PHYSICS CURRICULUM MAP

CURRICULUM INTENT

GCSE

Our course has been designed to give all our pupils really good understanding of what physics is, what physicists do, how they work, and how their discoveries drive enrichment and development of society as a whole.

Our department places practical work at its heart. Indeed, although more emphasis is placed on the “required practicals”, we go well over and above that number of experiments, and aim to supplement theoretical work as often as is feasible and effective. The experiments we do are an intrinsic part of learning in our department, and are aimed at increasing understanding of key principles, as well as developing investigative and evaluative skills. In recent years we have also embedded much more learning about practical work via online portals, and the pupils themselves will receive a “lab book” which they fill in during the course, which can be used as a revision resource for final exams.

Moreover, we are confident that we have structured the course so that they will be able to successfully continue their studies into A-level and beyond, irrespective of whether or not they have two or three GCSEs in science.

The aim of this course is to establish good critical and problem-solving skill through the practising of lateral thinking between the different sub-disciplines of physics. We also like to converse actively with colleagues across the curriculum so that we can adapt our teaching techniques to best echo linked skills and content across a wide range of subjects.

A-level We chose the OCR course as we felt this had a good balance between content and accessibility. Indeed, it has a rich mixture of classical physics and more modern approaches, which we feel mirrors the tension between these two areas of physics at the academic and professional level. We also feel that it builds nicely on the content of GCSE in a way that swiftly opens up to a picture of what physics at A-level can teach us about how our knowledge of the natural world can solve problems in medicine, cosmology and engineering (for example).

We team teach the course which effectively means we deliver the AS part in year 12 with one teacher doing the “mechanics” and one doing the “waves and electricity”. In the year 13/”A2” part of the course one teacher teachers thermal, circular motion, oscillations and cosmology, whilst the other teaches fields, radioactivity, particles and nuclear. By and large we are happy with the prescribed order as we feel it builds effectively from those first principles of mechanics, waves and electricity into the more modern/less familiar applications of capacitors, fields, particles etc.

That said in year 13 we change the order so that electric and magnetic fields are not encountered until the “other teacher” has taught the gravitational fields in the circular motion of orbits context.

Key stage 3

YEAR 9	Forces	Energy	Waves	Electricity	Particles	Motion

Key Knowledge	Representing Forces Mass and Weight Energy and Work Forces and Elasticity Hooke's Law	Changes in Energy stores Energy Dissipation Energy and Efficiency Heating and Insulating Energy Demands Evaluating energy resources	Nature of Waves Properties of Waves Wave Speed and depth Electromagnetic Spectrum and its uses Communications Reflection and refraction	Static electricity including Van der Graaf Current and charge Potential difference and resistance Series Circuits	Method of determining density for regularly and irregularly shaped objects. States of matter Changes of state Internal energy	Vectors and Scalars Speed and distance time graphs Investigating motion Velocity and acceleration Equations of motion Investigating acceleration
Key Subject Skills	Direct Proportionality Calculations Experimental Procedure Graphical analysis – calculating gradients and relating to formula.	Modelling Calculations Describing and evaluating processes Critical Analysis of energy resources	Experimental procedure Construct ray diagrams Apply Scientific knowledge to real world scenarios Standard form	Building Circuits Using electrical equipment and taking appropriate readings Calculations Determining relationships from experimental analysis	Experimental procedure Written communication in describing experimental procedure Considering resolution of instruments	Calculations Graphical Analysis – gradients and area under graph Calculations – rearrangement of complex equations Evaluation of experimental procedure.
Personal development: • **RSE** • **Online safety** • **Enrichment**						
Connections with careers	Careers with physics | Institute of Physics (iop.org)					

Home support	YR9GCSE16

Key stage 4: GCSE

YEAR 10	**Newton's laws of motion**	**Electromagnetism**	**Energy transfer and power**	**Radioactivity**	**Thermal Physics**	**Current Electricity**
Key Knowledge	Forces and braking Factors affecting stopping distance Newton's Laws Terminal Velocity	Magnetic fields Electric fields Electromagnetism Motor Effect	Energy Stores and transfers Efficiency and Power of devices	Atomic Theory Types of Radiation Structure of the atom Process of radioactive decay Activity and Half Life Radiation in Medicine	Specific Latent Heat Specific Heat Capacity Gas Pressure, volume and temperature relationships. Infra-red radiation and energy transfers	Electric charges and fields I-V Characteristics of components in circuits Non-Ohmic components and Semi-conductors Series and parallel circuits
Key Subject Skills	Investigating correlations Analysing graphs	Recalling Definitions Calculations Planning investigations	Calculations of Energy stores and Transfers Area under graphs	Linking cross science curricula Linking properties and characteristics of types of radiation	Calculations and measurements for SHC and SLH and determining uncertainties.	Circuit design and construction Calculations using Ohm's Law

