

GCSE Specification 1535

Edexcel Science : Single Award (Modular)

Please check that you have chosen the correct specification.

Some of the content is designated for the **Higher Tier** candidates only.
This content is printed in **bold**.

Page numbers in
Biology for You
(revised, 2002)

Module 1 : The human body – action and control

pages in **Biology for You**

The digestive system

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

Candidates will be assessed on their ability to:

• describe the functions of the parts of the digestive system:

55-61

– salivary glands

58

– oesophagus (gullet)

59

– stomach

59

– gall bladder

60

– pancreas

60

– small intestine

61

– large intestine (1.01)

61

• describe the functions of enzymes (carbohydrase, protease, lipase) and bile in digestion (1.02)

57, 60

• describe how the structure of villi helps the efficient absorption of the soluble products of digestion (1.03)

61

The blood

Candidates will be assessed on their ability to:

• recall that blood is a mixture of plasma, white blood cells, red blood cells and platelets (1.04)

97

• describe the function of blood in transport

98

– plasma carries hormones and small soluble molecules such as glucose, amino acids and carbon dioxide

101

– red blood cells carry oxygen (1.05)

98

• describe the function of blood in defence against infection	99
– white blood cells ingest bacteria and produce antibodies	99
– white blood cells, their function and relationship to their structure	99
– platelets bring about fibrin formation and the formation of a scab over a wound (1.06)	100
The nervous system	
<i>Candidates will be assessed on their ability to:</i>	
• describe how the structure of a neurone relates to its function (1.07)	119-120
• describe the path of electrical impulses in a simple reflex arc (1.08)	121, 123
• describe the role of the iris and pupil, retina and optic nerve in the iris reflex (1.09)	130
• explain the role of the cornea, ciliary body, suspensory ligaments and lens in forming sharp images of near and distant objects on the retina (1.10)	130-131 Phys4U : p. 208-11
• describe the main effects of	
– solvents on lungs and neurones	187
– alcohol on reaction times, liver and brain	188-189
– tobacco on respiratory and circulatory systems (1.11)	83-84
• understand how the use of drugs may	
– affect activities such as driving	188
– produce abnormal behaviour	185-186
– create the risk of viral infections (1.12)	186
• recall the effects on the body of	
– stimulants such as caffeine	186
– sedatives such as barbiturates	186
– pain killers such as paracetamol (1.13)	186
• describe the uses of paracetamol and the dangers of overdose (1.14)	186
• describe the uses of heroin in pain relief for terminally ill patients, and the dangers of addiction (1.15)	186
The kidney	
<i>Candidates will be assessed on their ability to:</i>	
• understand that homeostasis is the maintenance of a constant internal environment (1.16)	106-107
• recall that body water content and body temperature are both examples of homeostasis (1.17)	113, 110
• recall that urea is made in the liver from excess amino acids (1.18)	111
• describe the structure and function of the urinary system, to include the renal artery, renal vein, kidney, ureter, bladder and urethra (1.19)	111
• describe the structure and functions of the following parts of the nephron: glomerulus and Bowman's capsule, first and second coiled tube, capillary network and collecting tubule, to include ultra filtration and reabsorption (1.20)	112
• describe how the hormone ADH controls the water content of the blood (1.21)	113

The skin	
<i>Candidates will be assessed on their ability to:</i>	
• describe the function of the skin in defence against infection, to include the outer layer of dead cells, the physical barrier to the environment and the role of the oil glands (1.22)	109, 178
• explain the function of the skin in the control of body temperature	110
– sweat glands release sweat that contains water and salts	110
– evaporation of water in sweat removes heat from the skin (1.23)	110
• recall that the skin contains capillary loops which affect blood flow in the skin (1.24)	110
• explain the process of vasoconstriction and vasodilation in relation to the control of body temperature (1.25)	110
• understand how vasodilation increases heat loss by radiation and convection (1.26)	110
• understand that shivering involves the movement of muscles which releases heat (1.27)	110
• understand the importance of temperature in relation to enzyme activity (1.28)	109-110
• describe the function of the skin in the nervous system (1.29)	126
• recall that touch receptors and temperature receptors carry nerve impulses to the brain along sensory nerves (1.30)	126

