Collins

PHYSICS

AQA Physics for A-level Year 1 and AS

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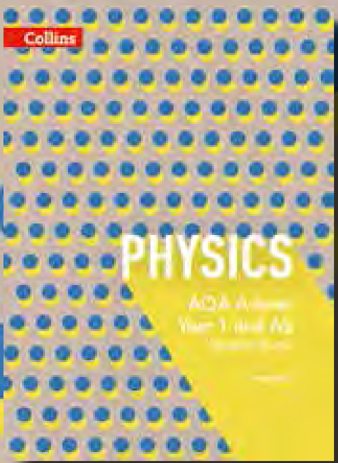

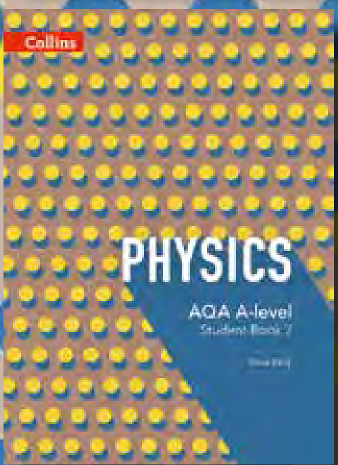

Your A-level students will need increased maths skills and stronger practical skills to successfully tackle the demands of AS and A-level Physics.

Our resources will help you deliver comprehensive support as students build the skills they need. Regular opportunities to consolidate and track progress will build towards confidence in the final examination.

- **Supporting you through the changes** – the change in assessment structure will bring challenges – our coherent structure of Student Books, Teacher Guides and Skills and Practice resources will help you to understand, plan for and master these challenges
- **Assess and progress** – from GCSE and across the linear course with varied skills practice integrated throughout the Student Books, Teacher Guides and Skills and Practice resources on Collins Connect
- **Prepare for practicals** – develop your students' theoretical understanding with advice and explanations of best practice, plus carry out Required Practicals effectively with full teacher support
- **Help prepare students for further study and scientific careers** with plenty of stretch and challenge questions that develop higher-order thinking skills

The Student Books have entered the AQA approval process

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Teaching A level Physics, how the resources support you:

Linear assessment

Terminal assessment in the form of three 2 hour papers at A-level and two 1.5 hour papers on the first four topics at AS Level

- Extensive practice questions embedded throughout help build synoptic understanding
- Online resources including video worked examples and downloadable practice papers develop the skills and written techniques that students need for their final assessment

Practicals

Assessment of practical skills will be by written exam only. Practical-based questions will form 15% of the total assessment

- Comprehensive Required Practical sections advise students on apparatus, techniques and how best to avoid common errors
- Detailed support for teachers and technicians in the Teacher Guides
- Practical based assignments and questions integrated throughout the Student Book and Teacher Guides

Maths

40% of assessment marks require the use of Level 2 mathematical skills

- Test and build mathematical skills with signposted Assignments throughout
- Video worked examples in the Skills and Practice resources model mathematical skills

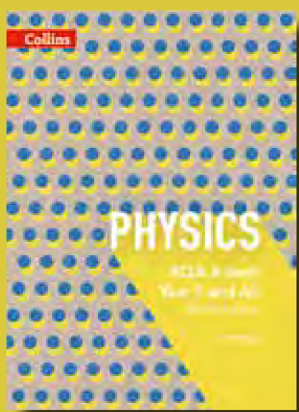
Standalone AS qualification

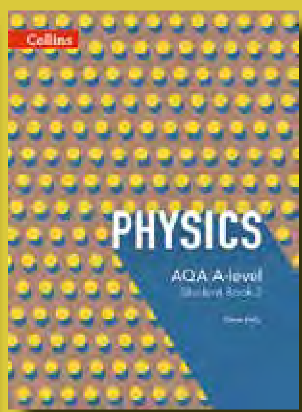
The AS becomes a stand-alone qualification, which doesn't contribute to the A-level grade

- Planning tools in the Teacher Guide and Student Book content matched to the 2015 specification enable you to easily co-teach AS and year one of A-level

