GCSE Science – Schemes of Work

Physics

Unit 2: Physics 2

Spec Reference	Summary of the Specification Content	Learning Outcomes *What most candidates should be able to do*	Suggested timing (hours)	*Opportunities to develop Scientific Communication skills*	Opportunities to develop and apply Practical and Enquiry skills	Self/Peer assessment Opportunities & resources *reference to past questions that indicate success*
P2.1 Forces and their effects Forces can cause changes to the shape or motion of an object. Objects can move in a straight line at a constant speed. They can also change their speed and/or direction (accelerate or decelerate). Graphs can help us to describe the movement of an object. These may be distance-time graphs or velocity-time graphs.						
P2.1.1 Resultant forces						
a b	Whenever two objects interact, the forces they exert on each other are equal and opposite. A number of forces acting at a point may be replaced by a single force that has the same effect on the motion as the original forces all acting together. This single force is called the resultant force.	Describe how forces occur in pairs, acting on different objects. Explain the term 'resultant force' and be able to determine the result of opposite or parallel forces acting in a straight line. Describe how a resultant force acting on an object may affect its motion.	*2*	**Developing explanations using ideas and models** Drawing a force diagram to represent forces acting on objects Calculating the resultant force. **Presenting and writing descriptions and explanations** Describe how a resultant force acting on an object may affect its motion.	*If forces cancel each other out, do they still exist?* Exhibition of situations for pupils to draw force diagrams, including the resultant force. *If there is an equal and opposite reaction to every force, does this mean that all forces are balanced?* Tug of war' type experiments using forcemeters. **Planning an approach Selecting and managing variables** *Do forces always cause movement?* Investigations with toy cars on ramps of different surfaces and different heights.	P2.1.1 Resultant forces success criteria items powerpoint

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c d e	A resultant force acting on an object may cause a change in its state of rest or motion.	Explain that if the resultant force acting on a stationary object is: ▪ zero – the object will remain stationary ▪ not zero – the object will accelerate in the direction of the resultant force. Explain that if the resultant force acting on a moving object is: ▪ zero – the object will continue to move at the same speed and in the same direction ▪ not zero – the object will accelerate in the direction of the resultant force.			*Does a constant force produce a constant speed?* Investigation of the effect of a constant force on the speed of a trolley, using forcemeters, dataloggers or ticker timers.	

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P2.1.2 Forces and motion						
b	The gradient of a distance-time graph represents speed.	Construct and interpret distance–time graphs for an object moving in a straight line when the body is stationary or moving with a constant speed.	4	**Communication for audience and purpose** Sketch a distance-time graph from a description of a journey. **Presenting and writing descriptions and explanations** Describe a journey from a distance-time graph Explain the difference between speed and velocity.	**Working critically with evidence** *Is a line of best fit always needed for a line graph?* Use datalogging equipment to graph distance and time and decide the most appropriate line to draw. *Which is the best train to catch?* Use of train timetables to build distance-time graphs to compare fast and through trains.	P2.1.2 Forces and motion success criteria items powerpoint Interactive motion graph can be found at www.practicalphysics.org/go/Experiment_206.html
c	**HT only** **Calculation of the speed of an object from the gradient of a distance-time graph.**	**HT only** **Calculate the speed of an object from the gradient of a distance-time graph.**				
d	The velocity of an object is its speed in a given direction.	Explain the difference between speed and velocity.		**Developing explanations using ideas and models** Calculation of speed from a distance – time graph HT Calculation of acceleration using the equation.		
e	The acceleration of an object is given by the equation: $a = \frac{(v-u)}{t}$	Use the equation to calculate acceleration.				Interactive software to show velocity-time graphs can be found at http://phet.colorado.edu/en/simulation/moving-man

