photographs:** None
- **Further reading and weblinks:**
*Use the following three websites for **Worksheet 3.50**:*
<http://discoveringthearctic.org.uk>
<http://discoveringantarctica.org.uk>
www.discover-the-world.co.uk
These websites are linked with the case study on pp. 218–9 in the Student Book:
http://commons.wikimedia.org/wiki/Category:Landscapes_of_Greenland?uselang=en-gb
<https://visitgreenland.com/things-to-do/>

Key concepts

- Greater care is needed in exploiting fragile landscapes.
- Fragile landscape can support fewer people sustainably.
- Ecotourism is one way of exploiting a fragile landscape.

Starter suggestions

Introduce the key term: *sustainable/sustainable development*. Success in exploiting the environment has to be done sustainably for it to be successful. The importance of this is obvious from the Aral Sea example studied in the previous lesson.

The region to be studied in this lesson, Greenland, is a polar region. Ask students to give their ideas on possibilities for economic development in such an environment. Use photos from the Wikimedia website (address above) to help.

Main lesson activities

- 1 Ask students what they already know about the world's polar regions, for example location, landscape characteristics, population, and economic possibilities. Would students classify these regions as fragile landscapes? Whatever they answer here (yes/no), ask for their reasons. Allow class discussion of ideas.
- 2 Now focus on Greenland as a case study of exploitation in a fragile environment. Begin with map A on p. 218 and the short piece of descriptive text. Students should note the main features of Greenland. Reference can also be made to the more general description of polar regions on pp. 217–18.

- 3** Greenland's traditional economy: students should list the ways in which Greenlanders made their living in the past. Many still live like this today, of course. Ask students if they think they would be happy to live in such a simple way. Depending on where you live, there may be similarities between Greenland and your local economy, or, equally, there may be great contrasts.

Return to the idea of sustainability discussed at the beginning of this lesson and ask the following questions:

- Do students consider this traditional Greenland economy to be sustainable?
 - Are population and resources in balance – that is, is Greenland over-populated, under-populated or in an optimum situation? Topic 1.1 pp. 8–11 in the Student Book gives an explanation of these terms.
- 4** Developing Greenland's economy through ecotourism: students need to know the definition of 'ecotourism'. Ask them to consider how this links with the definition of sustainable development discussed at the start of this lesson.

Students should make a list of the potential tourist attractions in Greenland. Photos **B** and **C** are useful here, as are the websites listed in **Resources**.

- 5** **Worksheet 3.50** is designed to guide students through creating a case study of tourism in an environmentally sensitive zone. The finished work from question **1** could be an assessment, while the photo gallery from question **2** could be judged as a class competition. This Worksheet links to **Now investigate** question **3**.

Students can learn more about the growth of tourism in Topic 3.4 pp. 181–8 in the Student Book.

- 6** Developing mineral deposits in Greenland: refer to map **D**, which shows the variety and distribution of known mineral wealth in Greenland. Students could write a description of the distribution in order to practise this skill. They should comment on the fact that all minerals marked are on, or close to, the coast. Ideally, they should realise that it is highly likely that there are other minerals inland, but, due to the ice sheet, people have not been able to explore for these. Students should note the example of the Black Angel Mine.

- 7** The following are some extra questions for students to answer as individuals or in small groups:

- What kind of problems could be caused by mining developments in such a fragile environment?
- Do you think the local people are likely to be in favour of the new mining opportunities or not? Suggest some reasons for your answer.

Give extra support by reminding students about the population/resource balance and terms like *over-population*, *under-population* and *optimum population*.

Give extra challenge by researching the following:

- the issues caused by tourists leaving litter on Greenland's ice sheet in the interior of the island
- other ecotourism locations such as the Galapagos Islands.

Plenary suggestions

Is the economic development of Greenland to date sustainable? Take a vote in the class.

Skills notes	Students have practice in map and photo interpretation, and have the opportunity for developing their internet and other research skills.
Assessment suggestions	Now investigate questions 1 and 2 offer opportunities for assessment.

3.7(4)

How much are we damaging our environment?

Assessment objectives

- Candidates should be able to reason and make judgements that demonstrate a sensitivity to, and a concern for, landscape, the environment and the need for sustainable development.
- Candidates should be able to reason and make judgements that demonstrate an appreciation of the attitudes, values and beliefs of others in environmental issues that have a geographical dimension.

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3.7 Environmental risks of economic development

- Describe how economic activities may pose threats to the natural environment, locally and globally
- Understand threats to the natural environment including soil erosion, desertification, enhanced global warming and pollution (water, air, noise, visual)

Topic link: this section goes into detail about the damage that can be caused by the economic activities studied throughout the rest of Section 3.

Differentiated learning outcomes

- **All students must** have a basic knowledge of the ways in which human beings are damaging the environment (Grade E/D).
- **Most students should** be able to describe some of the ways in which the environment is being damaged in relation to some of the industrial activities responsible (Grade C/B).
- **Some students could** have a detailed understanding of how a wide range of industrial activities can have negative effects on the environment and the specific types of threat they pose (Grade A/A*).

Resources

- **Student Book:** pp. 220–2
- **Worksheets:**
3.51 Environmental damage caused by tourism
3.52 Environmental lifestyle audit
- **Photographs:** None
- **Further reading and weblinks:** None

Key concepts

- Economic and industrial activities can have a huge negative impact on the natural environment.
- Environmental damage relates to both the atmosphere and natural water courses.
- Transport is a major contributor to global pollution.

Starter suggestions

Split the class into three large groups (or six smaller groups) and have them consider one of the following types of economic activity in the local area: factories, agriculture or tourism.

Give students five minutes to consider what kind of damage their industrial activity does to rivers and lakes, soils, the atmosphere and the natural vegetation.

Brainstorm the answers on the board. What are the common themes? ASK students to copy these into their notes.

Main lesson activities

- 1 Building on the starter exercise, encourage students to think more about the environmental damage caused by tourism and get them to add their thoughts to the spider diagram on **Worksheet 3.51**. They should consider all possible effects, such as those on the atmosphere (including long-distance air travel) and pollution of watercourses from hotel waste.

- 2 Explain to students that their lifestyles inevitably result in damage to the environment, with secondary impacts because they live in houses, eat imported food and use vehicles to travel around. Students can explore the impact of their lifestyle by carrying out an 'audit' of how their activities contribute to the environment being damaged or degraded. You might want to use the headings 'Earth', 'Air', 'Water' to show where the damage might occur, as on **Worksheet 3.52**.
- 3 Ask students for some suggestions for how to make their classroom more 'eco-friendly'. They should substitute something that is currently done for something that is more sustainable. Keep an eye out for paper being wasted, energy being used, windows open when the heating is on etc.
- 4 Create a trap to see whether there are industrial pollutants in the atmosphere in your local area. Using a folded piece of card and some adhesive tape (sticky side up), students can see how 'dirty' the local environment is by leaving it somewhere for a few days. How dirty is the tape when you come back to it? Try putting cards in different places to see which are most affected by such 'dirty air'.

Give extra support by carrying out main lesson activity 1 in groups rather than letting students come up with ideas by themselves.

Give extra challenge by having students expand the area in which they carry out main lesson activity 4. This could be used to try to identify 'hotspots' in the local area, placing cards near industrial estates or at busy road crossings, for example.

Plenary suggestions

Do students feel their home town is polluted? Where are the most polluted local areas? These could be marked on a map or the question could even be used to initiate a fieldwork study in the next lesson.

What types of pollution are students most concerned about? Encourage them to come up with practical ideas that could be used to cut down on local pollution sources.

Assessment suggestions	Questions 2 and 4 in the Now investigate section on pp. 221–2 of the Student Book provide opportunities to assess students' powers of description and analysis.
Skills notes	Main lesson activity 4 and the plenary exercise give some useful ways in which students can practise their fieldwork planning and techniques.

3.7(5)

The world gets warmer

Assessment objectives

- Candidates should be able to demonstrate knowledge and understanding of the interrelationships between people's activities and the total environment and an ability to seek explanations for them.
- Candidates should be able to reason and make judgements that demonstrate a sensitivity to, and a concern for, landscape, the environment and the need for sustainable development.

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3.7 Environmental risks of economic development

- Describe how economic activities may pose threats to the natural environment, locally and globally
- Understand threats to the natural environment of enhanced global warming

Topic link: this section goes into detail about the damage that can be caused by the economic activities studied throughout the rest of Section 3.

Differentiated learning outcomes

- **All students must** have a basic knowledge of the threats posed by global warming (Grade E/D).
- **Most students should** be able to describe why the Earth is getting warmer and some of the effects of global climate change (Grade C/B).
- **Some students could** have a detailed understanding of the causes and effects of global warming and the enhanced greenhouse effect and full case study knowledge of an area at risk from climate change (Grade A/A*).

Resources

- **Student Book:** pp. 222–4
- **Worksheet:** 3.53 Areas threatened by sea-level rise from climate change
- **Photographs:** None
- **Further reading and weblinks:**
There are plenty of websites describing and explaining the causes and effects of climate change, for example:
www.wwf.org.uk/what_we_do/tackling_climate_change/
www.bbc.co.uk/climate/evidence/

Key concepts

- There has been a gradual increase in global temperatures over the last 150 years.
- The increase in temperature is probably due to people's activities.
- Global climate change has a number of possible negative effects.

Starter suggestions

Find out what students already know about climate change.

Make a list on the board with two headings, 'Truth' and 'Myth', and try to explain on which side of the board the suggestions from students lie.

You could use some of the videos and news items from the web pages listed (especially from the BBC) or others from around the world, to put the subject of climate change into context for the students.

Main lesson activities

- 1 Read through the first few paragraphs of the Student Book on climate change and the enhanced greenhouse effect. Students should make a copy of diagram B to explain how the greenhouse effect works – they can add any information they find on climate change websites.
- 2 As a class make a list of the possible negative effects of climate change and then, working in groups, students can add any more they can think of. Discuss how many of these will affect your local area and your country as a whole. Looking at

the list of activities that help cause the enhanced greenhouse effect, how many of these take place in the local area and at what scale? Add notes from your discussions to the list of effects that you have made.

- 3 See if students can suggest any 'positive' aspects of global warming. We are always told about the negative aspects, but there are some changes in lifestyle that might be good news. Research these and put together an 'appendix' that could be added to a textbook on the impacts of global warming.
- 4 Journalist Dan Box made a journey to the Carteret Islands (featured in the Student Book) to find out more about the effects of climate change and sea-level rise on the people living there. Find out more by visiting his blog at <http://journeytothesinkinglands.wordpress.com/>.

