

# GCSE Specification 1540 – Edexcel Physics A

**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**.

## 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

<b>Units</b>	Chapters 31, 32
<i>Candidates will be assessed on their ability to:</i>	
<ul style="list-style-type: none"> <li>use the following units: ampere (A), coulomb (C), ohm (<math>\Omega</math>), volt (V), watt (W), kilowatt-hour (kW h) (P1.01)</li> </ul>	pages 259, 266, 267, 272-3
<b>Mains electricity</b>	Chapter 32
<i>Candidates will be assessed on their ability to:</i>	
<ul style="list-style-type: none"> <li>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)</li> </ul>	p. 275
<ul style="list-style-type: none"> <li>recall the hazards of electricity including frayed cables, long cables, damaged plugs, water around sockets and pushing metal objects into sockets (P1.03)</li> </ul>	p. 274-5
<ul style="list-style-type: none"> <li>describe the uses of insulation, double insulation, earthing, fuses and circuit breakers in a range of domestic appliances (P1.04)</li> </ul>	p. 274-5, 301, 312, worksheet
<ul style="list-style-type: none"> <li>recall that electrical heating is used in a variety of ways in domestic contexts (P1.05)</li> </ul>	p. 270-1
<ul style="list-style-type: none"> <li>understand that a current in a resistor results in the electrical transfer of energy and an increase in temperature (P1.06)</li> </ul>	p. 260, 270
<ul style="list-style-type: none"> <li>recall and use the quantitative relationship between power, current and voltage: power = current <math>\times</math> voltage <math>P = I \times V</math> and apply the above relationship to the selection of appropriate fuses (P1.07)</li> </ul>	p. 272, 275
<ul style="list-style-type: none"> <li>calculate the energy used by domestic appliances in kilowatt-hours and calculate domestic electricity bills, based on meter readings (P1.08)</li> </ul>	p. 273
<ul style="list-style-type: none"> <li><b>use the quantitative relationship between energy transferred, current, voltage and time:</b> <b>energy transferred = current <math>\times</math> voltage <math>\times</math> time</b> <math>E = I \times V \times t</math> (P1.09)</li> </ul>	p. 272
<ul style="list-style-type: none"> <li>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)</li> </ul>	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"> <li>explain whether a series or parallel circuit is more appropriate for a range of applications, including domestic lighting (P1.11)</li> </ul>	p. 256-7
	<ul style="list-style-type: none"> <li>understand that the current in a series circuit depends on the applied voltage and the number and nature of other components (P1.12)</li> </ul>	p. 256, 262
	<ul style="list-style-type: none"> <li>describe how current varies with voltage in wires, resistors, metal filament lamps and diodes and how this can be investigated experimentally (P1.13)</li> </ul>	p. 261, 265, 322
	<ul style="list-style-type: none"> <li>describe the qualitative effect of changing resistance on the current in a circuit (P1.14)</li> </ul>	p. 255, 260
	<ul style="list-style-type: none"> <li>describe the qualitative variation of resistance of LDRs with illumination and of thermistors with temperature (P1.15)</li> </ul>	p. 265, 325
	<ul style="list-style-type: none"> <li>recall and use the quantitative relationship between voltage, current and resistance: voltage = current <math>\times</math> resistance <math>V = I \times R</math> (P1.16)</li> </ul>	p. 259
	<ul style="list-style-type: none"> <li>understand that current is rate of flow of charge (P1.17)</li> </ul>	p. 255, 256, 266, 278
	<ul style="list-style-type: none"> <li>recall and use the quantitative relationship between charge, current and time: charge = current <math>\times</math> time <math>Q = I \times t</math> (P1.18)</li> </ul>	p. 266
	<ul style="list-style-type: none"> <li><b>recall electric current in solid metallic conductors is a flow of negatively charged electrons</b> (P1.19)</li> </ul>	p. 255, 256, 266
	<ul style="list-style-type: none"> <li><b>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</b> (P1.20)</li> </ul>	p. 278
	<ul style="list-style-type: none"> <li><b>recall that:</b> <ul style="list-style-type: none"> <li><b>voltage is the energy transferred per unit charge passed</b></li> <li><b>a volt is a joule per coulomb</b> (P1.21)</li> </ul> </li> </ul>	p. 267
Electric charge		Chapter 30
<i>Candidates will be assessed on their ability to:</i>		
	<ul style="list-style-type: none"> <li>describe common materials which are electrical conductors or insulators including metals and plastics (P1.22)</li> </ul>	p. 249
	<ul style="list-style-type: none"> <li>recall that insulating materials can be charged by friction (P1.23)</li> </ul>	p. 247
	<ul style="list-style-type: none"> <li>explain that positive and negative electrostatic charges are produced on materials by the loss and gain of electrons (P1.24)</li> </ul>	p. 248
	<ul style="list-style-type: none"> <li>recall that there are forces of attraction between unlike charges and repulsion between like charges (P1.25)</li> </ul>	p. 247
	<ul style="list-style-type: none"> <li>explain common electrostatic phenomena, including shocks from car doors and synthetic fabrics, in terms of the movement of electrons (P1.26)</li> </ul>	p. 248, 251, 252
	<ul style="list-style-type: none"> <li>describe the potential dangers and uses of electrostatic charges generated in everyday situations, eg fuelling aircraft and tankers, photocopiers and inkjet printers (P1.27)</li> </ul>	p. 252, 321