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f	The gradient of a velocity-time graph represents acceleration.	Construct and interpret velocity-time graphs for an object moving in a straight line when the body is moving with a constant speed, accelerating or decelerating.		Draw and interpret velocity-time graphs	*Are there always straight lines on a velocity time graph?* Use datalogging equipment to graph velocity and time and decide the most appropriate line to draw.	Information on representing motion can be found on the BBC GCSE Bitesize website at www.bbc.co.uk/schools/gcsebitesize/science/add_aqa/forces
g	**HT only** **Calculation of the acceleration of an object from the gradient of a velocity-time graph.**	**HT only** **Calculate the acceleration of an object from the gradient of a velocity-time graph.**		**HT only** **Use velocity-time graphs to calculate acceleration and distance travelled** Explain the difference between similar features on a distance-time graph with those on a velocity-time graph e.g. horizontal lines		Information on force, mass and acceleration can be found on the BBC GCSE Bitesize website at www.bbc.co.uk/schools/gcsebitesize/science/add_aqa/forces/
h	**Calculation of the distance travelled by an object from a velocity-time graph.**	**Calculate the distance travelled by an object from a velocity-time graph.**				

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a	The acceleration of an object is determined by the resultant force acting on the object and the mass of the object. $a = \frac{F}{m}$ Or $F = m \times a$	Use the equation relating force, mass and acceleration.		Calculations involving $F = m \times a$	*Is the acceleration always proportional to the applied force?* Investigations using datalogging equipment to measure force and acceleration of a trolley on a friction-compensated runway.	

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P2.1.3 Forces and braking						
a	When a vehicle travels at a steady speed the resistive forces balance the driving force.	Describe the concept of reaction time.	1	**Applications, implications and cultural understanding** Summarise a presentation from an outside speaker from police or road safety organisation or online equivalent.	**Obtaining and presenting primary evidence** Measurement of reaction times using stopwatches or falling rulers.	P2.1.3 Forces and braking success criteria items poerpoint Video clips about speed and stopping distance can be found at www.seattle-duiattorney.com/media/dui-videos.php
b	The greater the speed of a vehicle the greater the braking force needed to stop it in a certain distance.					
c	The stopping distance of a vehicle is the sum of the distance the vehicle travels during the driver's reaction time (thinking distance) and the distance it travels under the braking force (braking distance).	Explain the distinction between thinking distance, braking distance and stopping distance. Explain that for a given braking force the greater the speed, the greater the stopping distance.			**Working critically with secondary evidence** *Can a lorry stop faster than a car?* Research stopping distances at different speeds and for different vehicles	Video clips about distractions and driving can be found at www.youtube.com/user/MotorTorqueUK by searching for 'mobile phone' or from http://think.direct.gov.uk/index.html

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d	A driver's reaction time can be affected by tiredness, drugs and alcohol.	Appreciate that distractions may affect a driver's ability to react and describe the factors which could affect a driver's reaction time.		**Communication for audience and purpose** Design a persuasive poster about factors affecting thinking distance. **Presenting and writing descriptions and explanations** Explain how adverse road conditions affect braking distance.		
e	When the brakes of a vehicle are applied, work done by the friction force between the brakes and the wheel reduces the kinetic energy of the vehicle and the temperature of the brakes increases.					
f	A vehicle's braking distance can be affected by adverse road and weather conditions and poor condition of the vehicle.	Explain how adverse road conditions (including wet or icy conditions) and poor condition of the car (brakes or tyres) affect braking distance.				

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P2.1.4 Forces and terminal velocity						
a b c	The faster an object moves through a fluid the greater the frictional force that acts on it. An object falling through a fluid will initially accelerate due to the force of gravity. Eventually the resultant force will be zero and the object will move at its terminal velocity (steady speed). Draw and interpret velocity–time graphs for objects that reach terminal velocity, including a consideration of the forces acting on the	State which forces act on an object moving through a fluid. Describe and explain how the velocity of an object falling through a fluid changes as it falls. Explain why the use of a parachute reduces the parachutist's terminal velocity.	2	**Applications, implications and cultural understanding** Research the impact of fluid resistance on sports performance. **Presenting and writing descriptions and explanations** Use a velocity-time graph to describe and explain the stages of the fall of a sky-diver.	**Planning an approach Selecting and managing variables** *Does everything fall at the same speed?* Investigate how streamlined and non-streamlined shapes fall through water/washing-up liquid. Investigate how surface area will affect a falling mass. Paper cake cases, available in various sizes, are very effective.	P2.1.4 Forces and terminal velocity success criteria items powerpoint Video clips of skydiving can be found on www.youtube.com by searching for 'Head Rush: Terminal Velocity' or http://science.discovery.com/videos/head-rush-terminal-velocity.html

