

GCSE Specification 1522 – Edexcel Double Award Science

Please check that you have chosen the correct specification.

In both the Double and Single Award, some content is designated for the **higher tier candidates** only. This content is printed in **bold**.

B1 : Humans as organisms

page numbers in **Biology for You**

	Page numbers
• Cell activity	p. 6-40
• Nutrition	p. 44-68
• Circulation	p. 88-103
• Breathing and respiration	p. 69-87
• Nervous coordination	p. 118-131
• Hormonal coordination	p. 132-134
• Maintaining the internal environment	p. 105-117

Cell activity		
<i>Candidates will be assessed on their ability to:</i>		
	• recall that a nucleus, cytoplasm and a cell membrane are present in most animal cells (B1.01)	page 8
	• understand that substances move into and out of cells through the cell membrane by diffusion; define osmosis in terms of the movement of water molecules from a higher concentration of water to a lower concentration of water through a selectively permeable membrane; interpret data from experiments on osmosis (B1.02)	p. 18-28
	• understand that active transport across the cell membrane requires energy to move molecules from a low concentration to a high concentration (B1.03)	26
	• recognise that the co-ordinated activity of organisms results from the action of cells adapted to different functions; relate the structure of a motor neurone (nerve cell) to its function (B1.04)	12
Nutrition		
In order to meet statutory requirements, candidates following the Welsh National Curriculum should be taught how the presence of starch, sugar and protein in foods can be detected by testing.		44-53
<i>Candidates will be assessed on their ability to:</i>		
	• describe the functions of the mouth, oesophagus (gullet), stomach, small and large intestines, pancreas, liver and gall bladder (B1.05)	55-61
	• understand the role of the muscular wall of the gut in peristalsis (B1.06)	59

	<ul style="list-style-type: none"> explain how the structure of villi (large surface area, single layer of cells and capillary network) allows efficient absorption of the soluble products of digestion (B1.07) 	p. 61
	<ul style="list-style-type: none"> understand the role of bile and of digestive enzymes: bile neutralises stomach acid and emulsifies fats; amylase digests starch to simple sugars; proteases (eg pepsin) digest proteins to amino acids; lipase digests fats to fatty acids and glycerol (B1.08) 	60
	<ul style="list-style-type: none"> understand that enzymes are sensitive to temperature and pH; interpret data from experiments relating to digestion (B1.09) 	29-36
Circulation		
<i>Candidates will be assessed on their ability to:</i>		
	<ul style="list-style-type: none"> describe the composition of blood: plasma, red blood cells, white blood cells and platelets (B1.10) 	97
	<ul style="list-style-type: none"> understand the roles of these components in: the transport of oxygen, nutrients, carbon dioxide, urea, hormones and thermal energy (heat); combating infection, including the ingestion of micro-organisms and the production of antibodies which destroy micro-organisms; blood clotting (to prevent blood loss and entry of micro-organisms) (B1.11) 	98-100
	<ul style="list-style-type: none"> relate the structure of the heart to its function as a pump, including the roles of atria and ventricles, the valves in the heart and the coronary vessels (B1.12) 	92-94
	<ul style="list-style-type: none"> relate the structure of arteries, veins and capillaries to their functions (B1.13) 	88-89, 91
	<ul style="list-style-type: none"> understand that substances, including oxygen, carbon dioxide, glucose and urea, are exchanged by diffusion between capillaries and tissues (B1.14) 	98, 101
	<ul style="list-style-type: none"> recall the plan of the double circulatory system, including aorta, vena cava and blood vessels, to and from lungs, kidneys and liver (B1.15) 	90
Breathing and respiration		
<i>Candidates will be assessed on their ability to:</i>		
	<ul style="list-style-type: none"> describe the structure of the thorax including ribs, intercostal muscles, diaphragm, trachea, bronchi, bronchioles, alveoli and pleural membranes (B1.16) 	74-77
	<ul style="list-style-type: none"> explain the role of the intercostal muscles and diaphragm in ventilating the lungs (B1.17) 	76
	<ul style="list-style-type: none"> understand the similarities and differences between aerobic and anaerobic respiration; recall the word equation for anaerobic respiration in animal cells: glucose → lactic acid and energy released (B1.18) 	81-82
	<ul style="list-style-type: none"> explain how vigorous exercise can result in an oxygen debt (B1.19) 	82
Nervous coordination		
<i>Candidates will be assessed on their ability to:</i>		
	<ul style="list-style-type: none"> recall that the central nervous system (brain and spinal cord) is linked to sense organs by nerves (B1.20) 	118-120

	<ul style="list-style-type: none"> understand that stimulation of receptors in the sense organs sends electrical impulses along nerves into and then out of the central nervous system, resulting in rapid responses; describe the differences between voluntary and reflex responses (B1.21) 	p. 121-124
	<ul style="list-style-type: none"> describe the pathway taken by electrical impulses along a sensory neurone, a relay neurone and a motor neurone to an effector (muscle or gland); understand the role of transmitter chemicals at synapses; explain the removal of a finger from a hot object (B1.22) 	122-123
	<ul style="list-style-type: none"> describe the role of the iris and pupil, retina and optic nerve in the iris reflex (B1.23) 	130
	<ul style="list-style-type: none"> explain the role of cornea, ciliary body, suspensory ligaments and lens in forming sharp images of near and distant objects on the retina (B1.24) 	130-131
Hormonal coordination		
<i>Candidates will be assessed on their ability to:</i>		
	<ul style="list-style-type: none"> define hormones as chemicals released directly into the blood from glands: insulin from the pancreas, testosterone from the testes, oestrogen from the ovaries, progesterone from the ovaries and placenta, follicle stimulating hormone (FSH) and lutenising hormone (LH) from the pituitary gland (B1.25) 	132-134
	<ul style="list-style-type: none"> explain the role of insulin in regulating the level of blood sugar and its use in treating diabetes (B1.26) 	108
	<ul style="list-style-type: none"> describe the roles of oestrogen and testosterone in promoting secondary sexual characteristics and the production of gametes (B1.27) 	166
	<ul style="list-style-type: none"> explain: <ul style="list-style-type: none"> the role in the menstrual cycle of FSH, oestrogen, LH and progesterone the use of sex hormones in the control and promotion of fertility (B1.28) 	163
	<ul style="list-style-type: none"> describe the roles of adrenaline, released from the adrenal glands, in preparing the body for increased activity (B1.29) 	133
Maintaining the internal environment		
<i>Candidates will be assessed on their ability to:</i>		
	<ul style="list-style-type: none"> define homeostasis as the maintenance of a constant internal environment and understand why this is important (B1.30) 	106-107
	<ul style="list-style-type: none"> explain how sweating and shivering help to maintain constant body temperature (B1.31) 	109-110
	<ul style="list-style-type: none"> explain the role of vasodilation and vasoconstriction in temperature regulation (B1.32) 	110
	<ul style="list-style-type: none"> recall that carbon dioxide is removed by the lungs in exhaled air (B1.33) 	71-72
	<ul style="list-style-type: none"> recall that urea is removed by the kidneys in urine (B1.34) 	111
	<ul style="list-style-type: none"> describe the structure of a nephron to include Bowman's (renal) capsule and glomerulus, coiled tubules, collecting duct, arterioles and capillaries (B1.35) 	112