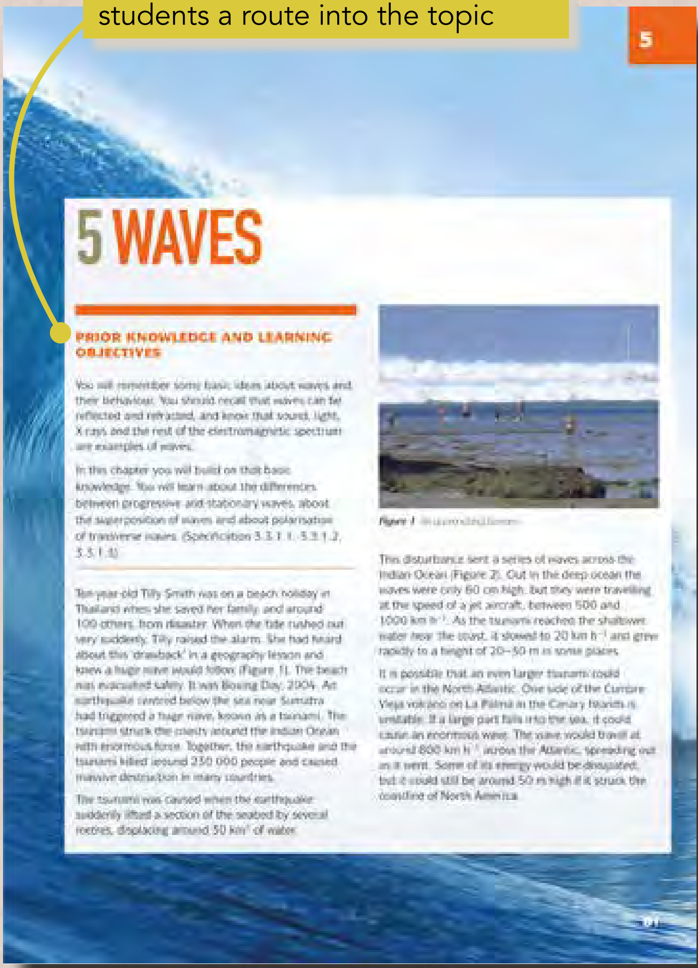
Comprehensive Student Support

The complete content coverage that your students will need. Help them build knowledge, application and evaluation skills through clear explanations set in real-life contexts, supported by maths and practical skills-focused assignments. Questions are integrated into every chapter to check knowledge, test skills and consolidate learning. Stretch and challenge questions extend students' understanding, and extensive practice questions help prepare for the final assessment.

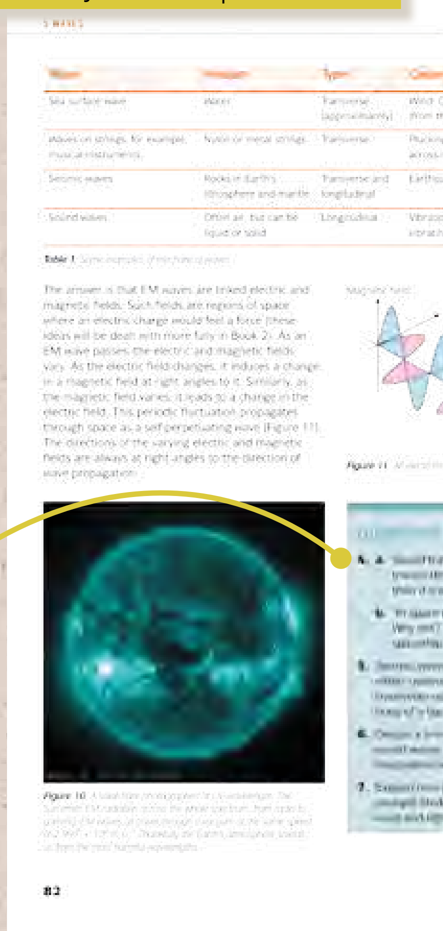




Prior knowledge section at the start of each chapter consolidates knowledge from GCSE and gives students a route into the topic