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	body.					
d	Calculate the weight of an object using the force exerted on it by a gravitational field: *W = m × g*	Calculate the weight of an object, given its mass.		Explain the difference between mass and weight		

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P2.1.5 Forces and elasticity						
a b c d	A force acting on an object may cause a change in shape of the object. A force applied to an elastic object such as a spring will result in the object stretching and storing elastic potential energy. For an object that is able to recover its original shape, elastic potential energy is stored in the object when work is done on the object to change its shape. The extension of an elastic object is directly proportional	Describe that when an elastic object is stretched it stores elastic potential energy. Explain the relationship between force and extension of an elastic object and be able to	1	**Presenting and writing descriptions and explanations** Use graphs to describe and explain the relationships between force and extension **Applications, implications and cultural understanding** Research toys that work using stored potential energy (pull back 'motor' cars etc). Use the equation $F = k \times e$ in calculations	**Obtaining and presenting primary evidence** *Does a spring stretch evenly?* Investigate the effect of forces on the extension of a spring. Investigate the effect of stretching elastic band catapults by different amounts on the distance a fired paper pellet travels.	P2.1.4 Forces and terminal velocity success criteria items powerpoint

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	to the force applied, provided that the limit of proportionality is not exceeded: $F = k \times e$	use the equation.				

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P2.2.1 Forces and energy						
a b c d e	When a force causes an object to move through a distance, work is done. Work done, force and distance are related by the equation: $W = F \times d$ Energy is transferred when work is done. Work done against frictional forces. Power is the work done or energy transferred in a given time. $P = \frac{E}{t}$	Calculate the work done on an object and the power developed.	1	**Presenting and writing descriptions and explanations** Use the ideas of work, power and energy to describe and explain various situations **Developing explanations using ideas and models** Calculations using the different equations.	**Obtaining and presenting primary evidence** *Is power different to work?* Demonstration of motor lifting a mass, and calculation of work and power. Practically measuring and calculating work done and power output in different situations, eg running up stairs, lifting sandbags onto a table, etc.	P2.2.1 Forces and energy success criteria items powerpoint

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f	Gravitational potential energy is the energy that an object has by virtue of its position in a gravitational field: $E_p = m \times g \times h$	Explain that when an object is raised vertically, work is done against gravitational force and the object gains gravitational potential energy. Calculate the change in gravitational potential energy of an object.			Measurement of initial gravitational potential energy (GPE) and final kinetic energy (KE) of a falling object, eg using a light gate and timer.	
g	The kinetic energy of an object depends on its mass and its speed: $E_k = \frac{1}{2} \times m \times v^2$	Describe the transfer of kinetic energy in particular situations, such as space shuttle re-entry or meteorites burning up in the atmosphere. Calculate the kinetic energy of a moving object.				

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P2.2.2 Momentum						
a b	Momentum is a property of moving objects: *p = m x v* In a closed system the total momentum before an event is equal to the total momentum after the event. This is called conservation of momentum.	Calculate the momentum of a moving object. Describe how momentum is conserved in collisions and explosions. Complete calculations involving two objects colliding or exploding.	1	**Presenting and writing descriptions and explanations** **Applications and implications** Discussion of use of jet packs for moving in space, and rocket travel. Work done by external force changing momentum of a body, eg work done by force changing shape of car in crumple zones. Importance of time during which work is done reducing the force involved.	**Working critically with primary evidence** *Why is it harder to stop a lorry than a car?* Demonstration of simple colliding system, eg moving trolley colliding with and adhering to a stationary trolley; measuring masses and velocities to calculate momentum before and after the collision. Demonstration of simple exploding system, eg two stationary trolleys joined by a compressed spring, and then released; measuring masses and velocities to calculate momentum after the collision, having started at rest.	**P2.2.2 Momentum success criteria items powerpoint** Information on kinetic energy and momentum can be found on the BBC GCSE Bitesize website www.bbc.co.uk/schools/gcsebitesize/science/add_aqa/forces

