Physics Year 12 Curriculum Overview

<table>
<tr><th colspan="3">What is the Year 12 Physics curriculum aiming to achieve?</th></tr>
<tr><th>What do we want our Year 12 Physicists to be like?</th><th>How are we building on prior learning?</th><th>How can parents/carers support their child’s learning?</th></tr>
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To develop and demonstrate use of the skills, knowledge and understanding of scientific methods: careful measurement, presentation of data using graphs and other forms of summary and display.
To use numbers of all sizes using standard form, to understand how physical quantities are represented and to understand relationships between these quantities based on units and changes in quantities.
To understand how mathematical relationships predict and quantify changes in physical quantities. To use of graph gradients to represent and calculate rate of change. To understand and make use of the physical significance of gradients, areas and intercepts.
To understand the significance and limitations of physical measurement, to estimate uncertainty and to understand the significance of a calculate result. To understand the use and limitations of simple equipment and when to apply them.
To be an independent scientist capable of using the above skills to explore relationships and changes, to record findings, to understand limitations and to interpret results using simple mathematical relationships. To use these relationships in unfamiliar scenarios.
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 self-manage improvement and preparation for assessment.
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We will make links to and build on the Physics topics from AQA Combined Science and AQA Physics GCSE
We will make use of numeracy skills developed during the GCSE Maths and Physics courses
We will build on our working scientifically skills in the areas of planning, presenting data, analysing data, enquiry and problem solving
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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 and to manage distractions from e.g. mobile phones
Purchase Pearson OCR A level Physics Student books 1
Purchase CGP revision guide
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How are we organising the Year 12 Physics curriculum?						
Teacher 1	Autumn 1	Autumn 2	Spring 1	Spring 2	Summer 1	Summer 2
Topics	Forces in Equilibrium On the Move1	On the Move2 Newton's Laws	Force and Momentum	Work, Energy and Power	Work, Energy and Power Revision	Circular Motion
Threshold Concepts	• Forces can be represented graphically by 2D vectors. • Vectors can be combined or subtracted using simple trigonometry • Physical quantities such as force can be evaluated using these simple graphical methods. • Equilibrium is achieved when forces balance and vector calculations can be applied here to calculate forces and directions. Complex situations reduce to simple addition and subtraction.	• Changes in quantities, such as displacement, with time can be represented using graphs and evaluated using gradients. • Instantaneous change is represented by tangents • Units reflect the quantities that are changing and can guide the calculation of quantities using graph gradient and/or area. • Physical measurement is inherently limited in precision and accuracy. Random and systematic error must be considered and quantified. • Forces at 90^0 to the starting motion do not induce changes in speed. This can be used to understand projectile motion. • Resultant force determines acceleration and friction and drag must be considered in real-world situations. • Motion can be analysed and predicted by applying Newton's Laws.	• Momentum is always conserved in isolated systems. This follows logically from Newton's third Law. • Impacts occur over a finite time and the characteristic plot of force against time allows the change of momentum to be determined. • The conservation of momentum in 2D can allow 2D motion to be analysed and predicted following collisions and explosions.	• Physical work is defined according to: work = force x distance • Energy is conserved in an isolated system. • Work involves the transfer of energy and the conservation of energy allows us to analyse systems that change as work is done. • Power is the rate of energy transfer • Machines are inherently less than 100% efficient and output power is a function of efficiency		• Motion in a circle implies acceleration. A resultant force perpendicular to the instantaneous direction of motion must exist. • Repeated circular motion is periodic motion and quantities such as frequency and period can be applied in the analysis (see Waves).
Skills	Use of vectors and trigonometry.	Graphs, gradients ad rate of change. Use of units. Deriving simple relationships. manipulating equations. **PAG 3: *Determination of g*** Use of electronic timing. Graphs/gradients. Error bars and estimating uncertainty. Percentage uncertainty. Sig. figs. Use of motion sensors. Use of ticker-tape timers. Manipulating equations.	Graphs: gradient and area.	Manipulating equations. Deriving relationships. Linear and quadratic relationships.	Preparing resources. Metacognition and understanding of best practice for effective embedding and improving.	

