# GCSE
# SCIENCE A, SCIENCE B, PHYSICS
# UNIT P1 – Example 2
## 4461, 4462, 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, *13.1/11.1 How is heat (thermal energy) transferred and what factors affect the rate at which heat is transferred?* 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.

| UNIT PHYSICS 1 | | | |
|---|---|---|---|
| **Total hours: 5** | **11.1/13.1 How is heat (thermal energy) transferred and what factors affect the rate at which heat is transferred?** | | |
| **Topic outline** | | **Teaching approach including possible experiments/investigation opportunities** | **Additional notes** |
| Emission and absorption of radiation<br>Conduction<br>Convection | | • Take temperature of water in shiny and painted tin cans near radiant heaters (heating up and/or cooling down)<br>• Drawing pins attached to a steel rod at equal intervals | |
| Insulation | | • Investigate materials to keep Arctic explorers warm | Also uses of metals as conductors. |
| Body shape and dimensions | | • Try different shaped/sized jelly or sandcastle moulds | Control either volume of liquid or shape of mould. Make jellies or cool soup! |

| Total hours: 4 | 11.2/13.2 What is meant by the efficient use of energy? | | |
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| **Topic outline** | | **Teaching approach including possible experiments/investigation opportunities** | **Additional notes** |
| Types of energy and examples of transducers | | • An energy 'circus'. Examples of energy devices | |
| Calculations of efficiency | | • Measure efficiency of using a Bunsen to heat water<br>• Compare with electrical heating | Needs a Labgas meter or similar. 12V caravan immersion heaters run on 8V work OK on most power supplies. |
| Effectiveness vs cost effectiveness | | • Build cardboard houses. Heat with 12V/24W lamp. Compare rise in temperature with/without cavity insulation/ceiling insulation | Locate thermometer in ceiling corner away from lamp. Good for 'validity of evidence'. |

| Total hours: 6 | 11.3/13.3 Why are electrical devices so useful? | | |
|---|---|---|---|
| **Topic outline** | | **Teaching approach including possible experiments/investigation opportunities** | **Additional notes** |
| Energy transferred | | • Look at labels on assortment of appliances<br>• Read electricity meter at home each day for a week. Try to explain daily differences. | Able students could calculate standby costs; very able could calculate reduction in vehicle mpg with headlights on. |
| The amount of electrical energy a device transforms depends on how long the appliance is switched on | | • Heat container of water using immersion heaters. Note temperature against time. | Good link to this with 11.1, 'the bigger the temperature difference, the faster the rate of heat transfer'. |
| Using transformers on the National Grid<br>How increasing voltage reduces energy loss | | • Use power-line demonstration to show how, without stepping up, only properties near power station get a satisfactory supply | It is impressive to show the converse, using a demountable transformer stepping down the 'mains' to 2V and welding two nails together with the high current.<br>Challenge students to light a 6V lamp from a 2V ac supply, using C-cores and 1mm insulated wire. |

| Total hours: 5 | 11.4/13.4 How should we generate the electricity we need? | | |
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| **Topic outline** | | **Teaching approach including possible experiments/investigation opportunities** | **Additional notes** |
| Energy from renewables can drive turbines directly | | • Make Savonius rotors out of tin cans, or make water wheels<br>• Datalog output from a photovoltaic panel over a period of time<br>• Use a lightmeter to measure lux vs distance from an open light source | This is mainly a research topic, which might lend itself to group presentations and/or model making. Opportunity to link this section to 10.8, societal aspects of scientific evidence, eg media debate on wind farms, Severn Barrage, nuclear power. |
| **Total hours: 6** | **11.5/13.5 What are the uses and hazards of the waves that form the electromagnetic spectrum?** | | |
| **Topic outline** | | **Teaching approach including possible experiments/investigation opportunities** | **Additional notes** |
| Different wavelengths are reflected, absorbed or transmitted differently by different substances and surfaces | | • Measure reflected and transmitted light from different colours of card/filters/coloured water/metal. Compare with demonstrated microwave source. | Opportunity to discuss 10.5 – sensitivity of equipment. How reliable are the results? |

| Topic outline | | Teaching approach including possible experiments/investigation opportunities | Additional notes |
|---|---|---|---|
| Microwaves pass through Earth's atmosphere and are used to send information | | • Measure attenuation of microwave passing through different thicknesses of damp paper | Can link loss of TV signal in heavy rain and mobile phone signal in heavy fog. |

| Total hours: 14 | 11.6/13.6 What are the uses and dangers of emissions from radioactive substances? | | |
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| **Topic outline** | | **Teaching approach including possible experiments/investigation opportunities** | **Additional notes** |
| Evaluate measures that can be taken to reduce exposure to nuclear radiations<br>Properties of radiations and their penetration through materials | | • Use G-M tube to note detected radiation from a beta source at different distances. Also use Radium source and different obstructing materials/thicknesses to note attenuation. | Demonstration only, but good opportunity to introduce most of the 'How Science Works' (section 10) procedures. |
| Half life | | • Group practical – have a shallow box of two hundred 1 cm cubes, coloured on one side. Shake tray, remove coloured-side-up cubes. Note number remaining. Repeat until fewer than 10 remain. | Good graph-drawing exercise. Half-life of one group can be compared with another, and with class total results, so good opportunity to talk about reliability of data and conclusion. |

| Total hours: 7 | 11.7/13.7 What do we know about the origins of the Universe and how it continues to change? | | |
|---|---|---|---|
| **Topic outline** | | **Teaching approach including possible experiments/investigation opportunities** | **Additional notes** |
| Telescope types |  | • Make simple telescope with 50 cm convex objective taped to one end of 34 cm length of 40 mm waste pipe. Use 10 cm convex lens on 34 cm of 32 mm waste pipe to slide in wider tube. Opportunity to investigate focal length, magnification, and telescope length with different lens combinations. | Convert to terrestrial telescope by replacing eyepiece with 10 cm concave lens. Note new length of telescope is difference in focal lengths, as opposed to former sum of focal lengths. |