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P2.3 Currents in electrical circuits The current in an electric circuit depends on the resistance of the components and the supply						
P2.3.1 Static electricity						
a b	When certain insulating materials are rubbed against each other they become electrically charged. Negatively charged electrons are rubbed off one material and onto the other. The material that gains electrons becomes negatively charged. The material that loses electrons is left with an equal positive charge.	Explain why rubbing some insulating materials causes them to become charged. Explain the role of electron movement in charging an insulator. State that like charges repel and unlike charges attract.	1	**Communication for audience and purpose** Devise a simple drama to illustrate friction resulting in charged particles, which are subsequently attracted or repelled (eg paint spray or electrostatic precipitator) **Applications, implications and cultural understanding** Research applications of static electricity. **Presenting and writing descriptions and explanations** Use the idea of charge particles to explain electrostatic effects.	**Obtaining and presenting primary evidence** *Is static really electricity?* Investigations of rubbed rods attracting and repelling. Demonstration of Van de Graaf generator.	P2.3.1 Static electricity success criteria items powerpoint **Video:** Dangers of static from nylon clothes http://www.ovguide.com/tv/brainiac_science_abuse.htm

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c	When two electrically charged objects are brought together they exert a force on each other.					
d	Two objects that carry the same type of charge repel. Two objects that carry different types of charge attract.					
e	Electrical charges can move easily through some substances, eg metals.					

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P2.3.2 Electrical circuits						
a c	Electric current is a flow of electric charge. The size of the electric current is the rate of flow of electric charge. The size of the current is given by the equation: $I = \frac{Q}{t}$ Circuit diagrams using standard symbols.	Describe that a flow of electrical charge constitutes a current. Use the equation relating current, charge and time. Recall and use the standard circuit symbols as shown in the specification. Draw and interpret circuit diagrams. Explain the concept of potential difference.	4	**Presenting and writing descriptions and explanations** Use circuit symbols to accurately draw a circuit diagram to represent a real circuit. Teacher 'dictates' circuits, which candidates draw. Explain the meaning of current, potential difference and describe how they are related.	**Working critically with primary evidence** *Does electricity always need a circuit to flow?* Setting up a simple circuit from a circuit diagram.	P2.3.2 Electrical circuits success criteria items powerpoint Information on resistance and resistors can be found on the BBC GCSE Bitesize website www.bbc.co.uk/schools/gcsebitesize/science/add_aqa/electricity Video clips or computer simulations of current as a flow of charge can be found at http://phet.colorado.

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b f	The potential difference (voltage) between two points in an electric circuit is the work done (energy transferred) per coulomb of charge that passes between the points. $V = \frac{W}{Q}$ The resistance of a component can be found by measuring the current through, and potential difference across, the component.	Use the equation relating potential difference with energy transferred and charge. Explain the concept of resistance and how resistance can be measured. **HT only** **Explain resistance in terms of ions and electrons**.		**Developing explanations using ideas and models** Calculations involving the following equations: $V = \frac{W}{Q}$ and $V = I \times R$ Draw a poster to illustrate understanding of electricity using different models e.g water flow, sweets in cups, fuel delivery. Evaluate the strengths and weaknesses of the models.	**Planning an approach, Selecting and managing variables, Assessing risk and working safely** *What can moving charge do?* Investigations to: • study the effect of changing resistance on the current in a circuit. • study the effect of changing battery voltage on the current in a circuit. • to measure current through and potential difference across a resistor and hence calculate resistance.	edu/en/simulation/circuit-construction-kit-dc There are a huge number of downloadable experiments from the Practical Physics website, which can be found at www.practicalphysics.org/go/Experiment_666.html A video clip on voltage and current can be found on the BBC website at www.bbc.co.uk/learningzone/clips by searching for clip '2'.

