Curriculum Mapping: Physics Year 12-13

St Martin's School
Be the best you can be

Year	Autumn 1	Autumn 2	Spring 1	Spring 2	Summer 1	Summer 2
Year 12	Module 2: Foundations of physics	Module 3: Forces and moton			Module 4: Electrons, waves and photons	
	Concepts/Tier 3 vocabulary **Physical quantities and units** This section provides knowledge and understanding of physical quantities and units. **Making measurements and analysing data** This section provides knowledge and understanding of physical measurements and treatment of errors and uncertainties. **Nature of quantities** This section provides knowledge and understanding of scalars and vectors quantities. Vector quantities add and subtract very differently to scalar quantities; hence it is important to know whether a quantity is a vector or a scalar.	*Concepts/Tier 3 vocabulary* **Motion** This section provides knowledge and understanding of key ideas used to describe and analyse the motion of objects in both one-dimension and in two-dimensions. It also provides learners with opportunities to develop their analytical and experimental skills. The motion of a variety of objects can be analysed using ICT or data-logging techniques. Learners also have the opportunity to analyse and interpret experimental data by recognising relationships between physical quantities. The analysis of motion gives many opportunities to link to How Science Works. Examples relate to	*Concepts/Tier 3 vocabulary* **Forces in action** This section provides knowledge and understanding of the motion of an object when it experiences several forces and also the equilibrium of an object. Learners will also learn how pressure differences give rise to an upthrust on an object in a fluid. There are opportunities to consider contemporary applications of terminal velocity, moments, couples, pressure, and Archimedes principle **Work, energy and power** Words like energy, power and work have very precise meaning in physics. In this section the important link between work done and energy is explored.	*Concepts/Tier 3 vocabulary* **Materials** This section examines the physical properties of springs and materials. Learners can 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 **Newton's laws of motion and momentum** This section provides knowledge and understanding of Newton's laws – fundamental laws that can be used to predict the motion of all colliding or interacting	*Concepts/Tier 3 vocabulary* **Charge and current** This short section introduces the ideas of charge and current. Understanding electric current is essential when dealing with electrical circuits. This section does not lend itself to practical work but to introducing important ideas. The continuity equation (I = Anev) is developed using these key ideas. This section concludes with categorising all materials in terms of their ability to conduct. **Energy, power and resistance** This section provides knowledge and understanding of electrical symbols, electromotive force, potential difference, resistivity and power.	*Concepts/Tier 3 vocabulary* **Electrical circuits** This section provides knowledge and understanding of electrical circuits, internal resistance and potential dividers. LDRs and thermistors are used to show how changes in light intensity and temperature respectively can be monitored using potential dividers. Setng up electrical circuits, including potential divider circuits, provides an ideal way of enhancing experimental skills, understanding electrical concepts and managing risks when using power supplies. Learners are encouraged to communicate scientific ideas using appropriate terminology. This

		detecting the speed of moving vehicles, stopping distances and freefall	Learners have the opportunity to apply the important principle of conservation of energy to a range of situations. The analysis of energy transfers provides the opportunity for calculations of efficiency and the subsequent evaluation of issues relating to the individual and society	objects in applications such as sport. Newton's law can also be used to understand some of the safety features in cars, such as air bags, and to evaluate the benefits and risks of such features. Learners should be aware that the introduction of mandatory safety features in cars is a consequence of the scientific community analysing the forces involved in collisions and investigating potential solutions to reduce the likelihood of personal injury	The scientific vocabulary developed here is a prerequisite for understanding electrical circuits. There is a desire to use energy saving devices, such as LED lamps, in homes. Learners have the opportunity to understand the link between environmental damage from power stations and the impetus to use energy saving devices in the home and how customers can make informed decisions when buying domestic appliances	section provides ample opportunities for learners to design circuits and carry out appropriate testing for faults and there are opportunities to study the many applications of electrical circuits **Waves** This section provides knowledge and understanding of wave properties, electromagnetic waves, superposition and stationary waves. The wavelength of visible light is too small to be measured directly using a ruler. However, superposition experiments can be done in the laboratory to determine wavelength of visible light using a laser and a double slit. There are opportunities to discuss how the double-slit experiment demonstrated the wave-like behaviour of light **Quantum physics** This section provides knowledge and

						understanding of photons, 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. The wave model is unable to explain the interaction of these waves with mater. This single experiment led to the development of the photon model and was the cornerstone of quantum physics. Learners have the opportunity to carry out internet research into how the ideas of quantum physics developed and how scientific community validates the integrity of new knowledge before its acceptance

	Justification: The aim of this module is to introduce important conventions and ideas that permeate the fabric of physics. Understanding of physical quantities, S.I. units, scalars and vectors helps physicists to effectively communicate their ideas within the scientific community	***Justification:*** The term force is generally used to indicate a push or a pull. It is difficult to give a proper definition for a force, but in physics we can easily describe what a force can do. A resultant force acting on an object can accelerate the object in a specific direction. The subsequent motion of the object can be analysed using equations of motion. Several forces acting on an object can prevent the object from either moving or rotating. Forces can also change the shape of an object. There are many other things that forces can do. In this module, learners will learn how to model the motion of objects using mathematics, understand the effect forces have on objects, learn about the important connection between force and	***Justification:***	***Justification:***	***Justification:*** The aim of this module is to ultimately introduce key ideas of quantum physics. Electromagnetic waves (e.g. light) have a dual nature. They exhibit both wave and particle-like behaviour. The wave–particle dual nature is also found to be characteristic of all particles (e.g. electrons). Before any sophisticated work can be done on quantum physics, learners need to appreciate what electrons are and how they behave in electrical circuits. A basic understanding of wave properties is also required. In this module, learners will learn about electrons, electric current, electrical circuits, wave properties, electromagnetic waves and, of course, quantum physics.	***Justification***