Electromagnetism		Chapter 35
<i>Candidates will be assessed on their ability to:</i>		
	<ul style="list-style-type: none"> <li>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)</li> </ul>	p. 296-9
	<ul style="list-style-type: none"> <li>understand that when a wire carrying a current is perpendicular to a magnetic field, the resulting force is perpendicular to both (P1.29)</li> </ul>	p. 296

Electromagnetic induction		Chapter 36
<i>Candidates will be assessed on their ability to:</i>		
	<ul style="list-style-type: none"> <li>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)</li> </ul>	p. 302-3
	<ul style="list-style-type: none"> <li>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)</li> </ul>	p. 304, 306
	<ul style="list-style-type: none"> <li>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)</li> </ul>	p. 307-9
	<ul style="list-style-type: none"> <li>describe the use of step-up and step-down transformers in the large-scale transmission of electrical energy (P1.33)</li> </ul>	p. 309
	<ul style="list-style-type: none"> <li><b>recall and use the quantitative relationship between input (primary) and output (secondary) voltages and the turns ratio for a transformer:</b>   <math display="block">\frac{\text{voltage(primary)}}{\text{voltage(secondary)}} = \frac{\text{turns(primary)}}{\text{turns(secondary)}}</math> <math display="block">\frac{V_P}{V_S} = \frac{n_P}{n_S} \quad (\text{P1.34})</math> </li> </ul>	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

<b>Units</b>	Chapter 1
<i>Candidates will be assessed on their ability to:</i>	
<ul style="list-style-type: none"> <li>use the following units: kilogram (kg), metre (m), metre<sup>2</sup> (m<sup>2</sup>), metre<sup>3</sup> (m<sup>3</sup>), metre/second (m/s), metre/second<sup>2</sup> (m/s<sup>2</sup>), newton (N), pascal (Pa) (P2.01)</li> </ul>	p. 6-7, 75, 85, 130, 138,
<b>Movement and position</b>	Chapter 18
<i>Candidates will be assessed on their ability to:</i>	
<ul style="list-style-type: none"> <li>understand distance – time graphs (P2.02)</li> </ul>	p. 134
<ul style="list-style-type: none"> <li>explain the difference between speed and velocity (P2.03)</li> </ul>	p. 130
<ul style="list-style-type: none"> <li>recall and use the quantitative relationship between acceleration, velocity and time:  <math display="block">\text{acceleration} = \frac{\text{change in velocity}}{\text{time taken}} \quad a = \frac{(v - u)}{t}</math> </li> </ul>	p. 130
<ul style="list-style-type: none"> <li>interpret speed-time graphs and determine acceleration from the gradient of the graph (P2.05)</li> </ul>	p. 132-3
<ul style="list-style-type: none"> <li><b>determine the distance travelled from the area between the curve and the time axis</b> (P2.06)</li> </ul>	p. 133
<b>Forces and movement</b>	Chapters 11, 14
<i>Candidates will be assessed on their ability to:</i>	
<ul style="list-style-type: none"> <li>recall a brief history of our understanding of forces including: <ul style="list-style-type: none"> <li>the Greek view – a single force needed to sustain motion</li> <li>Galileo and Newton – balanced forces allow an object to continue in uniform motion in a straight line or to remain at rest</li> <li>Newton – gravitational attraction acts between all masses (P2.07)</li> </ul> </li> </ul>	p. 368 p. 77 p. 139, 162
<ul style="list-style-type: none"> <li>recall that when two bodies interact, the forces they exert on each other are equal and opposite (P2.08)</li> </ul>	p. 94-5
<ul style="list-style-type: none"> <li>understand how to add forces which act along a line (P2.09)</li> </ul>	p. 96
<ul style="list-style-type: none"> <li>understand that friction can produce both accelerating and retarding forces (P2.10)</li> </ul>	p. 92-3, 98-9