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g	The current through a resistor (at a constant temperature) is directly proportional to the potential difference across the resistor.					
h	Calculate current, potential difference or resistance using the equation: *V = I × R*	Use the equation relating current, potential difference and resistance.		**Communication for audience and purpose** Use the graphs of experiment results (as current-potential difference graphs) to explain the role a component has in a circuit. Use the idea of ions and electrons to explain the shape of the graphs.	• measure current through, and potential difference across, a fixed resistor, as the current is varied. • measure current through and potential difference across, a filament light bulb, as the current is varied. • measure current through, and potential difference across, a diode, as the current is varied.	
i	The current through a component depends on its resistance. The greater the resistance the smaller the current for a given potential difference across the component					

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d e m n	Current–potential difference graphs are used to show how the current through a component varies with the potential difference across it. The current–potential difference graphs for a resistor at constant temperature. The resistance of a filament bulb increases as the temperature of the filament increases. The current through a diode flows in one direction only. The diode has a very high resistance in the reverse direction.	Describe and explain the features of current- potential difference graphs for a resistor, a filament bulb and a diode. **HT only** **Explain these features in terms of ions and electrons.**				

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o	An LED emits light when a current flows through it in the forward direction.	Explain why there is an increasing use of Light Emitting Diodes (LEDs) for lighting, as they use a much smaller current than other forms of lighting.			• observe the effect of current direction on the output of an LED.	A mechanical generator is available with an LED which only lights when the handle is turned in the right direction.
j	The potential difference provided by cells connected in series is the sum of the potential difference of each cell.	Work out the potential difference provided by a number of cells in series.				Useful information and activities can be found at www.hyperstaffs.info/work/physics/child/main.html and www.what2learn.com
k	For components connected in series how the resistance, current and potential difference are affected.	State and use the fact, that for components in series, the total resistance is the sum of the resistance of each component. State and use the fact, that for components in series, there is the same current through each component.				

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		State and use the fact, that for components in series, the total potential difference of the supply is shared between the components.				
l	For components connected in parallel how the resistance, current and potential difference are affected.	State and use the fact, that for components in parallel, the potential difference across each component is the same. State and use the fact, that for components in parallel, the total current through the whole circuit is the sum of the currents through the separate components.				
p	The resistance of a light-dependent resistor (LDR) decreases as light intensity increases.	Explain how the resistance of a LDR varies with light intensity. Explain how a LDR can be used, eg switching lights on when it gets dark.		**Applications, implications and cultural understanding** Research the practical uses of thermistors and LDRs.	• observe the effect of light intensity on the resistance of a LDR. • observe the effect of temperature on the resistance of a thermistor.	

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q	The resistance of a thermistor decreases as the temperature increases.	Explain how the resistance of a thermistor (negative temperature coefficient) varies with temperature. Explain how a thermistor can be used, eg as a thermostat.			These experiments can be repetitive and time consuming– some groups could do one and other groups a different one and present their findings to the rest of the class, reinforcing their understanding.	

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P2.4 Using mains electricity safely and the power of electrical appliances Mains electricity is useful but can be very dangerous. It is important to know how to use it safely. Electrical appliances transfer energy. The power of an electrical appliance is the rate at which it transforms energy. Most appliances have their power and the potential difference of the supply they need printed on them. From this we can calculate their current and the fuse they need.						
P2.4.1 Household electricity						
a b c	Cells and batteries supply current that always passes in the same direction. This is called direct current (d.c.). An alternating current (a.c.) is one that is constantly changing direction. Mains electricity is an a.c. supply. In the UK it has a frequency of 50 cycles per second (50 hertz) and is about 230 V.	Describe the difference between direct current and alternating current. Compare and calculate potential differences of d.c. supplies and the peak potential differences of a.c. supplies from diagrams of oscilloscope traces. **HT only** **Determine the period and hence the frequency of a supply from diagrams of oscilloscope traces.** Describe the structure of both	2	**Presenting and writing descriptions and explanations** Use diagrams to describe and explain the difference between a.c and d.c.	**Working critically with primary evidence** Demonstration of CRO traces of dc and ac; effect of increasing the voltage and the frequency on the shape of the trace; measurement of voltage and frequency from the trace.	P2.4.1 Household electricity success criteria items powerpoint Useful information on mains electricity can be found on the BBC GCSE Bitesize website at www.bbc.co.uk/schools/gcsebitesize/science/add_aqa/electricity