	<ul style="list-style-type: none"> • describe: <ul style="list-style-type: none"> • ultrafiltration in Bowman’s capsule • the composition of glomerular filtrate • reabsorption in the coiled tubules (B1.36) 	p. 112
	<ul style="list-style-type: none"> • explain the role of ADH in regulating the water content of the blood (B1.37) 	p. 113
	<ul style="list-style-type: none"> • understand the roles of skin, stomach acid and blood in defending the body against infection (B1.38) 	178
	<ul style="list-style-type: none"> • understand the role of the mucous membranes of the respiratory tract in defending the body against infection (B1.39) 	178
	<ul style="list-style-type: none"> • describe the harmful effects of: <ul style="list-style-type: none"> • solvents on the lungs and neurones • alcohol on reaction times, behaviour, liver and brain • smoking tobacco on the occurrence of bronchitis, emphysema, lung cancer and addiction to nicotine (B1.40) 	185-189
	<ul style="list-style-type: none"> • evaluate the use and misuse of drugs, including antibiotics (eg penicillin), pain killers (eg aspirin and heroin), stimulants (eg caffeine and amphetamines), sedatives (eg barbiturates) and the dangers of contracting HIV and hepatitis by the use of intravenous drugs (B1.41) 	184-187

B2 : Green plants as organisms You

page numbers in **Biology for**

• Cell activity	p. 9, 12, 214
• Nutrition	205, 207, 209, 215, 216, 211-213, 218
• Water relations and transport	21, 23, 224-225, 230, 214-215, 228, 243-245
• Control of growth	243-245

Cell activity		
<i>Candidates will be assessed on their ability to:</i>		
	• recall that a plant cell has a nucleus, cytoplasm and a cell membrane; it also has a cellulose cell wall, a large vacuole and (in green parts of plants) chloroplasts (B2.01)	p. 9
	• recognise that the co-ordinated activity of organisms results from the adaptation of cells to different functions; relate the structure of a palisade leaf cell to its function (B2.02)	p. 12, 214
Nutrition		
<i>Candidates will be assessed on their ability to:</i>		
	• understand that carbon dioxide and water are converted to glucose and oxygen by photosynthesis using sunlight energy absorbed by chlorophyll, the green pigment contained in chloroplasts (B2.03)	p. 205, 207
	• understand that carbon dioxide from the atmosphere diffuses in through stomata and oxygen diffuses out as a result of photosynthesis (B2.04)	p. 215
	• explain the pattern of gas exchange between a plant and the atmosphere resulting from photosynthesis and respiration over a 24 hour period (B2.05)	p. 216
	• describe how the rate of photosynthesis varies with carbon dioxide concentration, light intensity and temperature; interpret data from experiments relating to photosynthesis (B2.06)	p. 211-213
	• understand that plants use the glucose produced by photosynthesis for respiration to release energy, for conversion to starch for storage and to cellulose for cell walls, and as a component in protein synthesis (B2.07)	209
	• understand the need for mineral ions for healthy plant growth, including nitrates for protein synthesis and magnesium for chlorophyll; interpret data from water culture experiments (B2.08)	218

Water relations and transport		
<i>Candidates will be assessed on their ability to:</i>		
	<ul style="list-style-type: none"> explain how water is taken in by osmosis (B2.09) 	p. 21
	<ul style="list-style-type: none"> understand the role of water in maintaining cell turgidity to support plant tissues (B2.10) 	p. 23
	<ul style="list-style-type: none"> explain the uptake of mineral ions by active transport (B2.11) 	
	<ul style="list-style-type: none"> recall that the substances required for growth and reproduction are transported within plants in xylem (water and mineral ions) and in phloem (sugars and amino acids) (B2.12) 	224-225, 230
	<ul style="list-style-type: none"> understand how leaf structure (shape, cuticle, palisade layer, spongy layer, veins, guard cells and stomata) is adapted for photosynthesis and transpiration (B2.13) 	214-215
	<ul style="list-style-type: none"> explain how leaves lose water by transpiration, including the evaporation of water within the leaf and diffusion of water vapour through stomata; interpret data from experiments relating to transpiration (B2.14) 	227-229
	<ul style="list-style-type: none"> describe how atmospheric conditions affect the rate of transpiration (B2.15) 	228
Control of growth		
<i>Candidates will be assessed on their ability to:</i>		
	<ul style="list-style-type: none"> recall that auxins influence cell division and the elongation of cells at the tips of roots and shoots (B2.16) 	243-244
	<ul style="list-style-type: none"> describe commercial applications of plant hormones: stimulating the growth of roots in cuttings; regulating the development of fruits; killing weeds by disrupting their normal growth pattern (B2.17) 	245

B3 : Variation, inheritance and evolution

page numbers in **Biology for You**

• Variation	p. 255, 272-273, 276-279, 280-285
• Inheritance	278-291
• Evolution	300-305

Variation		
<i>Candidates will be assessed on their ability to:</i>		
• recall that the nucleus of a cell contains chromosomes on which genes (units of inherited information) are located (B3.01)		p. 272-273
• understand that each gene is a section of a molecule of DNA (B3.02)		273
• describe a DNA molecule as two strands coiled to form a double helix, the strands being linked by a series of paired bases (adenine with thymine and cytosine with guanine) (B3.03)		273
• understand that: <ul style="list-style-type: none"> • variation between individuals arises from genetic and environmental causes and from a combination of both • environmental conditions during growth and development cause variation between genetically identical individuals (B3.04) 		255
• understand: <ul style="list-style-type: none"> • that genes exist in alternative forms (alleles) which cause variation in inherited characteristics • the terms dominant and recessive • that some alleles cause diseases which can be inherited (B3.05) 		279 280 286-288
• recall that: <ul style="list-style-type: none"> • chromosomes are present as pairs in body cells and singly in gametes • 46 and 23 are the diploid and haploid numbers of chromosomes in human cells (B3.06) 		278 277
• understand that division of a cell by mitosis produces two cells which contain identical sets of chromosomes for growth and replacement; interpret diagrams showing the overall behaviour of chromosomes during mitosis (technical terms not required) (B3.07)		276

	<ul style="list-style-type: none"> understand that division of a cell by meiosis produces four cells, each with half the number of chromosomes for the formation of genetically different haploid gametes during sexual reproduction; interpret simple diagrams and photographs showing stages in meiosis (technical terms not required) (B3.08) 	p. 277
	<ul style="list-style-type: none"> define fertilisation as the fusion of haploid male and female gametes, restoring the diploid number of chromosomes in the zygote; explain the resulting genetic variation in the new generation of individuals (B3.09) 	p. 277
	<ul style="list-style-type: none"> explain that asexual reproduction involves only one parent and gives rise to genetically identical offspring (clones) (B3.10) 	234, 291
	<ul style="list-style-type: none"> recall that a mutation is a change in a gene, DNA or the number of chromosomes in a cell, which leads to genetic variation (B3.11) 	285
	<ul style="list-style-type: none"> understand that many mutations are harmful, some are neutral and a few are beneficial and can increase in the population by natural selection (B3.12) 	285
	<ul style="list-style-type: none"> understand that exposure to ionising radiation (including gamma rays, ultraviolet rays and X-rays) and some chemical mutagens (including chemicals in tobacco) increase the incidence of mutations (B3.13) 	285
Inheritance		
<i>Candidates will be assessed on their ability to:</i>		
	<ul style="list-style-type: none"> recall that the sex of a person is controlled by one pair of chromosomes, XX in a female or XY in a male, and describe the determination of the sex of offspring at fertilisation, using a genetic diagram (B3.14) 	278
	<ul style="list-style-type: none"> describe the mechanism of monohybrid inheritance using a crossing diagram (B3.15) 	282-284
	<ul style="list-style-type: none"> understand how individuals can be homozygous or heterozygous for particular alleles; distinguish between genotype and phenotype (B3.16) 	280-281
	<ul style="list-style-type: none"> predict probabilities of inheritance from parents using genetic diagrams (B3.17) 	282-284
	<ul style="list-style-type: none"> explain family trees showing the inheritance of polydactyly (dominant allele) and cystic fibrosis (recessive allele) (B3.18) 	286
	<ul style="list-style-type: none"> describe some of the implications of the outcome of the Human Genome Project (B3.19) 	291
	<ul style="list-style-type: none"> describe how selective breeding is used to develop crop plants and agricultural animals with desirable characteristics such as resistance to disease and high yields (B3.20) 	290
	<ul style="list-style-type: none"> understand that cloning is used to produce large numbers of identical individuals with desirable characteristics (eg plant cuttings) (B3.21) 	291
	<ul style="list-style-type: none"> describe the ethical implications of selective breeding and cloning (B3.22) 	290-291
	<ul style="list-style-type: none"> describe how the transfer of a required gene from a donor to a recipient, including the use of restriction enzymes and ligase, can produce genetically modified organisms (B3.23) 	289
	<ul style="list-style-type: none"> evaluate the ethical implications of genetic modification (B3.24) 	289

