
OCR Science Single Award 'A' (code 1984)

Please check that you have chosen the correct specification

5 SPECIFICATION CONTENT

Format

On the following pages, the first 2 columns show the specification content for each section of this syllabus specification.

The third column is provided to give additional information, in abbreviated form.

Abbreviation	Explanation and guidance
H	These are Learning Outcomes which are appropriate for candidates working at higher levels. Questions addressing these Learning Outcomes will only appear on the Higher Tier papers, and hence they are only appropriate for candidates likely to achieve A*A*, AA or BB grades.

The fourth column shows the relevant **page numbers** in

Biology for You

Chemistry for You

Physics for You

(the revised editions, first published in 2001).

Block 2.1 Introducing Biological Principles

Page Numbers
in
Biology for You

Learning Outcomes Candidates should be able to :

Cell structure and function			
1	recognise that animal and plant cells have certain structures in common to include the: <ul style="list-style-type: none"> cell membrane, controlling the movement of substances in and out of the cell cytoplasm containing enzymes, which are protein molecules that catalyse biological reactions nucleus, containing the genetic material mitochondria, the site of many of the reactions of respiration. 	H	8+9 8+9 8+9 9
2	describe in simple terms the life processes of movement, reproduction, sensitivity, growth, respiration, excretion and nutrition.		9
3	appreciate that these life processes are achieved by the co-ordinated action of cells acting together in tissues, organs and systems.		15-16

Block 2.2 Digestion

Page numbers
in
Biology for You

Learning Outcomes Candidates should be able to :

1	name and locate the main parts of the human digestive system to include mouth, oesophagus, stomach, small and large intestines and associated organs (liver and pancreas).		58-61
2	name the organs or glands that produce the enzymes amylase, protease and lipase.		58-60
3	explain the role of enzymes in digesting large food molecules to form small soluble molecules to include: <ul style="list-style-type: none"> starch to maltose, by amylase, in the mouth and small intestine proteins to amino acids, by proteases, in the stomach and small intestine fats to fatty acids and glycerol, by lipase, in the small intestine. 		31, 32, 34 57, 58, 59 60
4	demonstrate the action of amylase on starch and protease on proteins, by the use of simple food tests: <ul style="list-style-type: none"> starch (iodine solution) protein (biuret) simple sugars (Benedict's solution) 		32, 34 45, 46, 47

5	describe the role of stomach acid in sterilising food and adjusting pH for enzyme activity.		59
6	describe the role of bile in emulsifying fats.		60
7	describe the role of the small intestine in the absorption of the digested food.		61
8	explain how the small intestine is adapted for the role of absorption to include: <ul style="list-style-type: none"> • long length • folds • the structure and function of villi. 	H	61

Block 2.3 Transport

Page numbers
in
Biology for You

Learning Outcomes

Candidates should be able to :

Blood			
1	state that : <ul style="list-style-type: none"> • blood consists of plasma, red blood cells, platelets and white blood cells • plasma carries dissolved food substances, urea, carbon dioxide and hormones • red blood cells carry oxygen • platelets help in the clotting of blood. 		97-100
2	explain how the structure of red blood cells is adapted to their function (haemoglobin, surface area, no nucleus).	H	98
3	describe how blood, along with the skin, acts as defence against infection, limited to: <ul style="list-style-type: none"> • the skin and the formation of blood clots acting as barriers against infection • white cells protecting against infection either by engulfing microbes or by producing antibodies. 		99-100

Learning Outcomes

Candidates should be able to :

