

Physics 1		Higher and Separate Physics	
Red 	Amber 	Green 	
1. Conservation & Dissipation of Energy	Define a system as an object or group of objects and state examples of changes in the way energy is stored in a system		
	Describe how all the energy changes involved in an energy transfer and calculate relative changes in energy when the heat, work done or flow of charge in a system changes		
	Use calculations to show on a common scale how energy in a system is redistributed		
	Describe energy transfers involved when work is done and calculate the work done by recalling and using the equation: $[W = Fs]$		
	Describe what a joule is and state what the joule is derived from		
	Convert between newton-metres and joules.		
	Explain why work done against the frictional forces acting on an object causes a rise in the temperature of the object		
	Calculate the kinetic energy of an object by recalling and applying the equation: $[E_k = \frac{1}{2}mv^2]$		
	Calculate the amount of elastic potential energy stored in a stretched spring by applying, but not recalling, the equation: $[E_e = \frac{1}{2}ke^2]$		
	Calculate the amount of gravitational potential energy gained by an object raised above ground level by recalling and applying, the equation: $[E_e = mgh]$		
	Define power as the rate at which energy is transferred or the rate at which work is done and the watt as an energy transfer of 1 joule per second		
	Calculate power by recalling and applying the equations : $[P = E/t \text{ \& } P = W/t]$		
	Explain, using examples, how two systems transferring the same amount of energy can differ in power output due to the time taken		
	State that energy can be transferred usefully, stored or dissipated, but cannot be created or destroyed and so the total energy in a system does not change		
	Explain that only some of the energy in a system is usefully transferred, with the rest 'wasted', giving examples of how this wasted energy can be reduced		
HT ONLY: Suggest and explain ways to increase the efficiency of an intended energy transfer			
Calculate efficiency by recalling and applying the equation: $[\textit{efficiency} = \textit{useful power output} / \textit{total power input}]$			

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2. Energy Transfer by Heating	Explain ways of reducing unwanted energy transfers and the relationship between thermal conductivity and energy transferred		
	Required practical: <i>investigate the effectiveness of different materials as thermal insulators and the factors that may affect the thermal insulation properties of a material.</i>		
	Describe how the rate of cooling of a building is affected by the thickness and thermal conductivity of its walls		
	PHY ONLY: State that all bodies, no matter what temperature, emit and absorb infrared radiation and that the hotter the body, the more infrared radiation it radiates in a given time		
	PHY ONLY: Describe a perfect black body as an object that absorbs all the radiation incident on it and explain why it is the best possible emitter		
	PHY ONLY: Explain why when the temperature is increased, the intensity of every wavelength of radiation emitted increases, but the intensity of the shorter wavelengths increases more rapidly		
	PHY ONLY: Explain and apply the idea that the temperature of a body is related to the balance between incoming radiation absorbed and radiation emitted		
	PHY ONLY: Describe how the temperature of the Earth is dependent on the rates of absorption and emission of radiation and draw and interpret diagrams that show this		
	Calculate the amount of energy stored in or released from a system as its temperature changes by applying, but not recalling, the equation: $[\Delta E = mc\Delta\theta]$		
	Define the term 'specific heat capacity'		
	Required practical: <i>investigation to determine the specific heat capacity of one or more materials.</i>		
3. Energy Resources	List the main renewable and non-renewable energy resources and define what a renewable energy resource is		
	Compare ways that different energy resources are used, including uses in transport, electricity generation and heating		
	Explain why some energy resources are more reliable than others, explaining patterns and trends in their use		
	Evaluate the use of different energy resources, taking into account any ethical and environmental issues which may arise		
	Justify the use of energy resources, with reference to both environmental issues and the limitations imposed by political, social, ethical or economic considerations		

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4. Electric Circuits	PHY ONLY: Describe the production of static electricity by the rubbing of insulating surfaces		
	PHY ONLY: Describe evidence that charged objects exert forces of attraction or repulsion on one another when not in contact		
	PHY ONLY: Explain how the transfer of electrons between objects can explain the phenomenon of static electricity, including how insulators are charged and sparks are created		
	PHY ONLY: Draw the electric field pattern for an isolated charged sphere		
	PHY ONLY: Explain the concept of an electric field and the decrease in its strength as the distance from it increases		
	PHY ONLY: Explain how the concept of an electric field helps to Explain the non-contact force between charged objects as well as other electrostatic phenomena such as sparking		
	Draw and interpret circuit diagrams, including all common circuit symbols		
	Define electric current as the rate of flow of electrical charge around a closed circuit		
	Calculate charge and current by recalling and applying the formula: $[Q = It]$		
	Explain that current is caused by a source of potential difference and it has the same value at any point in a single closed loop of a circuit		
	Describe and apply the idea that the greater the resistance of a component, the smaller the current for a given potential difference (p.d.) across the component		
	Calculate current, potential difference or resistance by recalling and applying the equation: $[V = IR]$		
	Required practical: Use circuit diagrams to set up and check circuits to investigate the factors affecting the resistance of electrical circuits		
	Define an ohmic conductor		
	Explain the resistance of components such as lamps, diodes, thermistors and LDRs and sketch/interpret IV graphs of their characteristic electrical behaviour		
	Explain how to measure the resistance of a component by drawing an appropriate circuit diagram using correct circuit symbols		
	Required practical: use circuit diagrams to construct appropriate circuits to investigate the I–V characteristics of a variety of circuit elements		
	Show by calculation and explanation that components in series have the same current passing through them		
	Show by calculation and explanation that components connected in parallel have the same the potential difference across each of them		
	Calculate the total resistance of two components in series as the sum of the resistance of each component using the equation: $[R_{total} = R_1 + R_2]$		
Explain qualitatively why adding resistors in series increases the total resistance whilst adding resistors in parallel decreases the total resistance			
Solve problems for circuits which include resistors in series using the concept of equivalent resistance			

