



SAMPLE COURSE OUTLINE

PHYSICS
GENERAL YEAR 11

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Sample course outline

Physics – General Year 11

Unit 1 and Unit 2

Science Inquiry Skills

Science Inquiry Skills align with the Science Understanding and Science as a Human Endeavour content of the unit and are integrated into the learning experiences for Units 1 and 2.

- identify, research, construct and refine questions for investigation; propose hypotheses; and predict possible outcomes
- plan, select and use appropriate investigation methods, including preliminary trials, laboratory experimentation, and controlling variables to collect reliable data
- assess risk and address ethical issues associated with these methods
- work collaboratively and individually to conduct investigations, using appropriate measuring devices; safely, competently and methodically for the collection of valid and reliable data
- organise and clearly represent data in tables and appropriate graphs to identify trends, patterns and relationships
- describe sources of experimental error
- use appropriate standard international (SI) units and symbols
- use evidence to make and justify conclusions
- evaluate conclusions by considering the quality of available evidence and make recommendations for improving experimental method

Semester 1 – Unit 1: World of waves

Week	Key teaching points
1–2	<p>Wave motion</p> <ul style="list-style-type: none"> a wave is a means of energy transfer – longitudinal waves (particles vibrate parallel to the direction of movement) and transverse waves (particles vibrate perpendicular to the direction of movement) properties of mechanical waves waves can be represented graphically and diagrammatically wavefronts and rays, wave speed, wavelength, frequency, period, amplitude, phase calculate wave speed by applying the formula: $v = \frac{s}{t}, f = \frac{1}{T}, T = \frac{1}{f}, v = \lambda f$ resonance occurs when an object is vibrated by a source with the same frequency as its natural frequency, producing an increased amplitude of vibration
3–4	<p>Sound</p> <ul style="list-style-type: none"> sound is produced by a vibrating source volume of sound is related to the amplitude of the wave; pitch of a sound is related to the frequency of the wave reflection of sound waves can produce echoes <p>Task 1: Investigation - speed of sound, echoes</p> <ul style="list-style-type: none"> waves travelling in the same medium at the same time interfere with each other destructively or constructively. If the waves are of similar frequencies, beats may be produced ultrasound images (SHE) acoustic design (SHE) the function of the ear
5–6	<ul style="list-style-type: none"> standing waves can be produced in strings when waves interfere under certain circumstances noise cancelling technology (SHE) sound waves diffract around openings which are similar in width to the wavelength of the sound sound produced by, and tuning of, musical instruments (SHE) microwave ovens; microwaves in telecommunication (SHE) echolocation to navigate and locate prey (SHE) <p>Task 2: Test on Wave motion and Sound</p>
7–8	<p>Light</p> <ul style="list-style-type: none"> absorption and transmission of light; shadows light is the visible part of the electromagnetic spectrum all electromagnetic waves travel at the speed of light the frequency of light determines its colour the appearance of coloured objects in terms of their absorption, reflection or transmission of light stage lighting – coloured filters, shadows (SHE) state and apply the laws of reflection the angle of incidence and the angle of reflection are measured in relation to the normal the formation of images in plane mirrors; ray diagrams for plane mirrors real images can be projected on to a screen virtual images cannot be projected onto a screen

9–10	<ul style="list-style-type: none"> the formation of images in mirrors (converging and diverging) ray diagrams can be drawn to determine image formation in concave and convex mirrors measure object distance and image distance and determine magnification by applying the formula: magnification = $\frac{d_i}{d_o} = \frac{h_i}{h_o}$ parabolic reflectors can be used to focus or produce parallel rays
11–13	<ul style="list-style-type: none"> the speed of a wave varies with the medium, and this causes refraction (change in direction) in terms of a change in the speed of wave as it crosses an interface substances with high refractive index/optical density slow light down causing it to bend towards the normal; Snell's law can be verified in practical activities the change in direction of light rays is measured by constructing normal rays and measuring the angles of incidence and refraction <p>Task 3: Investigation of refraction, critical angle and behaviour of light in lenses</p> <ul style="list-style-type: none"> the critical angle for a medium can be observed in practical activities optic fibres in telecommunications (SHE) images produced by converging and diverging lenses ray diagrams can be drawn to determine image formation lenses use the terms 'optical centre', 'principal focus', 'principal axis', 'focal length', object distance and image distance as they apply to thin spherical lenses cameras, projectors (including digital) (SHE) impact of telescopes and microscopes on society; in medicine and astronomy (SHE)
14–16	<ul style="list-style-type: none"> measure object distance and image distance and determine magnification simple applications of the polarisation of light the structure and function of the eye eyesight in humans and animals (SHE) spectacles, colour vision (SHE) holograms (SHE) <p>Task 4: Presentation on research into vision in animals (compare a vertebrate and an invertebrate vision system)</p> <p>Task 5: Test on Light</p>