Dan's journey was funded by the Royal Geographical Society, and you can listen (in certain countries) to his journey on www.bbc.co.uk/programmes/b00mcwv1.
- 5 Students can create an annotated world map using **Worksheet 3.53** to show the places that are threatened by sea-level rise. What sorts of things do these places have in common? For example, students should be able to point out that many are low-lying islands, which may be swamped, and that many vulnerable areas are major population centres.

Give extra support by getting students to think in more depth about the local aspects of climate change – both in terms of causes and effects.

Give extra challenge by getting students to find out about the arguments presented by people who don't think climate change is occurring (they are known as 'climate change sceptics'). Can they counter these arguments with their own reasoned arguments based on scientific fact?

Plenary suggestions

Based on the exercises completed on both the negative and positive aspects of global climate change, discuss with students whether they think there will be more benefits than problems both for their own country and for planet Earth as a whole.

Challenge students to think of the consequences of climate change – these could include increased migration from low-lying islands, or food shortages as it becomes impossible to grow crops in some parts of the world.

Skills notes

Main lesson activity 5 above allows students to develop skills based on map and atlas work and to practise techniques of presentation.

3.7 (6)

Destruction of the forests

Assessment objectives

- Candidates should be able to demonstrate knowledge and understanding of the interrelationships between people's activities and the total environment, and an ability to seek explanations for them.
- Candidates should be able to reason and make judgements that demonstrate a sensitivity to, and a concern for, landscape, the environment and the need for sustainable development.

0460/2217 syllabus

3.7 Environmental risks of economic development

- Describe how economic activities may pose threats to the natural environment, locally and globally
- Understand threats to the natural environment including soil erosion, desertification, enhanced global warming and pollution (water, air, noise, visual)

Topic link: the effects of deforestation and soil erosion on agriculture are causes of the internal migration outlined in Topic 1.2 on pp. 21–6.

Differentiated learning outcomes

- **All students must** have a basic knowledge that trees are being cut down around the world (Grade E/D).
- **Most students should** be able to describe some of the causes and effects of global deforestation (Grade C/B).
- **Some students could** have a detailed understanding of the distribution, rate, causes and effects of global deforestation (including the effect on soil erosion) with reference to a specific case study country (Grade A/A*).

Resources

- **Student Book:** pp. 224–6
- **Worksheets:** 3.54 Deforestation in Borneo
- **Photographs:** None
- **Further reading and weblinks:**
Lots of facts on global deforestation can be found at:
<http://environment.nationalgeographic.com/environment/global-warming/deforestation-overview/>

Key concepts

- Global forest cover is decreasing as deforestation rates increase.
- Demands from MEDCs are increasing deforestation in LEDCs.
- Deforestation has local effects (including soil erosion) and global effects on climate change.

Starter suggestions

In groups, give students up to five minutes to make a list of all the reasons why people use forests – this should include everything from manufacturing opportunities such as paper making and furniture to recreational activities.

Collect some ideas from the class and then give students a few more minutes to have a look through their lists, marking those activities that involve cutting down trees and those that do not.

Are there more activities that come from deforestation or from leaving the forests intact?

Main lesson activities

- 1 Find some old maps of your local area going back into history as far as you can. Get students to analyse the maps for forest cover and to describe how it has changed over the time shown by the maps.

Extension: students could take this further by quantifying the amount of cover lost in percentage terms.

- 2 Forests often have an important place in the cultural history of a region. Ask students to quiz older relatives about their use of the forests around where you live. Do they have any special memories? Do the forests hold examples of folklore that could be told to the class? How do the older relatives feel about the forests being cut down? You could even get some of those questioned to come into class and retell their stories.
- 3 Using the information in the Student Book, including the diagrams and pictures, complete the case study factfile on deforestation in Borneo using **Worksheet 3.54**.
- 4 The Student Book has a picture of windblown dust being eroded from the Sahara. Using an atlas (preferably one that has information on global wind patterns), students should try to work out the countries where the sand will be dropped. Will this change in different seasons of the year? What will be the effects on the countries where the sand is deposited?
- 5 Internet research exercise: the Amazon, the world's largest area of tropical rainforest, is also under threat from deforestation. Students can use the internet to find out more about this case study and complete a one-page report detailing how much deforestation is taking place, the causes behind it and the effects on both the environment and the local people.

Give extra support by getting students to create a factfile similar to that for main activity 3, to complete the internet research exercise on the Amazon.

Give extra challenge by having students go into more depth for the internet research exercise on the Amazon, finding out about the global effects that deforestation there may have.

Plenary suggestions

Weigh up the advantages and disadvantages of the economic uses of the forests as outlined in this lesson. Do students think we can continue exploiting global tree resources as we are currently doing?

Revisit the map of global forest cover in the Student Book on p. 246 (or have a look at it online at www.grida.no/resources/11255). Can students spot any areas where we can increase the number of trees?

Assessment suggestions

Main lesson activity 5 above should provide an excellent opportunity to test the research capabilities of your students. Give extra marks for any research conducted outside of the use of the internet.

Skills notes

Main lesson activity 1 above allows students to complete some well-developed map skills work by quantifying the information they can see on the maps.

3.7 (7)

How can we conserve the environment?

Assessment objectives

- Candidates should be able to reason and make judgements that demonstrate a sensitivity to, and a concern for, landscape, the environment and the need for sustainable development.
- Candidates should be able to reason and make judgements that demonstrate a willingness to review their own attitudes in the light of new knowledge and experiences.

0460/2217 syllabus

3.7 Environmental risks of economic development

- Demonstrate the need for sustainable development and management
- Understand the importance of resource conservation

Differentiated learning outcomes

- **All students must** have a basic knowledge of sustainable development and the need to protect the environment (Grade E/D).
- **Most students should** be able to describe some of the ways in which sustainable development and environmental protection can be carried out (Grade C/B).
- **Some students could** have a detailed understanding of the need for sustainable development and environmental protection and the ways it can be carried out on individual, local and global scales (Grade A/A*).

Resources

- **Student Book:** pp. 227–9
- **Worksheets:**
3.55 Sustainable living
3.56 Reduce, re-use, recycle
- **Photographs:** None
- **Further reading and weblinks:**
Details of established environmental campaigns can be found at:
www.reduceuserecycle.co.uk
www.recycle-more.co.uk

Key concepts

- Everyday activities can have a huge negative effect on the environment.
- The three principles – reduce, re-use, recycle – can be used to help protect the environment.
- Ensuring sustainable development is the responsibility of everyone.

Starter suggestions

Outline the need for environmental protection and sustainable development outlined in the first few paragraphs of the Student Book.

Either set up the task in the **Now investigate** activity 1 on p. 228 as a homework exercise before the lesson, or complete it as part of the starter.

Students should be encouraged to think of the resources they use on a daily basis and to come up with ideas on how their use can be reduced.

Main lesson activities

- 1 Discuss with students whether it is really possible to live sustainably. Following on from the starter activity or diary activity in the Student Book, get students to choose a day when they try to change everything they use for something more sustainable – how far do they get? Some examples could include having a glass of tap water instead of tea or coffee, or walking or cycling to school instead of travelling in a vehicle.

- 2 In groups, students should discuss what the 'problem' areas are that may have stopped them from finishing the tasks in activity 1 above. When they have identified the problems, ask them to try to think of solutions and write them down on **Worksheet 3.55**. These can then be posted around the classroom for all to see.
- 3 Read through the 'Think global, act local' and 'Reduce, Re-use, Recycle' principles identified in the Student Book. Students then design a poster to encourage others to take part in these campaigns. Select the best ones from around the class, and display them in the classroom or around the school.
- 4 Building on the previous activity, see if you can hold a year or whole-school assembly to encourage others to take part in your sustainable development campaign.
- 5 Students return to the diary filled in as part of the starter exercise, and decide how many of the resources they used could be reduced, re-used or recycled. They can then complete the template on **Worksheet 3.56** using these ideas.
- 6 The information for Senegal in the Student Book has excellent examples of how recycling can lead to the development of other economic activities. Arrange for students to go out in to the local area and see if they can find examples of this type of recycling. If possible, examples can then be brought back into the class and put on display.

Give extra support by discussing the images on changing lifestyles (from car to bike to walking) before engaging students in the main lesson activities.

Give extra challenge by going further with the campaign for sustainable development. Students could write letters to local politicians asking what they intend to do to help people reduce, re-use and recycle.

Plenary suggestions

Complete activity 3 in the **Now investigate** section on p. 229 looking at recycling rates and facilities within your local area and across the country as a whole. Is there anything you can do to encourage more of this kind of activity?

Skills notes

The graph of recycling rates in Europe (graph C in the Student Book) can be used to practise other geographical display techniques – perhaps by having students redraw it as a pie chart.

3.7(8)

Looking after our natural environments

Assessment objectives

- Candidates should be able to reason and make judgements that demonstrate a sensitivity to, and a concern for, landscape, the environment and the need for sustainable development.
- Candidates should be able to recognise the role of decision making within a geographical context as affected by the physical and human contexts in which decisions are made.

0460/2217 syllabus

3.7 Environmental risks of economic development

- Demonstrate the need for sustainable development and management
- Understand the importance of resource conservation

Differentiated learning outcomes

- **All students must** have a basic knowledge of how environmental protection works at a national scale (Grade E/D).
- **Most students should** be able to describe some of the ways in which sustainable development and environmental protection are managed by national governments (Grade C/B).
- **Some students could** have a detailed understanding of the management strategies carried out by governments to ensure sustainable development of vulnerable areas while safeguarding livelihoods (with reference to a specific case study environment) (Grade A/A*).

Resources

- **Student Book:** pp. 229–31
- **Worksheets:**
3.57 The Great Barrier Reef
3.58 Visitors to the Great Barrier Reef
- **Photographs:**
Images of the Great Barrier Reef at:
www.terrageria.com/pacific/australia/great-barrier-reef/
- **Further reading and weblinks:**
The website of the Great Barrier Reef Marine Park Authority can be found at:
www.gbrmpa.gov.au/

Key concepts

- Large-scale environmental protection is often the responsibility of governments.
- Environmental protection needs to take account of the livelihoods of people working in vulnerable areas.
- The Great Barrier Reef Marine Park is an excellent example of sustainable conservation management.

Starter suggestions

Where is the Great Barrier Reef?

Ask students to find the reef in an atlas. Show students pictures of the reef – preferably from above and below the water (see weblink in **Resources** above). You could also locate the reef using Google Earth or another satellite mapping program and show it to your students on a big screen if possible.

How does it compare with other coral reefs? Are there any reefs in your local area? If not, try to find some other locations of major coral reefs from around the world.

