

## Long-term planning

### GCSE Physics (Trilogy) - Year 10 & Year 11

Year 10 GCSE Science Trilogy Physics	Autumn term 1	Autumn term 2	Spring term 1	Spring term 2	Summer term 1	Summer term 2
Electrical circuits  Electricity in the home  Molecules and matter  Radioactivity  Forces and motion	<b>Students will know that</b>					
	Atoms consist of protons neutrons and electrons and be able to state their respective charges. Like charges repel and like charges attract. Electric current is a flow of electrons. Electrons flow in a closed circuit due to a force from the interaction with an electric field. $\frac{\text{Charge } (C)}{\text{Time } (s)} = \text{Current } (A)$ Symbols can be used to represent components in circuits. Potential difference (V), current (A) and Resistance ( $\Omega$ ) are related by the following equation: Potential difference = current x resistance. There is various components that act as resistors and some of these are affected by outside factors.	Current and potential difference behave differently in series and parallel circuits. Resistors in series affect the total resistance of the circuit differently to those in parallel. The differences between alternating and direct current. Alternating current is used throughout mains circuits in the UK. DC current only comes from batteries. The national grid is the UK distribution network with a series of transformers and cables. Step up transformers are used to increase potential difference and decrease current. Step down transformers are used to decrease potential difference and increase current. The national grid is an efficient way to transfer energy. Plugs and sockets contain 3 wires. We use a variety of safety features in our electrical circuits at home. Short circuits can be dangerous.	Density = mass/volume. Matter exists in three states. Particles are arranged differently in solids liquids and gases. The kinetic energy of particles depends on their temperature. When substances change state (melt, freeze, boil, evaporate, condense or sublimate), mass is conserved. Internal energy is the total kinetic energy and potential energy of all the particles (atoms and molecules) that make up a system. Forces of attraction between particles are different in different states of matter. Energy needed to change the state of 1kg of matter from solid to liquid is called the specific latent heat of fusion. Energy needed to change the state of 1kg of matter from solid to liquid is called the specific latent heat of vapourisation.	Atoms consist of protons, electrons and neutrons and know their locations in the atom. The model of the atom has changed over time. Atoms are very small. Atoms that have lost or gained electrons become ions. Isotopes are atoms of the same element with different number of neutrons. Mass number represents the number of neutrons and protons in the nucleus. The atomic number represents the number of protons in the nucleus. Radioactive decay is a random process. Alpha, Beta and Gamma radiation are ionising. Ionising radiation can be dangerous to living things. Neutron radiation is non ionising. The activity of a radioactive sample can be measured by a Geiger counter. Activity of a substance is the number of unstable nuclei that decay per second.	Vector quantities have direction and magnitude and can be represented by a scale arrow but scalar only have magnitude. Forces are interactions between objects. Forces can be contact or non-contact. Newton's third law applies to all force interactions between objects. Multiple forces can be replaced with one single resultant force. Newton's first law states if the resultant force on an object is zero then there is no change to its velocity. Multiple forces can be represented on free body force diagrams. The centre of mass of an object is the point at which its mass can be thought of being concentrated. Vector diagrams can be used to resolve two forces into one resultant force. A single force can be resolved into two component forces at right	Speed is a scalar, and velocity is a vector quantity. Speed = distance/time Velocity = displacement/time Displacement/distance-time graphs can be used to track an objects movement. Acceleration = change in velocity/time taken. Speed/velocity-time graphs can be used to track an objects movement. The following are average speeds: walking- 1.5 m/s running- 3 m/s cycling- 6 m/s. Sound in air 330m/s Inertial mass = Force/acceleration. Mass of an object refers to the amount of matter it contains. Weight of an object is the force acting on a mass due to gravity. Terminal velocity is the velocity a falling object reaches when there is no resultant force acting upon it.