Week	Key teaching points
1–2	<p>Heat</p> <ul style="list-style-type: none"> • heat as a form of energy • heat energy flows from one object to another because of a difference in temperature • internal energy of a substance equals the sum of the kinetic energy and the potential energy of its particles • heat, internal energy and temperature • the kinetic theory of matter describe matter as a collection of moving particles. This theory can be used to explain the behaviour of substances as they are heated or cooled. As a substance heats up, its particles move faster (gain kinetic energy) • different types of thermometers • thermometers are calibrated using fixed points • absolute zero • effects of heat: thermal expansion and contraction • differential expansion of metals – different metals expand at different rates when heated and this property is applied in devices, such as thermostats
3–4	<ul style="list-style-type: none"> • different substances need different amounts of heat energy to raise their temperature. The heat capacity of a substance is the amount of heat needed to raise the temperature of 1 kilogram of the substance by 1 degree Celsius; apply the equation $Q = mc\Delta T$ • changes of state (melting, boiling, freezing, condensing, sublimation) involve changes in potential energy of the particles • substances remain at the same temperature while they are undergoing a change of state • latent heat is the heat involved in change of state and does not involve change in temperature; apply the equation $Q = mL$ • changes of state can be represented in graphs called heating/cooling curves
5–6	<ul style="list-style-type: none"> • the cooling effect of evaporation • vapour pressure affects the rate of evaporation • boiling point and freezing point and the factors which affect them: pressure, solute concentration • differences between evaporative and refrigerative air conditioners/cooling systems (SHE)
7–8	<ul style="list-style-type: none"> • heat transfer processes: conduction, convection and radiation and their applications • thermal insulation properties of materials, including ratings and classification • transformation to heat energy must be taken into account when considering the conservation of energy of a system <p>Task 6: Investigation of heat in your home or school. Students pose a question about temperature regulation in their home or school and collect data to reach a conclusion</p> <ul style="list-style-type: none"> • the principles of heat storage and transfer apply to the operation of common devices, for example, protective clothing, car radiators (SHE) • buildings can incorporate design features which make more efficient use of energy for heating, cooling and lighting (climate control systems), solar hot water systems, insulation (SHE) • ground source heat pumps (GSHP) or geexchange can be used to regulate temperatures in buildings (SHE) • temperature regulation in humans can involve shivering, sweating and extremes of temperature (hypothermia and hyperthermia) (SHE) • the role of heat transfer processes in global warming (SHE) <p>Task 7: Test on Heat</p>

9–10	<ul style="list-style-type: none"> the relationship between pressure and volume of a gas when the temperature is constant the relationship between temperature and volume of a gas when the pressure is constant the relationship between pressure and temperature of a gas when the volume is constant
11–12	<p>Nuclear radiation</p> <ul style="list-style-type: none"> structure of the atom, isotopes decay of unstable isotopes, production of alpha, beta, gamma radiation half-life of radioisotopes, radiometric dating Investigation: Penetration power of radiation industrial uses of radioisotopes, smoke alarms (SHE) <p>Task 8: Experiment – penetration power of radiation (class experiment with teacher handling radioisotopes)</p> <p>Task 9: Oral presentation on a nuclear radiation topic (e.g. safety measures for working with radioisotopes, medical diagnosis, medical treatment, advantages and disadvantages of nuclear power, production and use of radioisotopes, nuclear waste, nuclear weapons and their effects)</p>
13	<ul style="list-style-type: none"> effect of radiation on humans, radiation dose, safety precautions medical uses of radioisotopes (SHE) the role of the Open Pool Australian Lightwater (OPAL) reactor at Lucas Heights (SHE)
14–16	<ul style="list-style-type: none"> fission reactions production of electricity using nuclear reactors fusion reactions nuclear weapons (SHE) <p>Task 10: Test on Nuclear radiation</p>