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d e f g	Most electrical appliances are connected to the mains using cable and a three-pin plug. The structure of electrical cable. The structure and wiring of a three-pin plug. If an electrical fault causes too great a current, the circuit is disconnected by a	two-core and three-core cable. Describe the materials used in three-pin plugs and explain why they are used. State the colour coding of the covering of the three wires used in three-pin plugs. Explain the purpose and action of the fuse and the earth wire. Explain the link between cable thickness and fuse value. Explain why some appliances are double insulated, and therefore have no earth wire connection. Describe how RCCBs operate by detecting a difference in the current between the live and neutral wires.		Identify and correct wiring faults in a number of diagrams of a 3-pin plug. Or Identify domestic appliances which may not require a 3-pin plug and explain why. Describe and explain how earthing, a fuse and RCCBs may protect consumers.	**Assessing risk and working safely** *How do we make sure electricity does not kill us?* Experiment to wire a three-pin plug. **Working critically with primary evidence** Demonstration of the measurement of an increasing current through a length of fuse wire. Demonstration of a RCCB.	A useful animation can be found on the BBC website www.bbc.co.uk/learningzone/clips by searching for clip '10051'.

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	fuse or a circuit breaker in the live wire.	State that an RCCB operates much faster than a fuse.				
h	When the current in a fuse wire exceeds the rating of the fuse it will melt, breaking the circuit.					
i	Some circuits are protected by Residual Current Circuit Breakers (RCCB).					
j	Appliances with metal cases are usually earthed.					
k	The earth wire and fuse together protect the wiring of the circuit.					

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P2.4.2 Current, charge and power						
a	When an electrical charge flows through a resistor, the resistor gets hot.	Explain that a lot of energy is wasted in filament bulbs by heating. Less energy is wasted in power saving lamps such as Compact Fluorescent Lamps (CFLs).	1	**Presenting and writing descriptions and explanations**	**Obtaining and presenting primary evidence** *Is mechanical power the same as electrical power?* Experiment to measure the power of a low voltage light bulb and the energy transferred by measuring current, potential difference and time. Demonstration of measuring the energy transferred to a low voltage motor as it lifts a load (and compare to the gravitational potential energy gained by the load).	P2.4.2 Current, charge and power success criteria items powerpoint
b	The rate at which energy is transferred by an appliance is called the power: $P = \frac{E}{t}$	Use the equations connecting power with energy transferred and with current and potential difference. Use the equation connecting energy with potential difference and charge.		Calculations using the equations, including generic questions using their own domestic appliances. **Applications, implications and cultural understanding. Developing argument** Evaluate the benefits and drawbacks of using lower power devices such as CFLs		
c	Power, potential difference and current are related by the equation:					

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d	$P = I \times V$ HT only Energy transferred, potential difference and charge are related by the equation: $E = V \times Q$					