Evolution		
<i>Candidates will be assessed on their ability to:</i>		
	<ul style="list-style-type: none"> understand that fossils provide evidence of evolution (B3.25) 	p. 302-303
	<ul style="list-style-type: none"> describe how inherited variation can lead to evolution or extinction by the process of natural selection (B3.26) 	300-301, 305

B4 : Living organisms in their environment

page numbers in **Biology for You**

• Humans and the environment	p. 328-374
• Ecosystems	p. 359-373

Humans and the environment		
<i>Candidates will be assessed on their ability to:</i>		
	• understand the principles of interdependence, adaptation, competition and predation; explain how these factors influence the distribution and population sizes of organisms in a given terrestrial or aquatic environment (B4.01)	p. 328-343
	• describe the impact of human activity on the environment, including the pollution of air and of water; recall the effects of air pollutants (eg sulfur dioxide, carbon monoxide) and of water pollutants (eg sewage, nitrates and phosphates) (B4.02)	p. 344-349, 374
	• relate the level of impact on the environment to population size, economic factors and industrial requirements (B4.03)	330-333, 344-345
	• describe the effects of deforestation and overfishing; understand the importance of protecting natural populations (B4.04)	346, 341
Ecosystems		
<i>Candidates will be assessed on their ability to:</i>		
	• describe food chains quantitatively using pyramids of biomass (B4.05)	359
	• understand that energy is transferred through food chains and that energy and biomass are lost between trophic levels (B4.06)	360-363
	• understand that energy transfer can be maximised in food production, for example in fish farms (B4.07)	366
	• explain the techniques used to maximise food production in terms of optimum feeding conditions, disease and predator control (B4.08)	366
	• describe the stages in the carbon cycle, including the roles of micro-organisms; interpret carbon cycle diagrams (B4.09)	371
	• describe the stages in the nitrogen cycle, including the roles of nitrogen-fixing bacteria, decomposers, nitrifying bacteria and denitrifying bacteria (specific names of bacteria are not required); interpret nitrogen cycle diagrams (B4.10)	373

C1 : Classifying materials

page numbers in **Chemistry for You**

• Atomic structure	Chapter 3
• Bonding	Chapter 21, 22

Atomic structure		Chapter 3
<i>Candidates will be assessed on their ability to:</i>		
	• describe the structure of an atom as a nucleus containing protons and neutrons, surrounded by orbiting electrons arranged in shells (C1.01)	p. 28, 30
	• recall the relative mass and relative charge of a proton, a neutron and an electron (C1.02)	p. 29
	• understand the terms atomic number, mass number and relative atomic mass	p. 31, 34
	• describe the electronic structures of the first twenty elements in the periodic table in terms of numbers of electrons in electron shells, given the atomic numbers (C1.04)	p. 30-1, 70
	• explain the existence of isotopes (C1.05)	p. 33
	• calculate the relative atomic mass of an element from relative masses and abundances of its isotopes (C1.06)	p. 34
Bonding		Chapter 21, 22
<i>Candidates will be assessed on their ability to:</i>		
	• understand that atoms of different elements can combine to form compounds by the formation of new chemical bonds (C1.07)	p. 16
	• understand that ionic bonds can be made by the transfer of electrons to form cations and anions (C1.08)	p. 262-3
	• describe the formation of Na ⁺ and Cl ⁻ ions and hence the formation of ions in other ionic compounds from their atoms (C1.09)	p. 262-3
	• describe and explain the physical properties of giant ionic structures, including sodium chloride and magnesium oxide (C1.10)	p. 266-7
	• understand that covalent bonds can be made by electron sharing to form molecules (C1.11)	p. 270
	• describe the formation, including dot and cross diagrams, of simple molecules including H ₂ , HCl, H ₂ O and CO ₂ (C1.12)	271, Teacher Support Pack
	• describe and explain the physical properties of simple molecular substances	276
	• understand that covalent bond formation can also result in giant structures including diamond and graphite (C1.14)	272-3
	• describe and explain the physical properties of giant covalent structures including diamond and graphite (C1.15)	272-3
	• explain the difference between properties of simple molecular substances and giant covalent substances (C1.16)	276

C2 : Changing materials – formulae and equations

page numbers in **Chemistry for You**

<ul style="list-style-type: none"> Representing reactions 	Throughout

Representing reactions		
<i>Candidates will be assessed on their ability to:</i>		
	<ul style="list-style-type: none"> represent chemical reactions by word equations (C2.01) 	p. 17
	<ul style="list-style-type: none"> recall the formulae of elements and simple compounds in the specification (C2.02) 	throughout
	<ul style="list-style-type: none"> calculate relative formula mass from relative atomic masses (C2.03) 	p. 35
	<ul style="list-style-type: none"> write simple balanced equations (C2.04) 	24-5
	<ul style="list-style-type: none"> use the state symbols (s), (l), (g) and (aq) (C2.05) 	26
	<ul style="list-style-type: none"> write balanced equations to describe and explain a wide range of reactions including ionic equations and those occurring in electrolytic cells (C2.06) 	Throughout (Electrolysis in Chapter 9, 10)
	<ul style="list-style-type: none"> determine the formulae of simple compounds from reacting masses and understand that these are empirical (C2.07) 	358-61
	<ul style="list-style-type: none"> use chemical equations to calculate masses of reactants and products (C2.08) 	362-3

C3 : Patterns of behaviour – in elements and compounds

page numbers in **Chemistry for You**

• The periodic table	Chapter 4
• Noble gases	Chapter 6
• Alkali metals	Chapter 5
• Halogens	Chapter 6
• Transition metals	Chapter 5
• Chemicals from salt	Chapter 10
• Chemicals from calcium carbonate	Chapter 11

