Department	SCIENCE PHYSICS TRIPLE
Key Stage	KEY STAGE 4
Course Level	KS4
Exam Board	AQA

Units	Title	Weighting	Examination Method
1-4 Energy, Electricity, Atomic structure, Particles	Paper 1	50%	External written exam
5-8 Forces, Waves, Electromagnetism, Space	Paper 2	50%	External written exam

unit	**End Points**	**Substantive Knowledge** **What will they learn about in this topic?**	**Disciplinary Knowledge** **What subject concepts will be developed through this topic?**	**Assessment Method**	**Key Course Guides & Reading**
Unit 1 Energy	Students will develop the ability to describe all the changes involved in energy change. They will also be able to to calculate the amount of energy associated with a moving object, a stretched spring and an object raised above ground level. Students can then be able to consider the environmental issues that may arise from the use of different energy resources	**Energy stores and types** 1. Recall different forms of energy. 2. Identify different energy stores 1. Explain how energy can be transferred between energy stores. 2. Detail how the energy stores change for various different processes. **WORK DONE** 1. Provide a definitions for work done. 2. Recall and apply the equation for Work done to solve problems. 3. Calculate the energy changes in different systems using work done. 4. Detail the energy changes that occur in a system when work is done. **KE AND G.P.E** 1. Provide a definitions for work done. 2. Recall and apply the equation for Work done to solve problems. 3. Calculate the energy changes in different systems using work done.	Application of knowledge to different life scenarios Required practical activities, including all types of all equipments, Identification of control, independent and dependent variables in experimental design Graph and data analysis(Plotting graphs and reading tables) Ability to identify environmental issues arising from the use of energy and deal with the issues of political, social, ethical or economic considerations Significant numbers, line of best fit, Conversion of units	End of topic tests at the end of topic and Synoptic Test	**Revise the following keywords:** Energy Conservation Renewable Fossil fuel Specific heat capacity Uncertainty

		4. Detail the energy changes that occur in a system when work is done. **SPECIFIC HEAT CAPACITY** 1. State the relationship between energy, mass and temperature. 2. Explain how different materials affect the amount of energy required in temperature change. 3. Calculate the energy required to change an objects temperature. 4. Re-arrange the required equation appropriately. **CONSERVATION OF ENERGY** 1. Use ideas about changes in energy stores to explain a pendulum swinging. 2. State what the 'conservation of energy' is and explain why conservation of energy is important. 3. Explain what is meant by a 'closed system' and how they are used in science. 4. Compare and contrast changes to energy stores between closed and open systems **Energy Resources** 1. Explain the need for renewable energy resources. 2. Identify different renewable energy and non re-newable resources. 3. Detail how different energy resources meet our energy demands. 4. Discuss and compare different methods of renewable energy resources, with non renewable resources **Trends in energy.** **1.** Describe the environmental impact arising from the use of different energy resources 2. Identify why some energy resources are more reliable than others 3. Explain patterns and trends in the use of energy resources 4. Consider the environmental issues that may arise from the use of different energy resources **5.** Discuss environmental issues arising from the use of energy resources in relation to political, social, ethical and economic aspects			

Unit 2 Electricity	Students will be able to draw and interpret circuit diagrams,use graphs to explore whether circuit are linear or non-linear. Students will also be able to explain power ratings for domestic electrical appliances and the changes in stored energy when they are in use. They will gather information about National Grid system and how is it an efficient way to transfer energy.	**Static electricity** 1. Describe the structure of the atoms. 2. Explain how an atom can be 'charged' and how an object can have a 'charge' 3. Investigate how charged objects interact with each other due to electric fields. 4. Apply you knowledge of 'charges' to explain static electricity. **Current and charge** 1. Identify circuit symbols and their functions. 2. Build electrical circuits using circuit diagrams. 3. Draw circuits using appropriate symbols. 4. Define the term 'electrical current' and carry out current calculations. **Potential difference- Resistance** 1. Define potential difference in terms of work done and charge. 2. Model an electric circuit to explain current, voltage and resistance. 3. Investigate the relationship between current, voltage and resistance. 4. Use Ohm's law to carry out calculations. **Component characteristics** 1. Identify relationships shown by graphs. 2. Design & carry out an experiment to investigate the relationship between I & V for different electrical components. 3. Explain how current and voltage vary for a filament bulb, diode and fixed resistor. 4. Explain in detail what causes the current and voltage to change for key electrical components. **Series and Parallel Circuits** 1. Review series circuits rules 2. Explain the circuit rules for components in parallel circuits. 3. Investigate potential difference and current in parallel circuits. 4. Apply the parallel circuit rules to problems. 5. Review key words for the electricity topic. 6. Explain the current and potential difference rule for series circuits.	Application of knowledge to different life scenarios Required practical activities, including all types of all equipments, Identification of control, independent and dependent variables in experimental design Graph and data analysis(Plotting graphs and reading tables) Significant numbers, line of best fit, Conversion of units	End of topic tests at the end of topic and Synoptic Test	**Revise the following keywords:** Power Static Charges Transformer Insulator Conductor Pylons Components Frequency

