Physics Curriculum Map

Curriculum - Overview						
Year 7	Year 8	Year 9	Year 10	Year 11	Year 12	Year 13
During Year 7, students start to develop their ideas from KS2 about energy, forces, waves and space. We build working scientifically skills into our science curriculum. This includes; • Basic safety • Measuring accurately and units • Reliability, precision and accuracy • Calculating averages and identifying errors • Identifying and selecting variables • Adding data to and creating tables • Creating simple methods • Graphs • Patterns in data	During Year 8, students continue to develop their understanding light waves, space and forces. Energy transfer starts to delve into building on KS2 knowledge related to electricity. We continue build on their working scientifically skills, including; • Risk assessing • Bias and objectivity • Reducing bias and peer review • Method writing • Reliability, precision and accuracy • Judging data • Evaluating methods • Patterns in data • Graphs and lines of best fit • Hypothesis • Concluding • Analysis and evaluation	During Year 9 students complete their KS3 work on energy and electricity. Later in the year students move onto GCSE content and develop their understanding of energy further. Working scientifically skill development is continued in KS3 and develop these skills further at GCSE. • Reliability, precision and accuracy • Evaluating risk • Method creation • Analysis and evaluation • Designing further experiments and questions to support data • Concluding	**Information in bold is only relevant to separate science students.** During Year 10 students build further understanding about forces, motion, waves and light. New topics start to build links to their chemistry knowledge and focus on nuclear radiation. **In separate science, students build on their knowledge of space and investigate in depth the topic of astronomy.** Core practical work further enhances student skills. In Year 10 students carry out: • Investigating force, mass and acceleration • Investigating speed, frequency and waves in water.	**Information in bold is only relevant to separate science students.** During Year 11 students continue to build their understanding of forces, energy and electricity. Further links with chemistry are made, as students investigate the links between forces and matter. Core practical work further enhances student skills. In Year 11 students carry out: • Investigating thermal energy • Investigating electrical circuits • Investigating the density of solids and liquids • Investigating the properties of water • Investigating the extension of a spring	A-Level Physics is not as compartmentalized as GCSE Physics. Students delve deeper into the topics learned at KS3 and KS4 and will establish links between different aspects of the curriculum even more. In Year 12 students learn about Mechanics and Further Mechanics, Electricity, Particle Physics, Quantum Phenomena and Waves. The course includes Required Practical's (CPACs) that will be formally assessed. In Year 12 students carry out: • Measuring Gravitational Acceleration • Standing Waves • Laser Diffraction • Measuring Young's Modulus • Measuring the Resistivity of a Wire	In Year 13 students will continue their advanced learning of Physics with the introduction of Fields and Nuclear Physics. Students will also have to decide, as a group, which "Optional" module to study. The list of Optional modules is as follows: Astrophysics, Medical Physics, Engineering Physics. Students continue with Assessed Required Practical's: • Charging and Discharging of a Capacitor • Investigation of Magnetic Force on a Current-Carrying wire • Investigating Magnetic Flux Linkage using a Helmholtz Coil • Investigating Gamma

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• Predictions and hypothesis	• Global connectivity • Role of research		• **Refraction in glass blocks**		• Measuring Internal Resistance	Radiation and the Inverse-Square Law

