PHYSICS KEY STAGE 5 CURRICULUM OVERVIEW

By the end of Key Stage 5, students should:

Know	*By the end of the AQA A Level Physics course, students should know the fundamental principles that explain how the universe works — from the motion of everyday objects to the behaviour of subatomic particles. They should understand key topics such as forces, energy, waves, electricity, and particle physics, as well as more advanced concepts like nuclear physics, fields, and thermal physics. Students should know how physical laws, such as Newton's laws of motion and the laws of thermodynamics, describe and predict real-world phenomena. They should also understand how mathematical models are used to represent physical systems and how experimental data supports or challenges scientific theories. Overall, students should have a deep and connected understanding of the key ideas that underpin both classical and modern physics.*
Do	*Students should be able to apply physical principles to analyse and solve complex problems, using mathematical equations and logical reasoning. They should be able to plan, carry out, and evaluate practical experiments with accuracy and precision, demonstrating competence in collecting and interpreting data to draw valid conclusions. Students should be confident in using graphs, vectors, and algebraic methods to describe physical relationships and make predictions. They should also be able to link theoretical knowledge to real-world applications, such as electricity generation, motion, and medical imaging. Overall, students should be equipped with strong analytical, practical, and problem-solving skills that prepare them for further study in physics, engineering, or other science-related fields.*
Appreciate	*Students should appreciate the elegance and interconnectedness of physical laws and how they explain the behaviour of the universe, from subatomic particles to galaxies. They should recognise the importance of evidence-based reasoning, experimentation, and modelling in developing scientific knowledge. Students should also appreciate the real-world applications of physics in technology, medicine, energy, and engineering, as well as the ethical and environmental considerations that accompany scientific advances. Ultimately, they should develop a sense of curiosity, critical thinking, and respect for the precision, creativity, and problem-solving required in the study of physics.*

Curriculum coverage

	Topic	*Sub topic*	*Coverage*
Year 12	**Particles and Radiation**	What is matter made of and what types of particles are there?	*Structure of an atom; Matter and antimatter; Names and properties of Hadrons, Baryons, Leptons and quarks*
		How do different particles interact with each other?	*Pair Production and Annihilation interactions; Interactions of unstable particles; Conservation Laws*
		What is the photoelectric effect and what are its implications?	*The photoelectric effect; Excitation and de-excitation of electrons; Wave-particle duality*
	Waves and Optics	What are waves?	*Transverse and Longitudinal waves; Wave properties including refraction, reflection, diffraction and superposition; Phase and polarisation*
		How are stationary waves formed?	*Superposition of waves; Stationary and progressive waves; Stationary waves on a spring*
		How does light interact with slits and boundaries?	*Snell's law, total internal reflection and optical fibres; Young's double slit interference; Single slit diffraction; Diffraction grating and spectroscopy*
	Mechanics	How do forces affect the motion of an object?	*Forces in equilibrium; Suvat and freefall; Newton's laws of motion; Momentum*
		How much energy does a moving object possess?	*Work done, kinetic and potential energy; Power of a moving object; Energy transfers and efficiency*
		How do solid materials respond to deforming forces?	*Density; Springs; Stress and Strain*
	Electricity	What is electricity?	*Charge carriers; Current; Potential difference; Electrical power*
		What is resistance and how does it affect electrical circuits?	*Ohm's law and resistivity; Superconductors; Combining resistors; Signature I/V graphs of components; Resistance heating*
		How does electricity behave in a direct current circuit?	*Circuit rules; Series and parallel circuits; Potential divider circuits; Electromotive force and internal resistance*

Curriculum Coverage continued:

	Topic	Sub Topic	Coverage
Year 13	**Further Mechanics and Thermal Physics**	What is required for an object to move in a circle?	*Angular velocity; Centripetal force and acceleration; Applications of circular motion*
		What is simple harmonic motion (SHM)?	*Oscillations and principles of SHM; Simple pendulum; Mass-spring system; Forced vibrations and resonance*
		How do substances behave at different temperatures?	*Particle model and internal energy; Specific heat capacity and specific latent heat; Experiment and ideal gas laws; Kinetic theory of gases*
	Fields	How do fields affect the world around us?	*Gravitational fields and their effects on masses; Electrical fields and their effects on charges; Magnetic fields and their effects on magnets and magnetic materials; The motor effect and its applications*
		What is a capacitor and what is it used for?	*Capacitance; Charging and discharging capacitors; Dielectrics and capacitor design*
		How is the interaction between fields used to generate and manipulate electricity?	*Lenz's and Faraday's laws; Alternating current (AC) and the AC generator; Transformers*
	Nuclear Physics	What are the properties and uses of radiation?	*Rutherford's discovery of the nucleus; Alpha, beta and gamma radiation; Uses of isotopes; Dangers of radiation*
		What happens when unstable atoms decay?	*Decay equations; Half life; Activity; Nuclear radius*
		How do we get energy from a nucleus?	*Binding energy; Fission and fusion; Thermal nuclear reactor*
	Turning Points in Physics	How did we discover the electron?	*Cathode rays proving the existence of electrons; Using electron deflection to identify its specific charge; Millikan's oil droplet experiment to identify the charge of an electron*
		What is wave-particle duality and how do we take advantage of it?	*Young's slits proving the wave nature of light; Photoelectric effect proving the particle nature of light; Wave-particle duality; Optical and electron microscopes*
		What is special relativity and when is it relevant?	*The Michelson-Morely experiment to discover absolute motion; Inertial frames of reference; Time dilation; Length contraction; Relative mass at high velocity*

Wider Key Stage 5 Curriculum

Homework expectations - Students will be set independent work that will encourage them to use their study periods wisely and practice the new skills that they need for A level. Homework tasks for KS5 science students might include researching scientific concepts, completing data analysis, answering extended-response questions, preparing practical write-ups, or revising past exam questions. Students also have access to a range of resources via Microsoft Teams.