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P2.5 What happens when radioactive substances decay, and the uses and dangers of their emissions Radioactive substances emit radiation from the nuclei of their atoms all the time. These nuclear radiations can be very useful but may also be very dangerous. It is important to understand the properties of different types of nuclear radiation. To understand what happens to radioactive substances when they decay we need to understand the structure of the atoms from which they are made. The use of radioactive sources depends on their penetrating power and half-life.						
P2.5.1 Atomic structure						
a b	The basic structure of an atom is a small central nucleus composed of protons and neutrons surrounded by electrons. The relative masses and relative electric charges of protons, neutrons and electrons.	Describe the structure of an atom. Explain that, according to the nuclear model, most of the atom is empty space. State that an atom has no overall charge. Explain how results from the Rutherford and Marsden scattering experiments led to the 'plum pudding' model being replaced by the nuclear model. Explain how new evidence can cause a theory to be re-evaluated.	2	**Presenting and writing descriptions and explanations** Fill in the gaps' exercise relating to the number of protons, neutrons and electrons, atomic number and mass number of atoms of different isotopes. **Reaching agreement on scientific explanations** Explain how a new theory of the atom evolved based on fresh experimental evidence.	**Developing explanations using ideas and models** *If atoms are mainly empty space why don't we sink through the floor?* Make model atoms from different coloured plasticene and critically evaluate their strengths and weaknesses.	Video clips of atomic structure can be found on www.youtube.com by searching for 'Nuclear Energy Part 1'. Information on Atoms and Isotopes can be found on BBC GCSE Bitesize at www.bbc.co.uk/schools/gcsebitesize/science/add_aqa/radiation

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c	In an atom the number of electrons is equal to the number of protons in the nucleus. The atom has no overall electrical charge.	Explain the terms atomic number and mass number. Describe how an ion is formed.				
d	Atoms may lose or gain electrons to form charged particles called ions.					
e	The atoms of an element always have the same number of protons, but have a different number of neutrons for each isotope. The total number of protons in an atom is called its atomic number. The total number of protons and neutrons					

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	in an atom is called its mass number.					

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P2.5.2 Atoms and radiation						
a	Some substances give out radiation from the nuclei of their atoms all the time, whatever is done to them. These substances are said to be radioactive.	Be aware of the random nature of radioactive decay.	4	**Reaching agreement on scientific explanations** Find out about how the work of Marie Curie led to the discovery of a new element.	**Working critically with primary evidence Assessing risk and working safely** *Is radioactivity all around us?* Demonstration of radiation emitted from various sources, eg radioactive rocks, sealed sources, and luminous watch.	P2.5.1 Atomic structure and P2.5.2 Atoms and radiation success criteria items powerpoint Information on background radiation can be found on the BBC GCSE Bitesize website at www.bbc.co.uk/schools/gcsebitesize/science/add_aqa/radiation
b	The origins of background radiation	Describe and explain how background radiation originates from both natural sources, such as rocks and cosmic rays from space, and man-made sources such as the fallout from nuclear weapons tests and nuclear accidents.				
e	Properties of the alpha, beta and	Recall the relative ionising power, penetration through		**Presenting and writing descriptions and explanations**	Demonstrations of the properties of alpha, beta and	Interactive websites showing the nature

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	gamma radiations limited to their relative ionising power, their penetration through materials and their range in air.	materials and range in air of these three types of nuclear radiation. Recall that alpha particles are deflected less than beta particles and in an opposite direction.		Describe the basic properties of alpha, beta and gamma radiation… …..and use diagrams to explain how this relates to their structure. HT	gamma radiation. Discussion of conclusions (nature, size, speed).	of each type of nuclear radiation can be found at http://phet.colorado.edu/en/simulation/alpha-decay Information on Electrostatic model of alpha particle scattering can be found on the Practical Physics website at www.practicalphysics.org/go/Experiment_571.html
f	Alpha and beta radiations are deflected by both electric and magnetic fields but gamma radiation is not.	**HT only** **Explain the deflection of alpha and beta particles in terms of their relative mass and charge.**			Interactive activities on alpha decay, beta decay and the scattering of alpha particles.	
c	Identification of an alpha particle as two neutrons and two protons, the same as a helium nucleus, a beta particle as an electron from the nucleus and gamma radiation as	Recall the nature of the three types of nuclear radiation.			*Will all radioactivity disappear eventually?* Experiment to model radioactive decay using dice, coins or marked cubes.	

