KS5 Physics Curriculum Plan							
Unit	Core		Hinterland		NC Coverage	Assessment	Whole Education Opportunities
	Knowledge	Skills	Knowledge	Skills			
Module 1: Development of practical skills in physics	• Planning an experiment • Implementing experimental plans • The limitations in experimental procedures • Precision and accuracy of measurements and data	• Experimental design to solve problems • Identification of control variables • Evaluations of experimental methods • Correct use of apparatus and techniques • Appropriate units for measurements • Presenting observations and data in an appropriate format. • Analysis of data • Use of appropriate mathematical skills for analysis of quantitative data • Appropriate use of significant figures • Plotting and interpreting suitable graphs from experimental results • Plotting and interpreting suitable graphs from experimental results, including (i) selection and labelling of axes with appropriate scales, quantities and units (ii) measurement of gradients and intercepts • Identification of anomalies in experimental measurements • Refining of experimental design by suggestion of improvements to the procedures and apparatus.	• Be able to plan, implement, analyse and evaluate required practical procedures from unfamiliar experiments	• Correct use of research and referencing skills.	• 1.1.1 • 1.1.2 • 1.1.3 • 1.1.4 References in Appendix 3 of KS5 Science National Curriculum	• PLC/End of topic assessment • PR point assessments • Written Examination	**Mathematics** • Recognise and make use of appropriate units in calculations • Use an appropriate number of significant figures • Identify uncertainties in measurements • Plot two variables from experimental or other data • Understand linear relationships • Determine the slope and intercept of a linear graph • Calculate rate of change from a graph showing a linear relationship **Chemistry and Biology** • Linked to required practical techniques
Module 2: Foundations of physics	• Physical quantities have a numerical value and a unit • Base and Derived units • Prefixes and their symbols to indicate decimal submultiples or multiples of units • The conventions used for labelling graph axes and table columns. • Absolute and percentage uncertainties when data are combined • Scalar and vector quantities	• Checking the homogeneity of physical equations using S.I. base units • systematic errors (including zero errors) and random errors in measurements • Dealing with uncertainties • Vector addition and subtraction • Vector triangle to determine the resultant of any two coplanar vectors • Resolving a vector into two perpendicular components	• The use of vectors to ensure safety in sea and air travel	• Applying vectors by considering real life conditions	• 2.1.1 • 2.1.2 • 2.2.1 • 2.3.1 References in Appendix 3 of KS5 Science National Curriculum	• PLC/End of topic assessment • PR point assessments • Written Examination	**Mathematics** • Recognise and make use of appropriate units in calculations • Estimate results • Use calculators for trigonometry • Identify uncertainties in measurements • Use Pythagoras' theorem, and the angle sum of a triangle
Module 3: Forces and motion	• Terms and equations associated with uniform and non-uniform motion • Two-dimensional motion of a projectile with constant velocity in one direction and constant acceleration in a perpendicular direction • Force and the Newton as its Unit • One- and two-dimensional motion under constant force. • Motion of objects under the influence of forces • Couple, torque, equilibrium and factors which affect it. • Centre of mass and centre of gravity • Work, the joule and conservation of energy • Mechanical properties of matter • Reaction time, thinking, braking and stopping distance for a vehicle. • Power and the unit watt • Efficiency of a mechanical system • Hooke's law • Newton's three laws of motion • Force, momentum and its conservation	• Graphical representations of displacement, speed, velocity and acceleration • Use the formula for density; • Calculating the Young Modulus of a material using a given formula • Representing different forces experienced by objects in different situations • Calculating impulse using the area under a force–time graph **Techniques and procedures used to:** • investigate the motion and collisions of objects • determine terminal velocity in fluid • determine the acceleration of free fall • determine the of centre of gravity • investigate force–extension characteristics of materials • determine the Young modulus for a metal	• Forces and motion in the design of fast moving objects such as Formula 1 racing cars	• Applying Newton's Laws and how different designs of fast moving objects contribute to its efficiency in performance	• 3.1.1 • 3.1.2 • 3.1.3 • 3.2.1 • 3.2.2 • 3.2.3 • 3.2.4 • 3.3.1 • 3.3.2 • 3.3.3 • 3.4.1 • 3.4.2 • 3.5.1 • 3.5.2 References in Appendix 3 of KS5 Science National Curriculum	• PLC/End of topic assessment • PR point assessments • Written Examination	**Mathematics** • Recognise and make use of appropriate units in calculations • Make order of magnitude calculations • Distinguish between instantaneous rate of change and average rate of change • Apply the concepts underlying calculus • Draw and use the slope of a tangent to a curve as a measure of rate of change • Determine the slope and intercept of a linear graph • Calculate rate of change from a graph showing a linear relationship • Change the subject of an equation, including non-linear equations • Solve algebraic equations, including quadratic equations • Understand that linear relationships • Use calculators for trigonometry • Use sin, cos and tan in physical problems • Use an appropriate number of significant figures • Use angles in regular 2D and 3D structures • Use Pythagoras' theorem, and the angle sum of a triangle