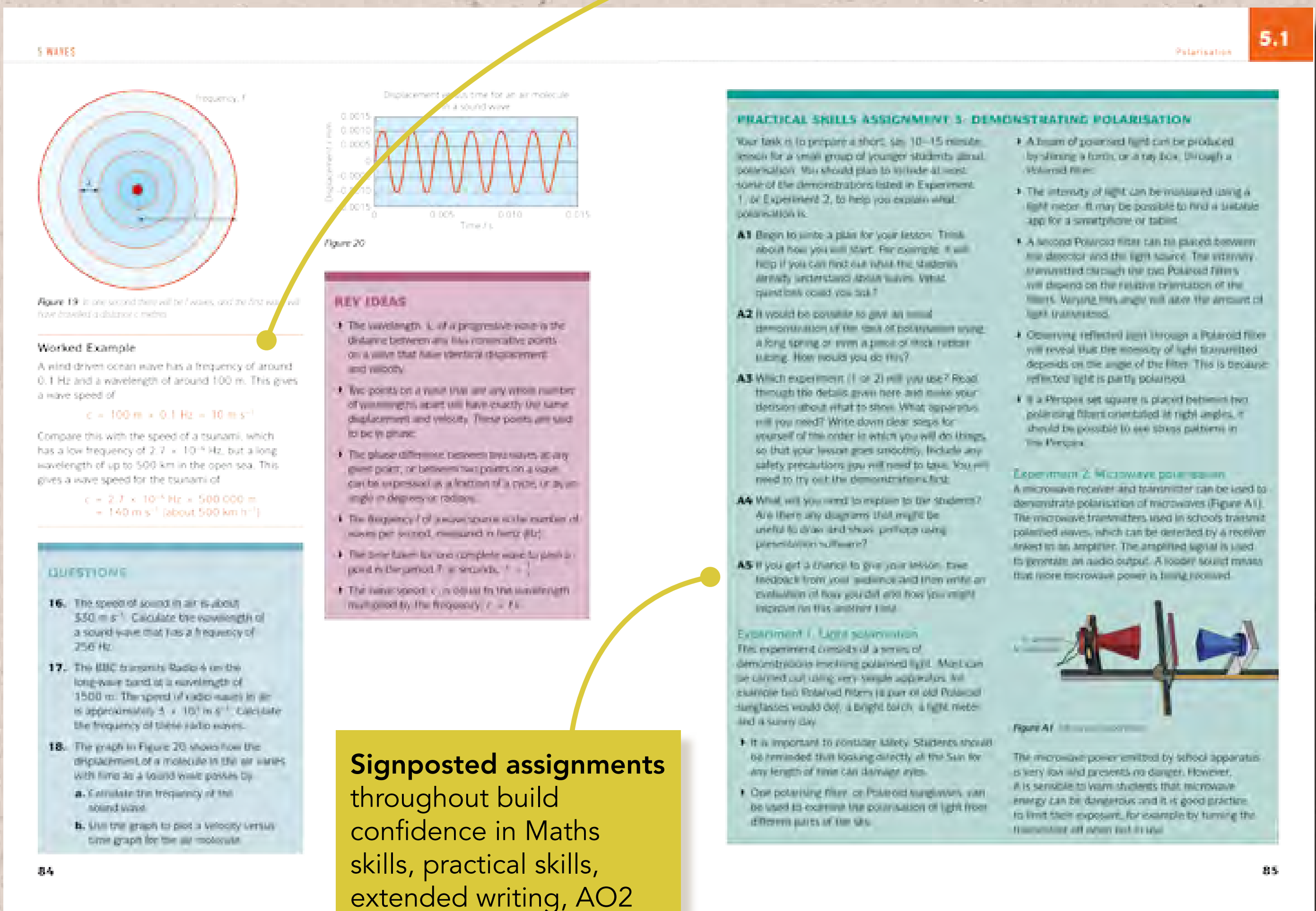


Stretch and challenge questions and activities encourage stronger students to move beyond the specification



In text questions provide opportunities to check understanding and progress, whether learning a topic for the first time or revisiting it as part of revision