	Proportionality and inverse proportionality	Written communication apply knowledge to real world contexts/uses	Linking motion to energy and power	Determining changes in nucleus during decay. Calculations of half-life including interpreting graphs.	Investigating relationships Planning investigations	Investigating component behaviour in circuits
Personal development: • **RSE** • **Online safety** • **Enrichment**	N/A	N/A	N/A	N/A	N/A	N/A
Connections with careers	Careers with physics | Institute of Physics (iop.org)					
Home support	BBC bitesize GCSE Educake yr10-PHY-TRIPLE-16 GCSE Physics Online videos					

Please note that subject content in ***italics is for the triple physics students*.**

YEAR 11	**Domestic electricity, and Momentum;** ***Domestic electricity, and Momentum***	**Investigating waves;** ***Space***	**Forces in action;** ***Pressure and surfaces, and Electromagnetic induction***	**Revision;** ***Waves in action, and Forces in action***	**Revision;** ***Revision***	***Please note triple content in italics***
Key Knowledge	A.C. and D.C. Potential Difference Cables and plugs in domestic electricity	Reflection and refraction Measuring properties of	Centre of mass Parallelogram of forces	*Refraction and Reflection*		

	Electrical appliances, fuses, circuit breakers. Efficiency and energy transfers Using conservation of momentum. SHARED TRIPLE AND DOUBLE CONTENT	waves in water and solids *Nuclear Fission and Fusion* *Formation of Solar System* *Life Cycle of stars* *Expansion and fate of the universe.* *Doppler Effect and Red Shift.*	Resolution of forces *Pressure in solids, liquids and gases.* *Atmospheric pressure* *Upthrust and Archimedes Principle.* *Generator Effect* *A.C. Generator* *Transformers construction and equations*	*Measuring properties of waves in water and solids* *Ultrasound properties and uses* *Seismic waves* *Light and colour* *Lenses uses, calculations and ray diagrams.* *Moments, levers, gears and simple machines* *Centre of Mass* *Parallelogram and resolution of forces*		
Key Subject Skills	Definitions and Calculations Using an oscilloscope to view a wave pattern and to measure potential difference and frequency of the mains electricity	Using ripple tanks to investigate wave properties and phenomenon *Linking energy production in industry and nature.* *Recalling knowledge and processes.*	Determining centre of mass experimentally Scale diagrams of forces *Calculations and Definition recall.* *Using field models to explain electromagnetic induction*	*Construction of ray diagrams and scale diagrams of forces* *Interpreting wave patterns and oscilloscope traces.*		

Personal development: • **RSE** • **Online safety** • **Enrichment**	N/A	N/A	N/A	N/A	N/A	N/A
Connections with careers	Careers with physics | Institute of Physics (iop.org)					
Home support	BBC bitesize GCSE Educake YR11- PHYSICSTRIPLE 2016 YR11-GCSEPHYSICS TRILOGY16 GCSE Physics Online videos					

Key Stage 5: A levels

YEAR 12	Foundations of physics and Motion / Electric current and resistance	Forces in action / Electric circuits	Work, energy, and power / Properties of waves	Materials / Superposition of waves	Laws of motion and momentum / Quantum physics	Thermal physics / Particle physics
Key Knowledge	• SI Units • Scalars and vectors • Uncertainty • Graphs of motion • Equations of motion/ • Charge and current	• W=mg • Centre of mass and free-body diagrams • Drag and Terminal velocity • Moments and equilibrium • Density	• Conservation of energy • Kinetic and gravitational potential energy • Power and efficiency/ • Wave properties	• Hooke's law • Elastic potential energy • Deforming materials • Stress-strain graphs and the Young modulus/ • Superposition	• Newton's laws • Conservation of momentum • Impulse • Collisions in 2D/ • Photons • The photoelectric effect	• Temperature • States of matter • Internal energy • Specific heat capacity • Specific latent heat/ • Rutherford scattering