Module 2 : Inheritance and survival Biology for You	Page numbers in Biology for You (revised, 2002)
Chromosomes and variation	
<i>Candidates will be assessed on their ability to:</i>	
<ul style="list-style-type: none"> recall that each human body cell contains 23 pairs of chromosomes giving a diploid number of 46 (2.01) 	272
<ul style="list-style-type: none"> understand that mitosis is the division of a cell to produce two cells with identical sets of chromosomes, for growth or replacement (2.02) 	276
<ul style="list-style-type: none"> describe the outcome of mitosis – the replication of each chromosome and the separation of the replicas (recall or use of technical terms is not required) (2.03) 	275-276
<ul style="list-style-type: none"> recall that each human gamete contains 23 chromosomes, the haploid number (2.04) 	277
<ul style="list-style-type: none"> understand that meiosis is the division of a diploid cell to produce four haploid cells with sets of chromosomes that are not genetically identical to produce gametes (sperm and ovum) (recall or use of technical terms is not required) (2.05) 	277
<ul style="list-style-type: none"> describe how the fusion of haploid male and female gametes (fertilisation) produces a diploid zygote (fertilised ovum or egg cell) (2.06) 	277
<ul style="list-style-type: none"> explain how sexual reproduction, involving fertilisation, leads to variation in the new generation (2.07) 	277
<ul style="list-style-type: none"> recall that individuals inherit some characteristics from their father through the sperm and some from their mother through the egg (2.08) 	277-278
<ul style="list-style-type: none"> explain how the sex of an individual depends upon X and Y chromosomes and is determined at fertilisation (2.09) 	278
<ul style="list-style-type: none"> describe the functions of the sex hormone testosterone in promoting secondary sexual characteristics in men (2.10) 	157, 166
<ul style="list-style-type: none"> describe the functions of the sex hormone oestrogen in promoting secondary sexual characteristics in women (2.11) 	158, 166
<ul style="list-style-type: none"> recall that oestrogen causes the lining of the uterus to thicken during the early part of the menstrual cycle (2.12) 	163
<ul style="list-style-type: none"> recall that progesterone maintains the lining of the uterus during the middle part of the menstrual cycle and during pregnancy (2.13) 	163
<ul style="list-style-type: none"> recall that manufactured sex hormones can be used to treat infertility in women (2.14) 	167-168
Genes and variation	
<i>Candidates will be assessed on their ability to:</i>	
<ul style="list-style-type: none"> understand that genes are parts of chromosomes which are found within the nucleus (2.15) 	272-273
<ul style="list-style-type: none"> understand that the unit of inheritance is the gene which is a section of a long chain (DNA) molecule; describe a DNA molecule as two strands coiled to form a double helix, the strands linked by a series of paired bases (adenine with thymine and cytosine with guanine) (2.16) 	273
<ul style="list-style-type: none"> describe some of the implications of the outcome of the Human Genome Project (2.17) 	291