The periodic table		Chapter 4-6
<i>Candidates will be assessed on their ability to:</i>		
	• recall that there are approximately 100 elements and that all materials are composed of one or more of these (C3.01)	p. 16
	• understand that the periodic table shows elements in order of increasing atomic number, arranged in rows (periods) (C3.02)	p. 42-3
	• recall that elements with similar properties appear in the same vertical column (group) (C3.03)	p. 44
	• recall the positions of the alkali metals (group 1), the halogens (group 7), the noble gases (group 0) and the transition metals in the periodic table (C3.04)	p. 44
	• understand the connection between the number of outer electrons and the position of an element in the periodic table (C3.05)	p. 70
	• understand that the reactions of elements depend upon the arrangement of electrons in their atoms (C3.06)	p. 70-1
	• recall that there is a gradual change in the properties of the elements from the top to the bottom of each group (C3.07)	p. 51, 62, 67, 71
Noble gases		Chapter 6
<i>Candidates will be assessed on their ability to:</i>		
	• relate the uses of noble gases to their physical properties and lack of chemical reactivity (C3.08)	p. 68-9
	• explain the monatomic nature of noble gases (C3.09)	p. 66
Alkali metals		Chapter 5
<i>Candidates will be assessed on their ability to:</i>		
	• recall that the alkali metals have comparatively low melting points and boiling points and are softer than other metals (C3.10)	p. 50

	<ul style="list-style-type: none"> describe the relative reactivity of the alkali metals as exemplified by their reaction with water (C3.11) 	p. 51
	<ul style="list-style-type: none"> recall that common compounds of the alkali metals are soluble in water and that the oxides and hydroxides of the alkali metals are alkaline (pH>7) (C3.12) 	p. 51, 47
Halogens		Chapter 6
<i>Candidates will be assessed on their ability to:</i>		
	<ul style="list-style-type: none"> recall the colours and physical states of the halogens at room temperature (C3.13) 	p. 62
	<ul style="list-style-type: none"> recall that halogens react with metals to form metal halides (C3.14) 	p. 63
	<ul style="list-style-type: none"> recall that halogens react with hydrogen to produce hydrogen halides which dissolve in water to form acidic solutions (pH<7) (C3.15) 	Teacher Support Pack
	<ul style="list-style-type: none"> describe the relative reactivity of the halogens as exemplified by their displacement reactions with halide ions in aqueous solution (C3.16) 	p. 63
	<ul style="list-style-type: none"> describe the use of fluorides in the water supply and in toothpaste, of chlorine in water purification and of iodine as an antiseptic (C3.17) 	p. 64, 103
Transition metals		Chapter 5
<i>Candidates will be assessed on their ability to:</i>		
	<ul style="list-style-type: none"> recall that transition metal compounds are generally coloured (C3.18) 	p. 57
	<ul style="list-style-type: none"> recall the use of transition metals and their compounds as catalysts (C3.19) 	p. 57
	<ul style="list-style-type: none"> relate the uses of titanium, iron and copper to their properties (C3.20) 	p. 56, 59, 97
Chemicals from salt		Chapter 10
<i>Candidates will be assessed on their ability to:</i>		
	<ul style="list-style-type: none"> recall that hydrogen, chlorine and sodium hydroxide are produced by the electrolysis of concentrated aqueous sodium chloride and know how to test for these substances (C3.21) 	p. 122
	<ul style="list-style-type: none"> describe the uses of sodium chloride, hydrogen, chlorine and sodium hydroxide (C3.22) 	64, 119, 124-5
Chemicals from calcium carbonate		Chapter 11
<i>Candidates will be assessed on their ability to:</i>		
	<ul style="list-style-type: none"> describe the thermal decomposition of calcium carbonate to make calcium oxide and carbon dioxide (C3.23) 	128-9
	<ul style="list-style-type: none"> describe the effect of water on calcium oxide and appreciate that the solution produced is lime water (C3.24) 	128-9
	<ul style="list-style-type: none"> understand why calcium oxide and calcium hydroxide are used to neutralise soil acidity (C3.25) 	156
	<ul style="list-style-type: none"> recall that calcium carbonate is used in the production of glass, cement and iron (C3.26) 	130-3, 91

C4 : Changing materials – useful products

page numbers in **Chemistry for You**

• Extraction and uses of metals	Chapter 8,9
• Useful products from crude oil	Chapter 13, 15

Extraction and uses of metals		Chapter 8, 9
<i>Candidates will be assessed on their ability to:</i>		
	• define oxidation in terms of gain of oxygen and reduction in terms of loss of oxygen (C4.01)	p. 90
	• define oxidation in terms of loss of electrons and reduction in terms of gain of electrons (C4.02)	115
	• understand that the extraction of metals involves reduction of their ores (C4.03)	90
	• recall how the way in which a particular metal is extracted from its ores is related to its position in the reactivity series (C4.04)	89, 98
	• understand that processes involving the use of large amounts of electricity are relatively expensive (C4.05)	98
	• describe the extraction of aluminium from purified bauxite including simple cell diagram, nature of electrolyte and electrodes, and reactions (C4.06)	107
	• relate the uses of aluminium to its properties (C4.07)	107-8
	• recall that carbon and carbon monoxide can reduce the oxides of less reactive metals (C4.08)	90, 98
	• describe the extraction of iron in the blast furnace, including outline diagram, raw materials, reactions and the formation and uses of slag (C4.09)	91
	• describe the purification of copper by electrolysis, including a simple diagram of the cell (C4.10)	113
Useful products from crude oil		Chapter 13
<i>Candidates will be assessed on their ability to:</i>		
	• recall that hydrocarbons contain carbon and hydrogen only and that crude oil is a mixture of hydrocarbons (C4.11)	p. 159
	• describe the fractional distillation of crude oil (C4.12)	p. 162-4
	• understand that the larger the hydrocarbon molecule, the higher the boiling point of the hydrocarbon and the less volatile it is at a given temperature (C4.13)	p. 163-4
	• recall the uses of the main fractions (gases, petrol, naphtha, kerosene, diesel oil, fuel oil, bitumen) (C4.14)	p. 164

	<ul style="list-style-type: none"> recall and explain the formation of the products of the complete and incomplete combustion (oxidation) of hydrocarbons, and the possible effect of these on the environment (C4.15) 	p. 187-9
	<ul style="list-style-type: none"> describe how to test for carbon dioxide (using lime water) and water (using cobalt chloride) (C4.16) 	p. 189
	<ul style="list-style-type: none"> explain that cracking involves the breaking down of larger hydrocarbon molecules into smaller, more useful ones, some of which have carbon-carbon double bonds (C4.17) 	p. 165
	<ul style="list-style-type: none"> describe the conditions used in industry to crack fractions obtained from crude oil (C4.18) 	165
	<ul style="list-style-type: none"> recall that, when alkanes are cracked, mixtures of alkanes and alkenes are formed (C4.19) 	165
	<ul style="list-style-type: none"> explain that alkanes are saturated hydrocarbons and that alkenes are unsaturated hydrocarbons (C4.20) 	167
	<ul style="list-style-type: none"> recall that methane is the main constituent of natural gas (C4.21) 	159
	<ul style="list-style-type: none"> recall the formulae of methane, ethane, propane and butane (not methyl propane) and draw the structures of these molecules (C4.22) 	159
	<ul style="list-style-type: none"> recall the formulae of ethene and propene and draw the structures of their molecules (C4.23) 	167
	<ul style="list-style-type: none"> describe how bromine water is used to distinguish between alkanes and alkenes (C4.24) 	167
	<ul style="list-style-type: none"> recall that polymers are large molecules which can be formed by a combination of many smaller molecules (C4.25) 	166
	<ul style="list-style-type: none"> explain how addition polymers are formed from unsaturated monomers (equations required but not conditions and mechanisms) (C4.26) 	168
	<ul style="list-style-type: none"> describe the uses and associated properties of poly(ethene), poly(propene) and poly(chloroethene) (C4.27) 	171