Organisms and habitats			
1	explain the meaning of the terms habitat, population and community.		328
2	recognise that different organisms are restricted to certain habitats and are not usually distributed at random in a habitat.		331, 336, 337
3	describe how the presence and number of predators influences the abundance of organisms in a habitat, as illustrated by a 'predator-prey' graph.		341-345
4	describe how competition acts as a factor in determining the distribution of organisms in a habitat, to include the competition of plants for light and water and the competition between animals for food.		339-340
5	explain how some organisms rely on the presence of organisms of a different species in order to exist in a habitat. (Candidates should be aware of one such mutualistic relationship).		373
6	explain how organisms are adapted to living in a particular habitat to include: <ul style="list-style-type: none"> the features of a polar bear, adapting it to living in a very cold climate the features of a camel, adapting it to living in a hot, dry climate. 	H	336-337 338 338
The influence of human activity on the environment			
7	recognise that increases in population size produce an increased demand for food production, waste disposal and energy.		333, 344-345
8	discuss the impact on the environment of the use of biological and chemical pest control methods that have been used in an attempt to increase food production.	H	364-365
9	discuss how an increased demand for energy has led to: <ul style="list-style-type: none"> the growth of industrial processes the introduction of attempts to limit the growth of acid rain and the greenhouse effect. 		347, 372
10	discuss the importance of limiting increases in populations, waste production and food and energy demands to sustainable levels.		344-346

	Conservation		
11	discuss the importance of conserving endangered species and habitats, to include examples from candidates' local areas and other international examples		350-351

Block 2.5 Response to Stimuli	Page numbers in Biology for You
--------------------------------------	---------------------------------------

Learning Outcomes

Candidates should be able to :

	Principles of response		
1	recognise that all organisms respond to changes in their surroundings and that this process involves a certain order of events stimulus ◊ receptor ◊ co-ordination ◊ effector ◊ response.		118
	Response to stimuli in animals		
2	recall that receptors detect a variety of stimuli, such as light, sound, pressure, temperature and chemicals.		126
3	state that a receptor transduces energy from a stimulus, to form a nerve impulse.	H	120
4	name and locate the parts of the human eye to include cornea, iris, pupil, lens, fovea, retina, optic nerve, ciliary muscles and blind spot.		130
5	explain the roles of the: <ul style="list-style-type: none"> • iris, pupil and retina in controlling the amount of light entering the eye • cornea and lens in producing a focused image on the retina • retina (including the fovea) in the detection of the light • rods and cones in different light intensities and in the detection of colour. 	H	130-131
6	describe, in simple terms, the structure of sensory and motor neurones and relate the structure of neurones to their functions.		120
7	appreciate that information from the receptors is sent to the central nervous system, for co-ordination, along sensory neurones.		119-120
8	recall that the stimulus may bring about a reflex or a voluntary action.		124-125

9	describe a reflex as a pathway of nervous impulses called a reflex arc that: <ul style="list-style-type: none"> • helps protect the body from damage • brings about a rapid response by involving few neurones • may involve the brain or the spinal cord but does not involve conscious thought unlike a voluntary action. 		123
10	realise that reflexes and voluntary actions both involve impulses being sent along motor neurones, to the effectors that bring about the response.		123
11	describe how nerve impulses travel across junctions (synapses) via chemical means and know that this process can be affected by various drugs including alcohol and solvents.		122
12	state that hormones: <ul style="list-style-type: none"> • are chemical messengers carried in blood plasma • are produced in ductless glands and released straight into the bloodstream • usually bring about a slower response than nervous messages but the response may be longer lasting. 	H	132-133
13	state examples of hormones, to include: <ul style="list-style-type: none"> • insulin produced in the pancreas • ADH produced in the pituitary gland • oestrogen and progesterone produced in the ovaries • testosterone produced in the testes. 	H	108 113 158 157
14	describe the role of oestrogen and progesterone: <ul style="list-style-type: none"> • in controlling physical changes during adolescence • in the control of the menstrual cycle. 		166 163
15	describe how hormones can be used: <ul style="list-style-type: none"> • to control and promote fertility • illegally, to enhance sporting performances. 		167-168 134

Block 2.6 HomeostasisPage numbers
in
Biology for You**Learning Outcomes** Candidates should be able to :