Curriculum – Topic Sequencing						
Year 7	Year 8	Year 9	Year 10	Year 11	Year 12	Year 13
P1: Forces and Energy Student build upon their KS2 knowledge of forces and start to develop their understanding of energy. They look at the nature of forces and forces type, measuring, drawing and calculating resultant forces. Students move towards energy stores, transfers and looking at examples in real life. The law of conservation of energy is explored along with its role in energy efficiency. **P2: Light**	**P7: Refraction of light** Student build upon their KS2 and Y7 learning about light and reflection. They look at the pinhole camera, how light is refracted and lenses. **P8: Seasons** Students build on KS2 knowledge about what we have day and night and further their understanding towards why we have seasons within different parts of the Earth.	**P13: Thermal energy transfer** Students build upon their understanding of thermal energy transfer by conduction and build knowledge about thermal energy transfer by convection and radiation. They apply this understanding to insulation in different situations. **P14: Electricity, magnetism and forces** Students build on their KS2 and KS3 knowledge of magnets and electricity, to investigate	**Motion** Building upon their KS3 knowledge of motion, students further develop their understanding of speed, distance-time graphs and acceleration. They are introduced to vectors and scalars as a way of categorising physical quantities. Students will learn to calculate speed, distance, and time by rearranging the corresponding equation in differing scenarios and they will learn to relate this to, and analyse, distance-time	**Energy – Forces Doing Work** Following on from the conservation of energy topic in Y10, students will learn about how energy in a system can be changed by doing work on the system. They will then look at power and how to calculate both work done and power. **Forces and their Effects** Further building on their understanding of forces, students will learn about rotational forces, calculating moments and exploring	**Assessed Required Practical** A separate endorsement of practical skills will be taken alongside the A-Level course. The endorsement is assessed by teachers. Students will learn how to work scientifically to take accurate and precise measurements, how to analyse data and write scientific reports. The skills and experience acquired during these practical's will also be tested in Paper 3.	**Fields** Briefly mentioned in Year 10 and Year 11, 'fields' is one of the great unifying ideas in Physics. Ideas from Mechanics and Electricity support this and are further developed. Students learn about Gravitational, Electrical and Magnetic Fields. Students will be introduced to Newton's and Coulomb's Laws, the concept of Gravitational and Electrical Field Strength,

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Building on students KS2 knowledge of light, they focus on the basics of light, exploring shadows and investigating the law of reflection.		electromagnets and move further into electric motors.	graphs as well as velocity-time graphs	how levers and gears work. They will use vector diagrams to work out effects of forces.		Potential and Energy for Radial and Uniform Fields and will appreciate how these link to their previous knowledge of Gravity and Potential Difference in circuits.
P3: Space and forces At KS2 students focus on movement of planetary bodies and explaining why we have day and night. Students build upon this through looking at the solar system, galaxies and the Universe and linking this to forces. Students investigate the difference between mass and the force of weight, exploring how weight is affected by gravity. **P4: How do we see?** Students start to build on their understanding of light and links to biology. Students investigate the eye and	**P9: Electrical circuits** Students start to build on their understanding of simple circuits in KS2. They focus on revisiting simple series circuits. Develop their ideas on current and expand their understanding through looking at potential difference, static electricity and electric fields. **P10: Falling, stretching and turning** Students build on their understanding of forces to investigate the forces involved in falling, stretching and turning objects.	**GCSE** **Motion** Students build upon their KS3 knowledge of forces and apply this further to motion. This includes building upon their skills in understanding speed and velocity. The graphical understanding of motion using distance-time and velocity-time graphs is further enhanced. **Conservation of Energy** Building on knowledge of energy stores and transfers including conduction, convection and radiation, students will begin learning how	**Motion and Forces** Taking their KS3 and Year 9 knowledge of forces and energy, students will further develop their understanding of resultant forces and the difference between mass and weight. Students will look at Newton's laws of motion and will explore factors that affect acceleration before looking at momentum and **energy in collisions** and strategies to reduce the impact of collisions. **Waves** Students continue building on their understanding of light	**Electricity and Circuits** Building on knowledge of circuits and resistance from KS3, students will explore current, voltage, and resistance in series and parallel circuits. Students will look at how resistance changes in a variety of different circuit components before learning about mains electricity and safety features in homes. **Static Electricity** Following on from the previous topic, students will begin to explore electric fields and phenomena caused by static electricity.	**Mechanics and Materials** Mechanics is the study of how forces affect motion and how energy is transferred between stores of energy. Students will use their knowledge about Motion, Forces and Energy from KS4 to further analyse more complex systems, in more detail. The module includes Forces and Force Diagrams with the addition of Trigonometry, Moments and Rotations, SUVAT Equations, Uniform Acceleration and 2D	Within the Gravitational Fields sub-unit, students are introduced to Orbital Mechanics of Satellites and Planets and Kepler's Third Law. Within the Electric Fields sub-unit, students will learn about how different distributions of charges affect the shape of electric fields and Capacitors, including their charging and discharging process, and their applications in circuits. Students will continue learning about