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	electromagnetic radiation.					Information on radioactive substances can be found on the BBC GCSE Bitesize website at www.bbc.co.uk/schools/gcsebitesize/science/add_aqa/radiation
d	**HT only** **Nuclear equations to show single alpha and beta decay.**	**HT only** **Balance nuclear equations, limited to the completion of atomic number and mass number.**		**HT only** **Questions on balancing nuclear equations.**		
h	The half-life of a radioactive isotope is the average time it takes for the number of nuclei of the isotope in a sample to halve, or the time it takes for the count rate from a sample containing the isotope to fall to half its initial level.	Recall the definition of half-life. Describe the shape of a radioactive decay graph and work out the half-life from it. Evaluate the appropriateness of radioactive sources for particular uses, including as tracers, in terms of the type(s) of radiation emitted and their half-lives.		**Communication for audience and purpose** Drawing graphs to show radioactive decay and calculating the half-life from the graph. Calculations and graphs involving half-life.		
g	The uses of and the dangers associated	Explain how the properties of each type of nuclear radiation		**Developing argument** Describe the uses and dangers of each		

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	with each type of nuclear radiation.	make it suitable for specific uses. Evaluate the possible hazards associated with the use of different types of nuclear radiation.		type of nuclear radiation. Evaluate the selection of an appropriate isotope for a given situation.		

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P2.6 Nuclear fission and nuclear fusion During the process of nuclear fission atomic nuclei split. This process releases energy, which can be used to heat water and turn it into steam. The steam drives a turbine, which is connected to a generator and generates electricity. Nuclear fusion is the joining together of atomic nuclei and is the process by which energy is released in stars.						
P2.6.1 Nuclear fission						
a b c d	There are two fissionable substances in common use in nuclear reactors: uranium-235 and plutonium-239. Nuclear fission is the splitting of an atomic nucleus. For fission to occur the uranium-235 or plutonium-239 nucleus must first absorb a neutron. The nucleus undergoing fission splits into two smaller	Explain the concepts of nuclear fission and chain reactions. Sketch or complete a labelled diagram to illustrate how a chain reaction may occur.	2	**Communication for audience and purpose** Prepare a presentation or poster which describes and explains nuclear fission. Or Use stop frame animation and plasticene to model nuclear fission.	*Why don't all atoms split apart?*	P2.6.1 Nuclear fission success criteria items powerpoint Video clips of nuclear fission and chain reactions can be found at http://phet.colorado.edu/en/simulation/nuclear-fission

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e	nuclei and two or three neutrons and energy is released. The neutrons may go on to start a chain reaction.					

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P2.6.2 Nuclear fusion						
a	Nuclear fusion is the joining of two atomic nuclei to form a larger one.	Explain the process of nuclear fusion.	2	Use stop frame animation and plasticene to model nuclear fusion.	*What is the difference between fission and fusion?*	P2.6.2 Nuclear fusion success criteria items powerpoint
b	Nuclear fusion is the process by which energy is released in stars.					Information on nuclear fission and fusion can be found on the BBC GCSE Bitesize website at www.bbc.co.uk/schools/gcsebitesize/science/add_aqa/radiation/
c	Stars form when enough dust and gas from space is pulled together by gravitational attraction. Smaller masses may also form and be attracted by a larger mass to become planets.	Describe the life cycles of stars. Explain how stars are able to maintain their energy output for millions of years.		**Communication for audience and purpose** Prepare a presentation or poster about the life cycle of stars.		Video clips showing the life cycle of stars can be found on www.brainpop.com by searching for 'lifecycle of stars'.

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d	During the 'main sequence' period of its life cycle a star is stable because the forces within it are balanced.	Describe how elements up to iron are formed during the stable period of a star, and elements heavier than iron are formed in a supernova.				
e	A star goes through a life cycle. This life cycle is determined by the size of the star.	Explain why the early Universe contained only hydrogen but now contains a large variety of different elements.				
f	Fusion processes in stars produce all of the naturally occurring elements. These elements may be distributed throughout the universe by the explosion of a massive star (supernova) at the end of its life.	Evaluate the uses of nuclear fusion and nuclear fission as methods of generating electricity.				