1	recognise the importance of maintaining a constant internal environment in the body, to include the regulation of: <ul style="list-style-type: none">• blood glucose level• temperature• water content• metabolic waste (carbon dioxide and urea).		107 108 110 111-113 111
2	name and locate the structures of the skin involved in maintaining a constant body temperature.		108
3	explain how variations in body temperature can adversely alter enzyme action.		108
4	explain, in simple terms, how humans control body temperature by: <ul style="list-style-type: none">• altering the blood flow to the skin• shivering• sweating• muscle / liver activity.		114
5	recall that cells in the brain detect the core temperature of the body and control these response mechanisms.	H	110
6	recognise that: <ul style="list-style-type: none">• waste products, e .g. urea, excess water and excess salt are removed from the blood by the kidneys• water entered the body in food and is produced in respiration• gain and loss of water must balance.		111 113 113
7	explain that kidneys filter blood at high pressure and then re-absorb water and useful substances.		112
8	outline how a hormone from the brain (ADH) promotes water re-absorption in the kidneys to prevent dehydration.	H	113

Learning Outcomes

Candidates should be able to :

Genes and chromosomes			
1	state that the nucleus contains the chromosomes.		272
2	describe chromosomes as including a long molecule of DNA, divided up into sections called genes, which may be copied and carried on to the next generation.		273
3	describe genes as chemical instructions, controlling the way cells develop and function, by coding for the production of a particular protein in the cytoplasm.	H	275, 279
4	state that the nucleus of each body cell of a species has a characteristic number of chromosomes e.g. 23 pairs in humans.		272, 276
5	understand how the inheritance of X and Y chromosomes results in male and female offspring.		278
Variation			
6	describe how variation may arise from genetic, environmental causes and a combination of both.		255
7	discuss the validity of Francis Galton's ideas on the importance of genetic and environmental factors on intelligence.		
8	appreciate that genetic variation arises from mutations and: <ul style="list-style-type: none"> • may be due to errors in the copying of chromosomes resulting in gene mutations • may result in cells with the incorrect number of chromosomes (chromosome mutations) • that ionising radiation and certain chemicals can increase the probability of a mutation occurring. 		285
9	appreciate that whilst some mutations are useful, most are harmful and may cause diseases, limited to: <ul style="list-style-type: none"> • cystic fibrosis, which is caused by a recessive gene mutation and can be inherited • Down's syndrome, caused by an extra chromosome. 		285 286

10	<p>recognise that sexual reproduction:</p> <ul style="list-style-type: none"> • is a source of genetic variation • involves the random fusion of gametes that are produced in meiosis containing half the usual number of chromosomes • produces variation by combining genes in different combinations in the gametes and by random fusion of gametes. 	H H	277
11	<p>recognise that asexual reproduction:</p> <ul style="list-style-type: none"> • produces offspring that are identical (clones) • involves mitosis, that is also used in growth, to produce identical cells with the same number of chromosomes • includes the reproduction of some plants by bulbs, stem tubers and runners • is used in the commercial propagation of plants by cuttings and micropropagation and understand the advantages of these methods. 	H H H	234 276 233 234
Manipulating genes			
12	appreciate that producing identical copies or clones of animals, using the nuclei from body cells, is now possible.		291
13	<p>discuss cloning in terms of:</p> <ul style="list-style-type: none"> • potential benefits and the various ethical dilemmas • the ways in which scientists inform the public and enter into debate about their discoveries. 		291
14	describe genetic engineering as the removal of genes from the DNA of one organism and the insertion into the DNA of another organism.		289
15	state examples of selective breeding in animals and plants e.g. dogs for appearance and behaviour, and plants for yield, flavour and disease resistance.		290
16	describe how selective breeding involves selecting parents with desirable traits, crossing them, selecting from their offspring and repeating the process over several generations.		290
Genetic crosses			
17	demonstrate the expected outcome of a monohybrid cross using an understanding of dominant and recessive alleles and the difference between genotype and phenotype.		280-284
18	explain monohybrid crosses, including reference to the terms gene, allele, homozygous, heterozygous, parental, F1 and F2 generations.	H	280-281
19	<p>discuss the contribution of Mendel's work to include:</p> <ul style="list-style-type: none"> • possible reasons why his work remained undiscovered for so long • accusations that his results are too statistically perfect. 		279
20	use the results of test crosses and family trees to determine the genotypes of organisms.	H	282-284