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learning about how we see colour. **P5: Thermal energy** Students continue to develop an understanding of energy, by focusing of thermal energy. They will investigate the difference between heat and temperature and focus on how thermal energy can be conducted.	**P11: Sound and pressure waves** Students develop their understanding of waves, by looking at wave properties. They build on light by comparing to sound waves, amplitude and frequency and how we hear.	to draw and analyse energy transfer diagrams by calculating efficiency and looking at ways of reducing wasted energy transfers. **From looking at factors that affect kinetic and gravitational energy, students will move on their calculations** before looking at renewable and non-renewable energy resources.	and sound waves from KS3 by learning about wave characteristics and behaviours including reflection, **refraction, and absorption,** as well as investigating wave speed, frequency and wavelength. **Students will further develop their understanding of the ear and explore the uses of ultrasound and infrasound.**	**Magnetism and the Motor Effect** Students continue building on their understanding of magnetic fields from KS3 and begin to explore permanent and induced magnetism and the effects of currents placed within a magnetic field.	Motion, Newton's Laws and Momentum Conservation during Collisions and Explosions, Work and Energy Conservation. Students will also investigate the Property of Materials and how they behave under stretching and compression, through the concept of Young Modulus.	Magnetic Fields, introduced in Year 11, but within a rigorous mathematical framework and will be able to appreciate the concepts of Magnetic Flux, Magnetic Flux Linkage and Magnetic Induction. This knowledge will then be used to investigate Rotating Coils, Transformers and Electricity Generators and their applications withing the National Grid.
P6: Forces and motion Students build upon their learning about forces to start linking to how forces affect motion. They investigate speed and how this is calculated. Learning about distance-time graphs, allows students an opportunity to explore how motion can be	**P12: Electrical resistance** Students develop their understanding about circuits, by comparing current and potential difference in series and parallel circuits and develop their knowledge, so that electrical resistance can be explained.		**Light and the Electromagnetic Spectrum** At KS3, students begin to learn about how colours behave. **In this topic, students develop this further as well as looking at how light behaves in reflection, refraction, and total internal reflection.** Students are introduced	**Electromagnetic Induction** Following on from topic 12, students will develop an understanding of transformers including equations for power and voltage. Students will then look at inducing current in a wire and understanding factors that can affect	**Particle Physics and Quantum Phenomena** This very exciting topic will be completely new to students, as it is not part of the KS4 curriculum. The unit includes the study of subatomic particles and their behaviour through quantum mechanics.	**Nuclear Physics** Building on their knowledge of Radioactivity from Year 10 and Particle Physics from Year 12, students will be introduced to the concepts of Binding Energy to explain Unstable Nuclei and Radioactive Decays and how the Activity of

shown in a graphical way and how information can be analysed. Students learn about relative motion and the role of air resistance in falling objects.			to the electromagnetic spectrum and its uses **before investigating factors affecting infrared emission and absorption.** **Radioactivity** Students build upon their understanding of atoms to explore the structure of atoms and how this leads to the idea of radioactivity. Students are introduced to alpha, beta, and gamma radiation, their properties, uses and dangers. **They will learn how radioactivity can be used in medicine as well as the advantages and disadvantages of nuclear fission and fusion.**	force on a current carrying wire in a magnetic field. **Particle Model** Drawing on KS3 knowledge of changes of state and properties of matter, students will investigate density of solids and liquids. Students will then explore the ideas of specific heat capacity and specific latent heat.	Students learn about the Standard Model of Particles Physics, Particle Interactions and the work carried out with Particle Accelerators. Students are also introduced to Quantum Mechanics. They will learn about the Wave-Particle Duality of Light and Sub-atomic particles, the structure of Hydrogen Atoms and the history of these theories.	Radioisotopes is measured to estimate their Half-Life. The properties of Alpha, Beta and Gamma decays that students learn in KS4 are reviewed and, through a more thorough analysis of historical experiments, students will be able to appreciate why specific isotopes emit Alpha, Beta or Gamma radiation, based on nuclear size. Students will continue learning about Nuclear Reactors and how Nuclear Fission and Fusion are achieved to generate energy using Einstein's Energy-Mass Equation.
			Astronomy **Continuing from KS3, students further develop their understanding of the**	**Forces and Matter** Following on from topic 14 and drawing on knowledge of forces from year 10, students	**Waves** Building on their knowledge of Waves and Electromagnetic	**Optional Module: Astrophysics** Building on their knowledge from Year

