Collins

GCSE science ready

Transition tests

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INTRODUCING *GCSE SCIENCE READY*

What is *GCSE science ready*?

GCSE science ready provides teachers with the tools to help them judge how far students have mastered the key ideas and skills at Key Stage 3, and then to respond in an innovative and effective way to ensure they have achieved mastery before GCSE.

It is a teaching tool of two parts.

- The first part consists of 40 transition tests which assess the entire AQA KS3 Science Syllabus, split into 'before' and 'after' tests, which cover the same syllabus content, but in slightly different ways to discourage rote learning. The 'before' tests diagnose gaps and weaknesses and the 'after' tests provide a second round of testing to ensure learning is embedded.
- The second part consists of 20 intervention tasks which provide a ready-made and targeted teaching response to gaps or weaknesses diagnosed by the tests. The intervention tasks mirror the topics covered by the tests to provide specific intervention solutions for areas highlighted by the testing.

At its heart this is a process that can be referred to as '**Assess – Teach – Assess**' and provides accurate progress monitoring as well as longevity of learning. In order to make teaching more effective, we need to have a clear idea about what has been mastered and what is still developing. In order to then have a positive impact upon student progress and outcomes, we need to be able to intervene and revisit ideas. Reassessing then allows us to gauge how far pupils have come.

We have worked hard to ensure this resource is highly relevant for teachers, saving time and supporting successful outcomes. To this end we have made sure that:

- the content is fully matched to the content, principles and organisation of the AQA Syllabus; its 10 big ideas and 16 enquiry processes
- the content is aligned with the GCSE (9–1) assessment objectives, required mathematical knowledge and working scientifically skills to ensure it supports GCSE mastery
- tests and interventions provide clear diagnoses of problem areas and support for struggling students, as well as indicating areas for progression and extension activities for exceptional students.
- all resources are provided in Word on CD-ROM allowing teachers to edit and print as required.

How should it be used?

The books are designed to be used flexibly according to need; it is not a publication that has to be used in one specific way in order to work effectively.

There are a number of ways in which these materials can be used.

1. **Bespoke to AQA but relevant to all specifications:** This tool is bespoke to the AQA KS3 Science Syllabus and is ideal for those who are using this structure in their teaching. However, this tool could equally be used with an existing scheme of work as it comprehensively covers all the key concepts and skills in the National Curriculum and it clearly outlines the topics each test and intervention cover.
2. **Use in class, at school or at home:** Time is precious at Key Stage 3 and each teacher will have a different approach to assessment and intervention activities and where they can be best integrated. The tests can be set in class, during personal study time or for homework. Intervention tasks can be set as active class activities, group discussion points or amended as homework questions.
3. **Use formatively or summatively at KS3 or GCSE:** The materials are designed to be used flexibly in response to how KS3 and GCSE is taught and how the class is progressing. Whether used consistently after each KS3 unit to ensure learning is embedded; in response to a particularly challenging topic; at the end of each year of KS3 to feed into revision; or just before GCSE to ensure students are 'GCSE ready', it will provide detailed guidance on what pupils have 'got' and what they are struggling with. The intervention tasks will provide a ready-made solution.

Key features of the intervention tasks

The intervention tasks are designed to complement the transition tests and to be used with them as part of the **Assess – Teach – Assess** model. These are available in a separate volume.

The intervention tasks:

- are fully matched to the AQA KS3 Science Syllabus, covering the big ideas it is based on, the enquiry processes it has identified and supporting the mastery goals necessary for success.
- provide 20 teaching interventions for use following the transition tests to support teachers in responding to gaps and weaknesses diagnosed.
- are structured to work alongside the transition tests with two tasks per big idea, the first for Part 1 topics and the second for Part 2 topics.
- place teaching support in context by linking to previous and forthcoming concepts, establishing why the task supports GCSE 'readiness' and referencing the relevant AQA mastery statements.
- include a variety of active task types, both open and closed, as well as simple suggestions for teacher-led dialogue to elicit students' ideas.
- Provides invaluable guidance on assessing student's responses including mastery criteria, common misconceptions and ideas for further interventions.
- offer flexible support for teachers who want to ensure learning is embedded and are particularly useful for non-specialists and those new to teaching.

How does this tool relate to Collins AQA KS3 Science course and Collins AQA GCSE Science course?