		7. Investigate current and potential difference in series circuits. Apply the series circuit rule to problems **AC/DC** 1. Identify AC and DC devices. 2. State and explain what is meant by direct current, DC. 3. State and explain what is meant by alternating current and relate to mains supply. 4. Determine period and frequency of a AC supply using diagrams. **Plugs and cables** 1. Review AC/DC current and how it caused us to have different plugs. 2. Recall the different colour wires in a plug. 3. Relate different wires to their function. 4. Identify and explain the safety features of a plug. **POWER** 1. State a definition for power. 2. Calculate the power of an appliance by the energy transferred. 3. Relate potential difference and current to electrical power. 4. Identify appropriate fuse ratings for appliances. 5. Identify the uses of resistance in conductors **National Grid** 1. Identify issues with transporting electricity around the country 2. Identify different parts of the national grid and describe their functions. 3. Evaluate the potential of placing power cables underground 4. Describe how a transformer works			

Unit 3: Particle model of matter	**S**tudents will be able to draw diagrams for different states of matter. Students will also be able to tell differences in density between the different states of matter in terms of the arrangement of atoms or molecules, Including drawing the graphs for cooling curves. Lastly they will be able to explain the motion in gas and how pressure changes the states of matter.	**Density** 1. State and explain the properties called volume, density and mass. 2. Use the density equation to calculate different properties of objects. 3. Describe in detail experiments to identify an objects density. 4. Explain how large objects such as ships float in water. **Changes in states of matter** 1. State key differences between solids, liquids and gases. 2. Identify properties of solids, liquids and gases. 3. Explain the energy differences between different states of matter. 4. Explain in detail the processes of evaporation and condensation. **Boiling and melting point** 1. Identify pure substances and mixtures. 2. Explain what is meant by melting point and boiling point of a substance. 3. Compare and contrast boiling and evaporation. **4.** Detail changes in state of substance using a graph. **Internal Energy** **1.** Explain what is meant by internal energy. 2. Identify and explain how you can increase internal energy. 3. Relate internal energy to properties of solids, liquids and gases. 4. Explain how particles in a gas exert a pressure. **Gas Pressure** 1. Recall how scientific theory and evidence work together. 2. Explain how the observation of 'Brownian motion' provides evidence for kinetic theory. 3. Relate the effects of changing temperature of a gas to pressure.	Diagrams for different states of matter, Application of knowledge to different life scenarios Required practical activities, including all types of all equipments, Identification of control, independent and dependent variables in experimental design Graph and data analysis(Plotting graphs and reading tables) Significant numbers, line of best fit, Conversion of units	End of topic tests at the end of topic and Synoptic Test	**Revise the following key words:** Sublimation Energy change Evaporation Motion Condensation Specific heat capacity Apparatus Density Mass vs weight