## Long-term planning

### GCSE Physics (Trilogy) - Year 10 & Year 11

	<p>The Earth wire prevents harm from short circuits.</p> <p>All electrical appliances are sold with an efficiency rating.</p> <p>Efficiency = <math>\frac{\text{output power}}{\text{input power}} \times 100\%</math>.</p> <p>Power = current x potential difference.</p>	<p>Temperature of a gas can affect its pressure.</p> <p>Random movement of gas particles is called Brownian motion.</p> <p>How gas pressure can affect its volume and vice versa.</p> <p>The unit of pressure is Pascals.</p>	<p>The half-life is the time taken for a radioactive sample to decrease its mass/count rate by half.</p> <p>Radiation emitted from unstable nuclei is used in nuclear medicine.</p> <p>Irradiation is the exposure to radiation whereas contamination is when radioactive substances are in/on the object.</p> <p>Using Ionising radiation and radiation in the environment can be dangerous.</p>	<p>angles to each other using vector diagrams.</p>	
<b>Students will know how to</b>					
<p>Explain the interaction of charged particles. <b>WS 1.2</b></p> <p>Apply and rearrange Charge = current x time <b>MS 3b, c</b></p> $[ Q = It ]$ <p>Construct and interpret circuit diagrams. <b>WS 1.2</b></p> <p>Construct basic electrical circuits. <b>AT6, 7</b></p> <p>Apply and rearrange <b>MS 3b, c</b> potential difference = current x voltage.</p> $[ V = IR ]$ <p><b>(Required practical 4)</b></p> <p>Construct circuits in order to collect data that allows the relationship between current and potential difference to be plotted. <b>AT6, AT7, Multiple WS and MS.</b></p>	<p>Calculate the total resistance in series and parallel circuits. <b>MS 1c, 3b, 3c, 3d</b></p> <p>Explain the design and use of DC series circuits for measurement and testing purposes. <b>WS 1.4</b></p> <p>Label the parts and wires of a plug and physically wire it. <b>WS 1.5, WS2.4</b></p> <p>Apply and rearrange <b>MS 3b, c, WS 1.4, WS 4.5.</b></p> <p>Power = energy/time</p> <p>Power = current x potential difference</p> <p>Power = <math>\frac{\text{current}^2 \times \text{resistance}}</math></p> <p>Charge = current x time</p> <p>Energy = potential difference x charge</p> <p>Energy = current x time x potential difference.</p> <p>Compare energy efficiency ratings. <b>WS 3.5</b></p>	<p>Apply and rearrange <b>MS 1a, b, c, 3b, c</b></p> $\text{density} = \frac{\text{mass}}{\text{volume}}$ $[ \rho = \frac{m}{V} ]$ <p><b>(Required practical 5)</b></p> <p>Use appropriate apparatus to make and record the measurements needed to determine the densities of regular and irregular solid objects and liquids. <b>AT 1, Multiple WS and MS.</b></p> <p>Compare and contrast the kinetic theory of different states of matter. <b>WS 1.2</b></p> <p>Use and interpret a temperature time graph to find the melting/boiling point of a substance. <b>WS 3.2</b></p>	<p>Compare historical models of the atom. <b>WS 3.8, WS 1.1, WS 1.2</b></p> <p>Compare the scale of atomic structure. <b>MS 1b, WS 4.4</b></p> <p>Compare alpha, beta, neutron and gamma radiation and the effect they have on the emitting nucleus. Also, their ionising and penetration properties and their suitability for certain uses. <b>WS 1.4, WS 1.5</b></p> <p>Balance nuclear equations. <b>WS 1.2, 4.1, MS 1b, c, 3c</b></p> <p>Use graphs to calculate half-life.</p> <p>Calculate activity using half-life. <b>MS 4a, WS 3.5, Ms 1b</b></p> <p>Convert from sieverts to millisieverts.</p>	<p>Apply Newton's third law to a variety of situations. <b>WS 1.2</b></p> <p>How to construct free body force diagrams. <b>WS 1.2</b></p> <p>Represent vector quantities on a scale diagram. <b>MS 4a, 5a, b</b></p>	<p>Carry out an experiment to calculate average speed. <b>MS 1a, c, 2f</b></p> <p>Apply and rearrange. <b>MS 3b, c</b></p> <p>Distance travelled = speed x time</p> $[ s = vt ]$ <p>Plot and analyse displacement/distance-time graphs. <b>MS 4a, b, c, d, f</b></p> <p>Apply and rearrange. <b>MS 1d, 3b, 3c</b></p> <p>Acceleration = change in velocity / time</p> $[ a = \frac{\Delta v}{t} ]$ <p>Plot and analyse speed/velocity-time graphs. <b>MS 4a, b, c, d, f, WS 3.3</b></p> <p>Apply and rearrange. <b>MS 3b, 3c</b></p>

