Scheme of work – Cambridge IGCSE® Physics (0625)

Unit 1: Light

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. Light is something that will, in any case, have been within the experience of all students.

Students are likely to be aware that light travels from a luminous source and is reflected and scattered by an object to the human eye where it is detected on the retina. Light may also travel from a luminous source directly to the eye. Words such as *transparent*, *opaque* and *translucent* are likely to be familiar to students embarking on this course. Students will probably be aware that light travels in straight lines and that its path is frequently represented by a *ray*. This rectilinear propagation is responsible for the formation of shadows and students might well have encountered these concepts: *umbra* and *penumbra*. These ideas can be used to explain solar and lunar eclipses. Not all students will be aware that stereoscopic vision relies on the assumption that light travels in straight lines and that during image formation in a mirror, the eye is tricked into seeing something that isn't where it seems to be. Students are likely to have seen rainbows and to have related this to the passage of light through a triangular prism; it is unlikely, however, that a student starting the Cambridge IGCSE Physics course will understand much of the physics that underlies these phenomena. Magnifying glasses and simple focusing experiments with lenses are also likely to be within the students' experience.

Context
Within the Cambridge IGCSE Physics course, *Light* can be treated as something of an isolated section and taught at any stage within the course. In particular, it does not need to be preceded by *Waves*. Mathematically it is relatively straightforward – although the Snell Law does require knowledge of the sine function. This would suggest that it is best suited to an early stage in the course.

There are many practicals that can be conducted during this section of the course and students can be made aware that a careful and meticulous approach, involving sharpened pencils, straight-edged rulers and general tidiness, can mark the difference between an accurate experiment or drawing and a much less useful one.

Outline
This unit contains ideas that relate to the familiar experience of many students and the ideas are not especially challenging. It can be used to introduce skills that will be needed in the rest of the course in a context that is not in itself a challenge.
(Please note: **(S)** in **bold** denotes material in the Supplement (Extended syllabus) only)

Syllabus ref	Learning objectives	Suggested teaching activities	Learning resources
3.2 (a)	Describe the formation, and give the characteristics, of an optical image by a plane mirror Use the law angle of incidence = angle of reflection	Use simple experiments with optical pins to find the position of the image in a plane mirror. Use ray box experiments to investigate angle of incidence = angle of reflection.	How to make a simple periscope: www.lightwave.soton.ac.uk/experiments/periscope/periscope.html IGCSE Physics Coursebook CD-ROM Activity Sheet 13.1 Unit 1: Past Paper Question Core 3
3.2 (a) (S)	**Perform simple constructions, measurements and calculations**	**Extend to draw simple ray diagrams.**	
3.2 (b)	Describe an experimental demonstration of the refraction of light Use the terminology for the angle of incidence *i* and angle of refraction *r* and describe the passage of light through parallel-sided transparent material Give the meaning of critical angle Describe internal and total internal reflection	Use rectangular transparent blocks (Perspex or glass) with optical pins or ray boxes to investigate refraction. Develop this to experiments with a semicircular transparent block to investigate critical angle and total internal reflection.	Instructions for a demonstration of total internal reflection; www.youtube.com/watch?v=BI56CcLkzzc More details on further experiments related to total internal reflection and much more: www.phys.virginia.edu/Education/outreach click on 8thgrade Physical Science Sol Activities then PS.9 to find total internal reflection IGCSE Physics Coursebook CD-ROM Activity Sheet 13.2 IGCSE Physics Coursebook CD-ROM Activity Sheet 13.3 Unit 1: Past Paper Question Core 1 Unit 1: Past Paper Question ATP 1
3.2 (b) (S)	**Recall and use definition of refractive index *n* in terms of speed** **Recall and use the equation sin *i*/sin *r* = *n*** **Describe the action of optical fibers particularly in medicine and communications technology**	**Extend the refraction work with the rectangular block to include quantitative use of sin i/sin r.** **Encourage deeper thought with able candidates by discussing refractive index in terms of the speed of light in different materials.** **Use inexpensive 'novelty' light items to demonstrate optical fibres.**	Unit 1: Past Paper Question Extension 2

Syllabus ref	Learning objectives	Suggested teaching activities	Learning resources
3.2 (c)	Describe the action of a thin converging lens on a beam of light Use the terms principal focus and focal length Draw ray diagrams to illustrate the formation of a real image by a single lens	Investigate converging lenses by: forming an image of a distant object (e.g. a tree or building seen from the laboratory window), bringing parallel rays from a ray box to a focus through a cylindrical lens, drawing ray diagrams to scale to show the formation of a real image.	There is a large amount of information and teaching on this website: www.physicsclassroom.com/Class/refrn/U14L5a.html or this animation: www.phy.ntnu.edu.tw/ntnujava/index.php?topic=48 IGCSE Physics Coursebook CD-ROM Activity Sheet 13.4
3.2 (c) (S)	**Draw ray diagrams to illustrate the formation of a virtual image by a single lens** **Use and describe the use of a single lens as a magnifying glass**	**Extend the ray diagram work to include the formation of a virtual image and use a magnifying glass.**	Unit 1: Past Paper Question Extension 1
3.2 (d)	Give a qualitative account of the dispersion of light as illustrated by the action on light of a glass prism	Use a simple experiment, or demonstration, to show that white light from a ray box or slide projector is dispersed by a prism. A single slit can be cut from a piece of stiff card and inserted in the slide carrier of the projector to produce a ray that can be shone through the prism on to a screen. Although not part of the syllabus, students will find it interesting to learn a little about mixing coloured lights at this stage.	Interactive colour mixing (no need for a colour mixing kit or blackout): www.phy.ntnu.edu.tw/java/shadow/shadow.html For prism work: www.mistupid.com/science/prism.htm IGCSE Physics Coursebook CD-ROM Activity Sheet 15.1 Unit 1: Past Paper Question Core 2