Key Stage 4 Curriculum Overview

Progression from Key Stage 3 and optional progression through Post-16 : Physics

	Autumn Term	Spring Term	Summer Term
Year 9			Students at the end of Key Stage 3 will be able to: Have an understanding of the fundamentals of energy changes and interactions of forces, compare types and uses of waves and have an understanding of electricty and how its generated. Including the 'big ideas' in physics: that all matter in the universe is made up of particles, objects can affect other objects at distance, changing objects motion needs a forec to be applied to it, ideas of energy being created and destroyed, Have an understanding of key scientific investigative proceedures and understand how to answer scientific questions about the natural world around them, including recording, collection and analysisng data, evaluating proceedures and identify further questions. Be able to critially think about the uses and implications of science and scientific advancements today and for the future Be devloping the ability to read and interpret scientific text Develop and understanding of careers in science and how scientific disciplines link to general career opportunities Describe associated processes and key characteristics in common language, beginning to use technical terminology accurately and precisely building an extended specialist vocabulary.

			Be able to apply their mathematical knowledge to their understanding of science, including collecting, presenting and analysing data, using numerical values and mathematical representations. Be able to relate scientific explanations to phenomena in the world around them and use modelling and abstract ideas to develop and evaluate explanations. Understand how our Earth fits into the solar system, how space exploration has changed and developed over time, creation of the universe, how the motion of the earth and moon affects day and night, seasons and tides and waves.
Year 10	1. Energy – energy calculations, efficiency, conduction, convection and radiation, insulation and renewable energy. 2. Electricity- current and charge, resistors, IV characteristics cables and plugs 3. Particle Model- latent heat	4. Atomic structure- radioactive decay, features of radioactivity sources 5. Forces – centre of mass, parallelogram of forces, speed velocity and acceleration, weight and terminal velocity.	6. Waves- wave equation, reflection and refraction, light IR, microwaves and radio waves, 7. Magnetism- magnetic fields and currents, electromagnets 8. Space (Triple only)- stars, satellites, planets RSE – See separate SOL
Year 11	1. Energy – energy dissipation, electrical devices, energy and power, specific heat capacity, energy and environment. 2. Electricity- power and appliances, electrical current and energy 3. Particle Model- gas pressure and temperature	4. Atomic structure- half life 5. Forces – resolution of forces, motion graphs, Newtons third law, momentum, forces and elasticity 6. Waves- communication, UV, Xrays and gamma rays, Water waves RP 7. Magnetism- communication, electric motors. 8. Space (Triple only)- expanding universe, red shift	Revision and exam preparation Tailored to each class PLC

By the end of Key Stage 4 students should be able to:

Students should be helped to understand how, through the ideas of physics, the complex and diverse phenomena of the natural world can be described in terms of a number of key ideas which are of universal application and which can be illustrated in the separate topics set out below.

These ideas include: • the use of models, as in the particle model of matter or the wave models of light and of sound • the concept of cause and effect in explaining such links as those between force and acceleration, or between changes in atomic nuclei and radioactive emissions • the phenomena of 'action at a distance' and the related concept of the field as the key to analysing electrical, magnetic and gravitational effects • that differences, for example between pressures or temperatures or electrical potentials, are the drivers of change • that proportionality, for example between weight and mass of an object or between force and extension in a spring, is an important aspect of many models in science. Students should be taught about

Students should have understanding of:

Energy • energy changes in a system involving heating, doing work using forces, or doing work using an electric current: calculating the stored energies and energy changes involved • power as the rate of transfer of energy • conservation of energy in a closed system, dissipation • calculating energy efficiency for any energy transfers • renewable and non-renewable energy sources used on Earth, changes in how these are used.

Forces • forces and fields: electrostatic, magnetic, gravity • forces as vectors • calculating work done as force x distance; elastic and inelastic stretching • pressure in fluids acts in all directions: variation in Earth's atmosphere with height, with depth for liquids, up-thrust force (qualitative)

Forces and motion • speed of sound, estimating speeds and accelerations in everyday contexts • interpreting quantitatively graphs of distance, time, and speed • acceleration caused by forces; Newton's First Law • weight and gravitational field strength • decelerations and braking distances involved on roads, safety.

Wave motion • amplitude, wavelength, frequency, relating velocity to frequency and wavelength • transverse and longitudinal waves • electromagnetic waves, velocity in vacuum; waves transferring energy; wavelengths and frequencies from radio to gamma-rays • velocities differing between media: absorption, reflection, refraction effects • production and detection, by electrical circuits, or by changes in atoms and nuclei • uses in the radio, microwave, infra-red, visible, ultra-violet, X-ray and gammaray regions, hazardous effects on bodily tissues.

Electricity • measuring resistance using p.d. and current measurements • exploring current, resistance and voltage relationships for different circuit elements; including their graphical representations • quantity of charge flowing as the product of current and time Science – key stage 4 16 • drawing circuit diagrams; exploring equivalent resistance for resistors in series • the domestic a.c. supply; live, neutral and earth mains wires, safety measures • power transfer related to p.d. and current, or current and resistance.

Magnetism and electromagnetism • exploring the magnetic fields of permanent and induced magnets, and the Earth's magnetic field, using a compass • magnetic effects of currents, how solenoids enhance the effect • how transformers are used in the national grid and the reasons for their use

The structure of matter • relating models of arrangements and motions of the molecules in solid, liquid and gas phases to their densities • melting, evaporation, and sublimation as reversible changes • calculating energy changes involved on heating, using specific heat capacity; and those involved in changes of state, using specific latent heat • links between pressure and temperature of a gas at constant volume, related to the motion of its particles (qualitative).

Atomic structure • the nuclear model and its development in the light of changing evidence • masses and sizes of nuclei, atoms and small molecules • differences in numbers of protons, and neutrons related to masses and identities of nuclei, isotope characteristics and equations to represent changes • ionisation; absorption or emission of radiation related to changes in electron orbits • radioactive nuclei: emission of alpha or beta particles, neutrons, or gammarays, related to changes in the nuclear mass and/or charge • radioactive materials, half-life, irradiation, contamination and their associated hazardous effects, waste disposal • nuclear fission, nuclear fusion and our Sun's energy

Space physics • the main features of the solar system

- **Working scientifically – across all science disciplines**
- pay attention to objectivity and concern for accuracy, precision, repeatability and reproducibility
- understand that scientific methods and theories develop as earlier explanations are modified to take account of new evidence and ideas, together with the importance of publishing results and peer review
- Evaluate risks.
- ask questions and develop a line of enquiry based on observations of the real world, alongside prior knowledge and experience
- make predictions using scientific knowledge and understanding
- select, plan and carry out the most appropriate types of scientific enquiries to test predictions, including identifying independent, dependent and control variables, where appropriate
- use appropriate techniques, apparatus, and materials during fieldwork and laboratory work, paying attention to health and safety
- make and record observations and measurements using a range of methods for different investigations; and evaluate the reliability of methods and suggest possible improvements
- apply sampling techniques.
- apply mathematical concepts and calculate results
- present observations and data using appropriate methods, including tables and graphs
- interpret observations and data, including identifying patterns and using observations, measurements and data to draw conclusions
- present reasoned explanations, including explaining data in relation to predictions and hypotheses
- evaluate data, showing awareness of potential sources of random and systematic error
- identify further questions arising from their results.
- understand and use SI units and IUPAC (International Union of Pure and Applied Chemistry) chemical nomenclature

- use and derive simple equations and carry out appropriate calculations
- undertake basic data analysis including simple statistical techniques.