ABBEY COLLEGE

Aspire & Challenge

Year 9 Physics Curriculum Overview

Topic	Timing	Key knowledge and skills	Progression and links	SEND/ More able	Assessment & recording; factual recall checks
Energy	Autumn Term, Half-term one	A system is an object or group of objects. There are changes in the way energy is stored when a system changes. Students should be able to describe all the changes involved in the way energy is stored when a system changes, for common situations. For example: • an object projected upwards • a moving object hitting an obstacle • an object accelerated by a constant force • a vehicle slowing down • bringing water to a boil in an electric kettle. The main energy resources available for use on Earth include: fossil fuels (coal, oil and gas), nuclear fuel, bio-fuel, wind, hydroelectricity, geothermal, the tides, the Sun and water waves. A renewable energy resource is one that is being (or can be) replenished as it is used. The uses of energy resources include: transport, electricity generation and heating. Students should be able to: • describe the main energy sources available • distinguish between energy resources that are renewable and energy resources that are non-renewable • compare ways that different energy resources are used, the uses to include transport, electricity generation and heating • understand why some energy resources are more reliable than others • describe the environmental impact arising from the use of different energy resources • explain patterns and trends in the use of energy resources. Descriptions of how energy resources are used to generate electricity are not required. Students should be able to: • consider the environmental issues that may arise from the use of different energy resources • show that science has the ability to identify environmental issues arising from the use of energy resources but not always the power to deal with the issues because of political, social, ethical or economic considerations.	Numeracy • Graph drawing • Standard Form • Ratios Literacy • Use of tier three words • Extended writing opportunities	Challenge: • Explaining how ideas on energy transfers all link together. • Higher level questions – evaluating risks and benefits of using various energy resources. • Conversion between units and/or standard form Scaffold: • Pre prepared results tables • Knowledge organisers • Scaffold for extended writing • Equation conversion assistance.	• 5 questions to start – recall activity every lesson. • Close the gap questions • Self and peer feedback on tasks completed • Structure strip • Past paper exam Qs. • Summative assessment at the end of the unit

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Particle Model of Matter	Autumn Term, Half-term 2	Students should: • Explain why some materials will float on water. • Calculate the density of materials. • Measure the density of a solid and a liquid. • Describe the arrangement of the particles in a solid, liquid, and gas. • Explain the behaviour of a material in terms of the arrangement of particles within it. • Describe the changes in behaviour of the particles in a material during changes of state. • State that the melting and boiling points of a pure substance are fixed. • Use the term 'latent heat' to describe the energy gained by a substance during heating for which there is no change in temperature. • Find the melting or boiling point of a substance by using a graphical technique. • Describe how the internal energy of an object can be increased by heating. • Describe how the behaviour of particles changes as the energy of a system increases. • Describe the energy changes by heating between objects within the same system. • Describe the changes in particle bonding during changes of state. • Calculate the latent heat of fusion and latent heat of vaporisation for a substance. • Measure the latent heat of fusion for water. • Describe the behaviour of particles in a gas as the gas is heated. • Outline Brownian motion and how this provides evidence for the particle nature of matter. • Describe the relationship between an increase in the temperature of a fixed volume of a gas and the increase in pressure of the gas. • Describe how the pressure of a gas can change when it is compressed or allowed to expand. • Use the relationship pV = constant to calculate the constant. • Explain why the temperature of a gas increases when it is compressed.	Numeracy • Rearranging equations Literacy • Use of tier three words • Extended writing opportunities	Challenge: • Mastery – SHC • Higher level questions – Boyle's Law, investigating pressure and volumes. Scaffold: • Pre prepared axes for graphs • Knowledge organisers • Scaffold for extended writing	• 5 questions to start – recall activity every lesson. • Close the gap questions • Self and peer feedback on tasks completed • Structure strip • Past paper exam Qs. • Summative assessment at the end of the unit