## Long-term planning

### GCSE Physics (Trilogy) - Year 10 & Year 11

<p><b>(Required practical 3)</b> Construct circuits in order to collect data that allows the relationship between resistance and wire length to be plotted. Plot graphs showing the resistance characteristics for a range of electrical components. <b>AT1, AT6, AT7, Multiple WS and MS.</b></p>	<p>Explain changes of state referencing forces of attraction and kinetic theory. <b>WS 4.1</b> Explain gas pressure using kinetic theory. <b>WS1.2, WS4.1</b> Apply and rearrange <b>MS 1a, 3b, c, d</b> Energy for a change in state = mass x specific latent heat <math>[ E = m L ]</math> Conduct experiments to measure the specific latent heat of fusion/vaporisation. <b>MS 4a, AT5</b> See random movement of gas molecules. <b>WS1.2</b></p>	<p><b>WS 4.4</b> Explain and compare hazards from a range of situations involving radioactive decay. <b>WS 1.5, WS 1.6</b></p>	<p><math>[ v^2 - u^2 = 2 a s ]</math> Apply and rearrange. <b>MS 3a, b, c, WS 4.2</b> Force = mass x acceleration <math>F = m a</math> Apply and rearrange <b>MS 3b,c</b> Weight = mass x gravity <math>[ W = m g ]</math> <b>(Required practical 7)</b> Investigate the effect of varying the force on the acceleration of an object of constant mass, and the effect of varying the mass of an object on the acceleration produced by a constant force. <b>AT 1, 2 and 3. Multiple WS and MS.</b></p>
<b>Vocabulary and the concepts they link to</b>			
<p>Proton Neutron Electron Charge Insulator Repel Attract Interaction Current Resistor Ammeter Voltmeter Cell Battery Diode Thermistor Series</p>	<p>Live wire Neutral wire Earth wire National grid Alternating current Direct current Fuse Power Efficiency Appliance</p>	<p>Density Mass Volume Meniscus Kinetic theory Melt Freeze Condense Vaporise Sublimate Pressure Fusion Exert Pascals</p>	<p>Nucleus Plum pudding Proton Electron Neutron Subatomic Unstable Ionising Radioactive Activity Decay Half-life Contamination Irradiation</p>
<p>Vector Scalar Resultant Resolve Newton Equilibrium</p>		<p>Acceleration Velocity Displacement</p>	

## Long-term planning

### GCSE Physics (Trilogy) - Year 10 & Year 11

	Parallel					
	<b>Assessment</b>					
	Energy recap assessment End of unit test: Electricity Key piece six-mark exam question	End of unit test: Electricity Key piece six-mark exam question	End of unit test: Molecules and matter Key piece six-mark exam question	End of unit test: Radioactivity Key piece six-mark exam question Paper 1 mock	End of unit test: Forces Key piece six-mark exam question	End of unit test: Motion Key piece six-mark exam question
	<b>Diversity &amp; development of cultural capital</b>					
	Electrician and electrical engineering links (college and apprenticeship). Lighting in homes and Christmas lights.	Choosing and purchasing electrical appliances. Readings on energy bills. Purchasing a home (energy surveys).	Story of the word Eureka and Archimedes. Why things float and sink! Air pressure (balloons, tyres, airplane cabins).	Cancer development. Cancer scans. Cancer treatment. Non-renewable energy. Radon gas survey when buying a house. Blue John mines and their radon gas detectors.	Approach vectors and navigation of aircraft and boats.	Tachograph in vehicles. Average speeds of athletes. Students own running speeds.
	<b>Cross-curricular opportunities and enrichment</b>					
	Maths (Rearrangement of equations, units and prefixes, decimal places and significant figures, interpreting and drawing graphs). Electronics (circuit diagrams and components).	IDP household bills.	Maths (Rearrangement of equations, units and prefixes, decimal places and significant figures, standard form and volumes of regular shapes). Chemistry (Solids, liquids and gases, bonding and Brownian motion)	Maths (graph skills). Chemistry (atomic structure), Biology (cancer development, cancer treatment and scans) Geography (Non-renewable energy resources, environmental disasters and pollution). History (Second world war and the cold war)	Maths (Rearrangement of equations, units and prefixes, decimal places and significant figures, standard form and symmetry)	Maths (Rearrangement of equations, units and prefixes, decimal places and significant figures, interpreting and drawing graphs).

