

Edexcel : GCSE specification 2109

Physics

First Certification Summer 2008

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Name : _____

Physics Unit P1 a	
Topic 9 — Producing and Measuring Electricity	Page numbers in New Physics for You
<p>Learning outcomes</p> <p>Learning outcomes, words or statements in bold indicate that this content is designated for Higher-tier students only.</p> <p>Students will be assessed on their ability to:</p> <ul style="list-style-type: none"> • distinguish between the two types of current (alternating and direct) P1 a 9.1 • describe sources of direct current, including batteries and solar cells P1 a 9.2 • describe how to produce an electric current by rotating a magnet in a coil of wire, as in a dynamo P1 a 9.3 • describe the factors that affect the size and direction of an induced voltage P1 a 9.4 • explain how changing the resistance in a circuit changes the current P1 a 9.5 • 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 P1 a 9.6 • recognise and explain applications depending on resistance change, such as controlling how long the shutter should be open on a digital camera P1 a 9.7 • explain that current is a rate of flow of negatively charged electrons and that it can be measured by an ammeter placed in series in a circuit P1 a 9.8 • interpret a battery's stated capacity in terms of Amp-hours and use it to predict the number of hours it should last when supplying a given current P1 a 9.9 • use primary data to explain how current varies with voltage for fixed value resistors and filament lamps and how this can be investigated experimentally P1 a 9.10 • use the relationship between the voltage, current and resistance: P1 a 9.11 <p>$V = I \times R$</p> <p style="text-align: right;">continued...</p>	<p>pages 248, 268, 299</p> <p>248, 260, 14, 103, 115</p> <p>296-299</p> <p>296, 300</p> <p>253-6</p> <p>319</p> <p>319</p> <p>249, 250</p> <p>115</p> <p>253-6, 259</p> <p>253</p>

<ul style="list-style-type: none"> investigate practically or otherwise the voltage and current output, and advantages/disadvantages of battery technology (dry cell or rechargeable), including considerations of their cost/performance and impact on the environment P1 a 9.12 	(252, 260)
<ul style="list-style-type: none"> discuss the impact that the electric telephone and electricity has had on making the modern world P1 a 9.13 	240, (289), 374-5
<ul style="list-style-type: none"> explore how a new technology, such as Maglev trains, develops as a result of scientific advances, such as the discovery of superconductivity P1 a 9.14 	(375)
<ul style="list-style-type: none"> use data relating the size of electric circuits to the processing speed of computers and suggest future applications P1 a 9.15 	(314)
<ul style="list-style-type: none"> demonstrate an understanding of how ICT can be used to collect and display data from electric circuits for analysis, and compare this with traditional methods in terms of reliability and validity of data. P1 a 9.16 	(worksheets)

Topic 10 — You're in Charge	Page numbers in New Physics for You
<p>Learning outcomes</p> <p>Learning outcomes, words or statements in bold indicate that this content is designated for Higher-tier students only.</p> <p>Students will be assessed on their ability to:</p> <ul style="list-style-type: none"> • evaluate whether renewable energies such as solar power and wind power can meet the UK's future electricity needs, and evaluate their economic, environmental and social impact P1 a 10.1 • consider the benefits and drawbacks when deciding about implementing technology, such as a new national grid for distribution of electricity P1 a 10.2 • explore how scientific ideas change over time in context of the medical uses of electricity, real and imagined P1 a 10.3 • explain how a simple electric motor works P1 a 10.4 • explain the concept of electrical power as the rate of transfer of electrical energy P1 a 10.5 • use the equation to calculate electrical power: (P1 a 10.6) Power = Current x Voltage • use the term 'efficiency' to be able to find efficiency from: (P1 a 10.7) $\frac{\text{useful output}}{\text{total input}} \times 100\%$ and recall this equation • interpret data about the efficiency of solar cells and suggest why they are not yet in widespread use P1 a 10.8 • use the equation to calculate the cost of electricity: cost = power x time x cost of 1 kWh where power is measured in kilowatts and time is measured in hours P1 a 10.9 • plan a way to test whether an energy efficiency measure, such as insulating a home, is cost effective P1 a 10.10 • explain how the earth wire, together with a fuse, provides protection for the user P1 a 10.11 • describe the advantages of a residual current circuit breaker (RCCB). P1 a 10.12 	<p>pages 14-15, 101-6</p> <p>(303)</p> <p>356-7, 375</p> <p>290-3</p> <p>266-7</p> <p>266</p> <p>102-4, 116</p> <p>103, 105, 115</p> <p>267</p> <p>12, 43</p> <p>269</p> <p>269, 272</p>