This tool is designed to be used alongside the Collins AQA KS3 course and the Collins AQA GCSE (9–1) course to provide a complete set of resources to support the 'five year journey' from year 7 to 11, ensuring the progression between KS3 and GCSE is seamless.

Bespoke to the AQA KS3 Syllabus and serving the priorities and assessment objectives of the AQA (9–1) GCSE this tool complements and support these courses.

THE AQA KEY STAGE 3 SYLLABUS

This teaching tool is relevant for all schools as it covers the Programme of Study for Key Stage 3 Science comprehensively, but it is designed to be bespoke to the AQA KS3 Science Syllabus.

The AQA KS3 Syllabus breaks down the scientific concepts into 10 big ideas across physics, chemistry and biology. Each of these are then sub-divided into four smaller topics. There is a suggested running order of these topics that reflects a progression in complexity. For example, AQA breaks the four topics in each Big Idea into pairs to be taught in year one and year two. They often sit together well but the association is stronger in some pairs than others. This structure is a suggestion and there is a degree of flexibility for teachers who wish to adapt this approach. However, what is important is to be able to revisit each of the ideas periodically to embed learning, a key tenet of AQA's 'spiral design for understanding'.

AQA's 10 big ideas	**Part 1**		**Part 2**	
1. Forces	Speed	Gravity	Contact forces	Pressure
2. Electromagnets	Voltage and resistance	Current	Electromagnets	Magnetism
3. Energy	Energy costs	Energy transfer	Work	Heating and cooling
4. Waves	Sound	Light	Wave effects	Wave properties
5. Matter	Particle model	Separating mixtures	Periodic table	Elements
6. Reactions	Metals and non-metals	Acids and alkalis	Chemical energy	Types of reaction
7. Earth	Earth structure	Universe	Climate	Earth resources
8. Organisms	Movement	Cells	Breathing	Digestion
9. Ecosystems	Interdependence	Plant reproduction	Respiration	Photosynthesis
10. Genes	Variation	Human reproduction	Evolution	Inheritance

Within each topic the ideas are grouped into 'Know', 'Apply' and 'Extend'. 'Know' and 'Apply' are equated to mastery and are summarised in 'mastery statements'. These statements clearly outline the key ideas, including key words, and how students should be able to apply them. Although the 'Extend' material is not essential for mastery, it offers a potential next step for students who have the ability to progress further.

Working scientifically is dealt with in a slightly different way. There are four main skill areas, each of which is broken down into four smaller areas or enquiry processes, 16 in all. Knowledge is dealt with in terms of both skills and skill integration, followed by the application of those skills.

AQA's 16 enquiry processes

Analyse

1. Analyse patterns

2. Discuss limitations

3. Draw conclusions

4. Present data

Communicate

5. Communicate ideas

6. Construct explanations

7. Critique claims

8. Justify opinions

Enquire

9. Collect data

10. Devise questions

11. Plan variables

12. Test hypotheses

Solve

13. Estimate risks

14. Examine consequences

15. Review theories

16. Interrogate sources

Although concepts (big ideas) and processes (enquiry processes) are dealt with separately, it is not intended that they should be delivered in this way. Each topic has a suggested investigation which shows how teaching can address and integrate both concepts and processes.

GCSE-readiness and the importance of mastery

The idea of mastery is a powerful one. We want students to master ideas and processes because we know that science is hierarchical and that to progress to higher levels, firm foundations need to be built. It is attractive to be able to say that something has been mastered (or not) because it enables us to manage and structure learning. But we know from our own experience that things, once learned, don't necessarily stay learned. Things we once understood, we may then find some time later are not so clear or crisp. How can we use the idea of mastery to secure progress?

This has direct relevance when looking at the role of Key Stage 3. The GCSE 9–1 specifications accredited and introduced in 2016 were designed to be rigorous and challenging. In order for students to make good progress from 11 to 16, KS3 has to be functional in building firm foundations. It needs to equip students with a 'working capital' of knowledge and understanding to enable them to approach KS4 courses with confidence, curiosity and a good chance of success and GCSE-readiness.

There are five aspects that are important to helping to make this a practical reality and the AQA KS3 Syllabus includes these.

The first thing is to be clear about which ideas and skills are the 'deal breakers'. It's no good saying 'it's all important' – it is, but we know that few students will grasp everything. A more useful approach is to identify which aspects can be equated to mastery, and focus effort on getting as many students as possible to that stage. Rather than spending time assessing what proportion of material each student has mastered, we can develop

creative approaches to ensure that most students are at the 'GCSE ready' point. The 'Know' and 'Apply' sections of the AQA KS3 Syllabus are really clear about this.