<ul style="list-style-type: none"> understand how some inherited characteristics can be modified by environmental conditions, eg the influence of the mother's diet or smoking on a baby's birth weight (2.18) 	255
<ul style="list-style-type: none"> explain how alternative forms of a gene (alleles) cause variation in a characteristic, to include eye colour (2.19) 	280
<ul style="list-style-type: none"> recall that some alleles cause diseases which can be inherited (2.20) 	286-288
<ul style="list-style-type: none"> understand the terms dominant and recessive (2.21) 	281
<ul style="list-style-type: none"> describe the mechanism of monohybrid inheritance using genetic diagrams (2.22) 	282-284
<ul style="list-style-type: none"> understand the terms homozygous, heterozygous, genotype and phenotype (2.23) 	280-281
<ul style="list-style-type: none"> predict ratios of genotypes and phenotypes in a given monohybrid cross (2.24) 	282-284
<ul style="list-style-type: none"> recall that a mutation is a change in the chemical structure of a gene (2.25) 	285
<ul style="list-style-type: none"> recall that mutations can be caused by ionising radiation, including ultraviolet light, X-rays and gamma rays, and by some substances in tobacco (2.26) 	285
<ul style="list-style-type: none"> describe how asexual reproduction leads to genetically identical individuals (clones) (2.27) 	234, 291
Genetically modified organisms	
<i>– Candidates will be assessed on their ability to:</i>	
<ul style="list-style-type: none"> describe how the transfer of a required gene from a donor to a recipient, including the use of enzymes, can produce genetically modified organisms (2.28) 	2889
<ul style="list-style-type: none"> understand that crop plants can be genetically modified, and the reasons for doing so (2.29) 	293
<ul style="list-style-type: none"> describe the potential benefits and ethical dilemmas posed by advances in genetic modification (2.30) 	293
Selection, survival and evolution	
<i>Candidates will be assessed on their ability to:</i>	
<ul style="list-style-type: none"> understand how adaptations such as 	
<ul style="list-style-type: none"> – hair colour, hair length, size of ears in mammals 	337-338
<ul style="list-style-type: none"> – gills, streamlined shape, mucus-covered scales in fish 	146-147, 264
<ul style="list-style-type: none"> – extensive roots, reduced leaves with thick cuticles in cacti 	336
allow survival in particular environmental conditions (2.31)	336-338
<ul style="list-style-type: none"> describe how competition between individuals of the same species controls population size (2.32) 	339-340
<ul style="list-style-type: none"> describe how the populations of predator and prey are dependent on each other (2.33) 	341-343
<ul style="list-style-type: none"> describe how new species may evolve from variants which are better adapted to their environment (2.34) 	300-301, 304
<ul style="list-style-type: none"> understand that fossils provide evidence for evolution (2.35) 	302-303
<ul style="list-style-type: none"> explain how natural selection can lead to evolution or extinction of species (2.36) 	298-301, 304-305
<ul style="list-style-type: none"> explain the principles of natural selection (2.37) 	298-301

• explain how selective breeding (artificial selection) can be used, for example,	290
– in cattle to improve the quality and quantity of milk	290
– to increase the number of offspring in sheep	290
– to increase yield from dwarf wheat (2.38)	290
Pollution and human survival	
<i>Candidates will be assessed on their ability to:</i>	
• recall that increasing population size leads to increased pollution (2.39)	333, 344-345
• interpret data on environmental change (2.40)	364, 372, 374
• describe how human activity can affect the environment, especially changes in population size, and in economic and industrial conditions, given suitable information (2.41)	344-350
• recall that burning fossil fuels releases harmful wastes into the air, especially smoke and acidic gases (2.42)	347, 372
• recall that acidic gases combine with water vapour to form acid rain which damages plants and animals (2.43)	347
• recall that some harmful substances occur in vehicle exhaust gases, including carbon dioxide, carbon monoxide, nitrogen oxides (2.44)	347
• describe how air pollution by vehicles can be reduced (2.45)	347, 372