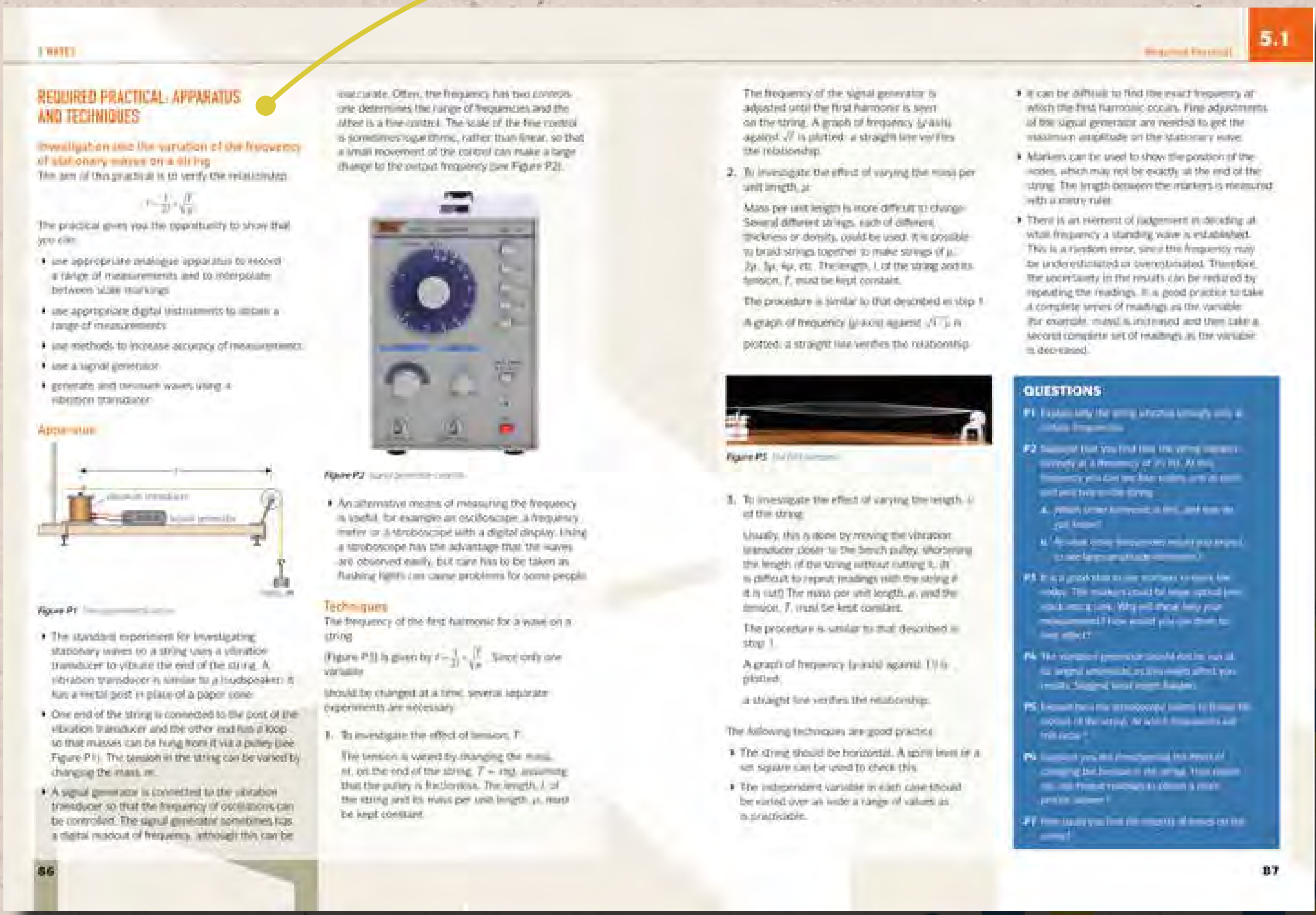
Boost understanding and mathematical skills with **worked maths examples**



Signposted assignments throughout build confidence in Maths skills, practical skills, extended writing, AO2 and AO3

Key ideas summary allows students to check progress easily and revise effectively for examinations

Required practicals pages provide comprehensive guidance on apparatus, experimental techniques and how best to avoid common errors



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Comprehensive Teacher Support

Teacher Guides help you deliver a linear course confidently with a clear sequence of learning mapped out in medium and long-term plans. The planning tools also enable you to co-teach AS and A-level. A wealth of differentiated activity sheets provide inspiration for fresh ways to develop students' skills in maths, practicals, analysis and evaluation. These extensive guides also provide support for hands-on practical work with activities, instruction guides and technician notes.

Lesson plan 5.7

Lesson 5.7 Stationary waves on a string

LEARNING OUTCOMES

In this lesson students carry out *Required practical 1: Investigation into the variation of the frequency of stationary waves on a string with length, tension and mass per unit length of the string*. This is compulsory for A-Level students and provides them with opportunities to develop and demonstrate (and for you to assess) their mastery of the following practical competencies:

- follows written procedures
- applies investigative approaches and methods when using instruments and equipment
- safely uses a range of practical equipment and materials
- makes and records observations.

and their skills in using apparatus and techniques in the following areas:

- use appropriate analogue apparatus to record a range of measurements and to interpolate between scale markings
- use appropriate digital instruments to obtain a range of measurements
- use methods to increase accuracy of measurements
- use a signal generator (and oscilloscope)
- generate and measure waves using a vibration transducer.

It is strongly advised that AS students also complete this required practical, as they can expect questions based on it in their examination Paper 2. As with all practical work, it will help to develop their hands-on skills and their understanding of the scientific process through investigation.

THE JOURNEY SO FAR

Students have learned that two waves of the same frequency with a fixed phase difference, travelling in opposite directions, superpose to create a stationary wave, and that such a situation is set up when a wave is reflected.

Students will need to be familiar with the apparatus, techniques and mathematics required before they embark on their assessed practical work. *Student Book 1, Chapter 5, Required practical 1* introduces students to all of these aspects. Working through these in an earlier lesson, together with a teacher demonstration of the apparatus, is essential.

