Physics Year 13 Curriculum Overview

What is the Year 13 Physics curriculum aiming to achieve?		
What do we want our Year 13 Physicists to be like?	How are we building on prior learning?	How can parents/carers support their child's learning?
• To continue to develop and demonstrate use of the skills, knowledge and understanding of scientific methods encountered in Year 12. • To use mathematical relationships confidently to predict and quantify changes in physical quantities. To use numbers and graphs independently in order to extract patterns and key quantities. To model periodic behaviour using trigonometric functions and to manipulate these e.g. by differentiating. • To develop the Year 12-derived understanding of measurement in more open, less-structured experiments, to plan effectively. To carry out analysis, sometimes using ICT with independence. • To understand the importance of independent work in embedding and consolidating classwork: to manage time effectively in order to complete not only set work but voluntary consolidatory work. • To self-assess and to self-manage improvement and to make effective preparations for assessment. To maintain up-to-date notes and revision resources that are amended and updated following feedback.	• We will make links to and build on topics covered in Year 12. • We will make use of numeracy skills developed during the GCSE Maths and built upon in an applied way during Year 12. This includes graph plotting, linearising equations, using logs and exponential equations. • We will build on our *working scientifically* skills in the areas of planning, presenting data, analysing data, enquiry and problem solving and these will be key elements of the preparation for Paper 3 in particular.	• Talk to your child about what they are learning in lesson: what did they find interesting? what did they find difficult and how will they deal with this? • Encourage reading and listening to science and Physics ideas and news. Popular science books and podcasts are widely available. • Ask your child to try to explain aspects of the world around you: how can they use what they know? • Support with homework tasks: help students to manage their time, plan effective revision and to manage distractions from e.g. mobile phones • Purchase Pearson OCR A level Physics Student book 2 • Purchase CGP revision guide

How are we organising the Year 13 Physics curriculum?						
Teacher 1	Autumn 1	Autumn 2	Spring 1	Spring 2	Summer 1	Summer 2
Topics	Simple harmonic motion	Radioactivity	Nuclear energy	Magnetic fields	Electromagnetic induction	
Threshold Concepts	Given a defining equation derived from initial conditions, many physical quantities can also be derived and the behaviour of simple systems with time predicted, analysed and quantified. Differential quantities can lead to predictable behaviour that can be represented graphically. Quantities associated with motion can be described using properties such as gradient of a plot, or the phase and amplitude of a sinusoidal function. The conservation of energy can be used as an approach to analyse and predict behaviour of periodic systems.	The inverse-square law (also seen in Gravitational Fields and Electric Fields) also applies to the propagation of electromagnetic radiation. Risk assessment for exposure to radioactive sources in is statistical in nature. Decay is governed by a differential equation whereby the rate is proportional to the amount present: this leads to exponential decay which in this case can be characterised by the *decay constant*. Processes found to be random on a microscopic scale can nevertheless be modelled using statistical approaches.	Mass and energy and interconvertible and are related by $E=mc^2$. Properties of microscopic particles are measured on appropriate scales with their own units e.g. mass according to the atomic mass scale. Quantities of mass and energy can both be expressed using eV. Nuclear processes produce an amount of energy determined by the mass defect and can be used for electrical energy production.	Magnetism and electricity are intimately related: currents cause magnetic fields and as such current experience forces in externally-applied magnetic fields. Individual moving charges experience forces that are perpendicular to their movement: as seen in Mechanics (Year 12), this can lead to circular motion with constant velocity. Relationships seen in the Circular Motion unit can be applied to make predictions (see Gravitational Fields and orbits).	Magnetism and electricity are intimately related: currents cause magnetic fields and changes in magnetic fields cause currents. Sinusoidally-varying quantities can be "averaged" using rms values. Alternating currents are associated with continuously-varying magnetic fields which in turn produce currents. This underpins technology such as the transformer.	
Skills		**PAG 12:** ***inverse-square law for gamma radiation*** Use of radiation source and detector. Research and referencing of literature sources.		**PAG 10:** ***how force on a wire depends on magnetic fields strength, current and length*** Managing variables to complete an investigation of multiple relationships. Using linear plots of data to obtain relationships and quantities relating proportional variables. **PAG 11:** ***search coil and magnetic field*** Use of oscilloscope (unaided).		