C5 : Patterns of behaviour – in reactions

page numbers in **Chemistry for You**

• Rates of reaction	Chapter 16, 17
• Energy transfers accompanying reactions	Chapter 15

Rates of reaction		Chapter 16, 17
<i>Candidates will be assessed on their ability to:</i>		
	• recall that the rates of chemical reactions vary from very fast, explosive reactions to very slow reactions which form no detectable products (C5.01)	p. 199
	• describe experiments to investigate the effect of temperature, concentration and surface area of a solid on the rate of a reaction (C5.02)	200-7
	• interpret the results of such experiments (C5.03)	200-7
	• recall and explain the effect of changes in temperature, concentration and surface area of a solid on a given rate of reaction (C5.04)	200-7
	• understand that reactions can occur when particles collide and that increasing the frequency and energy of collisions increases the rate of the reaction (C5.05)	203
	• describe the effect of a catalyst on a given rate of reaction (C5.06)	208
	• define enzymes as catalysts in biological systems and describe their use in washing powder, and food and drink manufacture (C5.07)	214-17
	• describe how the rates of enzyme-catalysed reactions vary with temperature and pH (C5.08)	213
Energy transfers accompanying reactions		Chapter 15
<i>Candidates will be assessed on their ability to:</i>		
	• recall that changes of temperature often accompany reactions (C5.09)	p. 190-1
	• define an exothermic reaction as one in which heat energy is given out, and give examples (C5.10)	190-1
	• define an endothermic reaction as one in which heat energy is taken in, and give examples (C5.11)	190-1
	• recall that the breaking of bonds is endothermic and that the making of bonds is exothermic (C5.12)	194

C6 : Changing materials – the environment

page numbers in **Chemistry for You**

<ul style="list-style-type: none"> Manufacture of ammonia and fertilisers 	Chapter 19, 20
<ul style="list-style-type: none"> The Earth and its atmosphere 	Chapter 25, 26

Manufacture of ammonia and fertilisers		Chapter 19, 20
<i>Candidates will be assessed on their ability to:</i>		
	<ul style="list-style-type: none"> describe the conditions under which ammonia is produced from nitrogen and hydrogen in the Haber process (C6.01) 	p. 240-1, 243
	<ul style="list-style-type: none"> understand that this reaction is reversible and may reach a dynamic equilibrium (C6.02) 	241
	<ul style="list-style-type: none"> understand how the position of a dynamic equilibrium is affected by changes of temperature and pressure, to include the Haber process as an example (C6.03) 	236, 241
	<ul style="list-style-type: none"> understand the consequential effects of these changes on the rate of attainment of equilibrium and the need to use a catalyst (C6.04) 	241
	<ul style="list-style-type: none"> recall that a nitrogenous fertiliser is manufactured by neutralising ammonia with nitric acid (C6.05) 	247
	<ul style="list-style-type: none"> recall that nitrogenous fertilisers promote plant growth (C6.06) 	242, 248
	<ul style="list-style-type: none"> understand that the process of leaching of artificial fertilisers causes excessive plant growth in rivers and lakes and may be harmful to health (C6.07) 	250
The Earth and its atmosphere		Chapter 25, 26
<i>Candidates will be assessed on their ability to:</i>		
	<ul style="list-style-type: none"> describe the composition of the atmosphere (C6.08) 	p. 314
	<ul style="list-style-type: none"> understand that the Earth's early atmosphere was probably formed from the gases produced by volcanic activity (C6.09) 	320-1
	<ul style="list-style-type: none"> recall that originally the atmosphere probably contained a large amount of carbon dioxide together with water vapour, hydrogen, nitrogen and carbon monoxide (C6.10) 	320-1
	<ul style="list-style-type: none"> explain the origin of the oceans by condensation of water vapour and describe how the percentage of carbon dioxide in the atmosphere was consequently reduced (C6.11) 	320-1
	<ul style="list-style-type: none"> explain that the first primitive plants released oxygen as a result of photosynthesis and that the percentage of oxygen in the atmosphere gradually increased (C6.12) 	320-1
	<ul style="list-style-type: none"> explain how the carbon cycle helps to maintain atmospheric composition, ie carbon dioxide is added to the atmosphere by respiration and combustion and removed by photosynthesis and dissolving in water (C6.13) 	318

	<ul style="list-style-type: none"> understand that the crystalline nature of igneous rocks and the fact that they do not contain fossils are evidence for their formation from hot, molten magma (C6.14) 	p. 332
	<ul style="list-style-type: none"> understand that crystal size in igneous rocks depends on the rate of cooling (C6.15) 	332
	<ul style="list-style-type: none"> understand that the presence of fossils in a rock is evidence that it has been formed from sediments (C6.16) 	330, Teacher Support Pack
	<ul style="list-style-type: none"> understand that in sedimentary rocks the deepest layers are usually the oldest, that sedimentary rocks may contain fossils, and that the type of fossil can help to date the rocks (C6.17) 	330, Teacher Support Pack
	<ul style="list-style-type: none"> explain how metamorphic rocks are formed by the action of heat and pressure on existing rocks (C6.18) 	331
	<ul style="list-style-type: none"> understand that metamorphic rocks having the same composition as other rocks is evidence for their formation from these rocks – eg marble and limestone are both calcium carbonate (C6.19) 	331

P1 : Electricity and magnetism

page numbers in **Physics for You**

• Units	Chapters 31, 32
• Mains electricity	Chapter 32
• Energy and potential difference in circuits	Chapter 31
• Electric charge	Chapter 30
• Electromagnetism	Chapter 35
• Electromagnetic induction	Chapter 36

Units	Chapters 31, 32
<i>Candidates will be assessed on their ability to:</i>	
<ul style="list-style-type: none"> use the following units: ampere (A), coulomb (C), ohm (Ω), volt (V), watt (W), kilowatt-hour (kW h) (P1.01) 	pages 259, 266, 267, 272-3
Mains electricity	Chapter 32
<i>Candidates will be assessed on their ability to:</i>	
<ul style="list-style-type: none"> identify the live, neutral and earth conductor in a correctly-wired plug and recall the colour of the insulation used on each conductor (P1.02) 	p. 275
<ul style="list-style-type: none"> recall the hazards of electricity including frayed cables, long cables, damaged plugs, water around sockets and pushing metal objects into sockets (P1.03) 	p. 274-5
<ul style="list-style-type: none"> describe the uses of insulation, double insulation, earthing, fuses and circuit breakers in a range of domestic appliances (P1.04) 	p. 274-5, 301, 312, worksheet
<ul style="list-style-type: none"> recall that electrical heating is used in a variety of ways in domestic contexts (P1.05) 	p. 270-1
<ul style="list-style-type: none"> understand that a current in a resistor results in the electrical transfer of energy and an increase in temperature (P1.06) 	p. 260, 270
<ul style="list-style-type: none"> recall and use the quantitative relationship between power, current and voltage: power = current \times voltage $P = I \times V$ and apply the above relationship to the selection of appropriate fuses (P1.07) 	p. 272, 275
<ul style="list-style-type: none"> calculate the energy used by domestic appliances in kilowatt-hours and calculate domestic electricity bills, based on meter readings (P1.08) 	p. 273
<ul style="list-style-type: none"> use the quantitative relationship between energy transferred, current, voltage and time: energy transferred = current \times voltage \times time $E = I \times V \times t$ (P1.09) 	p. 272
<ul style="list-style-type: none"> recall that mains electricity is alternating current (a.c.) and understand the difference between this and the direct current (d.c.) supplied by a cell (P1.10) 	p. 274, 305
Energy and potential difference in circuits	Chapter 31
<i>Candidates will be assessed on their ability to:</i>	
<ul style="list-style-type: none"> explain whether a series or parallel circuit is more appropriate for a range of applications, including domestic lighting (P1.11) 	p. 256-7
<ul style="list-style-type: none"> understand that the current in a series circuit depends on the applied voltage and the number and nature of other components (P1.12) 	p. 256, 262