Physics Unit P1 b

Topic 11 — Now You See it, Now You Don't	Page numbers in New Physics for You
<p>Learning outcomes</p> <p>Learning outcomes, words or statements in bold indicate that this content is designated for Higher-tier students only.</p> <p>Students will be assessed on their ability to:</p> <ul style="list-style-type: none"> • discuss the evidence that microwave radiation from mobile phones or masts poses health risks, and how this has been reported in the media P1 b 11.1 • discuss the characteristics of ultraviolet light in terms of amplitude, frequency and wavelength and relate them to the dangers of over-exposure P1 b 11.2 • describe the detrimental effects of excessive exposure to the following waves and explain this in terms of increasing frequency: <ul style="list-style-type: none"> ○ microwaves: internal heating of body tissue ○ infrared: skin burns ○ X-rays and gamma-rays: mutation or destruction of cells in the body P1 b 11.3 • use primary or secondary data to describe how differences in density of materials will cause waves to be reflected/refracted P1 b 11.4 • explain how scanning by reflection can be used for the following applications: <ul style="list-style-type: none"> ○ ultrasound: scanning a foetus during pregnancy ○ optical: iris recognition ○ discuss the advantages/disadvantages of such technology P1 b 11.5 • explain how scanning by absorption enables: <ul style="list-style-type: none"> ○ X-rays to see bone fractures ○ microwaves to monitor rain ○ ultraviolet light to detect forged bank notes by fluorescence P1 b 11.6 • explain how scanning by emission enables the use of infrared sensors to monitor temperature P1 b 11.7 <p style="text-align: right;">continued...</p>	<p style="text-align: center;">216-7</p> <p style="text-align: center;">208, 210, 212, 214</p> <p style="text-align: center;">209, 213-4</p> <p style="text-align: center;">209, 231-4</p> <p style="text-align: center;">208, 210, 214</p> <p style="text-align: center;">184-5, 187-9</p> <p style="text-align: center;">229</p> <p style="text-align: center;">356</p> <p style="text-align: center;">229, 356</p> <p style="text-align: center;">208, 210, 312</p> <p style="text-align: center;">211</p> <p style="text-align: center;">212</p> <p style="text-align: center;">211, 213</p>

<ul style="list-style-type: none"> ● discuss the benefits and drawbacks to society of a technology that is based on the properties of waves P1 b 11.8 	207-219
<ul style="list-style-type: none"> ● describe the advantages of sending information in the form of a digital signal compared with analogue P1 b 11.9 	218-9
<ul style="list-style-type: none"> ● discuss how the production of digital signals has created a range of music technologies, including synthesised instruments and altered the way we listen to and distribute music P1 b 11.10 	219, 233
<ul style="list-style-type: none"> ● describe how the property of total internal reflection of light waves allows optical fibres to transfer large amounts of information over long distances P1 b 11.11 	187-9, 192, 219, 314
<ul style="list-style-type: none"> ● describe the similarities and differences between longitudinal and transverse waves, giving examples of each type, including sound waves, ultrasound, seismic waves and electromagnetic waves P1 b 11.12 	166, 171, 225-9, 146-7
<ul style="list-style-type: none"> ● suggest reasons why scientists find it difficult to predict earthquakes and tsunami waves, given appropriate data P1 b 11.13 	(146-7, 373)
<ul style="list-style-type: none"> ● explain the terms: <ul style="list-style-type: none"> ○ amplitude ○ frequency ○ wavelength ○ speed of a wave P1 b 11.14 	167 167 167 167
<ul style="list-style-type: none"> ● use the relationship: speed = frequency x wavelength (P1 b 11.15) 	167, 209, 225
<ul style="list-style-type: none"> ● use the equation: speed = distance / time to calculate the distance to a reflecting surface if the time for the reflected wave to return is known P1 b 11.16 	122, 227, 228
<ul style="list-style-type: none"> ● use data about seismic waves passing through the Earth to draw conclusions about the types of materials that are found in the planet's interior P1 b 11.17 	147
<ul style="list-style-type: none"> ● describe how similarities and differences of waves can be represented in the electromagnetic spectrum P1 b 11.18 	208-9
<ul style="list-style-type: none"> ● recall that electromagnetic waves all travel at the same speed in a vacuum. P1 b 11.19 	209