Module 3: Chemical patterns Chemistry for You	Page numbers in Chemistry for You (revised, 2001)
Candidates will be assessed throughout this module on their ability to:	
<ul style="list-style-type: none"> recall the formulae of elements and simple compounds in the module 	Throughout
<ul style="list-style-type: none"> represent chemical reactions by word equations; write simple balanced equations and use the state symbols (s), (l), (g) and (aq) 	pages 24-6
<ul style="list-style-type: none"> write balanced equations to describe and explain a wide range of reactions including ionic equations 	Throughout
The structure of atoms	Chapter 3
<i>Candidates will be assessed on their ability to:</i>	
<ul style="list-style-type: none"> describe the structure of an atom as a nucleus containing protons and neutrons, surrounded by orbiting electrons arranged in shells (3.01) 	p. 28, 30
Elements and the periodic table	Chapter 4, 5, 6
<i>Candidates will be assessed on their ability to:</i>	
<ul style="list-style-type: none"> recall that there are about 100 elements in the periodic table arranged in order of ascending atomic number and recall that elements are the ‘building blocks’ of all materials (3.02) 	p. 42-3
<ul style="list-style-type: none"> recall the position of metals and non-metals in the periodic table (3.03) 	p. 48
<ul style="list-style-type: none"> locate the positions in the periodic table of 	
<ul style="list-style-type: none"> – the alkali metals 	p. 43
<ul style="list-style-type: none"> – the halogens 	p. 43
<ul style="list-style-type: none"> – the noble gases (3.04) 	p. 43
<ul style="list-style-type: none"> understand how the electron shells are filled in the atoms of the first twenty elements in the periodic table, eg potassium 2.8.8.1 (3.05) 	p. 70
<ul style="list-style-type: none"> understand the connection between the number of outer electrons and the position of an element in a group of the periodic table (3.06) 	p. 70
<ul style="list-style-type: none"> understand that the reactions of an element depend upon the arrangement of electrons in its atoms (3.07) 	p. 70-1
<ul style="list-style-type: none"> recall that there is a gradual change in properties of the elements from the top to the bottom of each group (3.08) 	p. 51, 62, 67, 71
<ul style="list-style-type: none"> understand that elements in the same group of the periodic table have similar chemical properties, as exemplified by the halogens (3.09) 	p. 62-3
The properties of halogens	Chapter 6
<i>Candidates will be assessed on their ability to:</i>	
<ul style="list-style-type: none"> recall that fluorine, chlorine, bromine and iodine are halogens (3.10) 	p. 43, 62
<ul style="list-style-type: none"> recall the variation in colour, the trends in boiling point and the physical states at room temperature, of the halogens (3.11) 	p. 62

• describe the reactions of chlorine with sodium and iron (3.12)	p. 63
• describe the variation in reactivity of the halogens with increasing atomic number, as shown by displacement reactions with solutions of other halides (3.13)	p. 63
• describe the use of chlorine in	
– water purification	p. 64, 301
– bleaching (3.14)	p. 62, 64-5
• recall the use of iodine solution as an antiseptic (3.15)	p. 64
Rates of reaction	Chapter 16, 17
<i>Candidates will be assessed on their ability to:</i>	
• recall that there is great variation in the rates at which different reactions take place (3.16)	p. 199
• understand that the rate of chemical reaction increases if	
– the temperature is increased	p. 206-7
– the concentration of reactant is increased	p. 204-5
– the surface area of a solid reactant is increased	p. 202-3
– a catalyst is used (3.17)	p. 208-9
• describe experiments to investigate the above effects (3.18)	p. 200-9
• understand that reactions can occur when particles collide (3.19)	p. 203
• understand that the rate of a reaction is increased by	
– increased frequency of the collisions	p. 203, 205, 207
– greater energy of the collisions (3.20)	p. 207
• describe how the rates of enzyme catalysed reactions vary with temperature and pH (3.21)	p. 213