		energy, appreciate how forces cause deformation and understand the importance of Newton's laws of motion.				
	Assessment: *End of unit assessments* *PAGS*	***Assessment:*** *End of unit assessments* *PAGS*	***Assessment:*** *End of unit assessments* *PAGS*	***Assessment:*** *End of unit assessments* *PAGS*	***Assessment:*** *End of unit assessments* *PAGS*	***Assessment:*** *End of unit assessments* *PAGS*
	Wider reading/Cultural capital The A Level Physics course will prepare learners for progression to undergraduate study, enabling them to enter a range of academic and vocational careers in mathematics-related courses, physical sciences, engineering, medicine, computing and related sectors.					
	Autumn 1	**Autumn 2**	**Spring 1**	**Spring 2**	**Summer 1**	**Summer 2**
Year 13	Module 5: Newtonian world and astrophysics		Module 6: Particles and medical physics			**Course complete**
	Concepts/Tier 3 vocabulary	***Concepts/Tier 3 vocabulary***	***Concepts/Tier 3 vocabulary***	***Concepts/Tier 3 vocabulary***	***Concepts/Tier 3 vocabulary***	*N/A*

	Thermal physics This section provides knowledge and understanding of temperature, mater, specific heat capacity and specific latent heat with contexts involving heat transfer and change of phase. Experimental work can be carried out to safely investigate specific heat capacity of materials. It also provides an opportunity to discuss how Newton's laws can be used to model the behaviour of gases and significant opportunities for the analysis and interpretation of data **Circular motion** There are many examples of objects travelling at constant speed in circles, e.g. planets, artificial satellites, charged particles in a magnetic field, etc. The physics in all these cases can be described and analysed using the ideas developed by Newton. This section provides	**Gravitational fields** This section provides knowledge and understanding of Newton's law of gravitation, planetary motion and gravitational potential and energy. Newton's law of gravitation can be used to predict the motion of orbiting satellites, planets and even why some objects in our Solar system have very little atmosphere with the opportunity to analyse evidence and look at causal relationships. Geostationary satellites have done much to improve telecommunications around the world. They are expensive; governments and industry have to make difficult decisions when building new ones. Learners have the opportunity to discuss the societal benefits of satellites and the risks they pose when accidents do occur	**Capacitors** This section introduces the basic properties of capacitors and how they are used in electrical circuits. The use of capacitors as a source of electrical energy is then developed. This section introduces the mathematics of exponential decay, which is also required for the decay of radioactive nuclei. Experimental work provides an excellent way to understand the behaviour of capacitors in electrical circuits and the management of safety and risks when using power supplies. The varied uses of capacitors give the opportunity for the consideration of their use in many practical applications **Electric fields** This section provides knowledge and understanding of Coulomb's law, uniform electric fields, electric potential and energy	**Electromagnetism** This section provides knowledge and understanding of magnetic fields, motion of charged particles in magnetic fields, Lenz's law and Faraday's law. The application of Faraday's law may be used to demonstrate how science has benefited society with important devices such as generators and transformers. Transformers are used in the transmission of electrical energy using the national grid and are an integral part of many electrical devices in our homes. The application of Lenz's law allows discussion of the use of scientific knowledge to present a scientific argument **Nuclear and particle physics** This section provides knowledge and understanding of the atom, nucleus, fundamental particles, radioactivity, fission and	**Medical imaging** This section provides knowledge and understanding of X-rays, CAT scans, PET scans and ultrasound scans. This section shows how the developments in medical imaging have led to a number of valuable non-invasive techniques used in hospitals. Not all hospitals in this country are equipped with complex scanners. Learners 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	

	knowledge and understanding of circular motion and important concepts such as centripetal force and acceleration	**Astrophysics and cosmology** This section provides knowledge and understanding of stars, Wien's displacement law, Stefan's law, Hubble's law and the Big Bang. Learners 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		fusion. Nuclear power stations provide a significant fraction of the energy needs of many countries. They are expensive; governments have to make difficult decisions when building new ones. The building of nuclear power stations can be used to evaluate the benefits and risks to society. Ethical, environmental and decision making issues may also be discussed. The development of the atomic model also addresses issues of scientific development and validation		
	Justification: The aim of this module is to show the impact Newtonian mechanics has on physics. The microscopic motion of atoms can be modelled using Newton's laws and hence provide us with an understanding of macroscopic quantities such as pressure and temperature. Newton's	***Justification***	***Justification:*** In this module, learners will learn about capacitors, electric field, electromagnetic, nuclear physics, particle physics and medical imaging.	***Justification:***	***Justification:***	N/A

	law of gravitation can be used to predict the motion of planets and distant galaxies. In the final section we explore the intricacies of stars and the expansion of the Universe by analysing the electromagnetic radiation from space. As such, it lends itself to the consideration of how the development of the scientific model is improved based on the advances in the means of observation. In this module, learners will learn about thermal physics, circular motion, oscillations, gravitational field, astrophysics and cosmology.					
	Assessment: *End of unit assessments* *PAGS*	***Assessment:*** *End of unit assessments* *PAGS*	***Assessment:*** *End of unit assessments* *PAGS*	***Assessment:*** *End of unit assessments* *PAGS*	***Assessment:*** *End of unit assessments* *PAGS*	*N/A*
	Wider reading/Cultural capital The A Level Physics course will prepare learners for progression to undergraduate study, enabling them to enter a range of academic and vocational careers in mathematics-related courses, physical sciences, engineering, medicine, computing and related sectors.					