Physics
Year 12 Curriculum Map

Term 1	Term 2	Term 3
Topics taught: **Development of practical skills:** Physics is a practical subject. The development and acquisition of practical skills is fundamental. The Physics A course provides learners with the opportunity to develop experimental methods and techniques for analysing empirical data. Skills in planning, implementing, analysing and evaluating, as will be assessed in the written papers. **Foundations of Physics:** 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 help physicists to effectively communicate their ideas within the scientific Community. **Motion:** 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 energy, appreciate how forces cause deformation and understand the importance of Newton's laws of motion.	**Topics taught:** **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. Learners could 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. **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. Experimental work must play a pivotal role in the acquisition of key concepts and skills. **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 (HSW7). The breadth of the topic covering sound waves and the electromagnetic spectrum provides scope for learners to appreciate the wide-ranging applications of waves and their properties.	**Topics taught:** **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 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. There are many opportunities for learners to carry out experimental work and analyse data using ICT Techniques. **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 them 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.

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Topics taught: **Electricity:** 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 a 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. Learners can appreciate how scientific ideas of quantum physics developed over time (HSW7) and their validity rested on the foundations of experimental work.		**Topics taught:** **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.

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Topics taught: **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 and oscillations:** 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. The concepts in this section have applications in many contexts present in other sections of this specification, such as planetary motion. This section provides knowledge and understanding of circular motion and important concepts such as centripetal force and acceleration. **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 must make difficult decisions when building new ones. Learners could discuss the societal benefits of satellites and the risks, they pose when accidents do occur. 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 could 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.	**Topics taught:** 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. This section provides knowledge and understanding of capacitors and exponential decay. 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 (HSW4). There are many opportunities for learners to use spreadsheets in the analysis and presentation of data. 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.	**Topics taught:** Nuclear and particle physics: This section provides knowledge and understanding of the atom, nucleus, fundamental particles, radioactivity, fission and fusion. Nuclear power stations provide a significant fraction of the energy needs of many countries. They are expensive; governments must 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. 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 has led to several 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.