The second thing is to analyse performance efficiently, to find out which ideas and skills have been mastered and to allow time to respond. Assessment is a cornerstone of this approach to inform next steps in teaching and learning.

The third aspect is being able to intervene if it becomes clear that some skills and ideas are not yet secure. The secret of good teaching is to find ways of coming at a concept from a different angle. Students value and appreciate teachers being able to explain ideas in different ways. It shouldn't be imagined that intervention means re-teaching using the same activities again. It is a cue for more creativity in the classroom, not less.

The fourth aspect is being able to apply and extend the use of ideas. Ideas in themselves are of little value; it is when they are used as tools to develop explanations, suggest applications or prompt further enquiry questions that they become powerful. Some facts may (or may not) have a passing interest but it is when the ideas are used to make sense of things or to devise approaches or solutions that deeper learning occurs.

The fifth aspect is being able to re-visit ideas. No matter how well learned in the first place, students may find it difficult to recall ideas if they have been unused for an extended period of time. If the teacher has a clear view of the underlying big ideas and engineers the curriculum so that they are revisited periodically, then students stand a better chance of retaining a grasp of them.

KEY FEATURES OF EACH TRANSITION TEST

Aims and coverage

The tests aim to provide comprehensive coverage of the mastery statements within the AQA KS3 Syllabus to allow teachers to check all required knowledge, understanding and skills and to identify gaps. There is coverage of enquiry processes and required mathematical equations to ensure working scientifically skills are embedded before the transition to GCSE.

Structure

The tests are structured according to the AQA KS3 Syllabus framework with two tests for each big idea, the first test for Part 1 topics, the second test for Part 2 topics. There are a total of 40 tests, with 20 'before' tests covering the entire syllabus and 20 'after' tests, covering the same syllabus content, to provide benchmarked assessment of learning progress.

Marks

Each test consists of 25 marks and is broken down into 10 'Know', 10 'Apply' and 5 'Extend' marks aligning with GCSE 9–1 assessment objectives.

Although all 'Know' questions have one mark each, the 'Apply' and 'Extend' questions have two or three marks depending on complexity. The mark scheme for each test is available at the back of the book and on the accompanying CD-ROM.

How to use the tests

The tests and intervention materials are designed to be used in a variety of ways; these are some examples:

- you could continue to run your KS3 schemes of learning as they stand and then towards the end of KS3 use these tests and interventions as a 'GCSE readiness' programme
- you could integrate the materials with your existing KS3 schemes of learning so that when you complete delivery of a particular big idea (e.g. Forces) you then run the tests and interventions
- you could alter the running order of your existing KS3 schemes of learning so that coverage is grouped into the ideas identified in the AQA KS3 Syllabus and then use the tests and interventions evenly spaced throughout the course.

However the materials are located within the course, the idea is that running the 'before' test and analysing student performance does three things:

1. it provides a global score which is an indicator of relative performance within the teaching group and between teaching groups
2. it provides a basis for comparative performance between topics. Effective intervention needs to be targeted on areas of greatest need and the structuring of the tests according to a big idea is a key feature.
3. it provides a breakdown between 'Know', 'Apply' and 'Extend'. This is crucial; it provides a strong basis to move beyond simply seeing that student A is performing better than student B to identifying the focus for intervention. If most students are getting strong scores on 'Know' but then perform less well on 'Apply', this should inform the focus of the intervention.

Are you GCSE ready?

Test 1: Forces 1 – Speed and Gravity

KNOW

[Each question = 1 mark]

01. If the various forces acting on an object add up to zero, which one of the following statements could be true?

A. It is travelling in a circular path at a steady speed.
B. It is accelerating.
C. It is travelling in a straight line at a steady speed.
D. It is slowing down and will shortly be at rest.

02. Complete this sentence: Speed can be calculated by…

A. …dividing distance by time
B. …dividing time by distance
C. …multiplying distance by time
D. …adding distance to time

03. Which of these best describes *average speed*?

A. The overall distance travelled divided by the time taken.
B. The reading on the speedometer of a car travelling at top speed.
C. The speed an object travels at when not accelerating.
D. The time taken to travel the total journey divided by the total distance.