	<ul style="list-style-type: none"> <li>recall and use the quantitative relationship between unbalanced force, mass and acceleration and apply this relationship to vehicular and human movement:  <b>force = mass <math>\times</math> acceleration</b>  <math>F = m \times a</math> (P2.11)</li> </ul>	p. 138-9
	<ul style="list-style-type: none"> <li>recall and use the quantitative relationship between weight, mass and <math>g</math>:  weight = mass <math>\times g</math>      <math>W = m \times g</math> (P2.12)</li> </ul>	p. 139
	<ul style="list-style-type: none"> <li>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)</li> </ul>	p. 75, 139
	<ul style="list-style-type: none"> <li>explain the forces acting on falling objects and why falling objects reach a terminal velocity (P2.14)</li> </ul>	p. 136
	<ul style="list-style-type: none"> <li>understand that the stopping distance of a vehicle is the sum of the thinking distance and the stopping distance (P2.15)</li> </ul>	p. 98
	<ul style="list-style-type: none"> <li>describe the factors affecting vehicle stopping distances including speed, mass, road condition and reaction time (P2.16)</li> </ul>	p. 98
<b>Forces and shape</b>		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"> <li>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)</li> </ul>	p. 100
	<ul style="list-style-type: none"> <li>describe how extension varies with applied force for a range of materials including springs and/or rubber bands (P2.18)</li> </ul>	p. 74
	<ul style="list-style-type: none"> <li>recall that particles in a gas have random motion and that they exert a force on the walls of the container (P2.19)</li> </ul>	p. 14-16
	<ul style="list-style-type: none"> <li><b>understand the relationship between the pressure and volume of a fixed mass of gas at constant temperature and use the quantitative relationship</b>  <math>P_1 \times V_1 = P_2 \times V_2</math> (P2.20)</li> </ul>	<b>p. 31, 35, 36</b>

## 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

<b>Units</b>	Chapter 21
<i>Candidates will be assessed on their ability to:</i>	
<ul style="list-style-type: none"> <li>use the following units: hertz (Hz), kilohertz (kHz), megahertz (MHz), metre/second (m/s) (P3.01)</li> </ul>	p. 175
<b>Properties of waves</b>	Chapter 21
<i>Candidates will be assessed on their ability to:</i>	
<ul style="list-style-type: none"> <li>describe longitudinal and transverse waves in ropes, springs and water (P3.02)</li> </ul>	p. 174
<ul style="list-style-type: none"> <li>state the meaning of amplitude, frequency, wavelength and period of a wave (P3.03)</li> </ul>	p. 175
<ul style="list-style-type: none"> <li>recall that waves transfer energy and information without transferring matter (P3.04)</li> </ul>	p. 174, 219
<ul style="list-style-type: none"> <li>recall and use the quantitative relationship between the speed, frequency and wavelength of a wave: speed = frequency <math>\times</math> wavelength <math>v = f \times \lambda</math> (P3.05)</li> </ul>	p. 175, 229
<ul style="list-style-type: none"> <li>use the quantitative relationship between frequency and time period: frequency = <math>\frac{1}{\text{time period}}</math> <math>f = \frac{1}{T}</math> (P3.06)</li> </ul>	p. 175, worksheet
<ul style="list-style-type: none"> <li>use the above relationships in a wide range of contexts including sound waves and electromagnetic waves (P3.07)</li> </ul>	p. 175, 219, 229
<ul style="list-style-type: none"> <li>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)</li> </ul>	p. 177