Module 4 : Chemistry in action Chemistry for You	Page numbers in Chemistry for You (revised, 2001)
Candidates will be assessed throughout this module on their ability to:	
<ul style="list-style-type: none"> recall the formulae of elements and simple compounds in the module 	Throughout
<ul style="list-style-type: none"> represent chemical reactions by word equations; write simple balanced equations and use the state symbols (s), (l), (g) and (aq) 	pages 24-6
<ul style="list-style-type: none"> write balanced equations to describe and explain a wide range of reactions including ionic equations 	Throughout
Crude oil	Chapter 13
<i>Candidates will be assessed on their ability to:</i>	
<ul style="list-style-type: none"> explain that crude oil was formed by the long-term effects of temperature and pressure on marine deposits (4.01) 	p. 160
<ul style="list-style-type: none"> recall that hydrocarbons contain carbon and hydrogen only (4.02) 	p. 159
<ul style="list-style-type: none"> understand that crude oil is a mixture of substances, most of which are hydrocarbons (4.03) 	p. 159
<ul style="list-style-type: none"> understand that the mixture of substances can be separated by fractional distillation, to yield fuels and other useful products (4.04) 	p. 162-4
<ul style="list-style-type: none"> describe the fractional distillation of crude oil (4.05) 	p. 162-4
<ul style="list-style-type: none"> describe some uses of the various fractions 	p. 164
<ul style="list-style-type: none"> – gases 	p. 164
<ul style="list-style-type: none"> – petrol (gasoline) 	p. 164
<ul style="list-style-type: none"> – kerosene (paraffin) 	p. 164
<ul style="list-style-type: none"> – diesel oil 	p. 164
<ul style="list-style-type: none"> – fuel oil 	p. 164
<ul style="list-style-type: none"> – bitumen (4.06) 	p. 164
<ul style="list-style-type: none"> evaluate data on the properties of different fractions related to the size of their molecules (4.07) 	p. 163-4
Burning fuels	Chapter 15
<i>Candidates will be assessed on their ability to:</i>	
<ul style="list-style-type: none"> understand that the products of complete combustion of hydrocarbons are carbon dioxide and water and that energy is released (4.08) 	p. 187
<ul style="list-style-type: none"> understand that oxidation is the addition of oxygen to a substance, eg the oxidation of methane to water and carbon dioxide (4.09) 	p. 187
<ul style="list-style-type: none"> understand that incomplete combustion can produce carbon and carbon monoxide (4.10) 	p. 187
<ul style="list-style-type: none"> recall that carbon monoxide is a toxic gas (4.11) 	p. 187
<ul style="list-style-type: none"> recall that incomplete combustion can occur in faulty gas appliances and other heating appliances and this can be dangerous (4.12) 	p. 198 (Q4)

Plastics	Chapter 13
<i>Candidates will be assessed on their ability to:</i>	
<ul style="list-style-type: none"> understand that cracking of some oil fractions (obtained from the fractional distillation of crude oil) yields useful hydrocarbon molecules, some of which have carbon-carbon double bonds (4.13) 	p. 165
<ul style="list-style-type: none"> recall the conditions used in industry to crack fractions obtained from crude oil (4.14) 	p. 165
<ul style="list-style-type: none"> describe the alkanes as saturated hydrocarbons and alkenes as unsaturated hydrocarbons which contain a double bond (4.15) 	p. 167
<ul style="list-style-type: none"> recall the formulae of methane, ethane, propane and butane and draw the structures of their molecules (4.16) 	p. 159
<ul style="list-style-type: none"> recall the formulae of ethene and propene and draw the structures of their molecules (4.17) 	p. 167
<ul style="list-style-type: none"> describe how bromine water is used to distinguish between alkenes and alkanes (4.18) 	p. 167
<ul style="list-style-type: none"> explain how addition polymers are formed from unsaturated monomers (4.19) 	p. 168
<ul style="list-style-type: none"> describe some uses of <ul style="list-style-type: none"> poly(ethene) poly(propene) poly(styrene) poly(chloroethene), (polyvinyl chloride, PVC) (4.20) 	p. 171
<ul style="list-style-type: none"> understand the problems of the disposal of some plastics (4.21) 	p. 172-3
Enzymes	Chapter 17
<i>Candidates will be assessed on their ability to:</i>	
<ul style="list-style-type: none"> describe the uses of enzymes in washing powders and in food and drink manufacture 	p. 214, 217
<ul style="list-style-type: none"> recall that the dairy industry uses enzymes made by microorganisms to produce yoghurt and cheese (4.23) 	p. 216
Types of chemical reactions	
<i>Candidates will be assessed on their ability to:</i>	
<ul style="list-style-type: none"> know that there are several different types of chemical reactions (4.24) 	Throughout
<ul style="list-style-type: none"> understand that neutralisation can be used to make salts, some of which may be used as fertilisers (4.25) 	p. 144-7, 246-7
<ul style="list-style-type: none"> understand the process of thermal decomposition, for example, as shown by the action of heat on limestone and copper carbonate (4.26) 	p. 128-9
<ul style="list-style-type: none"> describe the effect of water on calcium oxide and appreciate the solution produced is limewater (4.27) 	p. 128-9
<ul style="list-style-type: none"> understand why calcium oxide and calcium hydroxide are used to neutralise soil acidity 	p. 156
<ul style="list-style-type: none"> recall that calcium carbonate is used in the production of glass, cement and iron (4.29) 	p. 130-3, 91