Topic 12 — Space and its Mysteries	Page numbers in New Physics for You
<p>Learning outcomes</p> <p>Learning outcomes, words or statements in bold indicate that this content is designated for Higher-tier students only.</p> <p>Students will be assessed on their ability to:</p> <ul style="list-style-type: none"> describe conditions in interplanetary space in terms of atmosphere, temperature and weightlessness due to lack of gravity P1 b 12.1 describe how these conditions can be partly allowed for in spacecraft, including supply of air, heating/cooling, artificial gravity, exercise machines, etc P1 b 12.2 explain the difference between mass and weight P1 b 12.3 use the equation (P1 b 12.4): weight = mass x acceleration of free-fall $W = m g$ explain how a spacecraft might be powered in terms of action and reaction P1 b 12.5 describe how force = mass x acceleration, can be used to predict how an object behaves P1 b 12.6 discuss the possible social and economic benefits of knowledge about the universe and the technological advances which might accrue from its exploration P1 b 12.7 describe ways of discovering information about the universe other than humans travelling there, including soil experiments on landers (Viking/NASA Spirit and Opportunity rovers) and Search for Extraterrestrial Intelligence (SETI) P1 b 12.8 discuss how scientists are devising ways to overcome the problems of long space flights, including the deterioration of bones and heart, and the dangers of radiation P1 b 12.9 explain the role of gravity both on Earth and in astronomy, including the idea of black holes P1 b 12.10 use the unit of gravitational field strength – Newton per kilogram (N/kg) P1 b 12.11 describe stellar evolution from the nebula stage for small stars like our Sun and for more massive stars P1 b 12.12 discuss the risks of a global catastrophe such as a comet hitting the Earth, taking account the consequences, the chance of it occurring and any uncertainties P1 b 12.13 <p style="text-align: right;">continued...</p>	<p>160</p> <p>161</p> <p>9, 67-8, 131</p> <p>131</p> <p>84-5, 160</p> <p>130-1</p> <p>(154-5)</p> <p>159, 161</p> <p>160-1</p> <p>65, 150, 152-3, 157</p> <p>67, 131</p> <p>152, 157</p> <p>worksheet</p>

<ul style="list-style-type: none"> • describe how the orbit of a comet differs from that of a planet or an asteroid P1 b 12.14 	152
<ul style="list-style-type: none"> • use data sources to compare the relative sizes of and distances between Earth, our Moon, the planets, the Sun, galaxies and the universe P1 b 12.15 	151, 159
<ul style="list-style-type: none"> • show an understanding of how data-logging and remote sensing can provide information about the universe without us travelling there P1 b 12.16 	161
<ul style="list-style-type: none"> • describe the solar system as part of the Milky Way galaxy and discuss how this is related to other galaxies and the universe P1 b 12.17 	150-1, 157-8
<ul style="list-style-type: none"> • discuss and develop an argument for and against the idea that intelligent life exists elsewhere in the galaxy, using scientific evidence, and propose ways to find such life P1 b 12.18 	159
<ul style="list-style-type: none"> • be able to recognise that there are scientific questions which remain unanswered, such as the existence of extraterrestrial life and the nature of ‘dark matter’ that makes up much of the universe’s mass P1 b 12.19 	6, 158, 359
<ul style="list-style-type: none"> • describe the origin, current state and fate of the universe using the main theories (Big Bang, oscillating and steady state); and explain the supporting evidence for these theories, including microwaves and red shift P1 b 12.20 	158, 373
<ul style="list-style-type: none"> • describe how the existence of life on a planet is determined by the position of the planet in its solar system and the position of its star in its life-cycle. P1 b 12.21 	150, 157