<b>The Earth's layered structure</b>		<b>Chapter 20</b>
<i>Candidates will be assessed on their ability to:</i>		
	<ul style="list-style-type: none"> <li>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)</li> </ul>	p. 154-5
	<ul style="list-style-type: none"> <li>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)</li> </ul>	p. 156-7
	<ul style="list-style-type: none"> <li>understand that at plate boundaries, plates may: <ul style="list-style-type: none"> <li>slide past each other, causing earthquakes</li> <li>move towards each other, taking rock into the mantle</li> <li>move away from each other, resulting in volcanoes and/or formation of new rocks (P3.11)</li> </ul> </li> </ul>	p. 157
<b>The electromagnetic spectrum</b>		<b>Chapter 28</b>
<i>Candidates will be assessed on their ability to:</i>		
	<ul style="list-style-type: none"> <li>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)</li> </ul>	p. 218-9
	<ul style="list-style-type: none"> <li>recall the order of the electromagnetic spectrum in decreasing wavelength and increasing frequency, including the colours of the visible spectrum (P3.13)</li> </ul>	p. 216-9
	<ul style="list-style-type: none"> <li>recall some uses of electromagnetic radiations including:</li> </ul>	
	<ul style="list-style-type: none"> <li>radio waves: broadcasting and communications</li> </ul>	p. 177, 219, 221, 320, 335
	<ul style="list-style-type: none"> <li>microwaves: cooking and satellite transmissions</li> </ul>	p. 219, 221, 227, 320
	<ul style="list-style-type: none"> <li>infra-red: heaters, grills, night vision and remote controls</li> </ul>	p. 48-53, 219, 221, 227
	<ul style="list-style-type: none"> <li>visible light: optical fibres and photography</li> </ul>	p. 195-7, 200, 219, 206-7
	<ul style="list-style-type: none"> <li>ultraviolet: sunbeds, crime prevention and fluorescent lamps</li> </ul>	p. 218, 220, 226
	<ul style="list-style-type: none"> <li>X-rays: observing the internal structure of objects and materials, medical applications</li> </ul>	p. 218, 220, 226, 318
	<ul style="list-style-type: none"> <li>gamma rays: sterilising food and medical equipment (P3.14)</li> </ul>	p. 218, 220, 356-7
	<ul style="list-style-type: none"> <li>recall the detrimental effects of excessive exposure of the human body to electromagnetic waves of increasing frequencies including:</li> </ul>	
	<ul style="list-style-type: none"> <li>microwaves: internal heating of body tissue</li> </ul>	p. 219, 227
	<ul style="list-style-type: none"> <li>infra-red: skin burns</li> </ul>	p. 219
	<ul style="list-style-type: none"> <li>ultraviolet: damage to surface cells and blindness</li> </ul>	p. 218, 220
	<ul style="list-style-type: none"> <li>gamma rays: cancer, mutation (P3.15)</li> </ul>	p. 218, 220

<b>Light and sound</b>		<b>Chaps 23, 25, 29</b>
<i>Candidates will be assessed on their ability to:</i>		
	<ul style="list-style-type: none"> <li>recall that light waves are transverse waves which can be reflected, refracted and diffracted (P3.16)</li> </ul>	p. 174, 176-7, 184-7, 192
	<ul style="list-style-type: none"> <li>describe the role of total internal reflection in transmitting information along optical fibres and in prisms (P3.17)</li> </ul>	p. 195-7, 200
	<ul style="list-style-type: none"> <li>understand the difference between analogue and digital signals (P3.18)</li> </ul>	p. 312, 332
	<ul style="list-style-type: none"> <li><b>describe how digital signals can carry more information</b> (P3.19)</li> </ul>	<b>p. 333</b>
	<ul style="list-style-type: none"> <li>recall that sound waves are longitudinal waves which can be reflected, refracted and diffracted (P3.20)</li> </ul>	p. 174, 177, 229-31, 240, 245
	<ul style="list-style-type: none"> <li>recall that the frequency range for human hearing is 20 Hz – 20 000 Hz (P3.21)</li> </ul>	p. 232
	<ul style="list-style-type: none"> <li>understand the nature of ultrasound as high-frequency sound and its applications in scanning, cleaning and range or direction finding (P3.22)</li> </ul>	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