Module 5 : Energy and electricity Physics for You	Page numbers in Physics for You (revised, 2001)
Units	
<i>Candidates will be assessed on their ability to:</i>	
<ul style="list-style-type: none"> • use the following units: – volt (V), ampere (A), ohm (Ω), watt (W), kilowatt-hour (kWh) (5.01) 	p. 259, 266-7, 272, 272
Circuits	Chapter 31
<i>Candidates will be assessed on their ability to:</i>	
<ul style="list-style-type: none"> • recall that cells and batteries supply direct current and understand that direct current (d.c.) passes in one direction only (5.02) 	p. 254
<ul style="list-style-type: none"> • explain how changing the resistance in a circuit changes the current and how this can be achieved using a variable resistor (5.03) 	p. 259, 261
<ul style="list-style-type: none"> • describe how a voltmeter is placed in parallel with a component to measure the voltage (in volts) across it (5.04) 	p. 258
<ul style="list-style-type: none"> • understand how the current in a series circuit depends on the voltage of the source (5.05) 	p. 259
<ul style="list-style-type: none"> • recall and use the equation – voltage (V) = current (A) \times resistance (Ω) – $V = I \times R$ (5.06) 	p. 259
<ul style="list-style-type: none"> • describe how current varies with voltage for the following devices – fixed value resistors – filament lamps – diodes – and how this can be investigated experimentally (5.07) 	p. 265, 322, 261
<ul style="list-style-type: none"> • describe how the resistance of a light-dependent resistor (LDR) changes with light intensity and the resistance of a thermistor changes with a change of temperature (5.08) 	p. 265, 325
Mains electricity	Chapter 32
<i>Candidates will be assessed on their ability to:</i>	
<ul style="list-style-type: none"> • recall that the mains supply is alternating current and understand that alternating current (a.c.) changes direction (5.09) 	p. 274, 305
<ul style="list-style-type: none"> • recall that the mains supply can provide dangerous currents which can cause serious injury, or death, to users (5.10) 	p. 274
<ul style="list-style-type: none"> • recall the functions of live, neutral and earth wires – energy flows into a building or appliance through the live wire – the neutral wire is needed to make a complete circuit – the earth wire, together with the fuse, prevents electrocution (5.11) 	p. 274-5
<ul style="list-style-type: none"> • identify the live, neutral and earth conductors in a correctly wired plug and recall the colour of the insulation used on each conductor (5.12) 	p. 275

<ul style="list-style-type: none"> recall that a fuse is placed in the live conductor and understand that the fuse protects the appliance, circuit and connecting wires from overheating (5.13) 	p. 274
<ul style="list-style-type: none"> understand the action of a fuse <ul style="list-style-type: none"> a large current heats and melts a length of wire the melting of the wire breaks the circuit the correct choice of fuse depends on the current rating of an appliance (5.14) 	p. 274-5
<ul style="list-style-type: none"> understand that a residual current circuit breaker (RCCB) <ul style="list-style-type: none"> detects any difference in the currents in the live and neutral conductors acts quickly to protect the user should a leak to earth occur can be easily reset (5.15) 	Worksheet in the Teacher Support Pack
<ul style="list-style-type: none"> explain the use of insulation and double insulation in terms of safety, eg hairdryer, drill, vacuum cleaner (5.16) 	p. 275
<ul style="list-style-type: none"> understand that when an electric current passes through a resistor there is an energy transfer and the resistor is heated (5.17) 	p. 270
<ul style="list-style-type: none"> describe how the heating effect of an electric current is used in a variety of appliances, such as <ul style="list-style-type: none"> electric bar heaters immersion heaters kettles, cookers and irons (5.18) 	p. 270-1
<ul style="list-style-type: none"> understand that energy from the mains supply is measured in kilowatt-hours (5.19) 	p. 273
<ul style="list-style-type: none"> use the equation given below for calculating the cost of electricity <ul style="list-style-type: none"> cost = power (kW) × time (h) × cost of 1 kWh <i>(This equation will be provided if required) (5.20)</i> 	p. 273
Energy resources and transfer	Chapters 36, 2, 16
<i>Candidates will be assessed on their ability to:</i>	
<ul style="list-style-type: none"> explain that an electric current is generated by a magnet rotating inside a coil of wire <ul style="list-style-type: none"> on a small scale, as in a bicycle dynamo in the large-scale generation of electrical energy (5.21) 	p. 302-4, 113
<ul style="list-style-type: none"> recall how transformers are used in the transmission of electricity in the National Grid and explain the advantages and disadvantages of using overhead and underground cables (5.22) 	p. 308-9
<ul style="list-style-type: none"> understand a range of energy transfer chains illustrating the environmental implications of generating electricity <ul style="list-style-type: none"> the use of wind and water in electricity generation fossil fuel reserves and their use in electricity solar heating systems and electricity production through solar cells (5.23) 	p. 11-13, 110-15 p. 52, 113-14
<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 (5.24) 	p. 11-13, 113-15