Physics Unit P2

Topic 9 — As Fast as You Can!	Page numbers in New Physics for You
<p>Learning outcomes</p> <p>Learning outcomes, words or statements in bold indicate that this content is designated for Highertier students only.</p> <p>Students will be assessed on their ability to:</p> <ul style="list-style-type: none"> • explain that velocity is speed in a given direction and is a vector quantity P2 9.1 • define acceleration in terms of a change in velocity (this can mean change in magnitude and/or direction) and the time taken for the change P2 9.2 • draw and interpret velocity time graphs and determine acceleration from the gradient of the graph P2 9.3 • use the equation (P2 9.4): average velocity = displacement / time $v = s / t$ • use the equation (P2 9.5): acceleration = change in velocity / time $a = (v - u) / t$ • explain that if the resultant force acting on a body is zero, it will remain at rest or continue to move at the same speed in the same direction P2 9.6 • explain that if the resultant force acting on a body is not zero, it will accelerate in the direction of the resultant force P2 9.7 • calculate a resultant force using a range of forces (limited to the resultant of forces acting along a line) including resistive forces P2 9.8 • use the equation (P2 9.9): force = mass x acceleration $F = m a$ • explain that when two bodies interact, the forces they exert on each other are equal and opposite and that these are known as action and reaction forces P2 9.10 • draw and interpret a free-body force diagram P2 9.11 <p style="text-align: right;">continued...</p>	<p>122</p> <p>122, 70</p> <p>123-5</p> <p>122, 126</p> <p>122</p> <p>69, 87</p> <p>86-7, 89</p> <p>86-7, 89</p> <p>130-1</p> <p>84-5</p> <p>87</p>

<ul style="list-style-type: none"> demonstrate an understanding of how data about forces can be collected to be incorporated into spreadsheet software and then used to model 'what if' situations P2 9.12 	-
<ul style="list-style-type: none"> explain that falling objects are acted on by a downward force (weight) and an upward force (resistance) and that at the start of the fall the forces are unbalanced and the object accelerates P2 9.13 	64, 89
<ul style="list-style-type: none"> discuss, when an object falls through the atmosphere or other gas, resistance increasing with increasing speed and this may become equal in size to the weight of the falling object, which is when terminal velocity is reached P2 9.14 	89, 128
<ul style="list-style-type: none"> present an argument to explain how the stopping distance of a vehicle depends on the speed of travel P2 9.15 	83
<ul style="list-style-type: none"> discuss the impact of factors such as driver's reaction time and the condition of the vehicle and road, on stopping distance P2 9.16 	83
<ul style="list-style-type: none"> calculate the momentum of an object using the equation: momentum = mass x velocity P2 9.17 	136
<ul style="list-style-type: none"> explain how vehicles and theme park rides are designed to absorb momentum in collisions to reduce injury to passengers P2 9.18 	136, 138
<ul style="list-style-type: none"> assess the effectiveness of safety technology when travelling, including safety belts/harnesses, crumple zones and airbags to prevent injury, when provided with appropriate data P2 9.19 	138
<ul style="list-style-type: none"> interpret and translate between different ways of expressing the size of a risk P2 9.20 	216
<ul style="list-style-type: none"> be aware of the factors that influence people's willingness to accept risks, including the degree of familiarity, whether it is imposed or voluntary. P2 9.21 	216