<b>The Solar system</b>		<b>Chapter 20</b>
<i>Candidates will be assessed on their ability to:</i>		
	• interpret physical data on the planets, particularly with regard to their masses and their orbits in the Solar system (P4.01)	p. 160-1
	• 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
	• 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
<b>The rest of the Universe</b>		<b>Chapter 20</b>
<i>Candidates will be assessed on their ability to:</i>		
	• recall that the Sun is one of many millions of stars in a huge group called the Milky Way galaxy (P4.04)	p. 165
	• 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
	• 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
	• recall that small stars, like the Sun, eventually become red giants and later become white dwarfs (P4.07)	p. 165
	• 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
	• <b>recall evidence for the 'Big Bang' theory, including the different red shifts of light from distant galaxies and the background microwave radiation (P4.09)</b>	<b>p. 166-7</b>
	• 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

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

	<ul style="list-style-type: none"> <li>describe power as the rate of transfer of energy or the rate of doing work (P5.12)</li> </ul>	p. 118-19
	<ul style="list-style-type: none"> <li>use the quantitative relationship between power, work done (energy transferred) and time taken:  <math display="block">\text{power} = \frac{\text{work done}}{\text{time taken}} \quad P = \frac{W}{t} \quad (\text{P5.13})</math> </li> </ul>	p. 118
<b>Energy resources and electricity generation</b>		Chapter 2, 16
<i>Candidates will be assessed on their ability to:</i>		
	<ul style="list-style-type: none"> <li>understand a range of energy transfer chains illustrating the environmental implications of generating electricity, including: <ul style="list-style-type: none"> <li>the use of wind and water</li> <li>geothermal resources</li> <li>solar heating systems and electricity production through solar cells</li> <li>fossil fuel reserves</li> <li>nuclear power (P5.14)</li> </ul> </li> </ul>	<p>p. 11-13 p. 110-15</p> <p>p. 52, 113-14</p> <p>p. 359</p>
	<ul style="list-style-type: none"> <li><b>describe the advantages and disadvantages of methods of large scale electricity production using a variety of renewable and non-renewable resources (P5.15)</b></li> </ul>	p. 11-13, 113-15

## P6 : Radioactivity

page numbers in **Physics for You**

• Units	Chapter 39
• Radioactivity	Chapter 39

<b>Units</b>	Chapter 39
<i>Candidates will be assessed on their ability to:</i>	
• use the following unit: becquerel (Bq) (P6.01)	p. 360
<b>Radioactivity</b>	<b>Chapter 39</b>
<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 (P6.05)	p. 350-1
• <b>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</b> (P6.06)	<b>p. 355</b>
• 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"> <li>• radiation can cause mutations in living organisms</li> <li>• radiation can damage cells and tissue</li> <li>• the problems arising in the disposal of radioactive waste (P6.13)</li> </ul>	p. 220, 360, 373, worksheet

<b>P7 : Communications</b>	<b>Physics for You</b>
<b>Units</b>	
<i>Candidates will be assessed on their ability to:</i>	
use the following units metre (m), second (s), metre/second (m/s), metre/second <sup>2</sup> (m/s <sup>2</sup> ), newton (N), hertz (Hz) (P7.01)	p. 6-7, 130, 138, 175
<b>Communications systems</b>	<b>Chapter 38</b>
<i>Candidates will be assessed on their ability to:</i>	
recall that communications systems can be broken down into a number of blocks, each having specific functions (P7.02)	p. 332-3, 320, 335
recall the terms used for the various building blocks and their associated functions, including encoder modulator decoder storage transmitter receiver transducer amplifier (P7.03)	p. 332-3, 335
recall how light can be encoded to transmit information via an optical fibre (P7.04)	p. 332, 320
describe the advantages of using digital signals over analogue signals (P7.05)	p. 333
recall the different methods of storage and retrieval of information, including digital storage, as used with CD players analogue storage, as used in record players use of magnetic tape, photo-diode and diode-laser (P7.06)	p. 312, p. 312, p. 312, 313, 332
understand the physical principles of a variety of transducers, including moving coil loudspeaker moving coil microphone erase, record and playback heads of a tape recorder (P7.07)	p. 297, p. 334, p. 313
understand the terms noise and attenuation and how these can affect the quality of the received signal (P7.08)	p. 333
recall the use of regenerators and repeaters in electrical cable and optical fibre communications (P7.09)	p. 332