04. Which one of these endings to this sentence is correct?

The greater the speed of an object…

A. …the less time it will take to cover a set distance.
B. …the longer it will take to cover a set distance.
C. …the smaller the distance it will cover in a set time.
D. …the greater the mass of an object.

05. Which one of these is **not** an example of acceleration?

A. An object falling from rest due to gravity.
B. An object whose speed is increasing.
C. An object which is slowing down.
D. An object whose motion on a distance-time graph is shown by a straight line.

06. Which of these enables us to calculate the weight of an object?

A. mass ÷ gravitational field strength
B. mass × gravitational field strength
C. gravitational field strength ÷ mass
D. gravitational field strength + mass

07. Which of these is completely correct?

A. Mass is measured in N; Weight is measured in N
B. Mass is measured in N; Weight is measured in kg
C. Mass is measured in kg; Weight is measured in N
D. Mass is measured in kg; Weight is measured in kg

08. Complete this sentence: Gravitational field strength is greater if the mass of the objects…

A. …is greater and the distance between them is greater.
B. …is less and the distance between them is greater.
C. …is greater and the distance between them is less.
D. …is less and the distance between them is less.

09. How does the force of gravity on the Moon compare with the force of gravity on Earth?

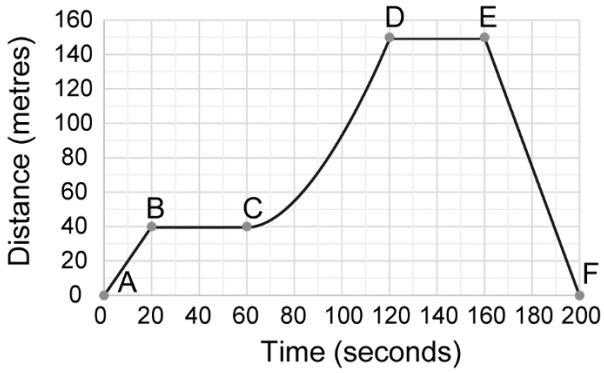
A. It is less, because the mass of the moon is less.
B. It is the same, because gravity is a constant.
C. It is more, because the moon is further away.
D. It is non-existent, because the moon has no atmosphere.

10. What is *mass*?

A. The amount of ‘stuff’ in an object.
B. A measure of how hard gravity pulls on an object.
C. Another word for weight.
D. A value dependent upon the gravitational field strength in an area.

APPLY

11. Look at this graph of a journey. It has five sections, A–B, B–C, C–D, D–E and E–F:



a. During which section was the object accelerating? **[1]**

b. Name a section in which the object was stationary. **[1]**

c. How fast was the object travelling in section E–F? **[2]**

d. Carl's mother is driving him to a football match. They are travelling along the road at 25 m/s and they are overtaken by a van travelling at 30 m/s. What is the speed of the van relative to Carl's car? **[1]**

12. The gravitational field strength on Mars is around 4 N/kg. The gravitational field strength on Earth is around 10 N/kg.

a. Carl weighs 400 N on Earth; what would he weigh on Mars? **[1]**

b. Carl weighs 24 N on Pluto; calculate Pluto's gravitational field strength. **[1]**

13. Edith and her group are measuring the speed at which they can cycle between two marks, 10 m apart, in the school playing field. They are comparing different students in the group; they are all using the same bike. This is the data they have gathered:

Amy	Beth	Cath	Danielle	Edith	Fran
2.0 s	1.8 s	1.9 s	2.2 s	2.0 s	1.7 s

a. Are there any anomalies in this data? **[1]**

b. Are there any *real differences* between the results for different students? **[1]**

c. Suggest a reason why the results are different for different students. **[1]**

EXTEND

15. Emily says that gravity is like any other force, because it pulls on objects.

Jo says it is different, because it doesn't physically touch an object.

Explain who is right. **[3]**

16. A track cyclist is travelling in an upright position at a constant speed of 8 m/s. Describe what would happen to her speed if:

a. the friction between the tyres and track was increased **[1]**;

b. she adopted a crouching position. **[1]**

Are you GCSE ready?