Topic 10 — Roller Coasters and Relativity	Page numbers in New Physics for You
<p>Learning outcomes Learning outcomes, words or statements in bold indicate that this content is designated for Higher-tier students only.</p> <p>Students will be assessed on their ability to:</p> <ul style="list-style-type: none"> • use the relationship (P2 10.1): potential energy transferred = <i>mass x acceleration of free-fall x change in height</i> $PE = m \times g \times h$ • use the relationship (P2 10.2): kinetic energy = $\frac{1}{2} \times \text{mass} \times (\text{velocity})^2$ $KE = \frac{1}{2} m v^2$ • apply the equation to situations that use electric motors (P2 10.3): electrical energy = voltage x current x time $E = V \times I \times t$ • explain that work done is equal to energy transferred P2 10.4 • use the equation (P2 10.5): power = work done / time taken $P = W / t$ • use the equation (P2 10.6): work done = force x distance moved in the direction of the force $W = F \times s$ • apply the principle of conservation of energy to examples involving gravitational potential energy, kinetic energy and other forms of energy P2 10.7 • describe how a roller coaster or other ride works, using concepts such as speed, acceleration, force and energy P2 10.8 • explain that an object moving in a circle at constant speed must be accelerating due to its direction changing P2 10.9 • explain that there must be a resultant force acting on an object which is moving in a circle in order to bring about this acceleration P2 10.10 <p style="text-align: right;">continued...</p>	<p>108</p> <p>109</p> <p>266</p> <p>99</p> <p>110-111</p> <p>97</p> <p>10-11, 98-101</p> <p>(99)</p> <p>70-1</p> <p>70-1</p>

<ul style="list-style-type: none"> • apply the fact that a force is directed to the centre of the circle eg by drawing diagrams P2 10.11 	70-1
<ul style="list-style-type: none"> • recognise that some theories, such as Einstein's theory of relativity, require creative imagination such as thought experiments, and do not emerge from experimental data automatically P2 10.12 	(153)
<ul style="list-style-type: none"> • discuss the fact that some scientists are often reluctant to accept new theories, such as Einstein's relativity, when they overturn long-established explanations P2 10.13 	370
<ul style="list-style-type: none"> • explain that Einstein's theory of relativity is believed because it led to predictions which were tested successfully in different situations, such as atomic clocks and cosmic rays. P2 10.14 	(373)

Topic 11 — Putting Radiation to Use	Page numbers in New Physics for You
<p>Learning outcomes</p> <p>Learning outcomes, words or statements in bold indicate that this content is designated for Higher-tier students only.</p> <p>Students will be assessed on their ability to:</p> <ul style="list-style-type: none"> • describe how radioactivity is used in household fire (smoke) alarms and for treating food so it keeps longer P2 11.1 • explain that X-rays and gamma rays have similar properties, including their ionising abilities, but are emitted from different sources P2 11.2 • describe the uses of radioactivity in medical applications for both diagnosis and treatment for patients and also for sterilisation of equipment P2 11.3 • describe the nature of each of the ionising radiations and compare their abilities to penetrate and to ionise P2 11.4 • describe the structure of an atom in terms of protons, neutrons and electrons and describe particular nuclei using symbols in the format : ${}^m X_p$ P2 11.5 • use the terms atomic (proton) number and mass (nucleon) number to explain the existence of isotopes P2 11.6 • explain that alpha and beta particles and gamma rays are ionising radiations emitted from unstable nuclei in a random process P2 11.7 • describe how the activity of a radioactive source decreases over a period of time P2 11.8 • use the concept of half-life to carry out simple calculations including graphical representations P2 11.9 • demonstrate an understanding of how graphical representations of half-life can be made using suitable software, and compare this to traditional methods of creating graphical representation P2 11.10 • recognise that scientific conclusion, such as those from radioactive dating, often carry significant uncertainties P2 11.11 • discuss how scientific ideas, such as the risks associated with radioactive sources, develop over time P2 11.12 • discuss the origin of the background radiation from Earth and space P2 11.13 <p style="text-align: right;">continued...</p>	<p>page 347</p> <p>208, 210</p> <p>346-7</p> <p>340-1, 208</p> <p>342-3</p> <p>343</p> <p>340-1, 345</p> <p>344</p> <p>344, 352</p> <p>worksheet</p> <p>(347, 352)</p> <p>350, 377</p> <p>340, 350</p>

