GCSE
ADDITIONAL SCIENCE, PHYSICS
UNIT P2 – Example 3
4463, 4451

Scheme of Work

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Introduction

This Outline Scheme of Work is one of a number of schemes prepared by practising teachers for the new AQA GCSE Sciences suite. It is hoped that other teachers will find them helpful as the basis for the fully detailed schemes prepared for teaching from September 2006. Each outline scheme covers one unit (B1, B2, B3, C1, C2, C3, P1, P2, P3) and for some units more than one outline scheme is available. This is because there are different, equally valid ways of approaching the teaching of the specifications and a single scheme would not show the range of possible approaches.

The AQA specifications are designed to be used with a wide range of resources, so this scheme does not assume the availability of any particular printed or electronic publications, or any special equipment. Teachers are enabled to use existing resources, including their own, together with resources specially purchased for the new specifications.

The outline scheme is arranged under the section headings of the relevant specification, for example, *13.1/12.1 How can we describe the way things movet?* The content in the section is further subdivided with a brief statement given of the coverage of each subdivision, together with activities that relate to that content and an indication of the number of hours it is suggested are needed to deliver that part of the content.

Opportunities to deliver 'How Science Works' and to use ICT are highlighted using the same icons as used in the specifications.

This identifies parts of the content which lend themselves to extended investigative work of the type needed to explore Sections 10.3–10.7 of the specifications. These sections are about obtaining valid and reliable scientific evidence.

This identifies parts of the content which lend themselves to activities which allow Sections 10.2 and 10.8–10.9 to be considered. These sections are about using scientific evidence, for example, how scientific evidence can contribute to decision making and how scientific evidence is limited.

This identifies where there are opportunities to use ICT sources and tools in teaching the specifications.

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UNIT P2			
Total hours: 4	**12.1/13.1 How can we describe the way things move?**		
Topic outline		**Teaching approach including possible experiments/investigation opportunities**	**Additional notes**
Calculate the acceleration of a body from the slope of a velocity time graph		• Ticker-timer tape of a trolley accelerated by a falling mass	Graphs can be generated at: http://www.walter-fendt.de/ph14e/acceleration.htm
Calculate the acceleration of a body from the equation		• Time a ball-bearing rolling down a gently sloping length of channel. To calculate 'g', use free-fall apparatus to time the flight of a ball-bearing dropping a fixed distance	To avoid measuring speeds directly, assume final speed is twice of the average speed to do the calculations

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Total hours: 4	12.2/13.2 How do we make things speed up or slow down?		
Topic outline		**Teaching approach including possible experiments/investigation opportunities**	**Additional notes**
Force = mass × acceleration		• Dynamics trolleys accelerated by different fallings masses	Link to power: weight ratios of vehicles. Possibly show extracts from BBC TV's 'Top Gear' programme.
A body falling through a fluid will initially accelerate, then reach its terminal velocity		• Drop ball bearings through tall tubes of glycerol. Mark the position on the tube every 2 seconds, or have student call out meter rule readings.	Try warming the glycerol to reduce the viscosity, and raise the terminal velocity.
Reaction times		• Make a mock-up of the rear of a car, complete with brake lights. Link the lights to a timer circuit that puts the lights on (and starts a timer) when a switch is thrown, and stops when a brake pedal is pressed.	Reaction time applet at: http://delphiforfun.org/programs/Reaction_times.htm