Test 2: Electromagnets 1 – Voltage and resistance and Current

KNOW

[Each question = 1 mark]

01. Which one of these endings to this sentence is **not** correct? Voltage is...

A. …shared between components in a parallel circuit.

B. …the amount of energy per unit of charge transferred through the electrical pathway.

C. …also known as the potential difference.

D. …shared between components in a series circuit.

02. A component has a current of 3 A and a potential difference of 9 V flowing through it. What is its resistance?

A. 27 Ω

B. 0.33 Ω

C. 81 Ω

D. 3 Ω

03. Which of these statements about resistance is **not** correct?

A. Resistance is measured in ohms.

B. Resistance is high in a material that is an electrical insulator.

C. Resistance in components in a circuit causes the current flowing to increase.

D. Resistance is a property of a component which makes it difficult for electrical charge to pass through.

04. Complete this sentence: When I add more components to a series circuit...

A. …the voltage in the circuit will increase.

B. …the current flowing in the circuit will increase.

C. …the total resistance in the circuit will decrease.

D. …the current flowing in the circuit will decrease.

05. Which one of these materials will have the least resistance?

A. A piece of silver wire.

B. A wooden spoon.

C. A sheet of paper.

D. A rubber bung.

06. Which of these statements describes something that would **not** happen when two charged objects are brought closer together?

A. The electric field strength increases.

B. The electric field strength decreases.

C. The objects repel each other.

D. The objects attract each other.

07. Which of these statements about electrons is **incorrect**?

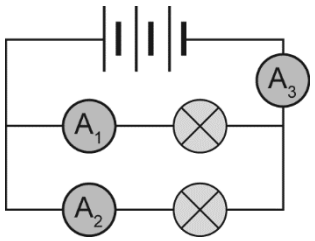
A. When an object loses electrons, it becomes negatively charged.

B. Electrons are tiny particles that are part of atoms.

C. Movement of electrons causes a flow of electric charge known as current.

D. Movement of electrons can result in a positively charged object.

08. Look at this circuit diagram. It contains a battery and two identical, working lamps:



Which of the following gives correct values for the readings of current on the ammeters?

A. $A_1 = 4.5$ A; $A_2 = 4.5$ A; $A_3 = 4.5$ A

B. $A_1 = 3$ A; $A_2 = 3$ A; $A_3 = 6$ A

C. $A_1 = 3$ A; $A_2 = 3$ A; $A_3 = 0$ A

D. $A_1 = 3$ A; $A_2 = 0$ A; $A_3 = 3$ A

09. Which statement is **incorrect**?

A. Charged objects are created when materials are rubbed together and electrons move from one surface to another.

B. Charged objects always repel each other.

C. Charged objects are surrounded by an electric field.

D. Charged objects are affected by an electrostatic force when in the electric field of another charged object.

10. Complete this sentence: A parallel circuit is one...

A. ...in which the components are on separate loops.

B. ...in which all components are on the same loop.

C. ...which runs next to another circuit, without touching it.

D. ...in which the current flowing is always constant.

APPLY

11. Some students made a simple electrical circuit containing cells, wires and a resistor in order to check whether the resistance information given for the resistor was correct. They changed the potential difference across the resistor by adding more cells. This is their data:

Potential Difference (V)	1.5	3	4.5	6
Current (A)	0.0028	0.0058	0.0086	0.0115

a. Draw a circuit diagram showing the circuit and how the students measured the voltage in that circuit. **[2]**

b. Use the data in the table to determine the resistance of the resistor. **[2]**

c. Explain the difference between the resistance in the wires and resistance in the resistor using an analogy, such as water in pipes. **[2]**

12. Darnel has made a series circuit containing a battery and two identical lamps.

a. Draw a circuit diagram for this circuit. **[1]**

b. Darnel adds a further lamp. Explain how this affects the current in the circuit. **[1]**

c. If he swaps one of the lamps for one with less resistance, what will happen to the current and why? **[1]**

d. If one of the lamps blows, what effect will this have on the current in the circuit? **[1]**

EXTEND

13. Chloe connects two bulbs in a series circuit with a 12 V battery: a small bulb which has a resistance of 50 ohms, and a larger one with resistance of 10 ohms.

a. Use the relationship between resistance, potential difference and current to work out the current flowing in the circuit. **[1]**

b. Across which of the bulbs will the potential difference be the greatest? **[1]**

c. Thinking about your answer to b, explain why one of the bulbs does not light. Try to include the term *energy* in your answer. **[1]**

14. Ravi complains to his friends at school that he frequently gets electrostatic shocks from the doors of the classroom. Explain how these shocks are caused. **[2]**

Are you GCSE ready?

Test 3: Energy 1 – Energy costs and Energy transfer

KNOW

[Each question = 1 mark]

01. What unit is used on food labels to list the energy content of food?

A. Newtons
B. Kilowatts
C. Kilojoules
D. Kilograms

02. A quarterly home energy bill is £224. This covers 2190 hours at a price of 8 p per kWh. What was the average power used over the period?