<b>Transmitting and receiving radio waves</b>	<b>Chapters 38, 28</b>
<i>Candidates will be assessed on their ability to:</i>	
recall a brief history of the development of sending and receiving information including communication by telegraph and telephone wireless transmissions leading to radio and television satellite communications (P7.10)	p. 370
<b>recall the nature of radio waves and understand how interference affects the quality of the received signals (P7.11)</b>	<b>p. 219, 221</b>
recall that transmitted radio waves can reach the receiver as ground, sky or space waves and recall the typical frequency ranges associated with these waves (P7.12)	p. 221
describe, by suitable diagrams, ground waves, sky waves and space waves (P7.13)	p. 221
recall the part played by the ionosphere in reflecting radio waves (P7.14)	p. 221
understand the importance of diffraction of radio waves, including by buildings, mountains, curvature of the Earth and transmission dishes (P7.15)	p. 177, 169
understand that the amount of diffraction depends upon wavelength and physical dimensions involved (P7.16)	p. 177
recall and use the relationships between wave speed ( $v$ ), frequency ( $f$ ) and wavelength ( $\lambda$ ) $v = f \times \lambda \quad f = \frac{v}{\lambda} \quad \lambda = \frac{v}{f} \quad (\text{P7.17})$	p. 175
recall that amplitude modulation (AM) and frequency modulation (FM) are used in radio communications and understand the difference between them (P7.18)	p. 335
recall that AM signals have a greater range and are more susceptible to noise than FM signals (P7.19)	p. 335
<b>Satellites</b>	<b>Chapter 20</b>
<i>Candidates will be assessed on their ability to:</i>	
recall the difference between passive and active satellites (P7.20)	p. 169
describe the different uses for satellite communications systems including telephone and television communications surveillance and monitoring navigation (P7.21)	p. 169
understand the features of a geostationary orbit and explain the importance to telecommunications of geostationary satellites (P7.22)	p. 162, 168-9, 221, 320
understand the connection between the Earth's spin and the use of monitoring satellites placed in low polar orbits (P7.23)	p. 168

<p>use the quantitative relationship between orbital speed, orbital radius and time period</p> $\text{orbital speed} = \frac{2\pi \times \text{orbital radius}}{\text{time period}}$ $v = \frac{2 \times \pi \times r}{T}$ <p><i>(This equation will be provided if required)</i> (P7.24)</p>	p. 168
<p>understand the role of the gravitational force of the Earth as the centripetal force on the satellite (P7.25)</p>	p. 162
<p>use the quantitative relationship between the force acting on a satellite, mass (<math>m</math>), orbital speed (<math>v</math>) and radius (<math>r</math>)</p> $\text{force} = \frac{\text{mass} \times (\text{orbital speed})^2}{\text{radius}} \quad F = \frac{m \times v^2}{r}$ <p><i>(This equation will be provided if required)</i> (P7.26)</p>	p. 78, 168, worksheet