Evolution			
21	<p>explain the meaning of Darwin's four observations that lead to his theory of evolution:</p> <ul style="list-style-type: none"> • all organisms potentially over reproduce • population numbers tend to remain fairly constant over long periods of time • organisms demonstrate variation • some of the variations are inherited. 		298-299
22	<p>describe how the process of natural selection may result in:</p> <ul style="list-style-type: none"> • changes within a species, as illustrated by the peppered moth • many changes over a period of time which may lead to a new species • failure of a species to change which may lead to extinction. 		301 304 305
23	<p>explain briefly how organisms may have become fossilised and recognise that fossils provide evidence for evolution.</p>		302-303

Learning Outcomes

Candidates should be able to :

1	recognise the potential hazards in carrying out chemical reactions and be able to use the Hazchem code as a method to warn of potential dangers.	379
2	recognise and use the hazard symbols for: <ul style="list-style-type: none"> • corrosive • highly flammable • toxic • harmful. 	379
3	recognise and use symbols to represent different elements.	14
4	state that compounds contain more than one type of atom chemically combined.	16
5	state that the particles in compounds are held together by strong forces called chemical bonds.	15
6	recognise and use formulae to represent compounds and be able to recognise different elements, and the number of atoms of each element, from the chemical formula of a compound.	15
7	state that compounds have properties different from the elements from which they are made.	22
8	represent chemical reactions by word equations that show all reactants and products.	17
9	represent simple reactions by balanced chemical equations using symbols.	24
10	recognise examples of: <ul style="list-style-type: none"> • thermal decomposition (see 3.1.14) • neutralisation (see 3.1.16 and 3.1.17) • oxidation (see 3.1.19) • reduction as the opposite of oxidation (see 3.2.8) limited to examples from the specification. 	129 143 90 90

11	state that limestone rock is an important raw material used in the manufacture of cement and glass.		130, 132
12	consider, evaluate and discuss the balance between the economic and social advantages of mineral extraction, limited to limestone, and the impact that this extraction has on the environment.		127
13	state the effect of heat on limestone to produce quicklime (calcium oxide) and recognise this as an example of thermal decomposition.		129
14	describe and explain the changes that take place when water is added to quicklime and recall the use of slaked lime (calcium hydroxide) in neutralising excess acidity on land and in lakes affected by acid rain.		129, 156
15	state that acids are a group of compounds that have characteristic properties, limited to their reactions with: <ul style="list-style-type: none"> • carbonates to produce carbon dioxide, a salt and water • some metals (limited to magnesium and zinc) to produce hydrogen and a salt • bases or alkalis to form a salt and water only. [Details limited to hydrochloric acid and sulphuric acid only, including the effect of sulphuric acid in acid rain on building materials such as metals and carbonates, and its use in making ammonium sulphate fertilisers.]		147 147 144, 146 [188, 246]
16	use patterns in the reactions above to make predictions for the reactions of other acids in neutralisation reactions.		Chapter 12
17	describe the tests for hydrogen and carbon dioxide.		Throughout
18	state that the combustion of hydrogen: <ul style="list-style-type: none"> • produces water as the only product • is an example of an oxidation reaction • gives out useful energy. 		125
19	recognise that chemical reactions may be accompanied by an energy change which, in solution, may be detected as a temperature change.		190
20	explain the terms exothermic and endothermic: <ul style="list-style-type: none"> • exothermic, as a chemical reaction which transfers energy, often in the form of heat, to the surroundings and may be detected by an increase in temperature (e.g. addition of water to quicklime, see 3.1.15) • endothermic, as a chemical reaction which takes in energy, often in the form of heat, from the surroundings and may be detected by a decrease in temperature (e.g. neutralising ethanoic acid with sodium carbonate, see 3.1.17). 		190-191

Block 3.2 Atomic Structure and the Periodic Table

Page numbers
in
Chemistry
for You

Learning Outcomes

Candidates should be able to :