	• IV characteristics • Resistance and resistivity • P.d. and e.m.f.	• Archimedes' principle / • Kirchoff's laws • Internal resistance • Potential dividers • Sensing circuits	• Reflection and refraction • Diffraction and polarisation • EM waves • Refractive index • Total internal reflection	• Two source interference • Young's double slits • Stationary waves • Harmonics	• Wave-particle duality	• The nuclear model • The standard model of particle physics
Key subjects Skills	• Expressing quantities in terms of SI base units • Testing for homogeneity • Resolving vectors • Judging quality of data by analysing and quantifying the impact of uncertainty on measurement • Analysing graphs • Problem solving with algebra (the "SUVAT" equations)/ • Using electrical multimeters to	• Free-body diagrams as a problem solving tool • Finding COM experimentally • Dynamics – describing how motion changes resistive forces and the impact that has on the motion • Statics - Determining whether or not a system is in equilibrium • Laboratory techniques to determine density	• Calculations involving energy transfers • Determining work done when force acts at an angle to direction of motion • Investigating the efficiency of a DC motor/ • Laboratory techniques to accurately measure wave phenomena • Using ray boxes to investigate the interaction of	• Investigative techniques to determine the relationship between causally linked variables • Techniques and procedures to determine the Young Modulus • Research and referencing skills (Materials research presentation)/ • Laboratory techniques to produce and accurately measure waves • Using resonance to measure the	• Estimating area under the graph and recognising its potential significance • Making predictions based on calculations involving conserved quantities • Application of conservation of momentum to multiple dimensions/ • Modern approaches to physics – the photon model	• Experimental techniques to measure material properties / • How scientific discoveries shape the models we use to describe nature

	make accurate measurements • Determining the possible significance of the gradient and y-intercept • "voltage" as a model for accounting for energy transfers within circuits	• Comparing measurements to "accepted" values/ • Understanding aspects of "real" circuit design • Designing circuits to solve problems	light and matter (Optics)	speed of sound and analysing the effect of error on that measurement	• Quantum physics and difficulties in its interpretation	
Personal development: • **RSE** • **Online safety** • **Enrichment**	N/A	N/A	N/A	N/A	N/A	N/A
Connections with careers	Careers with physics | Institute of Physics (iop.org)					
Home support	A-Level PHYSICS15 Physics & Maths Tutor (physicsandmathstutor.com) Full Video List | A Level Physics Online					

YEAR 13	Ideal gases / Radioactivity	Circular motion and oscillations / Nuclear Physics	Gravitational fields / Medical Imaging	Cosmology / Capacitance, and Electric and magnetic fields	Revision	
Key Knowledge	• Kinetic theory • Ideal gas laws • RMS speed and the Boltzmann constant/ • Radioactive decay • Nuclear equations • Half-life and activity • Modelling radioactive decay	• Angular velocity and the radian • Angular acceleration • Centripetal forces/ • $E=mc^2$ • Binding energy and nuclear stability • Fission and fusion •	• Gravitational fields • Newton's law of gravitation • Gravitational field strength • Kepler's laws • Gravitational potential • Gravitational potential energy/ • X-ray spectra • CAT Scans • Gamma camera • PET Scans • Ultrasonography	• Objects in the Universe • The Hertzsprung-Russell diagram • Energy levels in atoms • Spectra • Stellar luminosity • Astronomical distances • Doppler effect and Hubble's law • The Big Bang theory • Evolution of the Universe/ • Capacitors • Capacitors in series and parallel • Energy stored in capacitors • Charging and discharging capacitors		

				• Coulomb's law • Uniform fields • Charged particles in uniform electric fields • Electric potential and energy • Magnetic fields • The motor effect • Charged particles in magnetic fields • Electromagnetic induction • Faraday's law and Lenz's law • Transformers		
Key subjects Skills	• Experimental techniques to determine macroscopic properties of gases/ • Techniques used to determine the half-life of an isotope • Health and safety aspects of working with	• Conversion between degrees and radians • Techniques and procedures used to investigate circular motion • Techniques and procedures used to	• Explaining the uses of geostationary satellites/ • Written communication – accurate and effective description of scientific processes • Comparing and evaluating different	• Use of Wien's displacement law and Stefan's law to estimate the radius of a star/ • Investigating the charging and discharging of capacitors • Techniques and procedures used to determine the uniform		

	radioactive substance • Using excel spreadsheets to model physical processes	determine the period and frequency of simple harmonic oscillations/ • Evaluating nuclear technology as a tool for good and ill	imaging techniques	magnetic flux density between the poles of a magnet using a current-carrying wire and digital balance • Techniques and procedures used to investigate magnetic flux using search coils • Techniques and procedures used to investigate transformers		
Personal development: • **RSE** • **Online safety** • **Enrichment**	N/A	N/A	N/A	N/A	N/A	N/A
Connections with careers	Careers with physics | Institute of Physics (iop.org)					
Home support	A-Level PHYSICS15 Physics & Maths Tutor (physicsandmathstutor.com) Full Video List | A Level Physics Online					