	in collisions and interactions of bodies						• Use calculators to find and use power, exponential and logarithmic functions • Plot two variables from experimental or other data • Translate information between graphical, numerical and algebraic forms • Sketch graphical relationships • Calculate areas of triangles, circumferences and areas of circles, surface areas and volumes of rectangular blocks, cylinders and spheres **PE** • Motion in Sports
Module 4: Electrons, waves and photons	• Electric current – Rate of charge flow • The coulomb as the unit of charge • Mean drift velocity of charge carriers • Distinction between conductors, semiconductors and insulators • Distinction between e.m.f. and p.d. • Resistance and Ohm's Law • Variation of resistance and resistivity in different situations • The equations of electric power • Energy transfer, the kilowatt-hour (kW h) as a unit of energy; calculating the cost of energy. • Total resistance of two or more resistors • Potential divider circuits with variable components • Electromagnetic spectrum; properties and polarisation of electromagnetic waves • Refraction of light, refractive index ,critical angle, total internal reflection, polarisation and diffraction of all waves • Interference, coherence, path difference and phase difference • Young double-slit experiment • Stationary and progressive waves; nodes and antinodes • Fundamental mode of vibration; harmonics • The particulate nature of electromagnetic radiation • Photon as a quantum of energy of electromagnetic radiation • Demonstration of the photoelectric effect • Einstein's photoelectric equation • Work function and threshold frequency • Electron diffraction, including experimental evidence of this effect • Diffraction of electrons travelling through a thin slice of polycrystalline graphite by the atoms of graphite and the spacing between the atoms • The de Broglie equation	• Drawing circuit diagrams using circuit symbols • Applying Kirchhoff's first and second laws applied to electrical circuits • Analysing *I–V* characteristics of resistor, filament lamp, thermistor, diode and light-emitting diode (LED) • Analysis of circuits with different and arrangements • Using the equations for internal energy • Using potential divider equations • Using wave equations • Graphical representations of transverse and longitudinal waves • Graphical methods to illustrate the principle of superposition • Applying the principle of superposition of waves • Graphical representations of a stationary wave • techniques and procedures used to determine the speed of sound in air by formation of stationary waves in a resonance tube • Determine the Planck constant using different coloured LEDs. **Techniques and procedures used to:** • investigate the electrical characteristics for a range of ohmic and non-ohmic components • determine the resistivity of a metal • Determine the internal resistance of a chemical cell or other source of e.m.f. • investigate potential divider circuits which may include a sensor such as a thermistor or an LDR • demonstrate wave effects using a ripple tank • observe polarising effects using microwaves and light • investigate refraction and total internal reflection of light using ray boxes • determine the wavelength of light • Determine wave frequency with an oscilloscope	•	•	• 4.1.1 • 4.1.2 • 4.2.2 • 4.2.3 • 4.2.4 • 4.2.5 • 4.3.1 • 4.3.2 • 4.3.3 • 4.4.1 • 4.4.2 • 4.4.3 • 4.4.4 • 4.5.1 • 4.5.2 • 4.5.3 References in Appendix 3 of KS5 Science National Curriculum	• PLC/End of topic assessment • PR point assessments • Written Examination	**Mathematics** • Sketch different graphical relationships • Change the subject of an equation, including non-linear equations • Substitute numerical values into algebraic equations using appropriate units for physical quantities • Use of small angle approximations
Fields Module	• Gravitational fields, field lines, the strength and the mass of objects • Electrical fields, field lines and strength • Magnetic fields lines • Similarities and differences between the	• Graphical methods to represent fields of all three kinds to start building links earlier.	• Pre teach fields section to all students to ensure better understanding of individual field types	•	• Brought in to make order of teaching subjects in Year 2 more	•	

	gravitational field of a point mass and the electric field of a point charge				prgressive		
Module 5: Newtonian world and astrophysics	• Thermal equilibrium • Absolute scale of temperature (i.e. the thermodynamic scale) • Temperature measurements both in degrees Celsius (°C) and in kelvin (K) • Motions and spacing of atoms and molecules of solids, liquids and gases • Kinetic model for solids, liquids and gases and Brownian motion • Internal energy of a system and temperature changes associated with phases of substances • amount of substance in moles • Pressure in terms of the gas model • The Boltzmann constant • The radian as a measure of angle • Angular velocity, constant speed in a circle, centripetal acceleration and centripetal force • Displacement, amplitude, period, frequency, angular frequency and phase difference • Interchange between kinetic and potential energy during simple harmonic motion • Free and forced oscillations • Gravitational fields, field lines, the strength and the mass of objects • Newton's law of gravitation for the force between two point masses • Kepler's three laws of planetary motion • Geostationary orbit; uses of geostationary satellites. • Gravitational potential • Escape velocity • Planets, planetary satellites, comets, solar systems, galaxies and the universe • Life cycle of stars • Energy levels of electrons in isolated gas atoms and spectral lines • Transmission diffraction grating used to determine the wavelength of light • Distances measured in astronomical