1	recall that atoms consist of a central nucleus, composed of protons and neutrons, surrounded by orbiting electrons.		28
2	describe how electrons are arranged in shells around the nucleus.		30
3	construct and interpret diagrams of electronic configurations of the elements 1 to 20.		31, 70
4	recall that there are approximately 100 elements and that: <ul style="list-style-type: none">• all materials are composed of one or more of these• scientists are still discovering new elements.		16 TSP
5	describe how elements, such as the alkali metals and the halogens, can be grouped into families based on chemical and physical properties.		43
6	interpret given information about developments in ideas of atoms and atomic structure. [No recall expected.]		28, TSP
7	interpret given information about developments in ideas of the Periodic Table.[No recall expected.]		42, TSP
8	explain that the modern Periodic Table shows all of the elements arranged in order of atomic number.		43
9	recall that the vertical columns of elements are called groups and that the horizontal rows of elements are called periods.		43
10	explain the connection between the arrangement of the outer electrons in the atom and the position of the element in the Periodic Table.		70
11	recognise that elements in the same vertical group have similar properties.		43
12	explain the similarity of reactions of elements in the same group in terms of the number of electrons in their outer shells.		70
13	recall that the elements in Group 1 are called the alkali metals.		50
14	state the characteristic physical properties of the alkali metals, limited to trends in hardness, density and melting point.		50
15	describe and explain the reactions of the alkali metals with water and recognise the trend in increasing reactivity with increasing atomic number.		51
16	explain the trend in the reactivity of the alkali metals with water in terms of the distance of the outer electron from the nucleus.	H	71
17	recognise some of the hazards involved in the use of the alkali metals and be able to suggest a suitable action which should be taken to minimise each hazard		51

Block 3.3 Rates of ReactionPage numbers
in
**Chemistry
for You****Learning Outcomes**

Candidates should be able to :

1	recall simple examples of reactions that proceed at a variety of rates: <ul style="list-style-type: none">• chemical weathering of rocks• rusting• metals with acids• explosions.		199
2	describe and explain how the progress of a reaction is followed by the rate of formation of product or by the rate of disappearance of reactant.		199-201
3	plot and interpret graphs involving rate of formation of products and rate of consumption of reactants.		201
4	recall how the rate of reaction depends on: <ul style="list-style-type: none">• the concentration of reactants in solution• the pressure of any gases• the temperature• the size of any solid pieces.		204 205 206 202
5	recall that a catalyst can also affect the rate of reaction but is not used up.		208
6	recall: <ul style="list-style-type: none">• that different reactions need different catalysts• that manganese(IV) oxide acts as a catalyst in the decomposition of hydrogen peroxide• how to test for oxygen gas.		208
7	explain how: <ul style="list-style-type: none">• reactant particles must collide for a reaction to take place• not every collision leads to a reaction.		203 207
8	explain how changing: <ul style="list-style-type: none">• the concentration of solutions• pressure of gases• temperature• size of solid pieces can affect the rate of reaction in terms of the increased frequency of collisions and, for temperature, the increase in energy of the particles. [Activation energy is not required.]		205 205 207 203
9	recall that enzymes are: <ul style="list-style-type: none">• biological catalysts produced by living things• very specific in the reactions that they catalyse.		212
10	describe the use of enzymes in: <ul style="list-style-type: none">• brewing (including the word equation for fermentation)• biological detergents• softening the centres of some chocolates (using invertase).		214 213 217

Learning Outcomes Candidates should be able to :

1	recall that crude oil is a mixture of substances, most of which are hydrocarbons, and that it is a finite, non-renewable resource.		159-160
2	explain that hydrocarbons: <ul style="list-style-type: none"> • are compounds of carbon and hydrogen atoms only • have different boiling points • contain different numbers of carbon and hydrogen atoms. 		159, 163
3	explain how the process of fractional distillation can be used to separate the hydrocarbons in crude oil.		162-164
4	recall that fractions from crude oil can be used as fuels, limited to: <ul style="list-style-type: none"> • refinery gases (for bottled gases) • gasoline (for cars) • kerosene (for jet aircraft) • diesel (for cars and larger vehicles) • fuel oil (for heating systems). 		164
5	recall that the products from the complete combustion of hydrocarbons are carbon dioxide and water.		187
6	recall that the products from the incomplete combustion of hydrocarbons include carbon monoxide, which is a poisonous gas with no smell.		187
7	explain how larger, less useful, hydrocarbon molecules may be cracked by the use of heat or a hot catalyst to yield smaller, more useful, hydrocarbon molecules and hydrogen and understand the commercial importance of this reaction.	H	165
8	recall that cracking of hydrocarbon molecules yields alkenes such as ethene.	H	165
9	represent and interpret cracking reactions in terms of chemical formulae or displayed formulae.	H	165
10	describe how small alkene monomer molecules can react with themselves under suitable conditions to produce long chain polymer molecules.	H	168
11	represent and interpret polymerisation reactions in terms of simple graphical (displayed) formulae.	H	168