		4. Use knowledge of the relationship of pressure and temperature to different scenarios.			
Unit 4 Atomic Structure	Students will be able to describe the new evidence from the scattering experiment led to a change in the atomic model including the difference between the plum pudding model of the atom and the nuclear model of the atom. Students will also be able use knowledge to the uses of radiation and evaluate the best sources of radiation to use in a given situation Including Nuclear equations that are used to represent radioactive decay. They will also be able to explain the medical uses of these rays.	**Development of Atomic model** 1. To be able to describe how the nuclear model of the atom was established 2. To be able to explain why the 'plum pudding model' was rejected 3. To be able to explain why the nuclear model of the atom was accepted **Atoms Radiations** 1. Identify what a radioactive substance is 2. Describe the types of radiation given out from a radioactive substance 3. Explain how a radioactive substance emits radiation **Types of Radiation: Alpha, Beta, Gamma** 1. To be able to identify how far each type of radiation can travel in air. 2. To be able to describe the ionizing power of alpha, beta and gamma radiation. 3. To be able to explain why alpha, beta and gamma radiation is dangerous **Half life** 1. Define the term half-life 2. Relate half-life to radioactive decay 3. Draw half life graph and calculate half life from graphs 4. Describe how we can use half life in carbon dating **Radiation in nuclear medication** 1. To be able to choose a radioactive isotope for a particular job. 2. To be able to describe how radioactive isotopes are used in medicine. 3. To be able to explain how nuclear radiation can be used for medical imaging and radiotherapy can be used to kill cancer cells. **Nuclear fission and Fusion**	Completing diagrams for chain reaction Application of knowledge to different life scenarios Required practical activities, including all types of all equipments, Identification of control, independent and dependent variables in experimental design Graph and data analysis(Plotting graphs and reading tables) Significant numbers, line of best fit, Conversion of units	End of topic tests at the end of topic and Synoptic Test	**Revise the following keywords:** Nuclear fusion Fission reaction Radiation Tracer Scatter Alpha Beta Gamma Contamination Irradiation Radioactive

		1. To be able to describe nuclear fission and what a chain reaction is. 2. To be able to describe nuclear fusion and how nuclei can be made to fuse together 3. To be able to identify where the Sun's energy comes from and why it is difficult to make a nuclear fusion reactor			

unit	End Points	Substantive Knowledge What will they learn about in this topic?	Disciplinary Knowledge What subject concepts will be developed through this topic?	Assessment Method	Key Course Guides & Reading
Unit 5 Forces	Students will be able to use vector diagrams to illustrate resolution of forces, equilibrium situations and determine the resultant of two forces. They will also be able to Calculate the size of a force, or its distance from a pivot, acting on an object that is balanced. Students will be capable of Application to real life scenarios such are gearing systems in a car, the application of pressure in hydraulic systems and linking the conservation of energy	**Scalar vs Vector** **1.** State what scalar and vector quantities are 2. Draw diagrams that shows forces at work 3. Draw vector diagrams to show resultant forces **Gravity** 1. Describe the difference between weight and mass 2. Describe how to calculate the weight of an object 3. Explain the relationship between weight and mass experimentally **Work done** 1. Describe what "work" is in physics 2. Calculate work done 3. Describe the energy transfer involved when work is done. **Hooke's Law** 1. State what is meant elastically and inelastically deformed 2. Describe Hookes law 3. Use Hookes law to calculate the spring constant **Speed** 1. Describe speed and to calculate it 2. Draw a distance time graph and be able to interpret the lines of the graph 3. Calculate the speed of an accelerating object on a distance time graph **Velocity and Acceleration** 1. State the difference between velocity and speed 2. Calculate acceleration 3. Describe the velocity of an object changing direction **Newton's law 1 and 2**	Application of knowledge to different life scenarios Required practical activities, including all types of all equipments, Identification of control, independent and dependent variables in experimental design Graph and data analysis(Plotting graphs and reading tables) Ability to identify environmental issues arising from the use of energy and deal with the issues of political, social, ethical or economic considerations Significant numbers, line of best fit, Conversion of units	End of topic tests at the end of topic and Synoptic Test	**Revise the following keywords:** Inelastic Elastic Plastic Transfer Moment Pivot Load Momentum Acceleration Deceleration Spring constant Scalar Vector