<ul style="list-style-type: none"> • explain what is meant by the background radiation which we all experience and describe how regional variations within the UK are caused in particular by radon gas P2 11.14 	340, 350
<ul style="list-style-type: none"> • describe the dangers of ionising radiation in terms of tissue damage and possible mutations and relate this to the precautions taken while carrying out demonstrations at school P2 11.15 	214, 346, 350
<ul style="list-style-type: none"> • explain that the Earth's atmosphere and magnetic field protects it from radiation from space. P2 11.16 	-

Topic 12 — Power of the Atom	Page numbers in New Physics for You
<p>Learning outcomes</p> <p>Learning outcomes, words or statements in bold indicate that this content is designated for Higher-tier students only.</p> <p>Students will be assessed on their ability to:</p> <ul style="list-style-type: none"> • explore how scientists use theories to make predictions, including how Einstein suggested the possibility of releasing enormous amounts of energy trapped in an atom from his relation between mass and energy P2 12.1 • explain the principle of a chain reaction P2 12.2 • describe the fission of U-235 to produce two daughter nuclei and two neutrons P2 12.3 • describe a simple decay series starting from the daughter products of U-235 P2 12.4 • explain how a chain reaction can be used for both peaceful and destructive purposes P2 12.5 • explain how the chain reaction is controlled in a nuclear reactor P2 12.6 • discuss the benefits and drawbacks of nuclear power for generating electricity, including carbon dioxide emissions and safety issues P2 12.7 • describe the environmental and social impact of a nuclear power station on a locality P2 12.8 • describe how thermal energy from the chain reaction is transferred to electrical energy in a nuclear power station P2 12.9 • explain that the products of nuclear fission are radioactive and discuss the longterm possibilities for storage/disposal of nuclear waste P2 12.10 • understand that nuclear fusion requires extremely high temperatures and densities, and relate this to the difficulty of making a practical form of power P2 12.11 • describe how fusion differs from fission and recognise it as the energy source for stars P2 12.12 • appreciate that new scientific theories, such as 'cold fusion', are not accepted until they have been validated by the scientific community P2 12.13 <p style="text-align: right;">continued...</p>	<p>348, 371, 376</p> <p>348</p> <p>348</p> <p>worksheet</p> <p>348-9</p> <p>348-9</p> <p>105-6, 349</p> <p>-</p> <p>349, 104</p> <p>350, worksheet</p> <p>156</p> <p>156</p> <p>370, 358</p>

<ul style="list-style-type: none"> • explain common electrostatic phenomena in terms of the movement of electrons including shocks and earthing – examples include shocks from car doors, charges on synthetic fibres and lightning P2 12.14 	245, 246
<ul style="list-style-type: none"> • describe the forces that act between like charges (repulsive) and unlike charges (attractive) P2 12.15 	241
<ul style="list-style-type: none"> • explain that insulating and insulated materials can be charged by contact by the transfer of electrons P2 12.16 	242
<ul style="list-style-type: none"> • describe some of the potential dangers and uses of electrostatic charges, such as fuelling aircraft, fingerprinting and laser printing. P2 12.17 	246

Physics Unit P3

Topic 5 — Particles in Action	Page numbers in New Physics for You
<p>Learning outcomes</p> <p>Students will be assessed on their ability to:</p> <ul style="list-style-type: none"> distinguish between and use primary and/or secondary data discuss and evaluate evidence and data consider the ethical, contemporary and social issues. <p>At the end of this unit students will be able to describe and explain the following statements and carry out the tasks indicated:</p> <p>Gases</p> <ul style="list-style-type: none"> the term absolute zero, -273°C, in terms of the lack of movement of particles P3 5.1 the Kelvin scale of temperature and be able to convert between the Kelvin and Celsius scales P3 5.2 the effect of changing the temperature of a gas on the speed of its particles P3 5.3 relate the Kelvin temperature of a gas to the average kinetic energy of its particles (direct proportionality) P3 5.4 the pressure of a gas in terms of the motion of its particles P3 5.5 use the equation for a gas in a sealed container, the ratio (P3 5.6): $\text{Pressure} / \text{Temperature (Kelvin)} = \text{constant}$ $P / T = \text{constant}$ use the equation (P3 5.7): $P_1V_1 / T_1 = P_2V_2 / T_2$ <p>Atoms and nuclei</p> <ul style="list-style-type: none"> nuclei contain protons and neutrons and that neutrons are difficult to detect because they are neutral P3 5.8 the properties of alpha, beta, gamma, positron, and neutron radiation P3 5.9 the qualitative features of the curve obtained when the number of neutrons (N) is plotted against the number of protons (Z) for stable isotopes P3 5.10 <p style="text-align: right;">continued...</p>	<p>pages 6-7, 358-364</p> <p>27, 31</p> <p>27, 31</p> <p>26</p> <p>27, 31</p> <p>32, 34, 80</p> <p>32</p> <p>33</p> <p>342</p> <p>340-1, 357</p> <p>worksheet</p>