	<ul style="list-style-type: none"> describe how current varies with voltage in wires, resistors, metal filament lamps and diodes and how this can be investigated experimentally (P1.13) 	p. 261, 265, 322
	<ul style="list-style-type: none"> describe the qualitative effect of changing resistance on the current in a circuit (P1.14) 	p. 255, 260
	<ul style="list-style-type: none"> describe the qualitative variation of resistance of LDRs with illumination and of thermistors with temperature (P1.15) 	p. 265, 325
	<ul style="list-style-type: none"> recall and use the quantitative relationship between voltage, current and resistance: voltage = current \times resistance $V = I \times R$ (P1.16) 	p. 259
	<ul style="list-style-type: none"> understand that current is rate of flow of charge (P1.17) 	p. 255, 256, 266, 278
	<ul style="list-style-type: none"> recall and use the quantitative relationship between charge, current and time: charge = current \times time $Q = I \times t$ (P1.18) 	p. 266
	<ul style="list-style-type: none"> recall electric current in solid metallic conductors is a flow of negatively charged electrons (P1.19) 	p. 255, 256, 266
	<ul style="list-style-type: none"> recall that electric current in molten or dissolved electrolytes is a flow of negatively charged ions to the positive terminal and positively charged ions to the negative terminal (P1.20) 	p. 278
	<ul style="list-style-type: none"> recall that: <ul style="list-style-type: none"> voltage is the energy transferred per unit charge passed a volt is a joule per coulomb (P1.21) 	p. 267
Electric charge		Chapter 30
<i>Candidates will be assessed on their ability to:</i>		
	<ul style="list-style-type: none"> describe common materials which are electrical conductors or insulators including metals and plastics (P1.22) 	p. 249
	<ul style="list-style-type: none"> recall that insulating materials can be charged by friction (P1.23) 	p. 247
	<ul style="list-style-type: none"> explain that positive and negative electrostatic charges are produced on materials by the loss and gain of electrons (P1.24) 	p. 248
	<ul style="list-style-type: none"> recall that there are forces of attraction between unlike charges and repulsion between like charges (P1.25) 	p. 247
	<ul style="list-style-type: none"> explain common electrostatic phenomena, including shocks from car doors and synthetic fabrics, in terms of the movement of electrons (P1.26) 	p. 248, 251, 252
	<ul style="list-style-type: none"> describe the potential dangers and uses of electrostatic charges generated in everyday situations, eg fuelling aircraft and tankers, photocopiers and inkjet printers (P1.27) 	p. 252, 321


Electromagnetism		Chapter 35
<i>Candidates will be assessed on their ability to:</i>		
	<ul style="list-style-type: none"> recall that a force is exerted on a current-carrying wire in a magnetic field and the application of this effect in simple d.c. electric motors and loudspeakers (P1.28) 	p. 296-9
	<ul style="list-style-type: none"> understand that when a wire carrying a current is perpendicular to a magnetic field, the resulting force is perpendicular to both (P1.29) 	p. 296


Electromagnetic induction		Chapter 36
<i>Candidates will be assessed on their ability to:</i>		
	<ul style="list-style-type: none"> recall that a voltage is induced in a conductor when it moves through a magnetic field or when a magnetic field changes through a coil, and recall the factors which affect the size of the induced voltage (P1.30) 	p. 302-3
	<ul style="list-style-type: none"> describe the generation of electricity by the rotation of a magnet within a coil of wire and of a coil of wire within a magnetic field and the factors which affect the size of the induced voltage (P1.31) 	p. 304, 306
	<ul style="list-style-type: none"> recall the structure of a transformer and understand that a transformer changes the size of an alternating voltage by having different numbers of turns on the input and output sides (P1.32) 	p. 307-9
	<ul style="list-style-type: none"> describe the use of step-up and step-down transformers in the large-scale transmission of electrical energy (P1.33) 	p. 309
	<ul style="list-style-type: none"> recall and use the quantitative relationship between input (primary) and output (secondary) voltages and the turns ratio for a transformer: $\frac{\text{voltage(primary)}}{\text{voltage(secondary)}} = \frac{\text{turns(primary)}}{\text{turns(secondary)}}$ $\frac{V_P}{V_S} = \frac{n_P}{n_S} \quad (\text{P1.34})$ 	p. 308

P2 : Forces and motion

page numbers in **Physics for You**

• Units	Chapter 1
• Movement and position	Chapter 18
• Forces and movement	Chapters 11, 14
• Forces and shape	Chaps 11, 3, 6

Units	Chapter 1
<i>Candidates will be assessed on their ability to:</i>	
<ul style="list-style-type: none"> use the following units: kilogram (kg), metre (m), metre² (m²), metre³ (m³), metre/second (m/s), metre/second² (m/s²), newton (N), pascal (Pa) (P2.01) 	p. 6-7, 75, 85, 130, 138,
Movement and position	Chapter 18
<i>Candidates will be assessed on their ability to:</i>	
<ul style="list-style-type: none"> understand distance – time graphs (P2.02) 	p. 134
<ul style="list-style-type: none"> explain the difference between speed and velocity (P2.03) 	p. 130
<ul style="list-style-type: none"> recall and use the quantitative relationship between acceleration, velocity and time: $\text{acceleration} = \frac{\text{change in velocity}}{\text{time taken}} \quad a = \frac{(v - u)}{t}$ 	p. 130
(P2.04)	
<ul style="list-style-type: none"> interpret speed-time graphs and determine acceleration from the gradient of the graph (P2.05) 	p. 132-3
<ul style="list-style-type: none"> determine the distance travelled from the area between the curve and the time axis (P2.06) 	p. 133
Forces and movement	Chapters 11, 14
<i>Candidates will be assessed on their ability to:</i>	
 <ul style="list-style-type: none"> recall a brief history of our understanding of forces including: <ul style="list-style-type: none"> the Greek view – a single force needed to sustain motion Galileo and Newton – balanced forces allow an object to continue in uniform motion in a straight line or to remain at rest Newton – gravitational attraction acts between all masses (P2.07) 	p. 368 p. 77 p. 139, 162
<ul style="list-style-type: none"> recall that when two bodies interact, the forces they exert on each other are equal and opposite (P2.08) 	p. 94-5
<ul style="list-style-type: none"> understand how to add forces which act along a line (P2.09) 	p. 96
<ul style="list-style-type: none"> understand that friction can produce both accelerating and retarding forces (P2.10) 	p. 92-3, 98-9


