Sir William Ramsay School

EMPOWERING EVERYONE TO ACHIEVE

Curriculum Map for Science Physics Year 12

YEAR 12	Autumn 1	Autumn 2
Topics	**Foundations Of Physics** **Motion** **Charge & Current**	**Forces In Action** **Work, Energy & Power** **Energy, Power & Resistance** **Electrical Circuits**
Substantive Knowledge – The Knowledge and Content Taught By The Teacher	• In the Foundation of Physics students will learn about the units that scientists use to ensure that they are talking about the same things and counting them in the same way. Students will learn how scientists use estimates and measurements, including the study of errors, uncertainty, precision and accuracy. • In Motion, students will learn how to describe motion. They will build on previous knowledge and learn how to use both equations and graphs to describe and investigate motion. - In Charge and Current, students will learn to extend some of the ideas about electricity and circuits covered at GCSE. Students will revisit and build on their knowledge of charge and current, then they will learn about Kirchhoff's laws and how they can be used to calculate quantities in circuits. Finally, they will examine more deeply how charges move in materials.	• In Forces in Action, students will revisit the formula F = ma and the difference between mass and weight. They will also learn more about drag forces and how these affect the terminal velocity of a falling object, such as a skydiver. They will further develop their understanding of moments, before learning about pairs of forces that cause rotation - such as the forces applied to the pedals of a bicycle. Finally, they will build on what they learned at GCSE about pressure and density and will learn why some objects float, while others sink. • In Work, Energy and Power, students will revisit the principle of conservation of energy, the different forms of energy, and the efficiency of energy transfers, with a particular emphasis on the exchange between kinetic energy and gravitational potential energy. • In Energy, Power and Resistance students will learn how electricians can produce internationally recognised circuit diagrams, think about how electrical energy is transferred, learn more about resistance and think about how well different materials conduct electricity. • In Electrical Circuits students will consider more complex circuits that are used in real life. They will learn about Kirchhoff's second law and apply both of Kirchhoff's laws to solve circuit problems. They will explore how resistors behave in series circuits, parallel circuits and in sensing circuits.
Disciplinary Knowledge – The Knowledge Scientists	• The important ideas and conventions that permeate the fabrics of physics. • The well-defined and universally understood methods used by Physicists that measure physical phenomena and	• The Theory of Forces, origins and how motion changes when experiencing a resultant force. • The principles and development of conservation and momentum.

Need So They Can Collect, Understand and Evaluate Scientific Evidence	the methods that help Physicists across the globe effectively communicate their ideas with the scientific community. • Key ideas to describe and analyse motion in both 1 and 2 dimensions. • Quantum Physics Theory.	• Electromotive force and its development with different everyday jobs such as medicine and archaeology. • Exploring use and development of electrical circuits.
Skills	• The motion of a variety of objects can be analysed using ICT or data-logging techniques. • Students will have the opportunity to analyse and interpret experimental data by recognising relationships between physical quantities. • The analysis of motion links to detecting the speed of moving vehicles, stopping distances and freefall. • Students have the opportunity to appreciate how scientific ideas of quantum physics developed over time and their validity rested on the foundations of experimental work. • Students will evaluate the role of the scientific community in validating new knowledge and ensuring integrity. • Students will evaluate the ways in which society uses science to inform decision making.	• Use of theories, models and ideas to develop scientific explanations. • Use of knowledge and understanding to pose scientific questions, define scientific problems, present scientific arguments and scientific ideas.
Links To Prior Learning	• GCSE Physics - vectors/scalars and resolving vector calculations, forces and motion and electricity and charge.	• GCSE - forces and motion, energy, electricity and electrical circuits.
Literacy/ Numeracy	• Literacy - use of key word terminology in Physics. • Numeracy - substitution into linear and quadratic formulae, solving linear and quadratic equations and rearranging formulae.	• Literacy - use of describing words in Physics. • Numeracy - plotting experimental data onto a graph, the equation of a straight line and calculating rates of change from graphs.
Cross Curricular	• Electricity - Geography - Saving The Planet/Global Warming • Design & Technology - Circuits and Labelling • PSHE - Link with Reaction Times and Dangers of Drink Driving • Learner Driver Training - Speeding	• Electricity - Geography - Saving the Planet/Global Warming • Design & Technology - Circuits and Labelling • PSHE - Link with Reaction Times and Dangers of Drink Driving • Learner Driver Training - Speeding
Assessment	• Motion Assessment • Charge and Current Assessment	• Forces in Action Assessment • Work, Energy and Power Assessment • Energy, Power and Resistance Assessment • Electrical Circuits Assessment