<ul style="list-style-type: none"> identify radioactive isotopes from the fact that if an isotope does not lie on this curve it will be unstable and radioactive P3 5.11 	worksheet
<ul style="list-style-type: none"> an isotope that lies above the curve has too many neutrons to be stable and will undergo β^- decay (emit an electron) P3 5.12 	worksheet
<ul style="list-style-type: none"> process of β^- decay (a neutron becomes a proton plus an electron) P3 5.13 	345, worksheet
<ul style="list-style-type: none"> an isotope that lies below the curve has too few neutrons to be stable and will undergo β^+ decay (emit a positron) P3 5.14 	worksheet
<ul style="list-style-type: none"> the process of β^+ decay (a proton becomes a neutron plus a positron) P3 5.15 	worksheet
<ul style="list-style-type: none"> nuclei with more than 82 protons usually undergo α decay P3 5.16 	worksheet
<ul style="list-style-type: none"> as a result of β^- or β^+ decay nuclei often undergo rearrangement with a loss of energy as gamma radiation P3 5.17 	345, worksheet
<ul style="list-style-type: none"> the effects on the proton number (atomic number) and mass number of the nuclei of α, β^- and β^+ and gamma decay P3 5.18 	345
<ul style="list-style-type: none"> construct simple nuclear equations for alpha, beta and gamma decay from supplied nuclear data. P3 5.19 	345
Fundamental and other particles	
<ul style="list-style-type: none"> what is meant by a fundamental particle and give examples, including the electron and positron P3 5.20 	-
<ul style="list-style-type: none"> the properties of a positron (positively charged particle with the same mass as the electron) P3 5.21 	357
<ul style="list-style-type: none"> explore how scientists are creating fundamental particles, such as anti-matter P3 5.22 	-
<ul style="list-style-type: none"> the proton and neutron are not fundamental particles because each contain three particles called quarks. P3 5.23 	worksheet
<ul style="list-style-type: none"> account for the number of <i>up</i> and <i>down</i> quarks in protons and in neutrons in terms of charge and mass P3 5.24 	worksheet
<ul style="list-style-type: none"> β^- decay as a process that involves a down quark changing into an up quark (one neutron becomes a proton and an electron) P3 5.25 	worksheet
<ul style="list-style-type: none"> β^+ decay as a process that involves one up quark changing into a down quark (a proton becomes a neutron and a positron). P3 5.26 	worksheet
continued...	

Electrons and electron beams	
<ul style="list-style-type: none"> • electrons are 'boiled off' hot metal filaments and this is called thermionic emission P3 5.27 	308
<ul style="list-style-type: none"> • how to produce a beam of electrons using a simple electron gun with a heated cathode and an accelerating anode P3 5.28 	308-310
<ul style="list-style-type: none"> • use the equation (P 5.29) Kinetic energy = electronic charge x accelerating voltage $E = e \times V$ 	(261)
<ul style="list-style-type: none"> • that a beam of electrons is equivalent to an electric current and calculate current in terms of the rate of flow of electrons, given the electronic charge P3 5.30 	(308)
<ul style="list-style-type: none"> • how an electron beam, or a stream of charged particles (for example ink drops), can be deflected by the electric field between parallel charged metal plates and explain the factors which affect the amount of deflection P3 5.31 	310-311, 315
<ul style="list-style-type: none"> • the principal uses of electron beams, including: <ul style="list-style-type: none"> ○ TV picture tubes ○ computer monitors ○ oscilloscopes ○ the production of X-rays P3 5.32 	307, 309-311 309 310-311 312
<ul style="list-style-type: none"> • how instruments, such as particle accelerators, can help scientists develop better explanations about the physical world P3 5.33 	-
<ul style="list-style-type: none"> • the reasons for collaborative, international research into big scientific questions, such as particle physics. P3 5.34 	370