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Total hours: 3	12.3/13.3 What happens to movement energy when things speed up or slow down?		
Topic outline		**Teaching approach including possible experiments/investigation opportunities**	**Additional notes**
Work done (energy transformed) = force × distance moved		• Get students to find their 'mass' using bathroom scales, or a plank see-saw. Then get them to climb some stairs whilst being timed. From this, they can calculate the work they have done, and their power.	Give them a chocolate bar wrapper or crisp packet. Calculate how many times they have to climb the stairs to 'burn off' that energy. Link to diet versus lifestyle, and how it is better not to put on too much weight than have to lose it.
K.E. = $\frac{1}{2}mv^2$		• Drop a mass onto an empty drinks can from a height of say 25 cm. Repeat with mass at 100 cm (to give double the speed). Note substantially increased crushing.	Link to car crashes and crumple zones, speed limits and body damage.
Elastic potential energy		• Hooke's Law experiment with expendable springs	The rectangular area on the linear part of the extension/load graph is the work done, and hence the energy stored. Doubling the force gives 4 times the stored energy. Link to bedsprings, catapults, crossbows and vehicle suspension. http://delphiforfun.org/programs/catapult.htm - download for catapult investigation ideas and simulations.

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Total hours: 2	12.4/13.4 What is momentum?		
Topic outline		**Teaching approach including possible experiments/investigation opportunities**	**Additional notes**
Momentum = mass × velocity		• Use inelastic collisions between two dynamics trolleys. Have ticker-timer tape attached to initially moving trolley. Note how speed (and hence velocity) halves when hitting and sticking to another trolley.	This best done with computer simulations or linear air track collisions.
Force = change in momentum/sec		• Drop an uncooked egg into a cloth strung between four rigid posts by its corners with elastic. Repeat with thick cardboard instead of the cloth.	Link to crumple zones, new road sign piers, seat belt restraints, airbags etc. Difference between a glancing blow, and head on. Show video footage of testing cars (and dummies) to destruction.

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Total hours: 2	12.5/13.5 What is static electricity, how can it be used and what is the connection between static electricity and electric currents?		
Topic outline		**Teaching approach including possible experiments/investigation opportunities**	**Additional notes**
Static electricity		• Atmospheric humidity makes reliable experimentation unreliable, but it may be possible to count discharge sparks per second from a motorised van der Graaf generator. Plots against gap size.	
Total hours: 4	**12.6/13.6 What does the current through an electrical current depend on?**		
Topic outline		**Teaching approach including possible experiments/investigation opportunities**	**Additional notes**
Graph for resistor		• In 0.1A increments, pass up to 0.5A through a 5W 6.8 Ω wirewound resistor in water. Note potential differences.	
Graph for filament lamp		• Use 12V 24W raybox lamps. Go up in 1V increments.	
Graph for diode		• Go up in 0.1V increments. Diode starts conducting at around 0.6V.	A standard 1N40001 diode works well.

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Total hours: 4 — 12.7/13.7 What is mains electricity and how can it be used safely?

Topic outline		Teaching approach including possible experiments/investigation opportunities	Additional notes
Fuse wire current		• Use about 5 cm length of different thicknesses of eureka/constantan in a series circuit with a multimeter capable of measuring up to 10A. Turn voltage up and note maximum current before 'blowing'.	Protect benches with heatproof mats. Able groups could plot V against I and compare with filament lamp.

Total hours: 3 — 12.8/13.8 Why do we need to know the power of electrical appliances?

Topic outline		Teaching approach including possible experiments/investigation opportunities	Additional notes
Power = Current × potential diff		• Make a heating coil of 34 swg eureka. Suspend it in 30 ml water. Heat water on 4 V for a period of time and note temperature rise. Repeat using 8 V. • Theoretical temperature rise is not twice, but four times.	Coils burn out if removed from water before power is switched off. Why not mount coils below a hardboard disc that will sit on a small beaker?
Charge = current × time		• Electrolysis of acidulated water. Measure volume of gas against time. Repeat for different currents.	A simple visual demo is to fill a bucket with water. Quantity of water depends on flow rate and on time.

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Total hours: 4	12.9/13.9 What happens to radioactive substances when they decay? 12.10/13.10 What are nuclear fission and nuclear fusion?		
Topic outline		**Teaching approach including possible experiments/investigation opportunities**	**Additional notes**
Radioactivity		*No practical work possible*	

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