12	recognise the relationship between an addition polymer and the monomer from which it is formed.	H	168, 171
13	recall uses of polymers, limited to: <ul style="list-style-type: none"> • poly(ethene) for plastic bags and bottles • poly(propene) for crates and ropes • poly(chloroethene) [PVC] for drain pipes and insulation on electric cables and be able to link the properties of a polymer to its use.		170-171
14	evaluate the oil industry in terms of : <ul style="list-style-type: none"> • the usefulness of the products obtained • the potential impact on the environment of the extraction and transport of crude oil • the use of the substances obtained from oil, including issues relating to the use of plastics, their disposal and recycling • the role that different scientists have in the detection, extraction, purification and development of the uses of crude oil. 		Chapter 13

Block 4.1 Electric Circuits	Page Numbers in Physics for You
---------------------------------------	------------------------------------------------

Chapters 31, 38

Learning Outcomes Candidates should be able to :

1	identify cells, batteries and generators as electrical sources, and bulbs, resistors, bells, motors, LEDs, LDRs, thermistors and buzzers as parts of an electrical circuit where electrical energy is dissipated. [The electrical symbols for a cell, battery, power supply, filament bulb, switch, LDR, fixed and variable resistor, LED, motor, heater, thermistor, ammeter and voltmeter should be known.]		pages 254, 261, 324-325
2	recall that resistors are heated when electric current passes through them.		p. 270-1
3	describe and explain the effect of a variable resistor in controlling the brightness of a lamp and the speed of a motor.		p. 261
4	measure resistance by correctly placing a voltmeter and an ammeter in a circuit.		p. 261
5	state and be able to use the equation $V = I R$		p. 259
6	describe how current varies with voltage in a metal wire at constant temperature, a filament bulb and a silicon diode.		p. 265

Block 4.2 Wave Properties

Page numbers
in
Physics for You

Chapters 28, 21, 25, 29

Learning Outcomes Candidates should be able to :

1	recall the meaning of frequency, wavelength and amplitude.		p. 175
2	identify the wavelength and amplitude of a transverse wave.		p. 175
3	describe the effect on the loudness of a sound when the amplitude is changed.		p. 234
4	describe the effect on the pitch of a sound when the frequency is changed.		p. 234
5	describe how echoes are caused by the reflection of sound.		p. 230
6	recall that refraction involves the change in speed of a wave.		p. 193
7	explain how changing the speed of a wave causes a change in wavelength and this may cause a change in direction.		p. 176, 193
8	explain and illustrate how virtual images are caused by the refraction of light.		p. 202, 204
9	recall that waves can be reflected at a plane barrier and that the angle of incidence equals the angle of reflection.		p. 176, 185
10	explain and illustrate how plane waves are reflected at a concave barrier, and how circular ripples are reflected at a plane barrier.		p. 176, 178
11	recall that water waves can be refracted if they are slowed down.		p. 176

Block 4.3 Using Waves

Page numbers
in
Physics for You

Chapters 28, 25, 29, 20

Learning Outcomes Candidates should be able to :