Main lesson activities

- 1 **Worksheet 3.57** has an outline of the north-eastern coast of Australia. Using an atlas, add the outline of the Great Barrier Reef to the map, together with details of the islands on the reef itself. You could also add the major towns along the coast and any other information you can find about tourist destinations and attractions.
- 2 It's very unlikely that most students will ever visit the Great Barrier Reef, so why not turn a small part of the classroom into the reef itself? Ask students to research a

particular plant or animal that is found there, and spend the first part of a lesson building a picture of this fragile environment and annotating images of the reef. Get students to be creative in adding other displays to bring the reef to life.

- 3 Students should complete the first two activities in the **Now investigate** section on p. 231 using the templates on **Worksheet 3.58**. They first need to complete the table of visitor numbers and the pie graph, and then collect a piece of graph paper and draw a bar graph.
- 4 The Student Book shows the management strategies for the Great Barrier Reef – but the number of people visiting still causes environmental problems. In groups, and then as a class, discuss whether people should avoid visiting the Great Barrier Reef at all in order to ensure its survival.
- 5 Write a brief report on how the livelihoods of people are affected by the various activities on the Great Barrier Reef – tourism, agriculture, industry and urban growth. Include details on both the advantages and disadvantages of the different activities.

Internet homework exercise

Students should find another example of a fragile coral reef environment, either in their own country or overseas. The task is to conduct some research into the reef and the management strategies that are in place to protect it. Students should write up their findings as a detailed case study.

Give extra support by allowing students to complete a case study on the Great Barrier Reef as part of the assessment for main lesson activity 5.

Give extra challenge by adapting question 3 in the **Now investigate** section on p. 231 of the Student Book so that students complete it using an example other than the Great Barrier Reef.

Plenary suggestions

Having looked at a major global example (and success story) in environmental protection, bring things back down to a local level.

Are there any examples of environments students would like to see protected in the local area? If so, what kind of management strategies would they put in place to protect them?

Do they think their proposed strategies would have the desired effect?

Assessment suggestions

The homework exercise outlined above should provide a reasonable assessment of students' research capabilities and writing.

Skills notes

The worksheets for this lesson give good opportunities for students to practise their skills in drawing and annotating sketch maps and using other geographical techniques to display data.

3.7(9)

Conservation management and National Parks

Assessment objectives

- Candidates should be able to reason and make judgements that demonstrate a sensitivity to, and a concern for, landscape, the environment and the need for sustainable development.
- Candidates should be able to recognise the role of decision making within a geographical context as affected by the physical and human contexts in which decisions are made.

0460/2217 syllabus

3.7 Environmental risks of economic development

- Demonstrate the need for sustainable development and management
- Understand the importance of resource conservation

Differentiated learning outcomes

- **All students must** have a basic knowledge of the global system of National Parks (Grade E/D).
- **Most students should** be able to describe some of the reasons why National Parks have been set up and some of the ways in which they are protected (Grade C/B).
- **Some students could** have a detailed understanding of the global need for National Parks and the management strategies used in different countries to protect specific National Park areas (Grade A/A*).

Resources

- **Student Book:** pp. 232–4
- **Worksheets:**
3.59 National Parks and protected areas around the world
3.60 National Park factfile
- **Photographs:** None
- **Further reading and weblinks:**
The official website of the Yorkshire Dales National Park
www.yorkshiredales.org.uk

Key concepts

- In many countries National Parks have been set up to protect vulnerable environments.
- National Parks protect people's livelihoods as well as environmentally sensitive landscapes.
- The UK has one of the world's longest-established National Park systems.

Starter suggestions

Revision exercise: why was there a need for protection of the Great Barrier Reef?

In groups, give students three minutes to write down five threats to the reef and five ways in which these threats were managed.

Explain that there are many areas around the world that are protected in similar ways (although not always as successfully). Introduce this idea by asking students to read the opening paragraph and to look at the first table **A** in the Student Book.

Main lesson activities

- 1 Using an atlas, students should locate all the National Parks shown on table **A** in the Student Book. Then they mark all these locations on the blank world map on **Worksheet 3.59**. Their final task is to find five more examples of National Parks from around the world and to add them to their map.
- 2 For each of the five National Parks they added to their map in activity **1** above, students should write a paragraph explaining why these areas have been protected. They can use the internet to help them.

Extension: some students can take this exercise further by trying to find out the different ways in which the parks are managed.

- 3 What do students know about the National Parks within their own country? Working with a partner and using an atlas or a detailed map, they should find as many examples as they can of protected areas in your country. Remind students that they may have other names, such as 'reserves' or 'marine parks', in addition to being called National Parks. They should try to decide why these areas are protected.
- 4 Students should read through the information on the Yorkshire Dales National Park in the Student Book and then complete the factfile shown on **Worksheet 3.60**. (If they have more information than space available on the worksheet, they can continue writing on the other side of the worksheet.) The same worksheet could be used instead to create a case study of a National Park in your own country.
- 5 Tell students they are to imagine they are about to take a trip to a particular National Park (you can name a specific park). They must pack a suitcase for the trip, so need to think about the items to take. They should try to ensure that when they get to the destination, their visit has the least possible impact on the environment. At the same time they must be prepared for the climate and the landscape in the place they are about to visit. If possible students should use images from the internet or Google Earth to find out as much as they can about the place they are 'visiting' – environments under threat, methods of conservation, the people who live there.

Give extra support by handing out leaflets or brochures you have collected or downloaded from the internet, to help with main lesson activity 3 above.

Give extra challenge by giving students a range of National Parks to choose from for main lesson activity 5 above.

Plenary suggestions

Finish this section with a look back at all the different topics you have covered and how they all relate together.

Complete a 'carousel' session. This involves writing headings such as 'Environmental pollution', 'Environmental protection', 'Impacts of agriculture', 'Importance of secondary industry' on large pieces of paper and giving groups of students a few minutes to write as much as they know under one heading before moving on to the next.

Go through the results with the class to identify any gaps in understanding.

Assessment suggestions

Main lesson activity 5 above gives an opportunity to assess how students can apply their learning to a real-world situation.

Paper 1: Geographical Themes

exam practice

Examples of two answers

For each question there are two example answers. One answer should achieve a high mark, and the other answer should achieve a medium level mark. These are followed by comments and advice to help improve your answer.

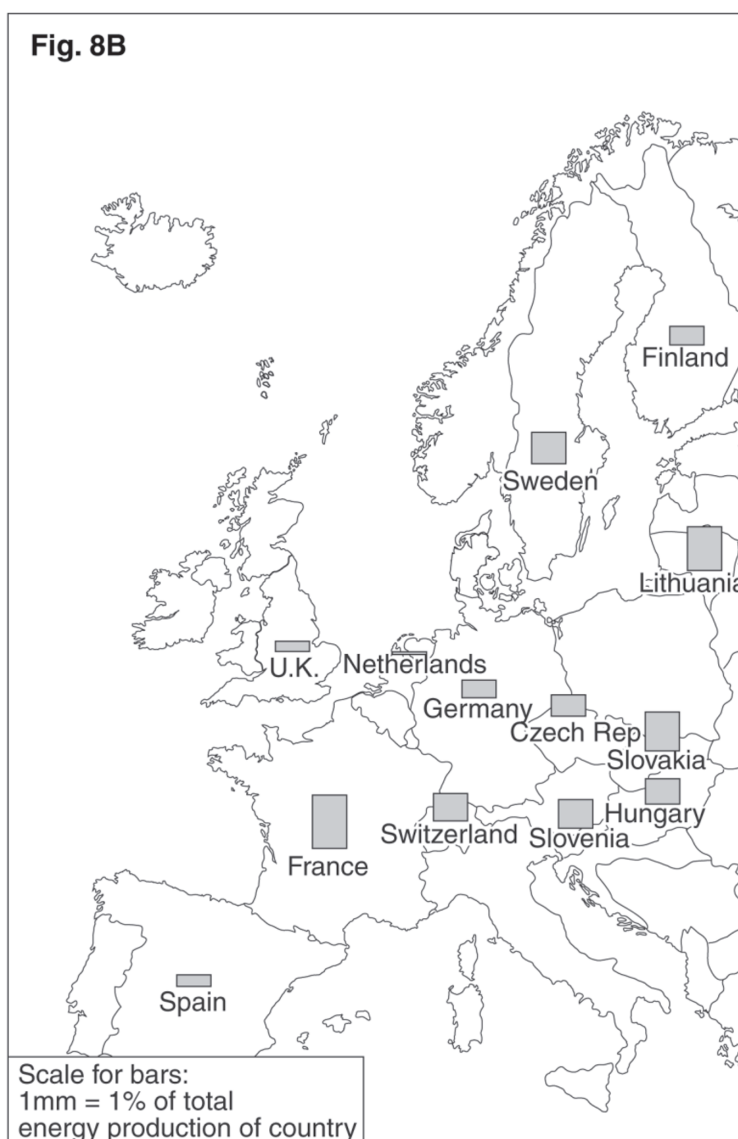
Read the questions and look at the resources, then study the two example answers. Can you understand how the marks may be awarded and the answer might be improved?

Question (a)

Study Figs 8A and 8B, which show information about the percentage of total electricity generated by nuclear power stations.

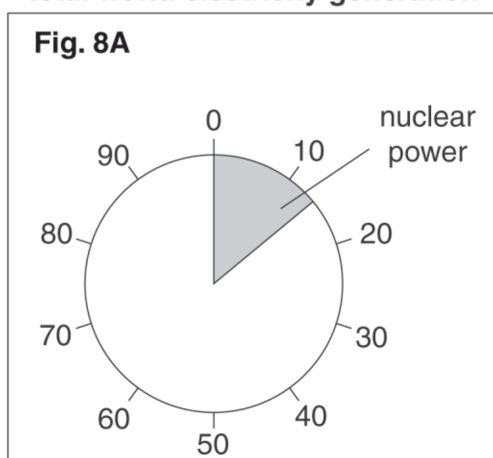
Percentage of total electricity generated by nuclear power stations for countries in Europe

Fig. 8B



Nuclear power as percentage of total world electricity generation

Fig. 8A



Question (a) (i)

Using Fig. 8A, state the percentage of the world's electricity which is generated by nuclear power stations. [1 mark]

(Adapted from Cambridge IGCSE Geography 0460 Paper 12 Q5a(i) November 2010.)

Answer 1

14% (✓)

Teacher's comment

The answer is correctly interpreted from the pie chart.

Answer 2

14 (✓)

Teacher's comment

The answer is acceptable even though it doesn't include the percentage sign, because the question states that the answer must be a percentage.