<ul style="list-style-type: none"> • understand the benefits of the use of low energy appliances, eg low energy light bulbs (5.25) 	p. 112, 226
<ul style="list-style-type: none"> • understand that insulation can reduce the transfer of energy between objects at different temperatures (5.26) 	p. 43-5
<ul style="list-style-type: none"> • describe some examples where the use of insulation results in the reduction of energy transfer: <ul style="list-style-type: none"> – loft insulation – double glazing – cavity wall insulation (5.27) 	p. 44-5
<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 (5.28) 	p. 44-5, 53

Module 6 : Waves, atoms and space Physics for You	Page numbers in Physics for You (revised, 2001)
Units	
<i>Candidates will be assessed on their ability to:</i>	
<ul style="list-style-type: none"> • Use the following units: – hertz (Hz), metre (m), newton per kilogram (N/kg) (6.01) 	p. 139, 175
Waves	Chapter 21, 28, 29
<i>Candidates will be assessed on their ability to:</i>	
<ul style="list-style-type: none"> • describe longitudinal and transverse waves in terms of frequency, wavelength and amplitude (6.02) 	p. 174-5
<ul style="list-style-type: none"> • recall that the electromagnetic spectrum includes radio waves, microwaves, infra-red (IR), visible, ultraviolet (UV), X-rays and gamma rays (6.03) 	p. 218-19
<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 (6.04) 	p. 216-19
<ul style="list-style-type: none"> • recall that the energy associated with an electromagnetic wave, and thus its potential danger, increases with increasing frequency (6.05) 	p. 218-19
<ul style="list-style-type: none"> • recall that all electromagnetic waves are transverse and travel at the same speed in a vacuum (6.06) 	p. 218-19
<ul style="list-style-type: none"> • understand the difference between analogue and digital signals (6.07) 	p. 312, 332
<ul style="list-style-type: none"> • understand some uses of electromagnetic radiation including 	
<ul style="list-style-type: none"> – radio waves: broadcasting and communications including satellite transmissions 	p. 169, 177, 219, 221, 320, 335
<ul style="list-style-type: none"> – microwaves: cooking and communications including satellite transmissions 	p. 169, 219, 221, 227, 320
<ul style="list-style-type: none"> – infra-red: grills, night vision, remote controls, security systems and treatment of muscular problems 	p. 48-53, 219, 221, 227
<ul style="list-style-type: none"> – visible light: vision and photography 	p. 206-11
<ul style="list-style-type: none"> – ultraviolet: sunbeds, security marking, fluorescent lamps and detecting forged bank notes 	p. 218, 220, 226
<ul style="list-style-type: none"> – X-rays: observing the internal structure of objects and materials including the human body 	p. 218, 220, 226, 318
<ul style="list-style-type: none"> – gamma rays: sterilising food and medical equipment, and treatment of cancers (6.08) 	p. 218, 220, 356-7
<ul style="list-style-type: none"> • understand the detrimental effects of excessive exposure of the human body to 	
<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 (including skin cancer) and eyes 	p. 218, 220
<ul style="list-style-type: none"> – X-rays: damage to cells (6.09) 	p. 218, 220