		1. Describe Newton's first law and apply it 2. Use F=ma to explain how force, acceleration and mass are linked. 3. Explain Inertia **Newtons's 3rd law** 1. Recall Newton's third law 2. Apply Newton's Third law in different situations 3. Compare all three of Newton's laws and their applications **Momentum** 1. State what is momentum . 2. Relate momentum to mass and velocity. 3. Calculate the momentum of an object with correct units. 4. Apply the conservation of momentum to 2 objects colliding or exploding. **Breaking and force** 1. Describe the two factors that affect braking 2. Explain factors that affect reaction time and braking distance 3. Estimate the forces involved in the deceleration of road vehicles			
Unit 6 Waves and optics	Students will be able to explain waves transfer energy from one place to another. Also Be able to explain key equipments used for detection such as satellites, RADAR and communication including Wi-Fi. They will be able to therefore explain in qualitative terms, how the differences in velocity, absorption and reflection between different types of wave in solids and liquids can	**Types of waves and wave feature** 1. Draw diagrams to show the features of transverse and longitudinal waves. 2. Give examples of both transverse and longitudinal waves. 3. Describe the propagation of both transverse and longitudinal waves. 4. Explain the changes in air pressure caused by longitudinal waves in regions of compression and rarefaction**.** **Wave speed calculations** 1. Calculate the wavelength of a wave from a labelled diagram of a wave.	Application of knowledge to different life scenarios Required practical activities, including all types of all equipments, Identification of control, independent and dependent variables in experimental design Graph and data analysis(Plotting graphs and reading tables) Significant numbers, line of best fit, Conversion of units	End of topic tests at the end of topic and Synoptic Test	**Revise the following keywords:** Spectrum Black body Radiation Ripples Earth waves Convex Concave Magnification Virtual image Radar Echo Infra red Diverging converging

	be used both for detection and exploration of structures which are hidden from direct observation	2. Calculate the frequency of a wave given the number of waves (possibly from interpreting a diagram) and the time. 3. Calculate the speed of a wave. Rearrange the equation to find any unknown given the other two values. **Ripple tank** 1. To identify the suitability of apparatus to measure the frequency, wavelength and speed of wave in a liquid and soild 2. To calculate speed of ripples on surface of water 3. To identify change in frequency changes the wavelength **Electromagnetic Spectrum** 1. Give the order of the electromagnetic spectrum. 2. Describe uses of each wave in the electromagnetic spectrum. 3. Describe how radio waves can be produced in electrical circuits and also the effect that radio waves may have on electrical circuits. HT only 4. Describe and explain the effects that gamma, X-rays and ultraviolet radiation have on the body. 5. Explain how the radiation dose that nuclear industry workers are exposed to is measured **Absorption of Infra red radiations** 1. To know that refraction, are due to the difference in velocity of the waves in different substances. 2. To know that Refraction does not happen when a wave enters a medium at 90^{o} to the surface. HT only. 3. To Use wave front diagrams to explain refraction in terms of the change of speed that happens when a wave travels from one medium to a different medium. HT only. 4. To investigate how the type of surface affects the amount of infrared radiation absorbed by a surface. **Reflection vs Refraction**			

		1. To construct labelled ray diagrams to illustrate the reflection of a wave at a surface. 2. State the law of reflection. 3. Describe and explain the effect of a wave moving from one medium into another. **Sound waves:** 1. Explain why sound waves travel faster in solids than they do in liquids and gases. 2. Interpret data on the speed of sound to draw conclusions about the type of material that the wave is travelling through. 3. Describe how sound waves travel from a source to the ear and the effect that this has inside the ear. 4. Describe sound waves in terms of pitch and frequency. 5. Describe and explain why ear defenders are a required piece of safety equipment when using pneumatic drills. **Lenses** 1. Describe the key features of a ray diagram where light passes through a lens. 2. Explain the difference between real and virtual images. 3. State situations where real images and virtual images are produced. 4. Construct ray diagrams for a camera, a projector and a magnifying glass using a convex lens. 5. Calculate the magnification of a lens using the magnification equation.			
Unit 7 Space and Universe	Students Will be able to explain the life cycle of stars and that this process is vital as it created the elements that we know of on the periodic table – without the life and death of stars, elements beyond	**The solar system and birth of a star** 1. Describe the different objects in our solar system and their location within our solar system. 2. Explain where in the solar system various groups of objects are likely to be found, e.g. the correct order of the planets, rocky dwarf planets and gas giants.	Diagram, reading flow charts for life cycle of star Application of knowledge to different life scenarios Required practical activities, including all types of all equipment,	End of topic tests at the end of topic and Synoptic Test	**Revise the following key words:** Supernova Big bang Red shift Centripetal force Orbits Solar system Black hole