Question (a) (ii)

Using Fig. 8B, compare the importance of nuclear power in France and Germany. Support your answer with statistics. [2 marks]

(Adapted from Cambridge IGCSE Geography 0460 Paper 12 Q5a(ii) November 2010.)

Answer 1

Nuclear energy is more important in France than Germany (✓). In France it is 7% of the total energy production, whereas in Germany nuclear energy only provides 2% of energy production (✓).

Teacher's comment

The answer makes a correct comparison between nuclear energy in the two countries. It then uses accurate statistics to support this comparison. It obeys the command words. You should always read the question carefully as many answers lose marks on this type of question because they only follow the first command and don't 'support the answer with statistics'.

Answer 2

In France nuclear energy produces 7% of the total energy production and in Germany 2% of the total (✓).

Teacher's comment

The figures are correct, but the answer does not make a comparison between the two countries. The figures should support the comparison between the countries. You will not gain credit if you do not obey the command words; in this question the command word is 'compare'. Look again at pp. 241 of the Student Book to check the meaning of common command words.

Question (a) (iii)

Suggest reasons why the importance of nuclear power varies from country to country. [3 marks]

(Adapted from Cambridge IGCSE Geography 0460 Paper 12 Q5a(iii) November 2010.)

Answer 1

Some governments may be against the use of nuclear power so little power is generated from uranium as they see it as a dangerous way of generating power (✓).

Some countries may find it too expensive to generate nuclear power because it is expensive to set up the power plant, maintenance costs may be too high and getting rid of the waste may be expensive (✓).

Nuclear power may also be important to other countries because they have no resources for other types of energy, such as few rivers so HEP cannot be used, or a lack of sunshine so solar power cannot be generated (✓).

Some countries are highly industrialised so there is a large demand for energy which nuclear energy can help to meet.

Teacher's comment

This answer includes three detailed reasons: government policy, cost and availability of other energy resources. The final idea about demand would also be worth credit. Remember to include at least as many ideas as there are marks for the question. Ideally include one extra idea to be sure you can gain full credit.

Answer 2

The importance of nuclear energy varies from country to country because it depends if they have the natural resources for nuclear energy production in that country. It can also depend on how near they are to a water supply. They might also have a cheaper alternative method of producing electricity (✓). Nuclear power is also expensive to produce and some countries might not be able to afford it (✓). People do not like nuclear power and think that it is unsafe.

Teacher's comment

The answer contains some irrelevant ideas. The availability of uranium or water is not a reason for the importance of nuclear power. Two ideas that would be credited are those related to possible alternative energy sources and the amount of money available to invest in nuclear power. The answer also includes the incorrect idea that countries need a raw material (uranium) to develop nuclear power. This can be imported. Another common error is that the importance of nuclear power is affected by people's attitudes. The only attitude that is important is that of the government.

Question (a) (iv)

Give **two** advantages and **two** disadvantages of using nuclear power stations to generate electricity. [4 marks]

(Adapted from Cambridge IGCSE Geography 0460 Paper 12 Q5a(iv) November 2010.)

Answer 1

Advantages:

1. It does not produce greenhouse gases like fossil fuels (✓).
2. A bit of uranium as fuel will produce a lot more energy than the same amount of coal (✓).

Disadvantages:

1. Nuclear waste is not easy to dispose of without causing harm to the environment (✓).
2. Accidents such as the one in Chernobyl cause a lot of radiation to be let out into the soil and atmosphere which will take hundreds of years to go away (✓).

Teacher's comment

The advantages and disadvantages are well explained and in sufficient detail. Remember that this question asks for two advantages and two disadvantages. You

will not be able to gain full credit if you only include advantages or disadvantages in your answer.

Answer 2

Advantages:

1. It is not as polluting as oil or gas.
2. It *does not* run out like fossil fuels. (✓)

Disadvantages:

1. It is very expensive.
2. It is dangerous because it gives off radiation, which causes cancer. (✓)

Teacher's comment

Two ideas would be worth credit. The advantage of 'not running out' is poorly expressed but would be acceptable. The answer would have been better if it had stated that 'uranium does not run out'. The disadvantage of the danger of a radiation leak would also be credited. The first advantage could have been credited if it had been more precise and referred to air or atmospheric pollution. You will not be given credit for 'pollution' by itself. The second disadvantage needed to explain what is expensive. The answer would be too vague to gain credit.

Question (b)

Study Fig. 9, which shows the location of the Paks nuclear power station in Hungary.



Fig. 9

Question (b) (i)

Describe the location of the Paks nuclear power station shown on Fig. 9. [3 marks]

(Adapted from Cambridge IGCSE Geography 0460 Paper 12 Q5b(i) November 2010.)

Answer 1

Paks is located in the south-western part of Hungary (✓). It is about 80km from the neighbouring country of Croatia (✓). It is located 200km away from the capital city (Budapest) (✓) to the south-south-west of the city.

Teacher's comment

The answer shows excellent examination technique. The description is accurate and detailed including precise measurements and compass directions.

Answer 2

Paks is on the outskirts of Hungary. It is in the south west (✓). It is near to the border.

Teacher's comment

The answer would gain credit for the suggestion that it is located in the south-west of the country. The other answers are too inaccurate. Paks is actually about 80 km away from the border. The answer does not make sufficient use of the map and scale provided. You should always include distance and direction when describing location.

Question (b) (ii)

Describe and explain the factors which influence the location of nuclear power stations. [5 marks]

(Adapted from Cambridge IGCSE Geography 0460 Paper 12 Q5b(ii) November 2010.)

Answer 1

The nuclear power stations have to be close to a water body (lake or sea) (✓) for water to create steam and cool the machinery (✓ dev). Nuclear power stations should also be located away from cities (✓) so there is less danger of them being harmed by leaks. They have to be close to uranium mines so it does not have to be transported long distances. If uranium is imported, like in Japan, the plant has to be close to the coast where the uranium can be unloaded directly to the power station (✓). The nuclear power plants have also got to be near to a labour source to work in the power station.

Teacher's comment

This answer contains many valid points and some irrelevant ideas. Credit would be given for the factor of nearness to a water source and this is further developed by what the water is needed for – that is, for cooling. A development mark may be awarded when an idea is described or explained in more detail. Also the factor of being located away from cities would be credited. Unfortunately the development idea which explains why this is a necessary factor would be too vague for credit. The danger of a radiation leak is not explained. Another factor that would be credited is location on the coast for direct unloading of uranium. Again, this idea could be developed further by explaining why this is so important. Two ideas that are incorrect are those that state that nuclear power stations have to be located near to uranium mines and nuclear power stations have to be located near to a workforce. Neither of these factors is a major influence on the location of a nuclear power station.

Answer 2

Nuclear power stations need to be located in areas with large open spaces (✓). They also need to be located in areas where there are not many people. They also need to be located near large sources of water (✓). Nuclear power stations need to be located near to a good transport route.

Teacher's comment

The answer describes the locating factors, but may gain more marks with a little development. The answer needs to explain why large open spaces and large sources of water are needed. The requirements of plenty of space and availability of water would both be credited. The factor relating to population density is too vague and needs to state 'away from cities' or 'away from densely populated areas'. Similarly the requirement of transport needs to be more precise, such as a railway line or main road, and explain why a good transport route is needed. Notice that this question has two command words: 'describe' and 'explain'. You will not gain full credit if you do not obey both commands. This answer does not give any explanation and so only attempts to answer part of the question.

Question (c)

Identify a form of energy and describe how its use threatens the natural environment in a named country or area which you have studied. [7 marks]

(Adapted from Cambridge IGCSE Geography 0460 Paper 12 Q5c November 2010.)

Answer 1

In Burkina Faso in Africa, fuelwood is used as an energy source. When wood is burnt, carbon dioxide is released which causes global warming which results in melting ice caps and flooding in some areas around the coast and some islands, such as the Maldives.

Cutting down trees removes a carbon sink meaning the level of carbon dioxide in the atmosphere will increase and oxygen levels will decrease.

Cutting down trees for fuelwood breaks down the natural cycle. Tree roots help to bind the soil together. Their removal leaves the ground bare and so soil erosion takes place leaving gullies and causing silting in rivers. When there are no trees left the bushes are also cleared and so the land is left bare. Desertification takes place through wind or water erosion, which removes the topsoil so no crops can be grown.

Chopping down trees also breaks the nutrient cycle. When leaves die, they break down into nutrients in the soil which keeps the soil fertile. With no nutrients being added to the soil, it soon becomes infertile.

Teacher's comment

The answer does not include detail about the named example. Although a country is named, no further details are given. The remainder of the answer could refer to other fuelwood burning areas. The first two paragraphs are irrelevant to the question. They concentrate on global effects rather than effects in one area or country.

In paragraph three there are two developed ideas: firstly that cutting down trees results in soil erosion and silting in rivers; secondly that removal of natural vegetation leaves the land open to soil erosion.

In paragraph four the breakdown of the nutrient cycle is another developed idea. Overall the answer shows good understanding of the effects of deforestation on the natural environment. The answer may be improved by including detail of the particular problems in Burkina Faso, such as place names, types of trees or soil type. Go back to the examples of a case study mark scheme on pp. 288–9 of the Student Book to check how this answer meets the requirements of an intermediate level rather than a high level answer.

Answer 2

COAL IN SOUTH AFRICA

Coal is a fossil fuel which can generate large amounts of electricity but it is harmful to the environment. To mine coal large machines are required and much land will have to be cleared. Also land will have to be cleared for the coal-fired power stations. This results in animals losing their habitats which may affect the whole ecosystem. Mining also contributes to deforestation which can lead to soil erosion and desertification. When coal is burnt it gives out harmful gases that cause air pollution and contribute to global warming.

Teacher's comment

The answer is vague and mixed up but does present one developed idea. Even though the case study refers to one country it does not include any detail about South Africa. There is no emphasis on any particular area of mining or electricity production. The idea of land clearance and its effect on habitats and local ecosystems is general but developed. The idea about deforestation is not very detailed. Reference to global warming is irrelevant to the question because the focus of the question is the effect on the country, not worldwide.

Paper 2: Geographical Skills exam practice

Examples of two answers

For each question there are two example answers. One answer should achieve a high mark and the other answer should achieve a medium level mark. These are followed by comments and advice to help improve your answer.

Read the questions and look at the resources, then study the two example answers. Can you understand how the marks may be awarded and the answer might be improved?

Question 1

Table 1 below shows the climate data for Manaus in the Amazon Basin.

