



Scheme of work – Cambridge IGCSE® Physics (0625)

Unit 2: Electricity 1

Recommended prior knowledge

Although Cambridge IGCSE Physics itself can be used as an introduction to Physics, it is unlikely that many students will not have studied some Physics or general Science previously. The use of electricity will, almost certainly, have been within the experience of all students although since it is very commonly misunderstood or not understood at all, there might well be misconceptions that need to be addressed early on. The media rarely distinguish between voltage, current and power and the ideas that current diminishes as it progresses through a circuit is curiously attractive and difficult to extirpate.

Students are likely to be aware that electricity is an enormously useful mechanism for transferring energy and are also likely to be aware that mains voltage electricity can be dangerous or even fatal. They might not realise how this relates to the human nervous system which is, itself, essentially electrical. The idea that electricity is solely industrial and not natural will also be difficult to counter but some pupils will have encountered electric eels or be aware of the electrical nature of lightning. Many students will have met simple experiments with light bulbs and simple cells and will know that a closed circuit is required before any energy can be transferred within the circuit. The fundamental effects of electricity – the heating, lighting, motor and chemical effects – might well be within the experience of most students. Those who have not previously come across ammeters might at least be familiar with fuses, trip switches and residual current circuit breakers. Similarly, they will probably have experienced various electrostatic effects. These might include making a balloon stick to the ceiling or hearing the crackling as a comb is pulled through hair that is dry and clean.

Context

Electricity is both a fundamental and a major component of many Physics courses and this is true of the Cambridge IGCSE Physics course. It is also one that students find hard to understand. That electricity can be neither seen nor heard nor smelt, renders it somehow less accessible. This, then, is unlikely to be the first unit taught. Simple practical experiments and the kinaesthetic experience of handling equipment might well assist in overcoming the difficulties many students encounter; there are many practical experiments that can be demonstrated or performed in class. The relationship between current and charge can be used to distinguish between a rate of change and the original quantity that is changing. This is an idea that has more general application within the course.

Outline

This unit contains ideas that do not immediately and directly relate to the familiar experience of many students and the concepts student tend to find somewhat hard to grasp. The teacher is likely to concentrate here on the basic ideas of the subject but experiments can be used to acquire the skills of graph plotting and calculations can be used to ensure that students are adept at rearranging equations. There are likely to be several unfamiliar units encountered properly for the first time here, and students can be encouraged to be meticulous in ensuring that the correct units are invariably included with numerical answers.

(Please note: **(S)** in **bold** denotes material in the Supplement (Extended syllabus) only)

Syllabus ref	Learning objectives	Suggested teaching activities	Learning resources
4.2 (b)	State that current is related to the flow of charge Use and describe the use of an ammeter	Use simple circuits to measure current.	This website contains a series of useful pages relating to electricity and magnetism. These are relevant to most of this unit. www.galaxy.net/~k12/electric/index.shtml IGCSE Physics Coursebook CD-ROM Activity Sheet 18.1
4.2 (b) (S)	Show understanding that a current is a rate of flow of charge and recall and use the equation $I = Q/t$ Distinguish between the direction of flow of electrons and conventional current	A Van de Graaf generator can be used with a microammeter to show that current is a flow of charge.	For some interesting information about static electricity and how the Van de Graaf works: www.engr.uky.edu/~gedney/courses/ee468/expmnt/vdg.html . www.wonderhowto.com/how-to-experiment-with-van-de-graaff-generator-272678/ Any mention of the Van de Graaf generator and students are asking about lightning – try this site also about the work of Benjamin Franklin: www.youtube.com/watch?v=RxcOXj9Udjc
4.2 (c)	State that the e.m.f. of a source of electrical energy is measured in volts		
4.2 (c) (S)	Show understanding that e.m.f. is defined in terms of energy supplied by a source in driving charge round a complete circuit	An analogy with water being pumped round a closed system (e.g. central heating) can be useful here to enable the students to have a mental picture which helps them to distinguish between current (the water) and e.m.f. (the energy from the water pump).	A good introductory lesson on current and e.m.f. www.mos.org/sln/toe/tennisballs.html
4.2 (d)	State that the potential difference across a circuit component is measured in volts Use and describe the use of a voltmeter	Continue the circuit work, measuring potential differences with a voltmeter.	

Syllabus ref	Learning objectives	Suggested teaching activities	Learning resources
4.2 (e)	<p>State that resistance = p.d./current and understand qualitatively how changes in p.d. or resistance affect current Recall and use the equation $R = V/I$</p> <p>Describe an experiment to determine resistance using a voltmeter and an ammeter Relate (without calculation) the resistance of a wire to its length and to its diameter</p>	<p>Extend the circuit work using an ammeter and a voltmeter to measure I and V and so calculate resistance of a resistor. By using samples of nichrome or constantan wire of different lengths and diameters suitable resistance comparisons can be made.</p>	<p>Why not create a vocabulary quiz at this stage to test knowledge in a different way?</p> <p>IGCSE Physics Coursebook CD-ROM Activity Sheet 18.2</p> <p>Unit 2: Past Paper Question Core 1 Unit 2: Past Paper Question Core 2 Unit 2: Past Paper Question Alternative to Practical 1 Unit 2: Past Paper Question Alternative to Practical 2</p>
4.2 (e) (S)	Recall and use quantitatively the proportionality between resistance and the length and the inverse proportionality between resistance and cross-sectional area of a wire	Extend the experimental resistance work to give quantitative results.	<p>Unit 2: Past Paper Question Alternative to Practical 3 Unit 2: Past Paper Question Extension 1</p>
4.2 (f) (S)	Recall and use the equations $P = IV$ and $E = IVt$		<p>www.sciencestage.com/v/591/electric-power-formula-ohm's-law.html IGCSE Physics Coursebook CD-ROM Activity Sheet 18.3</p>