	<ul style="list-style-type: none"> recall and use the quantitative relationship between unbalanced force, mass and acceleration and apply this relationship to vehicular and human movement: force = mass \times acceleration $F = m \times a$ (P2.11) 	p. 138-9
	<ul style="list-style-type: none"> recall and use the quantitative relationship between weight, mass and g: weight = mass $\times g$ $W = m \times g$ (P2.12) 	p. 139
	<ul style="list-style-type: none"> recall that a mass of 1 kg has a weight of 10 N on Earth; ie the Earth's gravitational field strength is 10 N/kg (P2.13) 	p. 75, 139
	<ul style="list-style-type: none"> explain the forces acting on falling objects and why falling objects reach a terminal velocity (P2.14) 	p. 136
	<ul style="list-style-type: none"> understand that the stopping distance of a vehicle is the sum of the thinking distance and the stopping distance (P2.15) 	p. 98
	<ul style="list-style-type: none"> describe the factors affecting vehicle stopping distances including speed, mass, road condition and reaction time (P2.16) 	p. 98
Forces and shape		Chaps 11, 3, 6
In order to meet statutory requirements, candidates following the Welsh National Curriculum should be taught the principle of moments and its application to situations involving one pivot.		
<i>Candidates will be assessed on their ability to:</i>		
	<ul style="list-style-type: none"> understand that the upward forces on a light beam supported at its ends vary with the position of a heavy object placed on the beam (P2.17) 	p. 100
	<ul style="list-style-type: none"> describe how extension varies with applied force for a range of materials including springs and/or rubber bands (P2.18) 	p. 74
	<ul style="list-style-type: none"> recall that particles in a gas have random motion and that they exert a force on the walls of the container (P2.19) 	p. 14-16
	<ul style="list-style-type: none"> understand the relationship between the pressure and volume of a fixed mass of gas at constant temperature and use the quantitative relationship $P_1 \times V_1 = P_2 \times V_2$ (P2.20) 	p. 31, 35, 36

P3 : Waves

page numbers in **Physics for You**

• Units	Chapter 21
• Properties of waves	Chapter 21
• The Earth's layered structures	Chapter 20
• The electromagnetic spectrum	Chapter 28
• Light and sound	Chaps 23, 25, 29

Units	Chapter 21
<i>Candidates will be assessed on their ability to:</i>	
<ul style="list-style-type: none"> use the following units: hertz (Hz), kilohertz (kHz), megahertz (MHz), metre/second (m/s) (P3.01) 	p. 175
Properties of waves	Chapter 21
<i>Candidates will be assessed on their ability to:</i>	
<ul style="list-style-type: none"> describe longitudinal and transverse waves in ropes, springs and water (P3.02) 	p. 174
<ul style="list-style-type: none"> state the meaning of amplitude, frequency, wavelength and period of a wave (P3.03) 	p. 175
<ul style="list-style-type: none"> recall that waves transfer energy and information without transferring matter (P3.04) 	p. 174, 219
<ul style="list-style-type: none"> recall and use the quantitative relationship between the speed, frequency and wavelength of a wave: speed = frequency \times wavelength $v = f \times \lambda$ (P3.05) 	p. 175, 229
<ul style="list-style-type: none"> use the quantitative relationship between frequency and time period: frequency = $\frac{1}{\text{time period}}$ $f = \frac{1}{T}$ (P3.06) 	p. 175, worksheet
<ul style="list-style-type: none"> use the above relationships in a wide range of contexts including sound waves and electromagnetic waves (P3.07) 	p. 175, 219, 229
<ul style="list-style-type: none"> understand that waves can be diffracted through gaps or when they pass an edge and that the extent of diffraction depends on the wavelength and the physical dimension (P3.08) 	p. 177
The Earth's layered structure	Chapter 20
<i>Candidates will be assessed on their ability to:</i>	
<ul style="list-style-type: none"> understand that the different ways in which longitudinal and transverse waves are transmitted through the Earth, and their paths and times of travel, provide evidence for the Earth's layered structure: crust, mantle, outer (liquid) core, inner core (P3.09) 	p. 154-5
<ul style="list-style-type: none"> recall that the Earth's outermost layer, the lithosphere, is composed of plates in relative motion and that plate tectonic processes result in the formation, deformation and recycling of rocks (P3.10) 	p. 156-7




	<ul style="list-style-type: none"> understand that at plate boundaries, plates may: <ul style="list-style-type: none"> slide past each other, causing earthquakes move towards each other, taking rock into the mantle move away from each other, resulting in volcanoes and/or formation of new rocks (P3.11) 	p. 157
The electromagnetic spectrum		Chapter 28
<i>Candidates will be assessed on their ability to:</i>		
	<ul style="list-style-type: none"> understand that light is part of a continuous electromagnetic spectrum which includes radio, microwave, infra-red, visible, ultraviolet, X-ray and gamma ray radiations and that all these waves travel at the same speed in free space (P3.12) 	p. 218-9
	<ul style="list-style-type: none"> recall the order of the electromagnetic spectrum in decreasing wavelength and increasing frequency, including the colours of the visible spectrum (P3.13) 	p. 216-9
	<ul style="list-style-type: none"> recall some uses of electromagnetic radiations including: 	
	<ul style="list-style-type: none"> radio waves: broadcasting and communications 	p. 177, 219, 221, 320, 335
	<ul style="list-style-type: none"> microwaves: cooking and satellite transmissions 	p. 219, 221, 227, 320
	<ul style="list-style-type: none"> infra-red: heaters, grills, night vision and remote controls 	p. 48-53, 219, 221, 227
	<ul style="list-style-type: none"> visible light: optical fibres and photography 	p. 195-7, 200, 219, 206-7
	<ul style="list-style-type: none"> ultraviolet: sunbeds, crime prevention and fluorescent lamps 	p. 218, 220, 226
	<ul style="list-style-type: none"> X-rays: observing the internal structure of objects and materials, medical applications 	p. 218, 220, 226, 318
	<ul style="list-style-type: none"> gamma rays: sterilising food and medical equipment (P3.14) 	p. 218, 220, 356-7
	<ul style="list-style-type: none"> recall the detrimental effects of excessive exposure of the human body to electromagnetic waves of increasing frequencies including: 	
	<ul style="list-style-type: none"> microwaves: internal heating of body tissue 	p. 219, 227
	<ul style="list-style-type: none"> infra-red: skin burns 	p. 219
	<ul style="list-style-type: none"> ultraviolet: damage to surface cells and blindness 	p. 218, 220
	<ul style="list-style-type: none"> gamma rays: cancer, mutation (P3.15) 	p. 218, 220
Light and sound		Chaps 23, 25, 29
<i>Candidates will be assessed on their ability to:</i>		
	<ul style="list-style-type: none"> recall that light waves are transverse waves which can be reflected, refracted and diffracted (P3.16) 	p. 174, 176-7, 184-7, 192
	<ul style="list-style-type: none"> describe the role of total internal reflection in transmitting information along optical fibres and in prisms (P3.17) 	p. 195-7, 200
	<ul style="list-style-type: none"> understand the difference between analogue and digital signals (P3.18) 	p. 312, 332
	<ul style="list-style-type: none"> describe how digital signals can carry more information (P3.19) 	p. 333

	<ul style="list-style-type: none"> recall that sound waves are longitudinal waves which can be reflected, refracted and diffracted (P3.20) 	p. 174, 177, 229-31, 240, 245
	<ul style="list-style-type: none"> recall that the frequency range for human hearing is 20 Hz – 20 000 Hz (P3.21) 	p. 232
	<ul style="list-style-type: none"> understand the nature of ultrasound as high-frequency sound and its applications in scanning, cleaning and range or direction finding (P3.22) 	p. 230, 240-1