The Electromagnetic Spectrum		
1	recall that the different types of electromagnetic waves form a continuous spectrum with a range of wavelength and frequency and that they transfer energy at the same speed in free space.	p. 218-9
2	list the parts of the spectrum in order of wavelength and frequency (gamma rays; X-rays; ultraviolet; light; infra-red; microwaves; radio waves).	p. 218-9
3	recall that microwaves cause heating when absorbed by water and cause burns when absorbed by body tissue.	p. 227
4	recall that infra-red radiation causes heating when absorbed by any object, and its use in radiant heaters.	p. 227, 270
5	recall that ultra-violet radiation is produced in fluorescent lights.	p. 226
6	recall that being out in the Sun for too long can cause sunburn and skin cancer from the ultra-violet radiation.	p. 220
7	explain that the darker the skin, the more ultra-violet radiation is absorbed by the skin and the less reaches the deeper body tissues to cause these cells to become cancerous.	p. 220
8	describe how information can be transmitted using electromagnetic radiation, including the use of satellites for global communication.	p. 221, 168-9, 320
9	explain that radio waves are readily diffracted and are therefore suitable for broadcasting.	p. 177
10	explain how information in narrow beams can be transmitted using microwaves.	p. 221, 320
11	describe the use of infra-red radiation in night photography.	p. 53, 221, 227
12	describe what happens to light incident on a perspex/glass-air surface both above and below the critical angle of incidence.	p. 195-7
13	describe how light is reflected at the inner face of a right-angled prism.	p. 196
14	explain how optical fibres are used in endoscopy.	p. 197, 200
15	explain how optical fibres allow the rapid transmission of data using digital signals.	p. 200, 320, 332

16	describe the transmission of data pulses using light in optical fibres.		p. 332
17	describe the difference between analogue and digital signals.		p. 332
18	describe the advantage of using digital signals to allow more information to be transmitted.	H	p. 332-3
19	explain that X-rays pass through flesh but are absorbed by bone.		p. 218, 318
20	list the safety precautions that should be taken when using X-rays and gamma-rays.		p. 360, 318
21	interpret given information about the development of ideas concerning the dangers involved with using X-rays and/or radioactive substances.		p. 360, 318
22	describe the use of gamma-rays as tracers to detect malfunction of organs and as treatment for killing body tissue.		p. 356-7, 220
Sound and Ultrasound			
23	recall that ultrasound is a high-frequency longitudinal wave.		p. 230, 240-1
24	explain how distances can be measured using echo-sounding. (recall of $\text{speed} = \text{distance}/\text{time}$ will be required.)		p. 230, 240
25	explain how the reflection of ultrasound by body tissue enables organs to be scanned.		p. 241
26	describe how ultrasound is used for pre-natal scanning.		p. 241
27	describe one non-medical use of ultrasound.		p. 240-1

Block 4.4 RadioactivityPage numbers
in
Physics for You

Chapter 39

Learning Outcomes Candidates should be able to :

1	describe how the breakdown of an unstable nucleus results in radioactive emission and the formation of a new element.		p. 355, 358
2	recognise that a stable nucleus can become unstable by the absorption of neutrons.		p. 358
3	explain that the level of background radiation, from a variety of sources, is higher in some places than in others.		p. 360
4	describe how to take background radioactivity into account when performing experiments.		p. 350, 360, worksheet
5	recall the relative penetration of alpha, beta and gamma emissions.		p. 350-1
6	apply this knowledge to explain why different emissions are suited to particular purposes including sterilisation, thickness measurement, treatment of cancer and tracer techniques.		p. 356-7
7	describe alpha, beta and gamma emissions in terms of atomic particles and electromagnetic waves.		p. 350-1
8	interpret given information about developments in ideas of radioactivity. [No recall is expected.]		p. 368
9	recall that exposure to ionising radiation can be harmful.		p. 360
10	describe the precautions that should be taken when handling radioactive materials.		p. 360
11	describe some effects of radiation on the human body.		p. 356, 360
12	explain how the effects of radiation depend on the energy and penetration of the emission as well as the amount of exposure.		p. 356, 360

Chapter 20

Learning Outcomes Candidates should be able to :

