Year 13 Physics Curriculum Unit Overview

Year 13 A Level Physics Module 5: Newtonian world and astrophysics				
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?**
Thermal physics Circular motion Oscillations Gravitational fields Astrophysics and cosmology	**Knowledge** Temperature; solid, liquid and gas; thermal properties of materials; Ideal gases; kinematics of circular motion; energy of a simple harmonic oscillator; damping; point and spherical masses; Newton's law of gravitation; planetary motion; gravitational potential and energy; stars; electromagnetic radiation from stars; cosmology; **Understanding** Absolute scale of temperature and thermal equilibrium; properties of particles in different states of matter and kinetic theory of gases; internal energy, links to temperature and absolute zero; Avogadro's number and the Mole; Maxwell Boltzmann distribution. Centripetal force and acceleration; equations using displacement, amplitude, period, frequency, angular frequency and phase difference; resonance, damping and oscillations; interchange between E_K and E_P during simple harmonic motion Gravitational fields and mass; point mass as a concept; Newton's law of gravitation; Kepler's three	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.	Ideas of temperature, matter, specific heat capacity and specific latent heat from GCSE are developed and extended to include ideal gases and quantitative treatment of particle motion. Circular motion is only touched on at GCSE; this section uses material learnt in Module 3 to explore objects travelling at constant speed in circles, e.g. planets, artificial satellites, charged particles in a magnetic field' Oscillations are new topic and knowledge and understanding of simple harmonic motion, forced oscillations and resonance is developed Newton's law of gravitation explains some of the topics from GCSE: planetary motion and gravitational potential and energy. The simple ideas from Space at GCSE are developed in Astrophysics and cosmology and take on a quantitative dimension.	OCR year 1 textbook OCR year 2 textbook OCR practical skills guide

	laws; gravitational potential and work done; escape velocity; life cycle of stars; Wien's displacement law and Stefan's law; emission line spectrum and absorption line spectrum; astronomical distances; cosmological principle; red shift; Big Bang and evolution of the universe. **Skills** Temperature measurement and conversion; electrical methods to determine SHC and latent heat; calculations for ideal gases, numerical and graphical; use of radians in calculations; calculations for circular motion and SHM; determination of g using a pendulum; interpretation of energy-displacement graphs for a simple harmonic oscillator; estimation the age of the Universe from data; use and manipulation of very complex equations; interpretation of Hertzsprung–Russell diagrams.			

Year 13 A Level Physics Module 6: Particle and Medical 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?**
Capacitors Electric fields Electromagnetism Nuclear and particle physics Medical imaging	**Knowledge** Capacitors; energy; point and spherical charges; Coulomb's law Learning; uniform electric field; electric potential and energy; magnetic fields; motion of charged particles; electromagnetism; the nuclear atom; fundamental particles; radioactivity; nuclear fission and fusion; using X-rays; diagnostic methods in medicine; using ultrasound. **Understanding** Equation relating to capacitance; charging and discharging; adding capacitance; capacitors as storage of energy; time constant; motion of charged particles in an electric field, magnetic field around a wire; changes in electric potential and potential energy; magnetic flux and flux density; EM induction. Alpha-particle scattering experiment; simple nuclear model of the atom; isotopes; strong nuclear force; particles and their corresponding antiparticles; classification of hadrons; classification of leptons; simple quark model of hadrons; types of decay in terms of quarks; properties and hazards of radiation; half-life of an isotope; fission and fusion; mass defect; binding energy.	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.	The use of capacitors as a source of electrical energy is developed and the maths of exponential decay is introduced. Electric fields, only touched on at GCSE, provides knowledge and understanding of Coulomb's law, electric fields, electric potential and energy. Electromagnetism explores; magnetic fields, motion of charged particles in magnetic fields, Lenz's law and Faraday's law, all of this is new material. Nuclear and particle physics builds on basic GCSE knowledge of the atom and radioactivity by introducing the quark model of the atom and the weak and strong nuclear forces. Medical imaging provides knowledge and understanding of X-rays, CAT scans, PET scans and develops on the material on ultrasound from GCSE.	OCR year 1 textbook OCR year 2 textbook OCR practical skills guide

	Structure of an X-ray tube; production of Xray photons; attenuation mechanisms; simple scatter, photoelectric effect, Compton effect and pair production; X-ray imaging with contrast media; CAT scans; medical tracers; gamma camera and diagnosis; PET scans and diagnosis; ultrasound and piezoelectric effect; A and B scans; Doppler effect. **Skills** Analysis of circuits containing capacitors; techniques used to investigate capacitors in both series and parallel combinations; plotting and interpreting exponential decay graphs; Coulomb's law; electric field strength; similarities and differences between the gravitational fields and electric fields; use of current balance; transformer calculations; graphical methods and spreadsheet modelling of radioactive decay; radioactive dating; procedures used to determine the half-life of an isotope; balancing nuclear transformation equations.			