unit • The Cosmological principle • Doppler effect; Doppler shift of electromagnetic radiation • Hubble's law • The expanding universe, microwave background radiation and the Big Bang Theory • Evolution of the universe and estimation of its age	• Graphical methods to relate the changes in displacement, velocity and acceleration during simple harmonic motion. • Using energy-displacement graphs for a simple harmonic oscillator • Using force–distance graph for a point or spherical mass; work done is area under graph • Using of Wien's displacement law to estimate the peak surface temperature (of a star) **Techniques and procedures used:** • For an electrical method to determine the specific heat capacity of a metal block and a liquid • For an electrical method to determine the specific latent heat of a solid and a liquid • To investigate PV = constant (Boyle's law) • To investigate circular motion using a whirling bung • to determine the period/frequency of simple harmonic oscillations	• Studying the design and stability of bridges by considering resonance and natural frequency	• Applying the knowledge to consider situations under which bridges may become unstable, based on their design	• 5.1.1 • 5.1.2 • 5.1.3 • 5.1.4 • 5.2.1 • 5.2.2 • 5.3.1 • 5.3.2 • 5.3.3 • 5.4.1 • 5.4.2 • 5.4.3 • 5.4.4 • 5.5.1 • 5.5.2 References in Appendix 3 of KS5 Science National Curriculum	• PLC/End of topic assessment • PR point assessments • Written Examination	**Mathematics** • Substitute numerical values into algebraic equations using appropriate units for physical quantities • Make order of magnitude calculations • Use of small angle approximations • Estimate results • Change the subject of an equation, including non-linear equations • Understand the relationship between degrees and radians and translate from one to the other • Solve algebraic equations, including quadratic equations **PE** • Angular motion in sporting activities
Module 6: Particles and medical physics	• Capacitance and the unit farad • Charging and discharging of a capacitor or capacitor plates with reference to the flow of electrons • Total capacitance of two or more capacitors in series and parallel • Energy stored by capacitor	• Analysis of circuits containing capacitors, including resistors • p.d. – charge graph for a capacitor; energy stored is area under graph • Charging and discharging capacitor through a resistor • graphical methods and spreadsheet	•	•	• 6.1.1 • 6.1.2 • 6.1.3 • 6.2.1 • 6.2.2 • 6.2.3 • 6.2.4 • 6.3.1	• PLC/End of topic assessment • PR point assessments • Written Examination	**Mathematics** • Use ratios, fractions and percentages • Use calculators to find and use power, exponential and logarithmic functions • Use logarithmic plots to test exponential and power law variations • Use logarithms in relation to quantities that range

	• Time constant of a capacitor–resistor circuit • Exponential decay graph • Electrical fields, field lines and strength • Modelling a uniformly charged sphere as a point charge at its centre • Coulomb's law for the force between two point charges • Similarities and differences between the gravitational field of a point mass and the electric field of a point charge • Motion of charged particles in a uniform electric field. • electric potential at a point and a distance • capacitance for an isolated sphere • Force–distance graph for a point or spherical charge • Electric potential from a point charge • Magnetic fields lines • Force on a current-carrying conductor • Magnetic flux density and the unit tesla. • Charged particles moving in a region occupied by both electric and magnetic fields • Magnetic flux and magnetic flux linkage • Faraday's law of electromagnetic induction and Lenz's law • Simple a.c. generator • Simple laminated iron-cored transformer • Alpha-particle scattering experiment • Atomic structure, particles and Nuclear forces • Radioactive decay • Nature, penetration, range of radiations and activity of a source • Half-life of an isotope and radioactive dating • Energy released (or absorbed) in simple nuclear reactions • Nuclear fission and reactors • Environmental impact of nuclear waste • Basic structure of an X-ray tube • Production of X-ray photons from an X-ray tube • X-ray attenuation mechanisms • X-ray imaging with contrast media • Computerised axial tomography (CAT) scanning • Advantages of a CAT scan over an X-ray image • Gamma camera and diagnosis • Positron emission tomography (PET) scanner and diagnosis • Ultrasound in diagnosis and behaviour with changing medium • Doppler effect in ultrasound and its applications	modelling of the equation for a discharging capacitor • Balancing of quark transformation equations in terms of charge • Balancing nuclear transformation equations • Graphical methods and spreadsheet modelling of the equation for radioactive decay **Techniques and procedures used:** • To investigate capacitors in both series and parallel combinations using ammeters and voltmeters. • To investigate the charge and the discharge of a capacitor using both meters and data-loggers • To determine the uniform magnetic flux density between the poles of a magnet using a current-carrying wire and digital balance • To investigate magnetic flux using search coils • To investigate transformers • To investigate the absorption of α-particles, β-particles and γ-rays by appropriate materials • To determine the half-life of an isotope such as protactinium			• 6.3.2 • 6.3.3 • 6.4.1 • 6.4.2 • 6.4.3 • 6.4.4 • 6.5.1 • 6.5.2 • 6.5.3 References in Appendix 3 of KS5 Science National Curriculum		over several orders of magnitude • Apply the concepts underlying calculus • Sketch graphical relationships • Understand simple probability • Estimate results • Make order of magnitude calculations **<u>Chemistry</u>** • Structure of an atom and Nuclear decay