LESSON OUTLINE

Engage and remind

Remind students what they are going to do in this lesson. Show them the apparatus and ensure that they all have a copy of *Activity sheet 5.7.1 Investigating the variation of frequency of stationary waves on a string*. This will guide them through their practical work and how to record and analyse their results. Although students will do the practical work in groups, those who are A-Level candidates *must* independently record their results and analysis.

Core activities

Ensure that students know what is meant by 'the first harmonic' and refer them to *Student Book 1, Chapter 5*. Refer to *Technician notes for Activity 5.7.1* to set up the practical. Give students a rough value for setting up the first harmonic for the lightest string. The aim is to verify that $f = (1/2l)\sqrt{(T/\mu)}$, so students need to carry out three separate experiments, varying in turn T (tension), μ (mass per unit length) *and* l (length). You may need to allow two lessons to complete the work. You could reduce the scope for AS-only students.

The signal generator may not give an accurate value of the frequency. A-Level students should, if possible, be given enough time to increase the accuracy of f by taking measurements for the second and possibly third harmonics as well as the first. Ensure that students understand the simple relationship between the frequencies for the different harmonics on a string, and they understand that the averaging reduces the overall uncertainty.

Some A-Level students could construct a calibration curve for the signal generator frequency, using an oscilloscope. See the *Stretch and challenge* section at the end of *Activity sheet 5.7.1*. Alternatively, a stroboscope could be used to construct a calibration curve, but this device is just as likely to be as badly calibrated as the signal generator, and care should be taken with its use as the flashing light can induce epileptic episodes. It is also likely to be very distracting for other students in the room.

Consolidate and look ahead

Ensure that all students have their results and their estimated uncertainties recorded by the end of the lesson. They can draw their graphs in the next lesson or for homework.

Support progress with a clearly signposted sequence of learning

Activity sheet 2.1.1

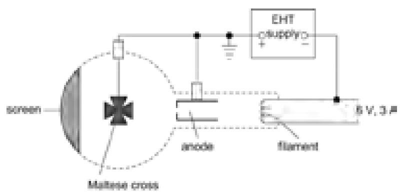
Understanding the Maltese cross tube

TASK 1

Observe the demonstration of a Maltese cross tube.

TASK 2

The diagram shows the circuit for a Maltese cross tube.



01. Identify the cathode (negative terminal) on the diagram.

02. Draw an arrow on the diagram to show the direction of the current in the tube.

03. Imagine a magnetic field is directed through the apparatus from North, on this side, to South on the opposite side. Determine which way the electron beam will move and mark it with an arrow on the diagram.

04. How could the apparatus be used to show that cathode rays are negatively charged particles?

05. The shadow cast by the negatively charged particles (electrons) remains sharp when the bean is deflected by the magnetic field. What does this tell you about the individual electrons?

06. Many electrons strike the Maltese cross and are absorbed. Where do they go?

07. If the cross is disconnected from the anode (positive terminal), the image looks more like a clover leaf. Explain why this clover leaf shape appears.

Stretch and challenge

08. The anode is earthed. If the potential difference between the anode and cathode is 2000 V, what is the potential of the anode and the potential of the cathode?

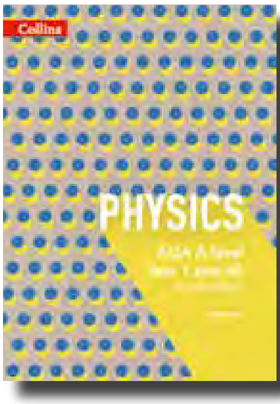
09. How would the potentials change if the cathode was earthed instead of the anode?

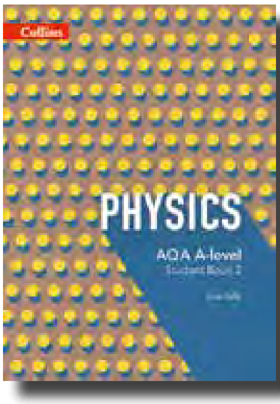
Find inspiration for fresh ways to develop students' skills in maths, practicals, analysis and evaluation with a wealth of differentiated Activity Sheets

Collins Connect

Online Skills and Practice Resources on Collins Connect

Develop your students' proficiency in key skills, using our engaging subscription resources with an emphasis on maths, written communication, AO2 and AO3. Video worked examples focused on maths, interactive example answers and a wealth of downloadable practice question papers will help your students develop and practise skills and prepare for exams.





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AQA A-level Physics Student Book 2	9780007597642	January 2016	£24.99
AQA A-level Physics Teacher Guide 1	9780008114268	September 2015	£150.00
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