Teacher 2	Autumn 1	Autumn 2	Spring 1	Spring 2	Summer 1	Summer 2
Topics	Matter and Radiation Quarks and Leptons1	Quantum phenomena	Materials1	Materials2	Revision	Thermal physics
Threshold Concepts	• Matter is composed of fundamental particles which can combine in set ways to create more massive particles and atoms. • On the atomic scale quantities are quantised. • Light is also quantised and displays particle-like behaviour. Energy is related to frequency. • Antimatter exists as a counterpart to matter with most properties the same. • Energy and matter are inter-related and the amount of energy associated with matter (and *vice-versa*) can be calculated in a straightforward way. • Quantised properties are conserved, and the Conservation Laws limit the possible outcomes from particle interactions.	• Experimental observations necessitated the introduction of quantum ideas, including the photon. • Many phenomena, including the photoelectric effect can be understood using quantum ideas and simple numerical relationships. • Nuclear processes are understood by applying conservation laws. The nucleus can be probed via collisions. • Electrons are arranged in energy shells and the quantisation of energy is responsible for discrete spectral lines in absorption and emission. • Light displays particle properties such as momentum exchange and wave properties such as diffraction. Their relative prominence depends on the method used to investigate light.	• Materials can obey Hooke's Law in compression and extension. This allows behaviour under stress to be predicted. • Deformation behaviour depends on intrinsic properties such as the Young Modulus but also on material dimensions. • Material behaviour can be analysed using simple graphs.	• Materials can obey Hooke's Law in compression and extension. This allows behaviour under stress to be predicted. • Deformation behaviour depends on intrinsic properties such as the Young Modulus but also on material dimensions. • Material behaviour can be analysed using simple graphs.		• Internal energy is the sum of potential and kinetic energies. • Temperature is an (intensive) measure of the average kinetic energy. Energy is an extensive property. • Heating materials results in either a change in temperature (increase in K.E.) or change in state (changes in P.E.). The First Law of Thermodynamics can be used as a basis for analysing heat transfer and temperature changes
Skills	Appreciating number and size. Standard form. Applying conservation ideas to Physics situations and calculations. New units: eV and MeV.	Graphs: gradient and intercept. Using linear relationships: y=mx+c	Using linear and quadratic relationships. Graphs: gradient and area.Using micrometer scales	PAG 4: *Determination of Young Modulus* Use of fiducial markers. Use of micrometers and micrometer scales. Graphs/gradients. Error bars,estimating uncertainty. Percentage uncertainty.	Preparing resources. Metacognition and understanding of best practice for effective embedding and improving.	

Teacher 3	Autumn 1	Autumn 2	Spring 1	Spring 2	Summer 1	Summer 2
Topics	Waves	Optics	Electric Current	dc circuits1	dc circuits2 Revision	Gases
Threshold Concepts	• There are limited and clearly-defined ways in which energy can be transferred via oscillations. • Waves can differ in wavelength, speed and frequency and these properties are related. • Waves can interact with each other and with matter via superposition and diffraction, respectively. • Stationary waves form via superposition and can be analysed using simple relationships. • A confined stationary wave may only adopt certain wavelengths and frequencies.	• Waves refract when crossing boundaries between materials. • Refraction governs wave behaviour in lenses and prisms, but can be avoided using total internal reflection. • Superposition of coherent sources results in interference. Simple addition and subtraction of wave amplitudes gives rise to interference effects such as those observed in the double-slit experiment. • Interference effects can be used to calculate *e.g.* the wavelength of light.	• Current is the flow of charge. Charge is quantised which allows the rate of flow of electrons or other charge carriers to be determined. • Where dissipative components exist in a circuit, voltage quantifies the work done to drive the current through them. • The resistance of a material to current flow is dependent on its dimensions. Materials have an intrinsic resistive property known as the resistivity which is temperature dependent.	• Conservation of energy and charge determines the behaviour of voltage and current in circuits. the resistance of multiple components can be calculated using these ideas. • Some components are engineered to display light- or temperature-dependent resistance and these can be incorporated into sensor devices.	• Conservation of energy and charge determines the behaviour of voltage and current in circuits. the resistance of multiple components can be calculated using these ideas. • Some components are engineered to display light- or temperature-dependent resistance and these can be incorporated into sensor devices.	• The experimental gas laws predict the behaviour of ideal gases and are derived from experiment. The laws involve macroscopic quantities: pressure, volume and temperature. • The absolute temperature scale must be used to calculate absolute values. This scale results from rigid shift of the Celsius scale by 273 degrees. • The macroscopic quantities can be connected to microscopic quantities such as rms velocity via a simple theoretical treatment of an ideal gas which involves momentum changes. • Once done, this shows that temperature is linked to average molecular kinetic energy.
Skills	Appreciating number and size. Manipulating simple equations and using units. Use of standard form. **PAG 1:** ***Frequency of stationary waves*** Use of a CRO and frequency generator. Measuring frequency. Estimating uncertainty.	Use of trigonometric functions. **PAG 2:** ***Interference effects*** Use of lasers. Use of calipers and Vernier scales. Estimating uncertainty.	Use of electrical components. Electrical measurements using meters. Understanding systematic (zero) and random error. Manipulating equations and deriving relationships. Graphs: gradient and units thereof.	Use of electrical components. Electrical measurements using meters. Understanding systematic (zero) and random error. Manipulating equations and deriving relationships. Graphs: gradient and units thereof.	**PAG 5:** ***Determination of resistivity*** Use of multimeters. Use of micrometers. Graphs and gradients. **PAG 6:** ***Investigation of emf and internal resistance*** Use of circuits and multimeters.	**PAG 8:** ***Investigation of Boyle's Law and Charles' Law***
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. Links to Chemistry: atomic structure, electron shell structure.
Extra-curricular opportunities	Physics clinics Physics drop-in sessions

What are the intended outcomes of the Year 12 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	PPE 2 End of unit tests	End of unit test
Impact on personal development (SMSC)						
Preparation for the next stage of education	Key skills and ideas are 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 assumed in Year 13. 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.					