P4 : The Earth and beyond

page numbers in **Physics for You**

• The Solar system	Chapter 20
• The rest of the Universe	Chapter 20

The Solar system		Chapter 20
<i>Candidates will be assessed on their ability to:</i>		
	<ul style="list-style-type: none"> interpret physical data on the planets, particularly with regard to their masses and their orbits in the Solar system (P4.01) 	p. 160-1
	<ul style="list-style-type: none"> describe the differences between the orbits of a planet and a moon, and also of a comet, and describe the different types of orbit of satellites around the Earth (P4.02) 	p. 158-9, 162-3, 168-9
	<ul style="list-style-type: none"> understand that the movements and orbits of planets and moons, and of comets and satellites, are determined by gravitational forces (P4.03) 	p. 158-9, 162-3, 168-9
The rest of the Universe		Chapter 20
<i>Candidates will be assessed on their ability to:</i>		
	<ul style="list-style-type: none"> recall that the Sun is one of many millions of stars in a huge group called the Milky Way galaxy (P4.04) 	p. 165
	<ul style="list-style-type: none"> describe the Universe as a system consisting of an enormous number of galaxies and be aware of the search for evidence of extraterrestrial life (P4.05) 	p. 166-7
	<ul style="list-style-type: none"> describe how stars form from very large clouds of hydrogen, helium and dust which collapse under the influence of gravity so that the core becomes hot enough for nuclear reactions to begin (P4.06) 	p. 163-4
	<ul style="list-style-type: none"> recall that small stars, like the Sun, eventually become red giants and later become white dwarfs (P4.07) 	p. 165
	<ul style="list-style-type: none"> describe the 'Big Bang' theory of the origin of the Universe and consider other theories such as the 'steady state' theory (P4.08) 	p. 166, 369
	<ul style="list-style-type: none"> recall evidence for the 'Big Bang' theory, including the different red shifts of light from distant galaxies and the background microwave radiation (P4.09) 	p. 166-7
	<ul style="list-style-type: none"> explain how the future of the Universe depends on the amount of mass present (P4.10) 	p. 166, worksheet

P5 : Energy resources and energy transfer

pages in **Physics for You**

• Units	Chapters 5, 16
• Energy transfer	Chaps 2, 8, 16
• Work and power	Chapter 16
• Energy resources and electricity generation	Chapters 2, 16

Units	Chapters 5, 16
<i>Candidates will be assessed on their ability to:</i>	
<ul style="list-style-type: none"> use the following units: degree Celsius (°C), joule (J), newton (N), watt (W), kilowatt (kW), megawatt (MW) (P5.01) 	29, 107, 118, 138
Energy transfer	Chaps 2, 8, 16
<i>Candidates will be assessed on their ability to:</i>	
<ul style="list-style-type: none"> describe energy transfers involving the following forms of energy: thermal, light, electrical, sound, movement (kinetic), chemical, nuclear and potential (elastic and gravitational) (P5.02) 	p. 8-9, 42-51, 110-11
<ul style="list-style-type: none"> understand that energy is conserved (P5.03) 	p. 108-9
<ul style="list-style-type: none"> recall that efficiency is the proportion of energy transferred to useful work and apply this to everyday situations (P5.04) 	p. 112, 122
<ul style="list-style-type: none"> describe a variety of everyday and scientific devices and situations, explaining the fate of the input energy in the above terms, including their representation by flow diagrams (Sankey diagrams) (P5.05) 	p. 112-3, 122
<ul style="list-style-type: none"> describe how insulation is used to reduce energy transfers from buildings and the human body (P5.06) 	p. 44-5, 53
<ul style="list-style-type: none"> understand that many insulating materials make use of the insulating properties of air that is not free to form convection currents (P5.07) 	p. 44-5, 53
Work and power	Chapter 16
<i>Candidates will be assessed on their ability to:</i>	
<ul style="list-style-type: none"> recall and use the quantitative relationship between work, force and distance moved in the direction of the force: work done = force × distance moved $W = F \times d$ (P5.08) 	p. 107
<ul style="list-style-type: none"> understand that work done is equal to energy transferred (P5.09) 	p. 109
<ul style="list-style-type: none"> recall and use the quantitative relationships: gravitational potential energy = mass × g × height $GPE = m \times g \times h$ kinetic energy = ½ × mass × speed² $KE = \frac{1}{2} \times m \times v^2$ (P5.10) 	p. 116-17
<ul style="list-style-type: none"> understand how conservation of energy produces a quantitative link between potential energy, kinetic energy and work (P5.11) 	p. 117
<ul style="list-style-type: none"> describe power as the rate of transfer of energy or the rate of doing work (P5.12) 	p. 118-19

	<ul style="list-style-type: none"> use the quantitative relationship between power, work done (energy transferred) and time taken: $\text{power} = \frac{\text{work done}}{\text{time taken}} \quad P = \frac{W}{t} \quad (\text{P5.13})$ 	p. 118
Energy resources and electricity generation		Chapter 2, 16
<i>Candidates will be assessed on their ability to:</i>		
	<ul style="list-style-type: none"> understand a range of energy transfer chains illustrating the environmental implications of generating electricity, including: <ul style="list-style-type: none"> the use of wind and water geothermal resources solar heating systems and electricity production through solar cells fossil fuel reserves nuclear power (P5.14) 	<p>p. 11-13 p. 110-15</p> <p>p. 52, 113-14</p> <p>p. 359</p>
	<ul style="list-style-type: none"> describe the advantages and disadvantages of methods of large scale electricity production using a variety of renewable and non-renewable resources (P5.15) 	p. 11-13, 113-15

P6 : Radioactivity

page numbers in **Physics for You**

• Units	Chapter 39
• Radioactivity	Chapter 39

Units	Chapter 39
<i>Candidates will be assessed on their ability to:</i>	
• use the following unit: becquerel (Bq) (P6.01)	p. 360
Radioactivity	Chapter 39
<i>Candidates will be assessed on their ability to:</i>	
• describe the structure of an atom in terms of protons, neutrons and electrons and use symbols such as ${}^{14}_6\text{C}$ to describe particular nuclei (P6.02)	p. 352-3
• understand the terms atomic (proton) number and mass (nucleon) number and explain the existence of isotopes (P6.03)	p. 353
• understand that alpha and beta particles and gamma rays are ionising radiations emitted from unstable nuclei in a random process (P6.04)	p. 350-1
• describe the nature of alpha and beta particles and gamma rays and recall that they may be distinguished in terms of penetrating power and ionising ability	p. 350-1
• describe the effects on the atomic and mass numbers of a nucleus of the emission of each of the three main types of radiation and understand how to complete balanced nuclear equations (P6.06)	p. 355
• understand that ionising radiation can be detected using a photographic film or a Geiger-Müller detector (P6.07)	p. 348-9
• recall the existence of background radiation from the Earth and from space, including the regional variations in the United Kingdom, eg because of radon gas released from rocks (P6.08)	p. 360
• understand that the activity of a radioactive source decreases over a period of time and is measured in becquerels (P6.09)	p. 354, 360
• recall the term half-life and understand that it is different for different radioactive isotopes (P6.10)	p. 354
• use the concept of half-life to carry out simple calculations on activity (P6.11)	p. 354
• describe the uses of radioactivity in medical and non-medical tracers, in radiotherapy and in the radioactive dating of archaeological specimens and rocks (P6.12)	p. 356-7, 362
• describe the dangers of ionising radiations including: <ul style="list-style-type: none"> • radiation can cause mutations in living organisms • radiation can damage cells and tissue • the problems arising in the disposal of radioactive waste (P6.13) 	p. 220, 360, 373, worksheet



End of syllabus content