## Long-term planning

### GCSE Physics (Trilogy) - Year 10 & Year 11

Year 11 GCSE Science Trilogy Physics Themes	Autumn term 1	Autumn term 2	Spring term 1	Spring term 2	Summer term 1	Summer term 2
<b>Forces and motion</b>	<b>Students will know that</b>					
<b>Wave properties</b>	<p>PAPER 2 Mock preparation</p> <p>EXAM Preparation</p> <p style="text-align: center;">GCSE PREPERATION AND EXAMS</p>					
<b>Electromagnetic waves</b>						
<b>Light</b>						
<b>Electromagnetism</b>						
	<p>Vector quantities have direction and magnitude, and can be represented by a scale arrow but scalar only have magnitude.</p> <p>Forces are interactions between objects.</p> <p>Forces can be contact or non-contact.</p> <p>Newton's third law applies to all force interactions between objects.</p> <p>Multiple forces can be replaced with one single resultant force.</p> <p>Newton's first law states if the resultant force on an object is zero then there is no change to its velocity.</p> <p>Multiple forces can be represented on free body force diagrams.</p> <p>The centre of mass of an object is the point at which its mass can be thought of being concentrated.</p> <p>Vector diagrams can be used to resolve two</p>	<p>Speed is a scalar, and velocity is a vector quantity.</p> <p>Speed = distance/time</p> <p>Velocity = displacement/time</p> <p>Displacement/distance-time graphs can be used to track an objects movement.</p> <p>Acceleration = change in velocity/time taken.</p> <p>Speed/velocity-time graphs can be used to track an objects movement.</p> <p>Newton's second law states that force = mass x acceleration.</p> <p>Inertial mass = Force/acceleration.</p> <p>Mass of an object refers to the amount of matter it contains.</p> <p>Weight of an object is the force acting on a mass due to gravity.</p> <p>Terminal velocity is the velocity a falling object reaches when there is no resultant force acting upon it.</p> <p>Braking distance + thinking distance = stopping distance.</p> <p>Typical human reaction time is 0.2-0.9s.</p> <p>Large decelerations can be dangerous.</p> <p>Momentum = mass x velocity.</p>	<p>Waves are a transfer of energy, not matter.</p> <p>Waves are longitudinal or transverse.</p> <p>All waves have specific parts and properties.</p> <p>Period = 1/frequency.</p> <p>Wave speed = frequency x wavelength.</p> <p>Refraction occurs as waves enter new mediums.</p> <p>Reflection occurs as waves meet the boundary of a new medium.</p> <p>Electromagnetic waves are transverse waves that all travel at the speed of light in a vacuum.</p> <p>Electromagnetic waves have different properties, uses and dangers dependent on their frequency and wavelength.</p> <p>Different electromagnetic waves are produced in a variety of ways.</p> <p>Some electromagnetic radiation is ionising.</p> <p>EM waves can be reflected at surfaces following the law of reflection.</p>	<p>Magnets can attract or repel each other.</p> <p>Magnets can attract magnetic materials.</p> <p>Magnets are surround by a magnetic field.</p> <p>Magnetic fields can be induced in magnetic materials.</p> <p>Electric currents produce magnetic fields.</p> <p>A solenoid is a coil of wire with a current passing through it.</p> <p>A current carrying wire in a magnetic field is subject to a force.</p>		

