



## Scheme of work – Cambridge IGCSE® Physics (0625)

### Unit 11: Electronics

#### Recommended prior knowledge

Beyond seeing an old-fashioned cathode tube television set or a c.r.o. display at a hospital, students will not have encountered much of this unit outside a physics classroom. The ideas are relatively straightforward but they build on ideas encountered earlier in the course and so this is a unit that is probably best left until the second half of the Cambridge IGCSE course.

Students will need to know what electrons are and where they come from and they will need to know some static electricity before studying the c.r.o. A knowledge of currents and voltages should precede the study of the diode and the transistor. Likewise the study of the a.c. generator (and inevitably the study to some limited extent of alternating currents) should precede teaching *rectification*. Students find the potential divider surprisingly difficult (partly perhaps because they find the concept of a potential difference hard to grasp) and it is best approached through practical experimentation that allows the student to see what is happening. It may then be dealt with theoretically.

#### Context

This unit groups together ideas that relate principally to the application of electricity and should not be tackled until the other electrical units have been covered. There is little in it that is genuinely difficult but without a fundamental and prior understanding of the other electrical units, confusion and misunderstanding would be inevitable.

#### Outline

This unit primarily deals with the application of ideas met in other units and there are few new ideas here – just the application of familiar ideas in important and new contexts.

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

Syllabus ref	Learning objectives	Suggested teaching activities	Learning resources
4.6 (a)	Describe the production and detection of cathode rays Describe their deflection in electric fields State that the particles emitted in thermionic emission are electrons	Use a demonstration diode to show thermionic emission. Use a deflection (e/m) tube and electrostatically charged rods to demonstrate deflection of cathode rays in electric fields.	Unit 11: Past Paper Question Extension 1

Syllabus ref	Learning objectives	Suggested teaching activities	Learning resources
4.6 (b) (S)	<p><b>Describe (in outline) the basic structure, and action, of a cathode-ray oscilloscope (detailed circuits are not required)</b></p> <p><b>Use and describe the use of a cathode-ray oscilloscope to display waveforms</b></p>	<p><b>Calculate the speed of the dot across the screen at different settings of the time base.</b></p> <p><b>Lead on from the deflection tube (see above) to the c.r.o. and demonstrate its use (e.g. in displaying frequency and amplitude of sound waves, as in Waves Unit).</b></p>	<p>This website enables students to control a wave on an oscilloscope screen:  <a href="http://www.phy.ntnu.edu.tw/~hwang/oscilloscope/oscilloscope.html">www.phy.ntnu.edu.tw/~hwang/oscilloscope/oscilloscope.html</a></p> <p>Unit 11: Past Paper Question Core 1</p> <p>Unit 11: Past Paper Question Extension 2</p>
4.3 (c)	<p>Describe the action of a variable potential divider (potentiometer)</p> <p>Describe the action of thermistors and light dependent resistors and show understanding of their use as input transducers</p> <p>Describe the action of a capacitor as an energy store and show understanding of its use in time-delay circuits</p> <p>Describe the action of a relay and show understanding of its use in switching circuits</p>	<p>Make a potential divider using a fixed and a variable resistor. Set up, in parallel, two voltmeters. Show that changing the resistance of the variable resistor causes one voltmeter reading to increase and the other to decrease. The larger resistor gets the larger share of the voltage. (The lion takes the lion's share).</p> <p>A series of straightforward circuits could be used here so that students become familiar with the various components. The circuits could model the action of temperature sensors, light sensors, alarms, etc.</p>	
4.3 (c) (S)	<p><b>Describe the action of a diode and show understanding of its use as a rectifier</b></p> <p><b>Describe the action of a transistor as an electrically operated switch and show understanding of its use in switching circuits</b></p> <p><b>Recognise and show understanding of circuits operating as light sensitive switches and temperature operated alarms (using a relay or a transistor)</b></p>	<p><b>Set up such circuits and show how they work.</b></p> <p><b>Display a half-wave rectified current using a c.r.o.</b></p> <p><b>Explain that devices such as phone chargers always include a rectifier.</b></p>	<p>Unit 11: Past Paper Question Alternative to Practical 1</p> <p><a href="http://www.allaboutcircuits.com/vol_3/chpt_3/4.html">www.allaboutcircuits.com/vol_3/chpt_3/4.html</a></p>

Syllabus ref	Learning objectives	Suggested teaching activities	Learning resources
4.3 (d) (S)	<p><b>Explain and use the terms digital and analogue</b></p> <p><b>State that logic gates are circuits containing transistors and other components</b></p> <p><b>Describe the action on NOT, AND, OR, NAND and NOR gates</b></p> <p><b>Design and understand simple digital circuits combining several logic gates</b></p> <p><b>State and use the symbols for logic gates (the American ANSI#Y32.14 symbols will be used)</b></p>	<p><b>Model logic gates with switches and show how two switches in series act as an AND gate – both must be on before the lamp is turned on etc.</b></p> <p><b>It is worth emphasising that logic gates are active components which require their own power source. A NOT gate with a 0 input, does not generate a voltage from nothing, it diverts the power supply voltage to the output.</b></p>	<p>IGCSE Physics Coursebook CD-ROM Activity Sheet 19.3</p>