	Hydrogen would not exist and hence life as we know it wouldn't exist. They will also understand that scientific theories can be amended based upon evidence. Theories can only be constructed from evidence we have and this needs to be verified and tested vigorously	3. Explain why Pluto is no longer classified as a planet. 4. Describe how a star forms from a cloud of dust and gas called a nebula. 5. Explain how the star starts to fuse hydrogen atoms together in a process called nuclear fusion when the temperature of the proto-star becomes high enough. **Lifecycle of a star** 1. Describe the similarities and differences between the lifecycles of small and large stars. 2. Explain how the length of a star's life cycle is affected by the size of the star. 3. Describe the conditions required for nuclear fusion. 4. Explain what is happening when hydrogen atoms fuse together and complete an equation to show hydrogen nuclei fusing together to make helium nuclei and other light elements. 5. Describe how the conditions in a supernova allow heavy elements to be formed. **Red Shift and the Big Bang Theory** 1. How does red-shift provide evidence of the Big Bang? 2. Explain how the red-shift of distant stars and galaxies shows that they are moving away from us. This is evidence of the universe starting off from a small point in space and expanding outwards. 3. Describe the red-shift of light from distant stars and galaxies as evidence of the stars and galaxies moving away from us. 4. The Big Bang theory suggests that the universe began from a very small region that was extremely hot and dense **Orbital motion** 1. Describe satellites as objects that orbit around larger objects in space. 2. Describe and explain how satellites can orbit the Earth in a (near) circular orbit at a steady speed even though they have a force at right angles accelerating them towards the Earth. 3. Explain how changing the speed of a satellite affects the orbital radius of the satellite.	Identification of control, independent and dependent variables in experimental design Graph and data analysis(Plotting graphs and reading tables) Significant numbers, line of best fit, Conversion of units		Dwarf planets Nebula

		4. Evaluate data on the orbital speeds of planets and use this to predict the orbital radius, assuming a circular orbit.			
Unit 8 Magnetism		**Magnetic field lines** 1. State the basic information about magnets and how they interact 2. Explain how to plot a magnetic field using a plotting compass 3. Explain what induced magnetism is and identify magnetic materials 4. Detail how a compass can be used for navigation **Magnetic Fields** 1. Explain the relationship between electric current and magnetic fields 2. Draw the magnetic field around a current carrying wire 3. Identify ways in which an electromagnetic field strength can be increased 4. Explain what an electromagnet is and how once can be made **Electromagnets and motors** 1. Explain the 'motor effect'; 2. Recall and use Flemings left-hand rule 3. State what is meant by magnetic flux density 4. Calculate the force on a current carrying wire 5. Detail how a simple electric motor works **The generator Effect** 1. Explain what the generator effect is 2. Explain how potential difference can be induced in a wire 3. Identify what affects the size of induced potential difference in a generator 4. Detail how to deduce the direction of induced current **AC-DC Generators** 1. Explain how the generator effect is used in an alternator to generate ac 2. Explain how a 'dynamo' generates dc current	Completing diagrams for chain reaction Application of knowledge to different life scenarios Required practical activities, including all types of all equipments, Identification of control, independent and dependent variables in experimental design Graph and data analysis(Plotting graphs and reading tables) Significant numbers, line of best fit, Conversion of units	End of topic tests at the end of topic and Synoptic Test	**Revise the following keywords:** • Transformer • Step-up • Step-down • a.c • p.d • Coil • Primary coil • Secondary coil • Iron core • Transfer • Conductor • Poles • Electromagnets

		3. Interpret graphs of potential difference generated in the coil against time. 4. Explain how a moving-coil microphone works. **Transformers** 1. Explain the principle behind transformers 2. Explain how the ratio of the p.d across two coils relates the number coil turns 3. Calculate the current from the transformer input supply to provide a set power output 4. Detail the advantages power transmission at high p.d			