## Long-term planning

### GCSE Physics (Trilogy) - Year 10 & Year 11

	<p>forces into one resultant force.</p> <p>A single force can be resolved into two component forces at right angles to each other using vector diagrams.</p>	<p>Momentum is conserved in collisions (closed system).</p> <p>Elastic materials return to their original shape after the forces are removed.</p> <p>Force applied = spring constant x extension</p>	<p>Refraction causes light to disperse through a prism shaped object.</p>			
<b>Students will know how to</b>						
	<p>Apply Newton's third law to a variety of situations.</p> <p><b>WS 1.2</b></p> <p>How to construct free body force diagrams. <b>WS 1.2</b></p> <p>Represent vector quantities on a scale diagram.</p> <p><b>MS 4a, 5a, b</b></p>	<p>Carry out an experiment to calculate average speed.</p> <p><b>MS 1a, c, 2f</b></p> <p>Apply and rearrange. <b>MS 3b, c</b></p> <p>Distance travelled = speed x time</p> $[ s = v t ]$ <p>Plot and analyse displacement/distance-time graphs. <b>MS 4a, b, c, d, f</b></p> <p>Apply and rearrange. <b>MS 1d, 3b, 3c</b></p> <p>Acceleration = change in velocity / time</p> $[ a = \frac{\Delta v}{t} ]$ <p>Plot and analyse speed/velocity-time graphs.</p> <p><b>MS 4a, b, c, d, f, WS 3.3</b></p> <p>Apply and rearrange. <b>MS 3b, 3c</b></p> $[ v^2 - u^2 = 2 a s ]$ <p>Apply and rearrange. <b>MS 3a, b, c, WS 4.2</b></p> <p>Force = mass x acceleration</p> $F = m a$ <p>Apply and rearrange <b>MS 3b,c</b></p>	<p>Compare transverse and longitudinal waves. <b>WS 1.2</b></p> <p>Describe wave motion. <b>MS 1c, 3b, c</b></p> <p>Measure the speed of sound in air. <b>AT1, WS 2.3, 2.4, 2.6, 2.7, 3.1, 3.5</b></p> <p>Measure the speed of water waves. <b>AT1, AT4, WS 2.3, 2.4, 2.6, 2.7, 3.1, 3.5</b></p> <p>Apply and rearrange. <b>MS 1c, 3b, c</b></p> <p>Period = 1/frequency</p> $[ T = \frac{1}{f} ]$ <p>Apply and rearrange. <b>MS 1c, 3b, 3c</b></p> <p>Velocity = frequency x wavelength</p> $[ v = f \lambda ]$ <p><b>(Required practical 8)</b></p>	<p>Plot a magnetic field. <b>WS 2.2</b></p> <p>Explain the strength of magnetic fields in various situations. <b>WS 2.2</b></p>		

## Long-term planning

### GCSE Physics (Trilogy) - Year 10 & Year 11

	<p>Weight = mass x gravity  <math>[ W = m g ]</math>  <b>(Required practical 7)</b>            Investigate the effect of varying the force on the acceleration of an object of constant mass, and the effect of varying the mass of an object on the acceleration produced by a constant force.  <b>AT 1, 2 and 3. Multiple WS and MS.</b>            Explain the factors that affect braking and thinking distance.  <b>WS 1.5, 2.2, MS 1a, c, AT 1</b>            Estimate the braking force of a vehicle.<b>MS 1d</b>            Measure human reaction time. <b>MS 3.5, 3.7</b>            Apply and rearrange. <b>WS 1.2 MS 3b, c</b>            Momentum = mass x velocity  <math>p = m v</math>            Apply and rearrange. <b>MS 3b, c, 4a</b>            Force = spring constant x extension.  <math>[ F = k e ]</math>            Plot and analyse Force-extension graphs. <b>WS 3.5</b></p>	<p>Make observations to identify the suitability of apparatus to measure the frequency, wavelength and speed of waves in a ripple tank and waves in a solid and take appropriate measurements.  <b>AT 4, Multiple WS and MS.</b>            Investigate how the amount of infrared radiation absorbed or radiated by a surface depends on the nature of that surface.  <b>AT 1, 4, Multiple WS and MS.</b></p>			
<b>Vocabulary and the concepts they link to</b>					
Vector Scalar Resultant Resolve Newton	Acceleration Velocity Displacement Momentum Rate Impact	Transverse Longitudinal Frequency Amplitude Frequency Period	North South Pole Flux Induce		

## Long-term planning

### GCSE Physics (Trilogy) - Year 10 & Year 11

		Collision	Electromagnetic Radio wave Microwave Infrared Ultraviolet X-ray Gamma Ionising				
	<b>Assessment</b>						
	Key piece six-mark exam question	End of unit test: Forces and motion Key piece six-mark exam question	End of unit test: Waves Paper 1 mock. Key piece six-mark exam question	End of unit test: Magnetism Key piece six-mark exam question			
	<b>Diversity &amp; development of cultural capital</b>						
	Approach vectors and navigation of aircraft and boats.	Tachograph in vehicles. Average speeds of athletes. Students own running speeds. Highway code. Driving theory test. Speed limits. Driving laws (drinking and phones). Bicycle helmets, boxing gloves, crash mats and everyday protective equipment.	Fireworks and thunder and lightning time delay.	School door release system.			
	<b>Cross-curricular opportunities and enrichment</b>						
	Maths (Rearrangement of equations, units and prefixes, decimal places and significant figures, standard form and symmetry)	Maths (Rearrangement of equations, units and prefixes, decimal places and significant figures, interpreting and drawing graphs).	Maths (Rearrangement of equations, units and prefixes, decimal places and significant figures)	Maths (Rearrangement of equations, units and prefixes, decimal places and significant figures)			