YEAR 12	Spring 1	Spring 2
Topics	**Materials** **Laws of Motion & Momentum** **Waves 1**	**Waves 2** **Quantum Physics**
Substantive Knowledge – The Knowledge and Content Taught By The Teacher	• In Materials students will build on what they already know about Hooke's Law and elastic potential energy. They will learn how forces affect different materials and see how these effects can be measured. • In Laws of Motion and Momentum students will build on their previous knowledge of motion and forces. They will explore these further and learn to solve more complex problems. They will learn about the implications of Newton's Laws for collisions and car safety. • In Waves 1, students will revisit wave types, wave properties, wave behaviour including reflection, refraction, total internal reflection and diffraction. They will learn more about how waves can be represented graphically and cover new ideas such as the polarisation of waves and why light is dimmer as you get further away from a light source. They will revisit the types and properties of electromagnetic waves.	• In Waves 2 students will learn what happens when there are two or more sources of waves - they will examine the combined effect of the waves. They will also learn how two progressive waves can combine to form a stationary wave. • In Quantum Physics, students will learn about quantisation, along with a more amazing aspect of quantum physics - the idea that the behaviour of both light and electrons can be explained by sometimes treating them as a wave and sometimes treating them as particles.
Disciplinary Knowledge – The Knowledge Scientists Need So They Can Collect, Understand and Evaluate Scientific Evidence	• Theory of materials and linking into engineering. • The laws of motion and momentum, their development and uses. • Waves and their properties and the development of theories.	• The development of the uses of waves. • The photon model and development linking to Quantum Physics theory.
Skills	• Students will carry out a range of experimental work to enhance their knowledge and skills, including the management of risks and analysis of data to provide evidence for relationships between physical quantities. There are opportunities to consider the selection of appropriate materials for practical applications. • Students will look at how to predict the motion of all colliding or interacting objects in applications such as sport. They will also study how Newton's Law can be used to understand some of the safety features in cars, such as air bags,	• Students will be expected to know about polarising filters for light and metal grilles for microwaves in demonstrating polarisation. • Internet research on the ideas of Newton and Huygens about the nature of light. • Student will study the photoelectric effect, de Broglie waves and wave–particle duality. In the photoelectric effect experiment, electromagnetic waves are used to eject surface electrons from metals. The electrons are ejected instantaneously and their energy is independent of the intensity of the radiation.

	and to evaluate the benefits and risks of such features. • There are opportunities to discuss how the double-slit experiment demonstrated the wave-like behaviour of light.	
Links To Prior Learning	• GCSE Physics - Forces and Elasticity, Newton's Laws of Motion and Waves	• GCSE Physics - Waves and the Particle Model
Literacy/ Numeracy	• Literacy - developing 'explain' questions in Physics. • Numeracy - standard form, ratios, fraction, decimals, percentages, substitution into formulae and motion graphs.	• Literacy - write up of practical investigations focussing on hypothesis and method writing structures. • Numeracy - estimation, exponential and logarithmic functions, resultant vectors, trigonometric functions using both degree and radian angles.
Cross Curricular	• Waves - photography and light, music pitch and frequency, drama projection of voice.	• Waves - photography and light, music pitch and frequency, drama projection of voice. • Atomic Structure - history of the Cuban missile crisis, the first nuclear bombs, Geography and Chernobyl/Hiroshima. • PSHE - the ethics surrounding nuclear power.
Assessment	• Materials Assessment • Laws of Motion and Momentum Assessment • Waves 1 Assessment	• Waves 2 Assessment • Quantum Physics Assessment

YEAR 12	**Summer 1**	**Summer 2**
Topics	**Stars** **Particle Physics**	**Cosmology** **Medical Imaging**
Substantive Knowledge – The Knowledge and Content Taught By The Teacher	• In Stars, students will learn about the following phenomena and their objectives: Objects in the Universe The Life Cycle of Stars The Hertzsprung–Russell Diagram Energy Levels in Atoms Spectra Analysing Starlight Stellar Luminosity • In Particle Physics, students will learn about how many fundamental particles there are and they make up everything in space.	• In Cosmology (the Big Bang), students learn what a light year really is and how old the universe is using evidence obtained over hundreds of years. In Medical Imaging, students will learn why medical imaging is better than looking directly at a problem by cutting open a patient. They will learn about many techniques such as X rays, CAT and PET scans, ultrasound and Doppler imaging.
Disciplinary Knowledge – The Knowledge Scientists Need So	• Developing ideas on the analysis of electromagnetic spectrum from space. • Ideas of the nature of the atom and the nucleus. Discovery of the nucleus	• Expansion of the universe theory, dark matter and dark energy. • Techniques and development of invasive and non-invasive methods of medical imaging.

They Can Collect, Understand and Evaluate Scientific Evidence		
Skills	• The breadth of the topic covering sound waves and the electromagnetic spectrum provides scope for students to appreciate the wide-ranging applications of waves and their properties. • In Particle Physics, students develop an understanding of the atom, nucleus, fundamental particles, radioactivity, fission and fusion. They will consider the pros and cons of nuclear power stations. The development of the atomic model also addresses issues of scientific development and validation.	• Students have the opportunity to appreciate how scientific ideas of the Big Bang developed over time and how its validity is supported by research and experimental work carried out by the scientific community. • Not all hospitals in this country are equipped with complex scanners. Students have the chance to discuss the ethical issues in the treatment of humans and the ways in which society uses science to inform decision making.
Links To Prior Learning	• GCSE Physics - Space and the Atomic Model	• GCSE Physics - Space and Radioactivity
Literacy/ Numeracy	• Literacy - articulating practical write ups in a coherent way using the scientific method. • Numeracy - significant figures and degrees of accuracy, arithmetic mean and probability.	• Literacy - developing long answer question structures with correct terminology. • Numeracy - orders of magnitude and indices.
Cross Curricular	• Atomic Structure - history of the Cuban Missile Crisis, the first nuclear bombs, Geography and Chernobyl/Hiroshima. • PSHE - the ethics of nuclear power. • Space - Philosophy & Ethics and Big Bang Theory, nebulas in Art.	• Atomic Structure - history Cuban Missile Crisis/first nuclear bombs, Geography and Chernobyl/Hiroshima, PHSE - ethics amongst nuclear power. • Space - Philosophy & Ethics and Big Bang Theory, nebulas in Art.
Assessment	• Stars Assessment • Particle Physics Assessment	• Cosmology Assessment • Medical Imaging Assessment