A. 1.28 kW
B. 0.78 kW
C. 1.28 kWh
D. 0.78 kWh

03. What is the *power* of a device?

A. The energy stored in the device.
B. The maximum energy the device can transfer.
C. The speed at which the device transfers energy.
D. The energy required for the device to operate.

04. Which of the following is a renewable source of energy?

A. Gas
B. Coal
C. Nuclear
D. Biomass

05. Which of the following is a fossil fuel?

A. Nuclear
B. Biomass
C. Crude oil
D. Geothermal

06. What energy transfer takes place when a ball rolls down a hill?

A. Kinetic energy to elastic energy.
B. Thermal energy to kinetic energy.
C. Kinetic energy to chemical energy.
D. Gravitational potential energy to kinetic energy.

07. What energy transfer takes place when a kettle is boiled?

A. Electrical energy to thermal energy.
B. Chemical energy to thermal energy.
C. Thermal energy to chemical energy.
D. Electrical energy to chemical energy.

08. Which row in this table correctly shows the energy store, useful transfer and dissipated energy when a lightbulb is plugged into the domestic mains and turned on?

	Energy store	**Useful transfer**	**Dissipated energy**
A.	Light	Electrical	Chemical
B.	Thermal	Electrical	Light
C.	Electrical	Light	Thermal
D.	Chemical	Light	Thermal

09. Which of the following transfers chemical energy to kinetic energy?

A. An athlete
B. A windmill
C. A ball rolling downhill
D. A battery operated torch

10. If a spring is compressed, what sort of energy is stored?

A. Kinetic
B. Elastic
C. Dissipated
D. Gravitational potential

APPLY

11. Give two advantages and two disadvantages of using coal-fired power stations. Your answers may cover scientific, environmental or social factors. **[4]**

12. List the energy transfers involved when energy is produced in a hydroelectric power plant and used to run a hairdryer. **[3]**

13. Explain how energy is dissipated in these situations:

a. An accelerating car **[1]**

b. A hot cup of tea **[1]**

c. A swimmer **[1]**

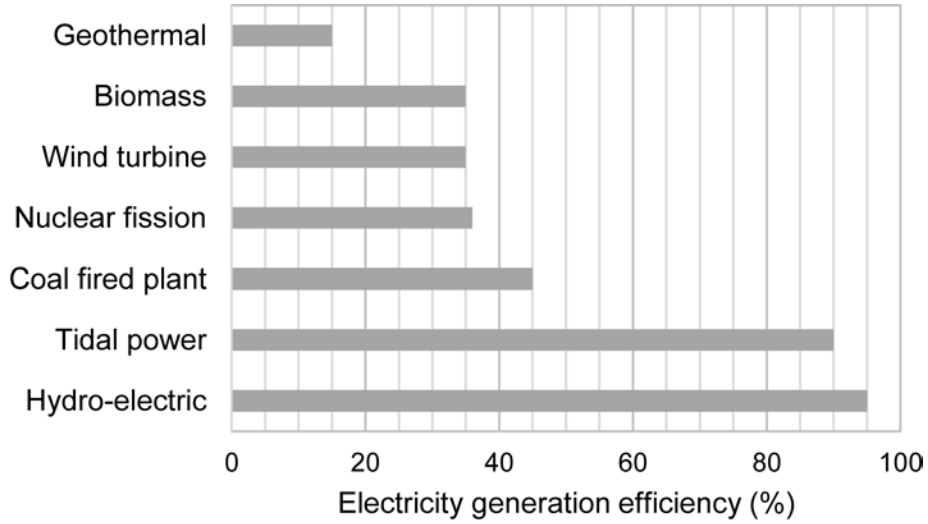
EXTEND

14. Wind farms are a clean source of energy, but many people don't want to live near one.

a. How would you persuade a government to invest in wind farms? **[1]**

b. How would you persuade a community that building a wind farm near them would be an asset to the area? **[1]**

15. Examine this chart which shows energy efficiency for different types of fuel.



a. What is the equation used to calculate energy efficiency? **[1]**

b. Why is there a steep change in efficiency between the coal fired plant and the tidal and hydro-electric power stations? **[1]**

c. How much energy is output for every 1000 J input to a hydro-electric plant? **[1]**