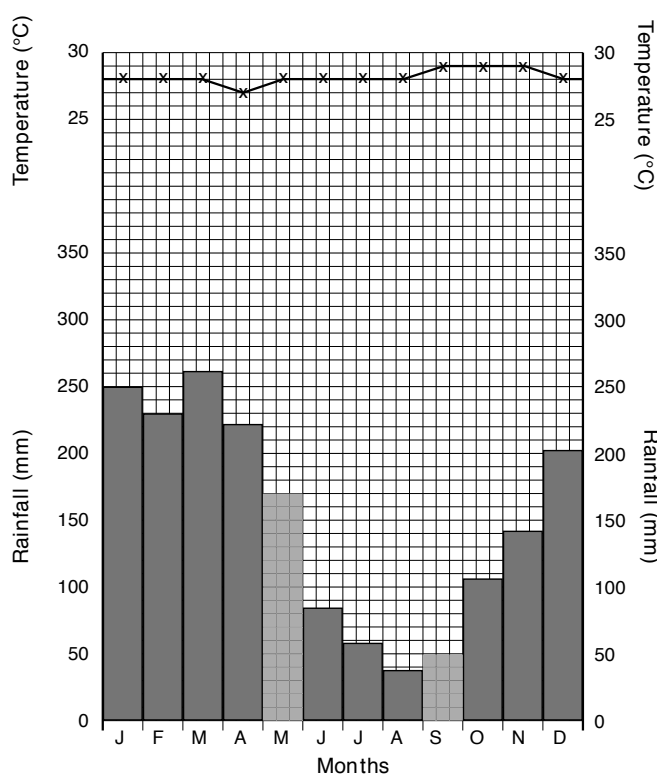
Table 1: Climate data for Manaus

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Average temperature (°C)	28	28	28	27	28	28	28	28	29	29	29	28
Average rainfall (mm)	249	230	262	221	170	84	58	38	50	107	142	203

Question (a) (i)

Use the information in Table 1 to complete Fig.1 below by plotting the rainfall for May and September. [1 mark]

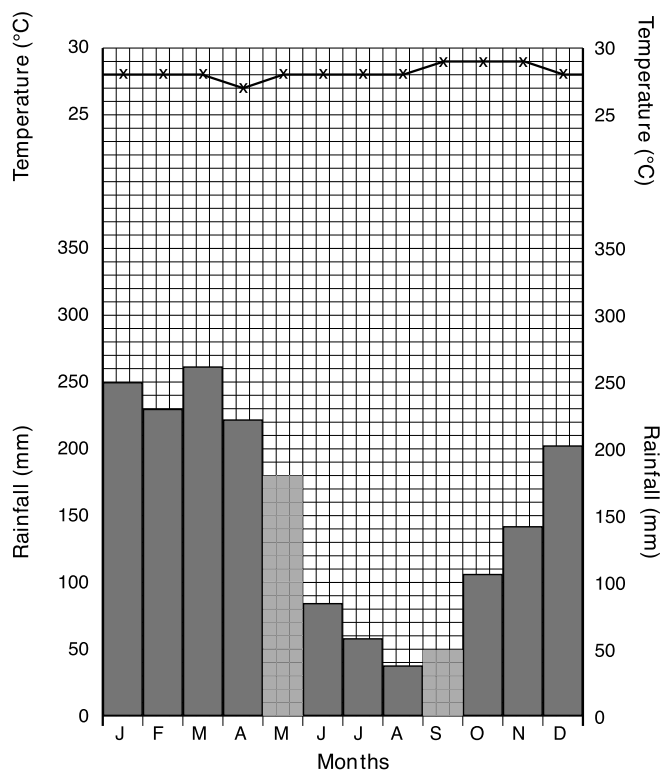
Answer 1



Teacher's comment

Both bars are completed accurately.

Answer 2



Teacher's comment

The bar for May is inaccurate; the bar for September is accurate. However, both bars need to be drawn accurately to gain credit.

Question (a) (ii)

Calculate the annual range of temperature. [1 mark]

Answer 1

2 (°C) (✓)

Teacher's comment

Calculation is correct (29 – 27).

Answer 2

224 (°C)

Teacher's comment

The answer is the difference in rainfall totals.

Question (a) (iii)

Circle the word below that describes the amount of annual rainfall. [1 mark]

low / moderate / high

Answer 1

High (✓)

Teacher's comment

The answer shows the correct choice.

Answer 2

Moderate

Teacher's comment

The answer is incorrect. Total rainfall of more than 1800 mm is high.

Question (a) (iv)

Describe the distribution of rainfall during the year. [2 marks]

Answer 1

Most rain falls at the beginning of the year, with peaks in January and March (•). Least rain falls during June to October.

Teacher's comment

Credit would be given for the inclusion of the two wettest months but no further credit would be given for the two driest months. To gain further credit the answer needed to include the idea that rain falls in every month.

Answer 2

In the first four months the rainfall is quite high as temperatures are also fairly high. Rainfall decreases at around June to September and increases again after September.

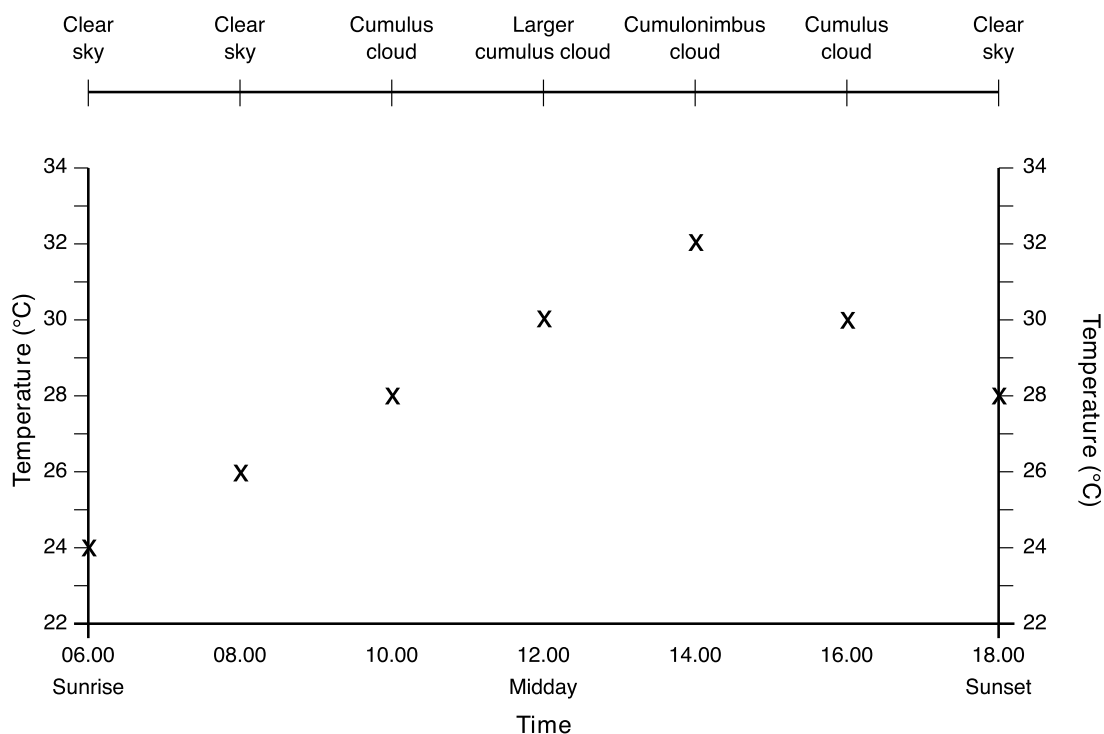
Teacher's comment

The answer would be too vague to gain credit. Although there is correct information it does not describe the distribution accurately enough. Remember to refer to particular months or seasons when describing how temperature or rainfall changes over a year.

Question (b)

Study Fig. 2, which shows temperatures and cloud types during one day at Manaus.

Fig. 2



Use information from Fig. 2 to state:

Question (b) (i)

the number of hours between sunrise and sunset at Manaus; [1 mark]

Answer 1

12 (✓)

Teacher's comment

The answer is correct.

Answer 2

12 (✓)

Teacher's comment

The answer is correct.

Question (b) (ii)

the temperature (°C) at 12.00 [1 mark]

Answer 1

30 (°C) (✓)

Teacher's comment

The answer is correct.

Answer 2

30 (°C) (✓)

Teacher's comment

The answer is correct.

Question (b) (iii)

the relationship between the temperature and the development of clouds. [1 mark]

Answer 1

As the temperature rises, the clouds become larger and there is more cloud. (✓)

Teacher's comment

The answer recognises the positive relationship between temperature and cloud cover.

Answer 2

As the temperature increases, the type of cloud changes.

Teacher's comment

The answer would not be credited. It does not identify the relationship between temperature and amount of cloud cover. The description of cloud change is too vague.

Question 2

Table 2 below shows the highest and lowest monthly rainfall totals recorded for Adelaide in Australia since 1980.

Table 2: Record monthly rainfall totals at Adelaide

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Highest rainfall total (mm)	42	63	106	105	128	175	160	129	151	105	107	73
Lowest rainfall total (mm)	1	0	0	1	8	12	22	11	16	1	1	6

Question (a) (i)

In which month was the largest difference between the highest rainfall total and the lowest rainfall total? [1 mark]

Answer 1

June (✓)

Teacher's comment

The answer is correct.

Answer 2

July (x)

Teacher's comment

The answer has been calculated incorrectly.

Question (a) (ii)

How can the Adelaide water authority make sure that people have enough water in dry months? [2 marks]

Answer 1

They can conserve water in wetter months (✓) to save it for when it is dry. They could also limit the amount of water used when it is dry (✓). Dams and reservoirs could be built to store water for when it is needed.

Teacher's comment

This answer contains three correct ideas: storage in wet months, conservation, construction of reservoir. However, it is likely that only two ideas would be needed for full credit. If you can think of more ideas to include it is worth doing so in order to be sure of scoring high marks.

Answer 2

They can build reservoirs (✓) which can hold water to be used in dry months. Have strict policies about water use in dry months so less water is used (✓).

Teacher's comment

The answer suggests two correct measures.

Question (b)

Study Table 3, which shows what water is used for in Queensland, Australia.