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Atomic Structure	Spring Term	Students should: • Describe some safety precautions used when dealing with radioactive materials. • Describe how a Geiger counter can be used to detect radiation. • Identify natural and man-made sources of background radiation. • Describe he plum pudding model of the atom. • Describe the evidence provided by the Rutherford scattering experiment. • Describe the properties of protons, neutrons, and electrons. • Calculate the number of neutrons in an isotope by using nuclear notation. • Describe the differences between isotopes. • Complete decay equations for alpha and beta decay. • Describe how the penetrating powers of radiation can be measured. • Describe the path of radiation types through a magnetic field. • Describe the process of ionisation. • Find the ratio of a sample remaining after a given number of half-lives. • State that all atoms of a particular isotope have an identical chance to decay in a fixed time. • Plot a graph showing the decay of a sample and use it to determine half-life. • Explain why alpha, beta, or gamma radiation is chosen for a particular medical application. • Describe how gamma rays can be used to destroy cancerous cells and the damage they may cause to healthy tissue. • Explain how precautions to reduce exposure to patients and medical staff work. • Describe induced nuclear fission in terms of neutron impacts and release. • Explain how an escalating induced fission reaction occurs. • Outline the function of the moderator, control rods, and coolant. • Outline the process of nuclear fusion. • Complete a nuclear equation showing simple fusion processes. • Describe the key design features of a nuclear fusion reactor. • Compare the risks and damage associated with alpha, beta, and gamma radiation. • Describe how damage caused by radioactive material can be reduced. • Discuss the difficulties associated with the handling and storage of nuclear waste.	Numeracy • Graphs Literacy • Use of tier three words • Extended writing opportunities CEIAG • Medical physics - radiologist	Challenge: • Mastery – SHC • Higher level questions – Calculating half life • Linking types of radiation to their uses • Explaining how a nuclear reactor works. Scaffold: • Pre prepared axes for graphs • Knowledge organisers • Scaffold for extended writing	• 5 questions to start – recall activity every lesson. • Close the gap questions • Self and peer feedback on tasks completed • Structure strip • Past paper exam Qs. • Summative assessment at the end of the unit

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Energy	Summer Term	A system is an object or group of objects. There are changes in the way energy is stored when a system changes. Students should be able to describe all the changes involved in the way energy is stored when a system changes, for common situations. For example: • an object projected upwards • a moving object hitting an obstacle • an object accelerated by a constant force • a vehicle slowing down • bringing water to a boil in an electric kettle. Throughout this section on Energy students should be able to calculate the changes in energy involved when a system is changed by: • heating • work done by forces • work done when a current flows Use calculations to show on a common scale how the overall energy in a system is redistributed when the system is changed. Students should be able to calculate the amount of energy associated with a moving object, a stretched spring and an object raised above ground level. The kinetic energy of a moving object can be calculated using the equation: kinetic energy = 0.5 × mass × speed ^{2} $E_k = 1/2\ m\ v^2$	Numeracy • Graph drawing • Standard Form • Ratios Literacy • Use of tier three words • Extended writing opportunities	Challenge: • Explaining how ideas on energy transfers all link together. • Higher level questions – evaluating risks and benefits of using various energy resources. • Conversion between units and/or standard form Scaffold: • Pre prepared results tables • Knowledge organisers • Scaffold for extended writing • Equation conversion assistance.	• 5 questions to start – recall activity every lesson. • Close the gap questions • Self and peer feedback on tasks completed • Structure strip • Past paper exam Qs. • Summative assessment at the end of the unit

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Energy	Summer Term	The amount of elastic potential energy stored in a stretched spring can be calculated using the equation: elastic potential energy = 0.5 × spring constant × extension ^{2} $E_e = 1/2\ k\ e^2$ (assuming the limit of proportionality has not been exceeded) The amount of gravitational potential energy gained by an object raised above ground level can be calculated using the equation: g . p . e . = mass × gravitational field strength × height $E_p = m\ g\ h$ The amount of energy stored in or released from a system as its temperature changes can be calculated using the equation: change in thermal energy = mass × specific heat capacity × temperature change $\Delta E = m\ c\ \Delta \theta$ The specific heat capacity of a substance is the amount of energy required to raise the temperature of one kilogram of the substance by one degree Celsius. Complete an investigation to determine the specific heat capacity of one or more materials. The investigation will involve linking the decrease of one energy store (or work done) to the increase in temperature and subsequent increase in thermal energy stored. Power is defined as the rate at which energy is transferred or the rate at which work is done. power = energy transferred/ time power = work done/ time An energy transfer of 1 joule per second is equal to a power of 1 watt. Students should be able to give examples that illustrate the definition of power eg comparing two electric motors that both lift the same weight through the same height but one does it faster than the other.			

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Energy	Summer Term	Energy can be transferred usefully, stored or dissipated, but cannot be created or destroyed. Students should be able to describe with examples where there are energy transfers in a closed system, that there is no net change to the total energy. Students should be able to describe, with examples, how in all system changes energy is dissipated, so that it is stored in less useful ways. This energy is often described as being 'wasted'. Students should be able to explain ways of reducing unwanted energy transfers, for example through lubrication and the use of thermal insulation. The higher the thermal conductivity of a material the higher the rate of energy transfer by conduction across the material. Students should be able to describe how the rate of cooling of a building is affected by the thickness and thermal conductivity of its walls. Students do not need to know the definition of thermal conductivity. Investigate the effectiveness of different materials as thermal insulators and the factors that may affect the thermal insulation properties of a material. The energy efficiency for any energy transfer can be calculated using the equation: efficiency = useful output energy transfer /total input energy transfer Efficiency may also be calculated using the equation: efficiency = useful power output/total power input (HT only) Students should be able to describe ways to increase the efficiency of an intended energy transfer.			