Teacher 2	Autumn 1	Autumn 2	Spring 1	Spring 2	Summer 1	Summer 2
Topics	Gravitational fields	Electric fields	Capacitors	Option: Astrophysics	Option: Astrophysics Revision	
Threshold Concepts	Fields are areas of space where forces are experienced; they possess direction and magnitude (strength) and can be represented vectorially. The equations governing fields are common to different types of field, which allows ready extension of relationships derived in say, the context of gravity to other fields such as the electric field. Fields can possess field strength and potential which are linked to forces and energy, respectively once a test mass or charge, for example is placed in the field The inverse-square relationship can be applied to many phenomena. Combining field ideas with circular motion can allow simple analysis of e.g. objects in orbit and can explain observed behaviour.	Electric fields are analogous to gravitational fields but can be repulsive. The medium must also be characterised and taken into account.	Capacitance is the ability of a medium to store charge. Decay is governed by a differential equation whereby the rate is proportional to the amount present: this leads to exponential decay which in this case can be characterised by the *time constant*. This is seen to be analogous to the situation encountered in Radioactive Decay. Graphs can be analysed to obtain key quantities such as current and energy stored. Exponential decay curves can be linearised by taking logs.	Lenses refract light and produce images. These images can be manipulated in terms of magnification and brightness by careful choice and arrangement of lenses and mirrors. The behaviour of optical systems can be predicted using principal rays. Telescopes can be designed on this basis. Wave ideas can be applied to optical systems in order to predict resolution. Stars exist in different classes and have well-defined life-cycle that is dependent on their mass. Light from stars can be used to quantify temperature, size and luminosity velocity by applying theoretical relationships. Astronomical distances can be calculated based upon the principle of standard candles and the use of the inverse-square law. Details of the early stages of the Universe can be inferred from present observations and by considering multiple strands of evidence.		
Skills			**PAG 9: Charging and discharging capacitors** Building a circuit unaided to fulfil a brief. Managing independent, dependent and control variables. Use of spreadsheets to plot data and to obtain quantities from the plot. Using logs to linearise a non-linear dataset.			

Enrichment within the curriculum	Online talks and lectures. Multiple books and podcasts recommended.
Cross curricular links	Links to Mathematics: use of equations, units, trigonometric functions and conservation of quantities. Calculus, while not explicitly part of the specification, can be used where appropriate to extend and deepen understanding. Students should be exposed to ICT-based modelling e.g. using spreadsheets to model the behaviour of functions. Links to Chemistry: atomic structure, electron shell structure. The mole and Ideal Gas Laws.
Extra-curricular opportunities	Physics clinics Physics drop-in sessions

What are the intended outcomes of the Year 13 Physics curriculum?						
	Autumn 1	Autumn 2	Spring 1	Spring 2	Summer 1	Summer 2
Opportunities to show progress (Assessments)	End of unit tests	End of unit tests	PPE 1 End of unit tests	End of unit tests	Revision for external exams. PPE paper. Multiple opportunities to complete past papers open-book and otherwise	End of unit test
Impact on personal development (SMSC)						
Preparation for the next stage of education	Key skills and ideas were embedded via the Year 12 curriculum. Year 13 builds on some of the content but more importantly requires students to utilise the skills, approaches to learning and resilience they have developed. The ability to make competent use of equations, graphs, units and equipment will be important for further technical education courses. The Required Practical component is intended to equip students so that they are comfortable when encountering undergraduate practical work for the first time. A-level Physics equips students for a range of undergraduate courses and careers including those associated with Physics, Engineering, Materials Science, Electronics, Astronomy and many other fields which make use of numeracy, problem solving and practical acumen.					