Table 3

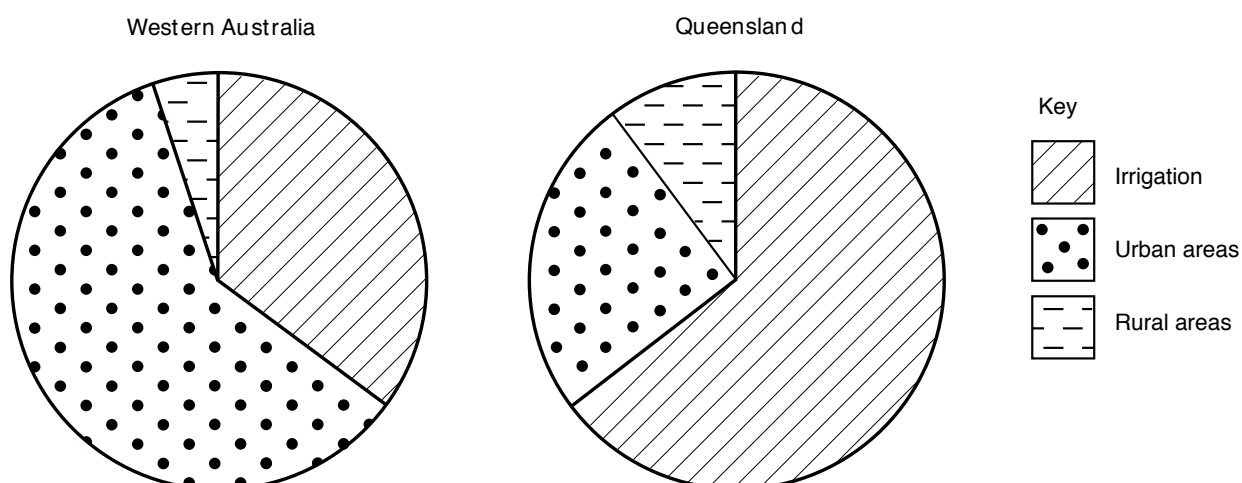
Different uses of water	Percentage of water used
Irrigation	65
Urban areas	25
Rural areas	10

Question (b) (i)

On Fig. 3 complete the pie graph for Queensland using the information in Table 3.
Use the key provided for shading. [3 marks]

Answer 1

Fig. 3



Teacher's comment

The pie chart is completed accurately.

Answer 2

Fig. 3



Teacher's comment

The answer shows the angle measured accurately but the segments have not been shaded.

Question (b) (ii)

Which user consumes the largest amount of water in Western Australia and what proportion of the supplies does it use? [1 mark]

Answer 1

Urban uses 60% of the water supplies. (✓)

Teacher's comment

Both parts of the answer are correct.

Answer 2

Urban uses most water.

Teacher's comment

Although the answer correctly identifies the largest consumer, its proportion is not measured from the pie chart. So no credit would be awarded.

Question (b) (iii)

Using the information given only, compare water use for irrigation in the two states. [1 mark]

Answer 1

Queensland uses about double the amount for irrigation than Western Australia uses. (✓)

Teacher's comment

This is a correct answer.

Answer 2

In Queensland irrigation uses about 65% whilst Western Australia it uses 35%. (✓)

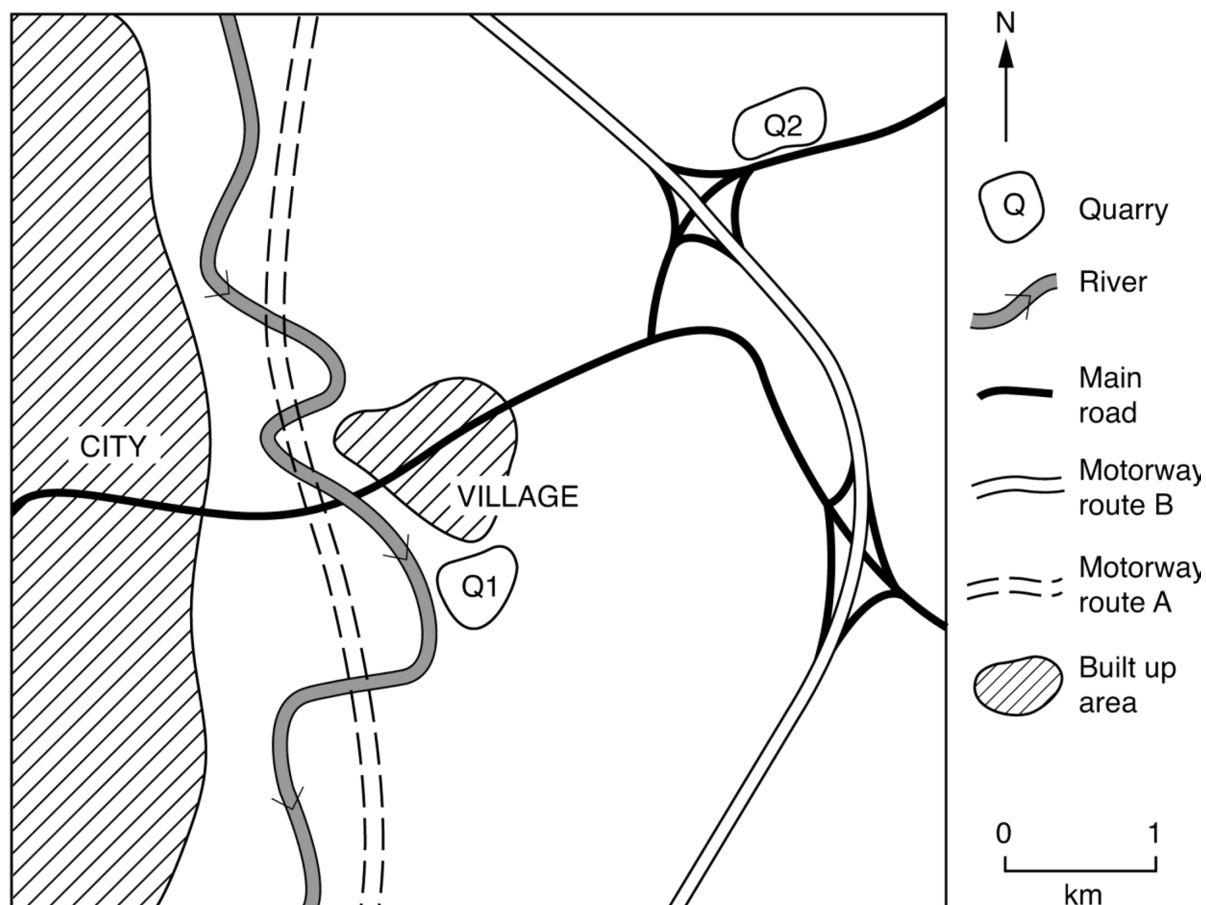
Teacher's comment

The answer compares percentage figures accurately. Remember that if the question command is 'compare' you must identify the difference between the two amounts.

Question 3

Fig. 4 is a map of an area of Europe where a motorway is to be built to by-pass a large city.

Fig. 4



Question (a)

Two possible routes for the motorway, **A** and **B** are shown on Fig. 4. Route **B** was chosen and Route **A** was rejected.

Suggest **two** reasons for the rejection of Route **A**. [2 marks]

(Adapted from Cambridge IGCSE Geography 0460 Paper 2 Q6a June 2006.)

Answer 1

1. Route A would create noise for the village. (✓)
2. Bridges would need to be built across the river. (✓)

Teacher's comment

Both reasons are correct to explain why Route **A** would be rejected.

Answer 2

1. It goes near a village and city.
2. It will be noisy for people living nearby. (✓)

Teacher's comment

If the two ideas are linked together it may be possible to gain some credit. By themselves both reasons are too vague to gain credit.

Question (b)

A local supply of rock and gravel to build the motorway was needed. Two possible sites for a quarry or open-cast mine for the rock and gravel, **Q1** and **Q2**, are shown on Fig. 4. Site **Q2** was chosen and site **Q1** was rejected.

Question (b) (i)

Suggest why site **Q2** was chosen. [5 marks]

(Adapted from Cambridge IGCSE Geography 0460 Paper 2 Q6b(i) June 2006.)

Answer 1

Site Q2 is near to motorway route B which was chosen. (✓) So it would be nearer to move rock and gravel to the motorway. Site Q2 is not near to the village or city so noise (✓) and dust (✓) from blasting will not be a nuisance to local people or disturb wildlife.

Teacher's comment

The answer correctly recognises that site Q2 is nearer to where the rock is needed to build the motorway. The answer could have explained that a benefit of the quarry being near to the motorway is that it would cost less to transport rocks and gravel. The answer gains credit for stating benefits of the quarry being located away from settlements and wildlife.

Answer 2

Site 1 is too near the village so there would be a lot of noise from lorries going through it. (✓) Site 2 is nowhere near the village so lorries would not cause noise.

Teacher's comment

The answer focuses on why site 1 was not chosen which would be allowed. The idea about how noise might affect the village would be credited. No further credit would be given because the answer repeats the same information about site 2.

Question (b) (ii)

Suggest a use for the disused quarry or open-cast mine after the motorway has been built. [1 mark]

(Adapted from Cambridge IGCSE Geography 0460 Paper 2 Q6b(ii) June 2006.)

Answer 1

It could be developed as a wildlife reserve to attract all kinds of animals and birds.

Teacher's comment

This is a valid use of the disused quarry and could be credited.

Answer 2

It could be used to mine more rock which is taken away on the motorway.

Teacher's comment

The answer has misunderstood the question and has not realised that the quarry is no longer being used.

Paper 4 (IGCSE): Alternative to Coursework exam practice

Paper 3 (O Level): Geographical Investigations

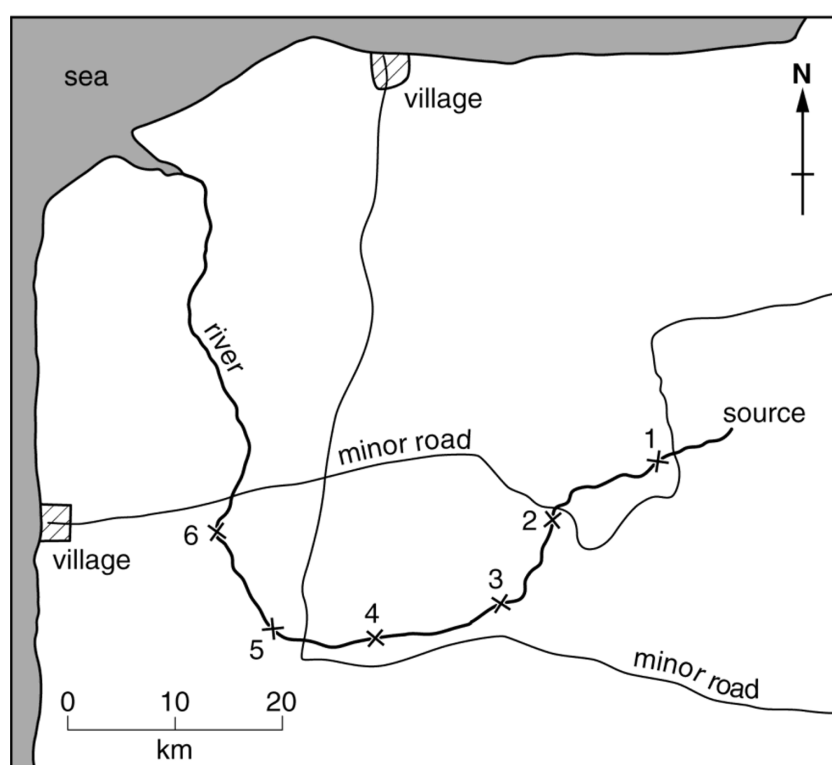
Examples of two answers

For each question there are two example answers. One answer should achieve a high mark and the other answer should achieve a medium level mark. These are followed by comments and advice to help improve your answer.