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5. Electricity in the Home	Explain the difference between direct and alternating voltage and current, stating what UK mains is		
	Identify and describe the function of each wire in a three-core cable connected to the mains		
	State that the potential difference between the live wire and earth (0 V) is about 230 V and that both neutral wires and our bodies are at, or close to, earth potential (0 V)		
	Explain that a live wire may be dangerous even when a switch in the mains circuit is open by explaining the danger of providing any connection between the live wire and earth		
	Explain how the power transfer in any circuit device is related to the potential difference across it and the current through it		
	Calculate power by recalling and applying the equations: $[P = VI]$ and $[P = I^2 R]$		
	Describe how appliances transfer energy to the kinetic energy of motors or the thermal energy of heating devices		
	Calculate and explain the amount of energy transferred by electrical work by recalling and applying the equations: $[E = Pt]$ and $[E = QV]$		
	Explain how the power of a circuit device is related to the potential difference across it, the current through it and the energy transferred over a given time.		
	Calculate efficiency by recalling and applying the equation: $[\text{efficiency} = \text{useful power output} / \text{total power input}]$		
	Describe, with examples, the relationship between the power ratings for domestic electrical appliances and the changes in stored energy when they are in use		
	Identify the National Grid as a system of cables and transformers linking power stations to consumers		
Explain why the National Grid system is an efficient way to transfer energy, with reference to change in potential difference reducing current			

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6. Molecules & Matter	Calculate the density of a material by recalling and applying the equation: [$\rho = m/V$]		
	Recognise/draw simple diagrams to model the difference between solids, liquids and gases		
	Use the particle model to explain the properties of different states of matter and differences in the density of materials		
	Required practical: use appropriate apparatus to make and record the measurements needed to determine the densities of regular and irregular solid objects and liquids		
	Recall and describe the names of the processes by which substances change state		
	Use the particle model to explain why a change of state is reversible and affects the properties of a substance, but not its mass		
	State that the internal energy of a system is stored in the atoms and molecules that make up the system		
	Explain that internal energy is the total kinetic energy and potential energy of all the particles in a system		
	Calculate the change in thermal energy by applying but not recalling the equation [$\Delta E = m c \Delta\theta$]		
	Calculate the specific latent heat of fusion/vaporisation by applying, but not recalling, the equation: [$E = mL$]		
	Interpret and draw heating and cooling graphs that include changes of state		
	Distinguish between specific heat capacity and specific latent heat		
	Explain why the molecules of a gas are in constant random motion and that the higher the temperature of a gas, the greater the particles' average kinetic energy		
	Explain, with reference to the particle model, the effect of changing the temperature of a gas held at constant volume on its pressure		
	Calculate the change in the pressure of a gas or the volume of a gas (a fixed mass held at constant temperature) when either the pressure or volume is increased or decreased		
	PHY ONLY: Explain, with reference to the particle model, how increasing the volume in which a gas is contained can lead to a decrease in pressure when the temperature is constant		
PHY ONLY: Calculate the pressure for a fixed mass of gas held at a constant temperature by applying, but not recalling, the equation: [$pV = \text{constant}$]			
PHY ONLY: Explain how work done on an enclosed gas can lead to an increase in the temperature of the gas, as in a bicycle pump			

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7. Radioactivity	Describe the basic structure of an atom and how the distance of the charged particles vary with the absorption or emission of electromagnetic radiation		
	Define electrons, neutrons, protons, isotopes and ions		
	Relate differences between isotopes to differences in conventional representations of their identities, charges and masses		
	Describe how the atomic model has changed over time due to new experimental evidence, inc discovery of the atom and scattering experiments (inc the work of James Chadwick)		
	Describe and apply the idea that the activity of a radioactive source is the rate at which its unstable nuclei decay, measured in Becquerel (Bq) by a Geiger-Muller tube		
	Describe the penetration through materials, the range in air and the ionising power for alpha particles, beta particles and gamma rays		
	Apply knowledge of the uses of radiation to evaluate the best sources of radiation to use in a given situation		
	Use the names and symbols of common nuclei and particles to complete balanced nuclear equations, by balancing the atomic numbers and mass numbers		
	Define half-life of a radioactive isotope		
	HT ONLY: Determine the half-life of a radioactive isotope from given information and calculate the net decline, expressed as a ratio, in a radioactive emission after a given number of half-lives		
	Compare the hazards associated with contamination and irradiation and outline suitable precautions taken to protect against any hazard the radioactive sources may present		
	Discuss the importance of publishing the findings of studies into the effects of radiation on humans and sharing findings with other scientists so that they can be checked by peer review		
	PHY ONLY: State, giving examples, that background radiation is caused by natural and man-made sources and that the level of radiation may be affected by occupation and/or location		
	PHY ONLY: Explain the relationship between the instability and half-life of radioactive isotopes and why the hazards associated with radioactive material differ according to the half-life involved		
	PHY ONLY: Describe and evaluate the uses of nuclear radiation in exploration of internal organs and controlling or destroying unwanted tissue		
	PHY ONLY: Evaluate the perceived risks of using nuclear radiation in relation to given data and consequences		
	PHY ONLY: Describe nuclear fission		
	PHY ONLY: Draw/interpret diagrams representing nuclear fission and how a chain reaction may occur		
PHY ONLY: Describe nuclear fusion			