			Solar System by exploring how theories and observations have changed over time. They will be introduced to life cycles of stars and explore theories on the origin of the universe and corresponding evidence, including redshift and CMBR.	will explore the links between temperature, pressure, and volume, **as well the relationship between pressure, density and depth.** Students will investigate elastic and inelastic distortion leading to an understanding of Hooke's law. Students will calculate work done in stretching and finish.	Waves from Year 10, students will review the basics of Waves, including Reflection and Refraction. Students will learn about Standing Waves and their applications, Phase Difference and Radians. Electromagnetic Waves will be reviewed, and a more mathematical approach will be used to investigate and appreciate the applications of Polarisers, Refraction, using Snell's Law and Diffraction through Single and Doubles slits and Diffraction Gratings. **Electricity** Following on from the study of Electricity and Circuits in Year 11, students will be exposed to more complex systems. With	10, students will learn about Telescopes, their Lens/Mirror arrangements and how they are able to magnify objects trillions of kilometres away. Students will learn how different telescopes are used to observe different parts of the electromagnetic spectrum and the benefits of space vs. ground-based observations. Students will also learn about star magnitudes and how we can use magnitude observations to measure distances and learn the evolution of stars and galaxies. Students will then apply their knowledge of electromagnetic waves for redshift calculations to investigate Hubble's Law and the Big Bang theory.

					their new advance knowledge of Work and Energy, students will be able to appreciate the concepts of Potential Difference, Current and Resistance, Resistivity and Electro-Motive Force. Students will learn how to analyse complex Series and Parallel circuits using Kirchhoff's Laws, including Potential Dividers, Wheatstone Bridges and Rectifiers and their applications in every-day devices.	**Engineering Physics** Engineering Physics is a combination of Mechanics and Further Mechanics to investigate Rotating Systems and advanced Thermodynamical Systems. Students start by learning the concepts of Inertia, Moment of Inertia and Angular Kinetic Energy and torque. Students will then explore the Laws of Thermodynamics and different types of Engine Cycles, building upon their knowledge of Kinetic Theory and the applications of Thermodynamics to devices such as refrigerators and heat pumps.
					Further Mechanics and Thermal Physics This unit deals with the application of Mechanics to Oscillating Systems and the Thermal Systems.	**Medical Physics** This module deals with the applications of Physics in the medical field.

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					Students will learn how the equations of motion are adapted to describe objects that oscillate or follow circular motion. Building on their knowledge from Year 10, students will investigate Centripetal Forces for different scenarios. Students will learn about the Simple Harmonic Motion of Mass-Spring Systems, Pendulums and the concepts of Resonant Frequency and Dampening and their applications. Building on their knowledge from Year 11, students will investigate the Gas Law for Ideal Gases and how they behave under compression and expansion. Using their new knowledge of Momentum and Energy, students will be able to mathematically describe the Kinetic Theory of Gases, learned in Year 11, and how Thermal Energy is	Students will learn about the Physics of the eye and ear as sensory organs building upon their KS3 knowledge. A more mathematical approach allows students to understand how, for example, lenses are used to help with vision issues. Building on their knowledge of Nuclear and Particle Physics, students will be introduced to medical imaging using Ionising Radiation, including X-Ray, CT and MRI scans. Using previous knowledge of Waves, including Reflection and Refraction, students will learn about the usage of non-ionising radiation techniques, such as Ultrasound Scans to investigate medical issues.

					transferred between systems.	