Read the questions and look at the resources, then study the two example answers. Can you understand how the marks may be awarded and the answer might be improved?

Fig. 4

Sketch map of river



Key

× 1 river sampling sites

Table 2: Results at sampling sites

sampling site	distance from source (km)	Hypothesis 1	Hypothesis 2	
		velocity (metres per second)	average length of long axis (cm)	average score of roundness
1	4	0.50	19	2
2	13	0.60	15	2
3	24	0.52	14	4
4	33	0.68	10	3
5	43	0.70	11	5
6	53	0.75	6	5

A group of students studied how the characteristics of a river change downstream. A sketch map of the river is shown in Fig. 4. They wanted to see if the river was typical of most rivers. To do this they decided to test the following hypotheses:

- **Hypothesis 1** Velocity increases downstream
- **Hypothesis 2** Size and shape of the bedload changes downstream

Question (a)

The students selected six sampling sites along the course of the river.

The distance of each site from the river's source is shown in Table 2.

Suggest **three** factors the students should have considered in choosing the sampling sites. [3 marks]

(Adapted from Cambridge IGCSE Geography 0460 Paper 4 Q2a June 2009.)

Answer 1

1. Is the area suitable for measuring or is it too dangerous to enter the water? (✓).
2. The distance between the measuring points should be the same (✓).
3. It may be too deep or too shallow to measure at certain points of the river.

Teacher's comment

The first two ideas would be worth credit. However, the third answer does not explain why the river may be too deep. This could link back to factor 1.

Answer 2

1. The distance to the source of the river.
2. They have to choose places which are scattered.
3. They have to choose accessible places (✓).

Teacher's comment

The first two answers would be too imprecise to gain credit. The idea that sites should be scattered is correct but more importantly they should be evenly scattered along the course of the river.

Question (b)

At each site, the students measured the velocity of the river. The results of this test for sampling site 1 are shown in Fig. 5.

Fig 5. River recording sheet – Sampling site 1

Sampling site: 1

Measurement of velocity

Length of time for a small floating object to travel 10 metres:

Test 1 17 seconds

Test 2 23 seconds

Test 3 20 seconds

Mean length of time to float 10 metres = $\frac{60}{3}$ seconds = 20 seconds

Velocity = $\frac{\text{distance}}{\text{time}}$

= $\frac{10 \text{ metres}}{20 \text{ seconds}}$

= 0.5 metres per second

Question (b) (i)

Use the information in Fig. 5 to describe how the students measured the velocity. Refer to equipment they would use. [4 marks]

(Adapted from Cambridge IGCSE Geography 0460 Paper 4 Q2b(i) June 2009.)

Answer 1

First they will need a small floating object like a twig or stick. Then one person stands at a point on the bank and the other person stands at another point 10 metres downstream (✓). The second person will need a stopwatch and when the first person releases the object the second person starts the stopwatch (✓). When the object reaches him the second person stops the watch and records the time in seconds (•). They repeat this test three times to find the average (✓). They then use the formula distance divided by time to find the velocity.

Teacher's comment

This answer describes the method clearly. Although more ideas could be included, such as using marker poles to show the 10 metre distance, the answer includes four ideas which would be worth crediting.

Answer 2

They put a floating object in the river so it would move downstream (✓) and calculated how long it took to reach another point which is 10 metres from the place where the object was thrown into the river (✓). To do this experiment they need a floating object, a watch, and something to measure the 10 metres that the object has to move.

Teacher's comment

The answer is not well written but would gain credit, for reference to the floating object and what it is used for, and for stating that the experiment will be done over 10 metres. The answer does not include any reference to timing the floating object, repeating the method and taking an average, or how to calculate the velocity.

Question (b) (ii)

Before the students began their fieldwork, their teacher worked with them on a pilot study. The results of the study are shown in Fig. 6.

Complete Fig. 6 to calculate the mean velocity of the river at this sampling site. Show your calculations. [3 marks]

(Adapted from Cambridge IGCSE Geography 0460 Paper 4 Q2b(ii) June 2009.)

Fig 6. Pilot survey river recording sheet

Sampling site:

Measurement of velocity

Length of time for a small floating object to travel 10 metres:

Test 1 27 seconds

Test 2 20 seconds

Test 3 28 seconds

Mean length of time to float 10 metres

Velocity = $\frac{\text{distance}}{\text{time}}$

=

=

Answer 1

Mean length of time to float 10 metres = $\frac{75}{3} = 25 \text{ seconds} (\checkmark)$

Velocity = $\frac{10 \text{ metres}}{25 \text{ seconds}} (\checkmark)$

= 0.4 metres per second ($\checkmark$)

Teacher's comment

The calculation is correct at all stages.

Answer 2

Mean length of time to float 10 metres = $\frac{75}{3} = 25 \text{ seconds} (\checkmark)$

Velocity = $\frac{10 \text{ metres}}{25 \text{ seconds}} (\checkmark)$

= 0.4

Teacher's comment

The answer is calculated correctly but it would not gain full credit because the unit of measurement of velocity is not included. Always remember to include units when you are calculating or using figures in description or explanation.

TIP

Many answers do not show an understanding of the term 'pilot study', even though it is an important part of fieldwork. Make sure that you know an accurate definition and why it is useful.

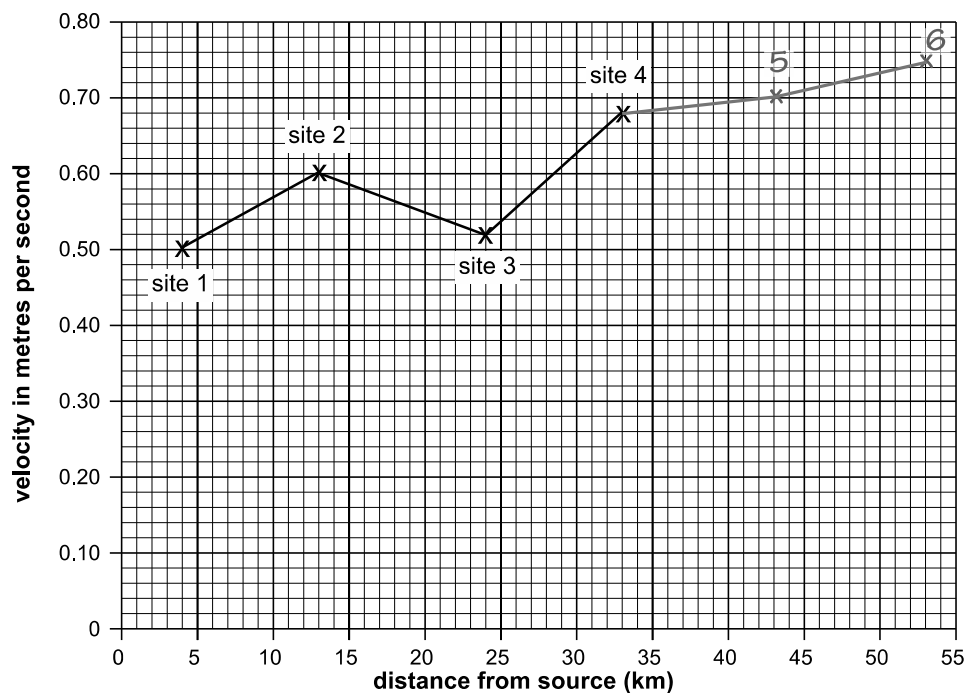
Question (b) (iii)

The results which the students obtained at the sampling sites are shown in Table 2 (on p. 230). Use these results to complete Fig. 7 to show how velocity changes downstream. [2 marks]

(Adapted from Cambridge IGCSE Geography 0460 Paper 4 Q2b(iii) June 2009.)

Answer 1

Fig. 7: Changes in velocity downstream

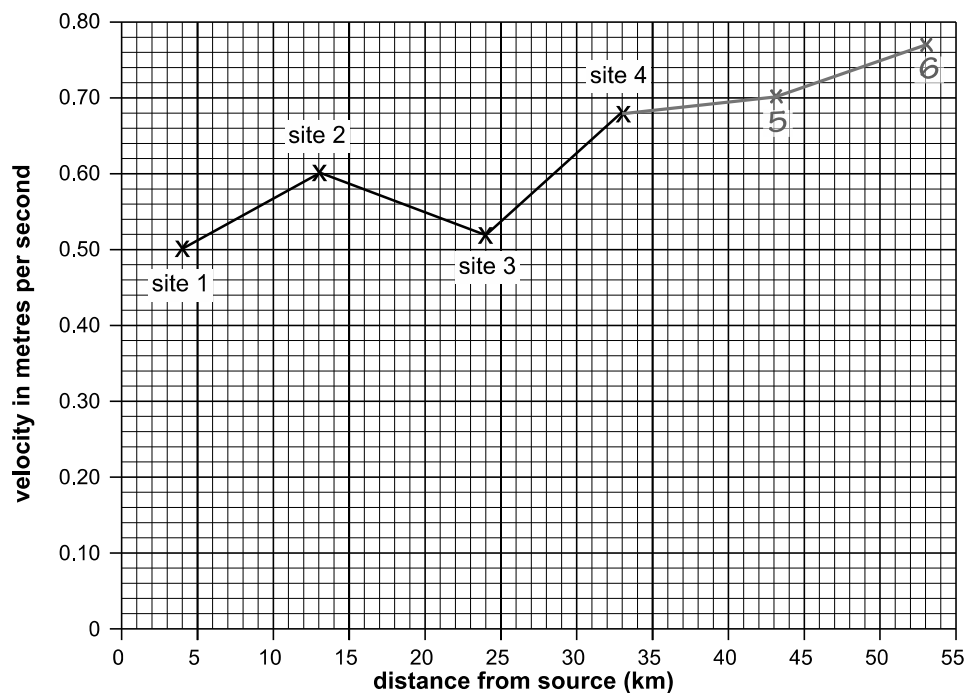


Teacher's comment

Marks would be awarded for accurate plotting of the two points and completion of the line.