1	recall the names and properties of bodies in the Universe, to include: <ul style="list-style-type: none"> the planets in the Solar System comets meteors stars, galaxies and natural satellites. 		p. 160-1, 163, 165
2	explain that the orbit time of a planet depends on its distance from the Sun.		p. 160-1
3	explain that the Moon remains in orbit around the Earth, and the planets orbit the Sun, because of the gravitational attractive forces between them.		p. 158-9, 162
4	interpret given information about developments in ideas about models of the Solar System.		p. 369, 163, worksheet
5	explain that the orbit period of an artificial satellite increases with increasing height above the Earth's surface.		p. 162, 168
6	describe the variation in gravitational force with distance.		p. 162
7	explain the variation in speed of a comet during its orbit around the Sun.		p. 163
8	describe how stars evolve over a long time scale from formation to final state. [Candidates should be familiar with the following terms: fusion, red giant, white dwarf, supernova, neutron star, black hole.]		p. 165
9	explain that theories for the origin of the Universe must take into account that: <ul style="list-style-type: none"> light from other galaxies is shifted to the red end of the spectrum the further away galaxies are, the greater the red shift. 		p. 166
10	recognise that one way of explaining this is that: <ul style="list-style-type: none"> other galaxies are moving away from us very quickly galaxies furthest from us are moving fastest. 		p. 166
11	explain how knowledge of the rate of expansion of the Universe enables its age to be estimated.		p. 166
12	explain that there are possible futures for the Universe depending on the amount of mass in the Universe and the speed at which the galaxies are moving apart.		p. 166
14	interpret given information about developments in ideas on the origin of the Universe. [No recall is expected.]		p. 369
15	discuss how scientists are trying to find evidence for life on other planets in the Solar System and elsewhere in the Universe.		p. 167

Block 4.7 Using Electricity

Page numbers
in
Physics for You

Chapters 30, 31, 32

Learning Outcomes Candidates should be able to :

Electricity in the Home		
1	explain that a direct current is always in the same direction but an alternating current changes direction.	p. 254, 274
2	recall that energy is supplied to houses via the live and neutral wires.	p. 274
3	recall that in normal use no current passes in the earth wire.	p. 275
4	explain that the live wire has to be insulated from the earth and neutral wires.	p. 274-5
5	explain how fuses and circuit breakers prevent fire due to electrical faults.	p. 275, 270, 312
6	explain how the earth wire, together with the fuse or circuit breaker, prevents electrocution.	p. 275
7	explain why double-insulated appliances do not need an earth wire.	p. 275
8	explain that energy can be transferred from the electricity supply by means of convection currents and also as electromagnetic waves, including infra-red and microwaves.	p. 270-1, 227
9	use the equation $\text{energy efficiency} = \frac{\text{useful energy output}}{\text{total energy input}}$	p. 112
10	explain the meaning of energy efficiency in the contexts of heating buildings and the performance of machines.	p. 112, 122
11	describe how domestic insulation reduces energy transfer by conduction, convection and radiation.	p. 44-51
12	use data on energy efficiency measures to evaluate cost-effectiveness of different approaches.	p. 45, 112
13	use the equation $\text{energy} = \text{power} \times \text{time}$ to calculate energy transfer in joules and kilowatt-hours.	p. 272-3
14	recall that a domestic electricity meter measures the energy transfer in kilowatt-hours.	p. 273
15	calculate the cost of electrical energy from a knowledge of the power, the time and the unit cost.	p. 273

Block 4.7 ElectromagnetismPage numbers
in
Physics for You

Chapters 35, 36

Learning Outcomes Candidates should be able to :

1	recall that a voltage is induced in a conductor when the magnetic field through it changes.	p. 303
2	describe how the size of the induced voltage depends on the rate at which the change occurs.	p. 303
3	recall the effect of reversing the change.	p. 302-3
4	explain that an alternating current is generated when a magnet rotates within a coil of wire.	p. 304
5	explain that a changing magnetic field in one coil of wire can induce a voltage in a neighbouring coil.	p. 307
6	explain that a transformer changes the size of an alternating voltage.	p. 308-9
7	describe the construction of a transformer as two coils of wire wound on an iron core.	p. 308
8	describe the difference in action and in construction of a step-up and a step-down transformer.	p. 308-9
9	describe the energy flow through a coal-burning power station.	p. 113
10	discuss the social and environmental issues associated with different methods of generating electricity.	p. 113-115
11	explain that electricity is generated by rotating an electromagnet within coils of wire.	p. 304, 306
12	describe power losses in transmission.	p. 309
13	describe the use of transformers in power transmission.	p. 309
14	explain why the use of transformers dictates the use of alternating current.	p. 309

end of specification content