<b>P8 : Particles</b> <b>Physics for You</b>	
<b>Units</b>	
<i>Candidates will be assessed on their ability to:</i>	
use the following units kelvin (K), coulomb (C), ampere (A), volt (V), joule (J), pascal (Pa), speed (m/s) (P8.01)	p. 29, 85, 107, 130, 266
<b>Ideal gas molecules</b>	<b>Chapter 6</b>
<i>Candidates will be assessed on their ability to:</i>	
understand that there is an absolute zero of temperature which is -273 °C (P8.02)	p. 29, 33
describe the kelvin scale of temperature and be able to convert between the kelvin and Celsius scales (P8.03)	p. 29, 33
understand that an increase in temperature results in an increase in speed of gas particles and that the kelvin temperature of the gas is proportional to their average kinetic energy (P8.04)	p. 16, 36
explain the pressure exerted by a gas in terms of the motion of its particles (P8.05)	p. 14, 36, 89
describe the qualitative relationship between pressure and kelvin temperature for a gas in a sealed container (P8.06)	p. 34, 36
<b>use the quantitative relationship between the pressure and the kelvin temperature</b> $\frac{P_1}{T_1} = \frac{P_2}{T_2} \quad (\text{This equation will be provided if required}) \quad (\text{P8.07})$	<b>p. 34</b>
<b>Atoms and nuclei</b>	<b>Chapter 39</b>
<i>Candidates will be assessed on their ability to:</i>	
describe the results of Geiger and Marsden's experiments with gold foil and $\alpha$ -particles (P8.08)	352, 368, worksheet
describe Rutherford's nuclear model of the atom and how it accounts for the results of Geiger and Marsden's experiment and understand the factors (charge <b>and speed</b> ) which affect the deflection of $\alpha$ -particles by a nucleus (P8.09)	p. 352
recall the qualitative features of the curve obtained when the number of neutrons ( $N$ ) is plotted against the number of protons ( $Z$ ) for stable isotopes (P8.10)	worksheet
understand that if an isotope does not lie on this curve it will be unstable and radioactive	worksheet
recall that an isotope that lies above the curve has too many neutrons to be stable and will undergo $\beta^-$ - decay (emit an electron) (P8.12)	worksheet
understand that in the process of $\beta^-$ - decay a neutron becomes a proton plus an electron	p. 355
recall that an isotope that lies below the curve has too few neutrons to be stable and will undergo $\beta^+$ - decay (emit a positron) (P8.14)	worksheet
understand that in the process of $\beta^+$ - decay a proton becomes a neutron plus a positron (P8.15)	worksheet
describe the effects on the proton (atomic) and mass numbers of a nucleus of $\beta^-$ and $\beta^+$ - decay (P8.16)	p. 355

recall that nuclei with greater than 82 protons usually undergo $\alpha$ - decay (P8.17)	worksheet
recall that as a result of $\beta^-$ or $\beta^+$ - decay nuclei often undergo rearrangement with a loss of energy as $\gamma$ -radiation (P8.18)	p. 355
understand that a nucleus of U-235 can be split (fission) by collision with a neutron and that this process releases energy in the form of kinetic energy of the fission products (P8.19)	p. 358-9
recall that the fission of U-235 produces two daughter nuclei and a small number of neutrons	p. 358
understand that a chain reaction can be set up if the neutrons produced by one fission strike other U-235 nuclei (P8.21)	p. 358
describe in outline how the fission process can be used as an energy source to generate electricity (P8.22)	p. 358-9
understand that the products of nuclear fission are radioactive and the implications this has for their safe storage over prolonged periods (P8.23)	p. 360, worksheet
<b>Electrons and other particles</b>	<b>Chapter 37</b>
<i>Candidates will be assessed on their ability to:</i>	
recall that the electron is a fundamental, negatively charged particle (P8.24)	p. 314, 352
recall that the proton and neutron are not fundamental particles but each contains three particles called quarks (P8.25)	worksheet
<b>recall that the positron is a fundamental, positively charged particle with the same mass as the electron (P8.26)</b>	worksheet
<b>recall that there are two types of quark in protons and neutrons and that <math>\beta</math> decay occurs when one quark changes to the other type, which in turn causes the neutron to become a proton (<math>\beta^-</math> - decay) or the proton to become a neutron (<math>\beta^+</math> - decay) (P8.27)</b>	worksheet
understand that electrons are ‘boiled off’ hot metal filaments and this is called thermionic emission (P8.28)	p. 314
understand the principles of a simple electron gun with a heated cathode and accelerating anode (P8.29)	p. 314-5
<b>use the quantitative relationship between kinetic energy gained, electronic charge and accelerating voltage</b> <b>kinetic energy = electronic charge <math>\times</math> accelerating voltage</b> $KE = e \times V$ <i>(This equation will be provided if required)</i> (P8.30)	worksheet
recall that a beam of electrons is equivalent to an electric current <b>and perform simple calculations involving the rate of flow of electrons and the current, given the electronic charge</b> (P8.31)	p. 266, worksheet
understand that an electron beam, or a stream of charged ink drops, can be deflected by the electric field between parallel charged metal plates (P8.32)	p. 315, 321
understand the principal uses of electron beams, including TV picture tubes, computer monitors, oscilloscopes, the production of X-rays (P8.33)	p. 315-318
understand how an oscilloscope can be used to measure voltage and frequency (P8.34)	p. 317

end of subject content