Answer 2

Fig. 7: Changes in velocity downstream



Teacher's comment

The answer would not gain full credit because site 6 is plotted inaccurately.

Question (b) (iv)

By looking at their results, what conclusion could the students make about

Hypothesis 1 (Velocity increases downstream)? [2 marks]

(Adapted from Cambridge IGCSE Geography 0460 Paper 4 Q2b(iv) June 2009.)

Answer 1

Hypothesis 1 is likely to be true (✓) since the velocity increases with the distance from the source. Even though at site 3 the velocity decreases (✓) overall the velocity increases from 0.5 to 0.75 metres per second.

Teacher's comment

Credit would be gained for the conclusion that the hypothesis is correct. The answer recognises that site 3 is an anomaly to the general pattern. Also the answer includes a correct interpretation of the graph by including velocity figures.

Answer 2

Yes the hypothesis is true (✓). The data shows that as the river gets nearer to the sea the water goes faster and faster.

Teacher's comment

The conclusion that the hypothesis is correct would be credited. However, the answer does not use the results to support this conclusion. Instead it repeats the idea of the hypothesis in a different way.

TIP

You will usually gain credit for making the right decision about whether a hypothesis is true/correct or false/incorrect.

Question (c)

Question (c) (i)

At each site, the students also sampled and measured stones on the river bed (bedload).

Describe a sampling technique they could use to get an accurate sample of bedload material. [2 marks]

(Adapted from Cambridge IGCSE Geography 0460 Paper 4 Q2c(i) June 2009.)

Answer 1

The student may use a 50cm x 50cm grid and throw it into an area of bedload randomly (✓). This sample can be used to make the answer fairer and more accurate by finding the average size of the bedload sample.

Teacher's comment

The answer does not show a good understanding of a sampling technique. Credit would be given for reference to a random sampling method, but the answer then becomes irrelevant as it suggests what can be done with this sample.

Answer 2

Some rocks could be chosen and measured at every site. So that not only smooth rocks but also angular rocks are chosen.

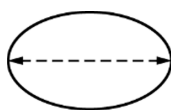
Teacher's comment

The answer understands the idea of choosing rocks but does not suggest a method to carry out this sampling.

Question (c) (ii)

Having collected their sample, the students wanted to find out the size and 'roundness' of each stone. Using the equipment shown in Fig. 8 they decided to make two simple measurements:

- the longest axis as shown below

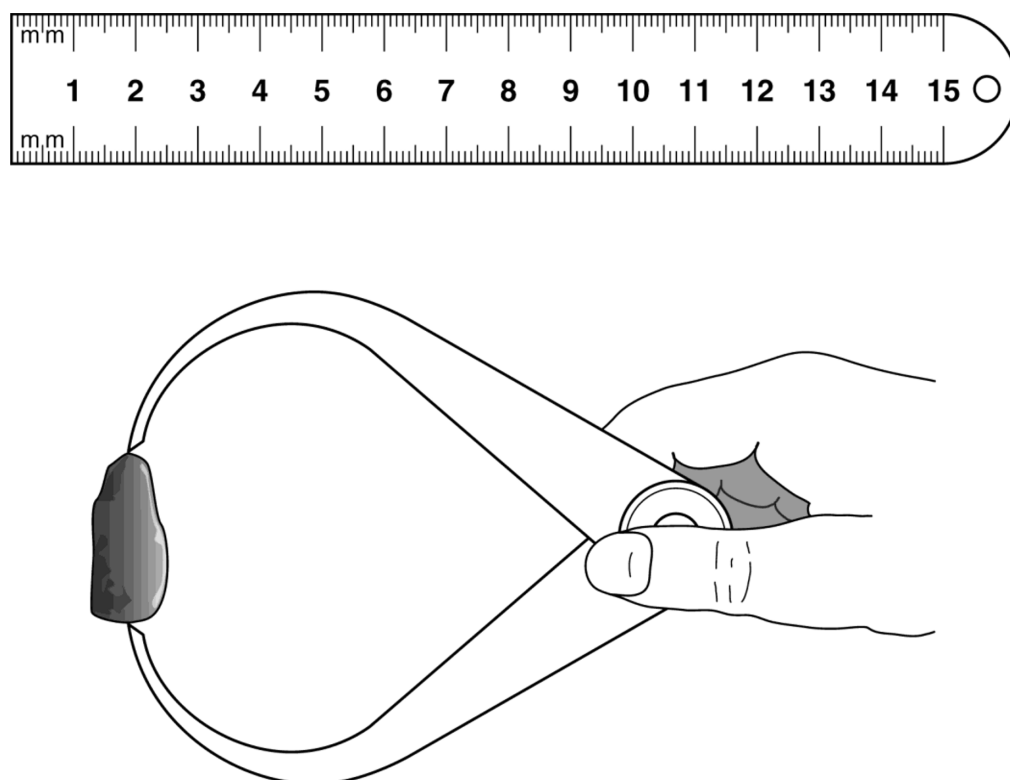


- the roundness of the stone.

Describe how they made the measurements. [2 marks]

(Adapted from Cambridge IGCSE Geography 0460 Paper 4 Q2c(ii) June 2009.)

Fig. 8 Equipment used to test Hypothesis 2



Roundness index chart

Shape						
Score	0	1	2	3	4	5
Description	very angular	angular	a little angular	a little rounded	rounded	very rounded

Answer 1

For the longest axis the students needed to find the longest side and measure the length by using a ruler to measure along it (✓). To measure roundness they used the roundness index chart to and compared it with the stone to judge its roundness (✓).

Teacher's comment

Both descriptions show how the equipment is used to make the two measurements.

Answer 2

The rock is held in the callipers and the gap between the two points of the callipers are measured with the ruler (✓). The roundness could be measured by hand or using a tape measure.

Teacher's comment

The first description uses correct terminology when it refers to the callipers. However, the answer does not use the roundness index chart to suggest how roundness can be measured.

Question (c) (iii)

The results of this investigation are shown in Table 2 (on p. 230). From these results, what conclusions could the students make about how the size and shape of bedload changes downstream (**Hypothesis 2** – Size and shape of the bedload changes downstream.)? [2 marks]

(Adapted from Cambridge IGCSE Geography 0460 Paper 4 Q2c(iii) June 2009.)

Answer 1

The hypothesis is true. The average length of the longest axis changes, at 4 km from the source it is 19 cm but at 53 km it is 6 cm, which shows that it decreases. (✓). The average roundness increases downstream from 2 at site 1 to 5 at site 6 which shows the change in bedload to become rounder downstream (✓).

Teacher's comment

The answer includes two valid conclusions – that bedload becomes smaller and more rounded downstream. It also supports these conclusions with data from the table. No credit would be given for agreeing with the hypothesis because the question requires conclusions.

Answer 2

The hypothesis is correct as you go downstream the rocks become rounded. At sites 1 and 2 the rocks are angular and at sites 5 and 6 the rocks are very rounded. (✓).

Teacher's comment

The answer describes the change in roundness well and concludes that rocks become rounder downstream. However, the answer does not include a conclusion about how the size of bedload changes downstream.

Question (c) (iv)

Explain why the size and shape of bedload changes downstream. [2 marks]

(Adapted from Cambridge IGCSE Geography 0460 Paper 4 Q2c(iv) June 2009.)

Answer 1

As the bedload travels downstream it gets eroded in different ways, e.g. hydraulic action. This wears away the bedload and makes it smaller (✓).

Teacher's comment

The answer includes a type of erosion and links this to a reduction in size of the bedload. However, the answer should also explain how hydraulic action can reduce the size and change the shape of bedload material.

Answer 2

As the river flows downstream it transports and erodes the rocks so that they become smaller and rounder.

Teacher's comment

The answer would not be credited as it needs to explain how erosion will make the rocks smaller and rounder.

Question (d)

Suggest improvements the students could have made to the data collection methods to make the results more reliable. [4 marks]

(Adapted from Cambridge IGCSE Geography 0460 Paper 4 Q2d June 2009.)

Answer 1

They might try to collect more samples of bedload to make their results more reliable (✓). They could also do more tests to measure the objects travelling 10 metres (✓). They might decide to do the tests at more sites as there is a big gap between some of them (✓). They may need to do the measurements on different days to see if there are any changes to the results (✓). They might use electronic machines to test the speed of the river which may be more accurate.

Teacher's comment

This is a comprehensive answer which includes five possible improvements. The answer does not just suggest improvements but explains how they might improve the reliability of results. The final idea of using electronic machinery could be credited even though the answer does not include the term flowmeter.

Answer 2

They could add some more sampling sites, especially near to the mouth of the river so the results are more accurate (✓). Also sample more rocks so the results can be checked and be more reliable (✓).

Teacher's comment

The two suggested improvements would be credited. However, more suggestions are required to gain full credit.

Question (e)

In order to extend their fieldwork, the students could have investigated the impact of people on the river. State **one** impact people could have had on a river. Describe how the impact could be investigated. [4 marks]

(Adapted from Cambridge IGCSE Geography 0460 Paper 4 Q2e June 2009.)

Answer 1

People may throw litter into the river and pollute it. If people in the villages use the river for washing, let their animals into it or pour their waste into it the river will be polluted (✓).

The students could use a pH indicator to measure the acidity in different parts of the river (•). Where there is high acidity means it is more polluted which means there is more human impact on the river. For example near to villages it is likely to be more polluted than near the source, so the students can compare their results (✓).

Teacher's comment

The answer correctly identifies that pollution is a valid impact of people on a river. It suggests that one way to measure water pollution is to use pH indicator. This idea is developed by the suggestion that results from different parts of the river can be compared to see if the impact of pollution varies. To gain more credit the answer could have suggested another way to measure the pollution, for example by using a Biotic Index, or further developed the idea of testing the river at different sites, or explained how pH indicator paper works.

Answer 2

Building a dam across a river will affect the flow of the river and may slow it down (✓). The velocity of the river could be tested by using a flowmeter before and after the dam (✓). Dams are often built to store water for the village and so farmers can irrigate their fields. Building a dam will also affect the processes of transportation, erosion and deposition.

Teacher's comment

The answer identifies one way that people can affect the river, by building a dam across it. The use of a flowmeter to measure velocity is also a valid method to use in fieldwork. Unfortunately, the answer does not describe how this fieldwork could be done in order to compare the velocity above and below the dam. The answer becomes irrelevant when it explains why the dam is built. The impact on river processes is another topic that could be investigated but only one impact can be credited.

TIP

The final part of the question often asks you to suggest how an investigation could be extended or improved. This can be a challenging question if you have not prepared for it. Think about how you might answer this question as you are completing your other answers.