<ul style="list-style-type: none"> describe the change of direction of light as it enters glass from air and as it leaves glass into air (eg, glass block, glass prism) (6.10) 	p. 176, 192
<ul style="list-style-type: none"> understand the refraction of light in terms of the change of speed when light crosses a boundary (6.11) 	p. 176, 193
<ul style="list-style-type: none"> recall that light and infra-red radiation pass through an optical fibre with very little energy loss (6.12) 	p. 197, 200, 320, 332
<ul style="list-style-type: none"> recall that sound is transmitted as a longitudinal wave (6.13) 	p. 174, 229
<ul style="list-style-type: none"> understand that sound with frequencies greater than 20,000 Hz is known as ultrasound and recall that human ears detect a limited range of frequencies (6.14) 	p. 230, 232
<ul style="list-style-type: none"> describe the use of ultrasound in medical imaging and echo sounding (6.15) 	p. 230, 240-1
Space	Chapter 20
<i>Candidates will be assessed on their ability to:</i>	
<ul style="list-style-type: none"> recall that the Moon orbits the Earth and that some other planets also have moons (NB names of moons are not required) (6.16) 	p. 159-161
<ul style="list-style-type: none"> understand gravitational field strength, g, and recall that it is different on other planets and the Moon to that on Earth (6.17) 	p. 136, 139, 159, 161
<ul style="list-style-type: none"> explain that gravitational force <ul style="list-style-type: none"> causes the planets to orbit the Sun causes the Moon and artificial satellites to orbit the Earth causes comets to orbit the Sun (6.18) 	p. 158, 159, 163
<ul style="list-style-type: none"> describe how the orbit of a comet differs from that of a planet (6.19) 	p. 163
<ul style="list-style-type: none"> recall that the solar system is part of the Milky Way galaxy <ul style="list-style-type: none"> describe a galaxy as a large collection of millions of stars state that the Universe is a large collection of galaxies (6.20) 	p. 165-6
<ul style="list-style-type: none"> describe the methods used to gather evidence for life elsewhere <ul style="list-style-type: none"> soil experiments on landers (eg Viking) listening on radio wavelengths (SETI) (6.21) 	p. 167
<ul style="list-style-type: none"> describe the evolution of small stars like our Sun through stages from nebula to main sequence to red giant, white dwarf and black dwarf (6.22) 	p. 165
<ul style="list-style-type: none"> understand that gravitational forces cause a nebula to collapse to form a star (6.23) 	p. 163-4
<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 (6.24) 	p. 166, 369
<ul style="list-style-type: none"> outline the evidence in support of the current theory about the origin of the Universe <ul style="list-style-type: none"> the 'Big Bang' red shift gives evidence that the Universe is expanding microwaves give evidence of the original explosion (6.25) 	p. 166-7
<ul style="list-style-type: none"> explain how the future of the Universe depends on the amount of mass present (6.26) 	p. 166, worksheet

Atoms	Chapter 39
<i>Candidates will be assessed on their ability to:</i>	
<ul style="list-style-type: none"> understand the terms atomic (proton) number and mass (nucleon) number and explain the existence of isotopes (6.27) 	p. 353
<ul style="list-style-type: none"> use symbols such as ${}^1_6\text{C}$ to describe particular nuclei (6.28) 	p. 353
<ul style="list-style-type: none"> understand that radioactivity arises from the breakdown of an unstable nucleus of an atom and is a random process (6.29) 	p. 354
<ul style="list-style-type: none"> recall the three main types of radiation from radioactive sources and their comparative mass, charge and ionisation ability (6.30) 	p. 350-1
<ul style="list-style-type: none"> describe the properties of alpha and beta particles and gamma radiation, including their penetrating powers and their uses in smoke alarms, for controlling the thickness of sheet material and sterilising medical instruments (6.31) 	p. 350-1, 356-7
<ul style="list-style-type: none"> 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 (6.32) 	p. 360
<ul style="list-style-type: none"> 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 (6.33) 	p. 360, worksheet
<ul style="list-style-type: none"> describe the problems associated with the safe disposal of radioactive waste (6.34) 	p. 359, 360, worksheet

End of syllabus content