Topic 6 — Medical Physics	Page numbers in New Physics for You
<p>Learning outcomes</p> <p>Students will be assessed on their ability to:</p> <ul style="list-style-type: none"> distinguish between and use primary and/or secondary data discuss and evaluate evidence and data consider the ethical, contemporary and social issues. <p>At the end of this unit students will be able to describe and explain the following statements and carry out the tasks indicated:</p> <ul style="list-style-type: none"> what is meant by refraction P3 6.1 the role of total internal reflection in the transmission of light along an optical fibre P3 6.2 the use of optic fibres in endoscopes P3 6.3 examples of the use of endoscopes P3 6.4 the principles and use of pulse oximetry P3 6.5 work done is equal to energy transferred P3 6.6 use the equation (P3 6.7): work done = force x distance moved in the direction of the force $W = F \times s$ use the equation (P3 6.8): power = work done / time taken $P = W / t$ the term – basal metabolic rate (BMA) P3 6.9 use the equation (P3 6.10): frequency = 1 / time period. $f = 1 / T$ how the fact the muscle cells can generate potential differences can be used in medical applications P3 6.11 how action potentials can be measured with an Electrocardiogram (ECG) to monitor heart action P3 6.12 the characteristic shape of a normal ECG in terms of heart action P3 6.13 the term intensity and use the equation (P3 6.14) intensity = power of incident radiation/area $I = P / A$ <p style="text-align: right;">continued...</p>	<p>6-7, 358-364</p> <p>168, 184</p> <p>187, 189, 192</p> <p>192</p> <p>192</p> <p>356</p> <p>99</p> <p>87</p> <p>110-111</p> <p>-</p> <p>(299)</p> <p>356</p> <p>356</p> <p>356</p> <p>214</p>

<ul style="list-style-type: none"> • use the word 'radiation' to describe any form of energy originating from a source P3 6.15 	46, 214, 340
<ul style="list-style-type: none"> • the intensity of radiation will decrease with distance from a source and/or with the nature of the medium through which it is being transmitted P3 6.16 	214
<ul style="list-style-type: none"> • what is meant by a thermal neutron and use them in nuclear equations P3 6.17 	(348)
<ul style="list-style-type: none"> • perform calculations on momentum conservation in one dimension P3 6.18 	137-8
<ul style="list-style-type: none"> • the bombardment of certain stable elements with proton radiation to make them into radioactive isotopes that usually emit positrons P3 6.19 	-
<ul style="list-style-type: none"> • what happens when a positron meets with an electron (they annihilate each other with the production of gamma rays) P3 6.20 	357
<ul style="list-style-type: none"> • the meeting of a positron with an electron is an example of momentum and mass/energy conservation P3 6.21 	357, 348
<ul style="list-style-type: none"> • examples of the use of positron emission tomography (PET) scanning P3 6.22 	357
<ul style="list-style-type: none"> • the effects of radiation on living matter P3 6.23 	214, 346
<ul style="list-style-type: none"> • the importance of limiting exposure to radiation P3 6.24 	214, 350
<ul style="list-style-type: none"> • the application of radiation in treating malignant tumours P3 6.25 	210, 347
<ul style="list-style-type: none"> • radiation treatment does not always lead to a cure and that it is sometimes used to reduce suffering (palliative care) P3 6.26 	-
<ul style="list-style-type: none"> • social and ethical issues relating to the introduction of new medical techniques. P3 6.27 	357