Year 12 Physics Curriculum Unit Overview

Year 12 A Level Physics Module 1: Development of practical skills in Physics				
What are we learning?	**What knowledge, understanding and skills will we gain?**	**What does mastery look like?**	**How does this build on prior learning?**	**What additional resources are available?**
Independent thinking The use and application of scientific methods and practices Researching and referencing Use of instruments and equipment	**Knowledge** Selection of appropriate equipment; safe methods of working; identification and reduction of errors (random and systematic); calculation of uncertainties; problem solving; approaches to research; referencing systems; record keeping. **Understanding** Students will understand how to use a wide range of laboratory equipment to safely carry out relevant practical work in order to obtain accurate and reproducible results. **Skills** a) use of appropriate analogue apparatus to record a range of measurements b) use of appropriate digital instruments to obtain a range of measurements c) use of methods to increase accuracy of measurements d) use of a stopwatch or light gates for timing e) use of calipers and micrometers for small distances, using digital or vernier scales f) correctly constructing circuits from circuit diagrams using DC power supplies, cells, and a range of circuit components g) designing, constructing and checking circuits using DC power supplies, cells, and a range of circuit components h) use of a signal generator and oscilloscope i) generating and measuring waves use of a laser or light source to investigate characteristics of light k) use of ICT such as computer modelling, or data logger collect data l) use of ionising radiation, including detectors.	The ability to work entirely independently when carrying out practical work. To work with a high level of safely, ensuring the health and safety of self and peers by carefully considering the hazards and risks associated with the task. The ability to design robust investigations alone or as part of a student team without teacher input. Consistently produce accurate results. Critical reflection and evaluation of results produced, and steps taken to improve in future tasks.	Further develops the practical skills acquired in GCSE Science / Physics from both the general practical activities and specifically from the Required Practicals	OCR year 1 textbook OCR year 2 textbook OCR practical skills guide

Year 12 A Level Physics Module 2: Foundations of Physics				
What are we learning?	**What knowledge, understanding and skills will we gain?**	**What does mastery look like?**	**How does this build on prior learning?**	**What additional resources are available?**
Physical quantities S.I. units Scalars and vectors Precision and accuracy Uncertainties and errors	**Knowledge** Physical quantities have a numerical value and a unit; Système Internationale (S.I.) base quantities and their units – mass (kg), length (m), time (s), current (A), temperature (K), amount of substance (mol); derived units of S.I.; base units prefixes and their symbols to indicate decimal submultiples or multiples– pico (p), nano (n), micro (μ), milli (m), centi (c), deci (d), kilo (k), mega (M), giga (G), tera (T); scalar and vector quantities; basic trigonometry **Understanding** Systematic errors (including zero errors) and random errors in measurements; precision and accuracy; absolute and percentage uncertainties; graphical treatment of errors and uncertainties; line of best fit; absolute and percentage uncertainties; percentage difference. Conventions used for labelling graph axes and table columns; vector addition and subtraction; application of trigonometry to solving problems. **Skills** Making estimates of physical quantities; using and rearranging equations, use of vector triangle to determine the resultant of any two coplanar vectors; resolving a vector into two perpendicular components using graphical and trigonometric methods.	The ability to work entirely independently when carrying out calculations. Flawless application or trigonometry to problems. Comprehensive understanding of the manipulation of equations. Consistently produce accurate results from calculations. Critical reflection and evaluation of work produced, and steps taken to improve in future tasks.	This section builds directly from GCSE Science, starting with basic units and equations. Important basic physics skills are developed, in particular using and manipulating more complex equations. The use of standard form becomes the norm. The role of errors and uncertainties is developed in the context using the student's own data. Finally, Trigonometry is introduced at this level to solve a range of vector problems.	OCR year 1 textbook OCR year 2 textbook OCR practical skills guide

Year 12 A Level Physics Module 3: Forces and Motion				
What are we learning?	**What knowledge, understanding and skills will we gain?**	**What does mastery look like?**	**How does this build on prior learning?**	**What additional resources are available?**
How to model the motion of objects using mathematics. Understand the effect forces have on objects. The important connection between force and energy How forces cause deformation The importance of Newton's laws of motion.	**Knowledge** - Kinematics; Linear motion; Projectile motion; Dynamics; Motion with non-uniform acceleration; Equilibrium; Density and pressure; Work and conservation of energy; Power; Springs; Mechanical properties of matter; Newton's laws of motion; Collisions **Understanding** - Links between displacement, instantaneous speed, average speed, velocity and acceleration; velocity–time graphs; acceleration is gradient; displacement is area under graph; the equations of motion for constant acceleration; reaction time and thinking distance; braking distance and stopping distance, projectile motion; F=ma and weight; how friction and drag affect the motion of objects. Principle of moments; CoM; conditions for equilibrium; links between density and pressure; Archimedes' principle; forces do work; conservation of energy; energy transfer = work; what links power, energy and time. Effects of forces on materials; Hooke's law and young's Modulus; behaviour of materials under stress / strain. Newtons three laws of motion, impulse, conservation of momentum; types and effects of collisions. **Skills -** Graphical representations of displacement, speed, velocity and acceleration; finding gradient, finding area under lines, including non-linear plots; measuring acceleration g of free fall; drawing free-body diagrams; determination of terminal velocity; calculation of moments, including the use of trigonometry, finding efficiency of systems; measurements to prove Hooke's law; Calculations relating to collisions.	The ability to work entirely independently when carrying out calculations. Flawless application or trigonometry to problems. Comprehensive understanding of the manipulation of equations. Consistently produce accurate results from calculations. Excellent reproducibility and accuracy for experiments, including robust data collection and analysis. Critical reflection and evaluation of work produced, and steps taken to improve in future tasks.	Builds on the key ideas from GCSE used to describe and analyse the motion of objects in both one-dimension and in two dimensions and provides opportunities to develop analytical and experimental skills. Further develops idea of the motion of an object when it experiences several forces and the equilibrium of an object. Introduces that pressure differences give rise to an upthrust on an object in a fluid. Defines precise more meanings for terms including work energy and power and explores in more detail the link between work done and energy. The analysis of energy transfers provides the opportunity to perform more complex calculations of efficiency. Extends the work done at GCSE on the physical properties of springs and materials, including experimental work.	OCR year 1 textbook OCR year 2 textbook OCR practical skills guide

Year 12 A Level Physics Module 4: Electrons, Waves and Photons				
What are we learning?	**What knowledge, understanding and skills will we gain?**	**What does mastery look like?**	**How does this build on prior learning?**	**What additional resources are available?**
Charge and current Energy, power and resistance Electrical circuits Waves Quantum physics	**Knowledge** - Charge; mean drift velocity; circuit symbols; e.m.f. and p.d; resistance; resistivity; power; series and parallel circuits; internal resistance; potential dividers; wave motion; electromagnetic waves; superposition; stationary waves; photons; the photoelectric effect; wave–particle duality' **Understanding** - Equations for charge and current; elementary charge; Kirchhoff's laws; e.m.f. and p.d in terms of energy transfer and equations for same; Ohm's law; I–V characteristics of components; equations for power, energy transfer and cost of electricity. Properties and types of waves; terminology of waves; parts and properties of the EM spectrum; interaction of waves; properties of standing waves and harmonics; TIR and refractive index; Photons and particles and waves, the [quantum] energy of hotons; electronvolts as a unit of energy; the photoelectric effect and work function; the de Broglie equation and electron diffraction. **Skills** - Setting up a range of circuits, including potential dividers; determining mean drift velocity of charge carriers; use of y = mx + c; calculating resistance; techniques and procedures used to investigate the electrical characteristics for a range of ohmic and nonohmic components and the resistivity of metals; circuit analysis. Use of oscilloscope; graphical representations of transverse and longitudinal waves and their interactions; measuring waves; Young's double-slit experiment; graphical method of finding h from LED's; diffraction grating experiments.	The ability to work entirely independently when carrying out calculations. Flawless application or trigonometry to problems. Comprehensive understanding of the manipulation of equations. Consistently produce accurate results from calculations. Excellent reproducibility and accuracy for experiments, including robust data collection and analysis. Critical reflection and evaluation of work produced, and steps taken to improve in future tasks.	Additional ideas of charge and current are explored beyond those from GCSE. Ideas on energy, power and resistance from GCSE are built upon with further electrical symbols, electromotive force, potential difference, resistivity and power being explore in depth. Knowledge and understanding of electrical circuits are enhanced using a wider range of components and concepts than appear in GCSE. Many new equations are introduced leading to a wide range of calculations being required. Setting up electrical circuits, including potential divider circuits, enhances experimental skills, understanding electrical concepts and managing risks when using power supplies GCSE knowledge and understanding of wave properties, electromagnetic waves, superposition and stationary waves is developed as the unit explores how superposition experiments can be done in the laboratory to determine wavelength of visible light using a laser and a double slit. Quantum physics is introduced to provide knowledge and understanding of photons, the photoelectric effect, de Broglie waves and wave–particle duality.	OCR year 1 textbook OCR year 2 textbook OCR practical skills guide