The Island VI Form

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Post-16 Curriculum - Physics

Subject Curriculum Overview

Subject	Physics
Qualification / Specification	AQA A level Physics 7408
Awarding Body	AQA
Level	3
Curriculum Lead	Paul Clarkson
Teaching Staff	Peter Palmer
Guided Learning Hours	360 hours (broken into 5 hours per week)
Year(s) Delivered	12 & 13
Last Review Date	June 2026
Next Review Date	June 2027

1. Curriculum Intent

Physics involves thinking about a range of ideas and scales from the origin of the universe and how it is held together down to the constituents of the nucleus of an atom. Developing ways of thinking is a major part of being able to deal with this huge range of systems including some that are very abstract. These ways of thinking are all based around defining the simplest version of a complex system, reasoning quantitatively and critiquing models. It is not just about being able to manipulate mathematical formulas as if you lose sight of the physical meaning behind the quantities within the formulas or models you would be prone to making mistakes or unable to infer the correct result. You don't just need to be fluent at mathematics but understand what is behind the maths in the real world. You will also learn to become comfortable with the limitations to the various models that have been developed by Physics and accept that limitations don't make a model wrong or useless but rather the system must be modelled differently for those situations. We cannot fully explain everything in the universe, yet, but every model gets us closer. You will pick up skills in mathematical modelling, critical thinking, the scientific method and a good grounding in the current models and Physics theories.

A successful Physics student will have all the tools needed to allow them to study any area of Physics that interests them beyond A level even if they are not continuing with the subject to a higher level of study. They will also be confident in simplifying a system to allow a model to be constructed that will enable problem solving of even a very complex system. These sort of thinking and problem solving skills are exactly what a whole range of employers are seeking and will prepare you for further study or training in a whole range of subjects. These include Physics or other Science degrees or research as well as engineering (of all types) and work in the various fields of medical imaging (could involve operating MRI or X-ray machines or PET scan machines to interpreting or improving the images produced) and even finance (eg modelling stock markets to make predictions for investments).

2. Foundational Knowledge

Area	Essential Knowledge / Skills	Why It Matters
Classical Mechanics	Know which Physics quantities are scalars or vectors. Be able to combine vectors by either scale drawing or mathematical techniques. Be able to separate a vector into two perpendicular components. Be able to apply these techniques to solve a variety of problems. Be able to describe Newton's three laws of motion and use them to solve motion and statics problems. Be able to calculate momentum, apply the law of conservation of momentum and relate rate of change of momentum to Newton's laws. Be able to use the equations of uniform motion to solve both linear and parabolic motion problems. Be able to apply the circular motion formula to solve a range of problems. Be able to use the model for simple harmonic motion.	Builds upon the simple GCSE beginnings to give you a tool kit of mathematical models that can be used to solve forces and motions problems for a range of different systems and start to understand the limitations of these classical models as well as appreciating their elegance and enormous range of uses.
Energy	A model for quantifying the amount of energy through various stores and pathways to ensure that energy is always conserved.	Building again from GCSE there are formulae for quantifying the amount of energy within any store or pathway and as you know energy is conserved this can allow you to make predictions for a system based on these quantities.
Waves	Using the GCSE wave definitions combined with the ideas of polarisation, phase, coherence, superposition and interference to examine stationary waves, progressive waves, two source interference, diffraction, refraction and total internal reflection.	Build a set of mathematical models that enable you to account for common phenomena experienced by all types of waves along with their uses.
Materials	Build upon the Hooke's law model for describing materials to examine material behaviour in terms of stress and strain.	Hooke's law defines the behavior of materials with specific lengths and cross-sectional areas whereas stress-strain graphs and the Young modulus constant describe the behaviour dependent only on the type of material not it's dimensions. Understanding the behaviour of different materials under stress is immensely important for all aspects of engineering.
Atomic structure, radiation & Nuclear Physics	The history of the model for the structure of an atom is revisited and undated to include the full detail of the constituents of nucleons. A basic form of the standard model for particle physics is studied along with Feynman diagrams for representing particle	The evolution of the atomic model in science is a perfect example of how different models can work up to a point and often need modifying to take really fine detail into account without taking away from the validity of the lower resolution model for lower resolution explanations.

	interactions. Alpha, beta minus and gamma decay are all reviewed and updated with several other forms of decay from unstable nuclei alongside what makes them unstable. Mass defect and binding energy is studied and used to further explain the stability of nuclei and why nuclear fission and fusion occur.	
Quantum Mechanics	The development of the ideas of quantum mechanics is studied along with a few of it's surprising predictions and outcomes via the photoelectric effect, excitation leading to absorption spectra, deexcitation leading to emission spectra and DeBroglie wavelengths.	This is the ultimate adaptation of our model to account for matter and radiation and is responsible for most of our biggest leaps in understanding and technology over the last century. A highly controversial theory originally, it made the most absurd predictions all of which have so far been proven correct. If you want to know more, Richard Feynman's books and lectures are a good place to start.
Electricity	Develop confidence in building electrical circuits from circuit diagrams as well as drawing diagrams of the circuit that you have built. Using Ohm's law from GCSE along with Kirchhoff's laws of conservation of charge and energy to account for the distribution of current and potential difference around a variety of circuits containing different resistors (components) including potential divider circuits with and without internal resistance in the cell.	With these skills you can design circuits as well as confidently investigate current and potential difference distribution around circuits and predict the behaviour of different types of resistor.
Thermal Physics	Building upon the ideas of specific heat capacity and specific latent heat from GCSE to account for the behaviour of different substances when their temperature is changed or they undergo a state change, we look at combining substances of different temperatures to make predictions about the final temperature of how much of a substance will undergo a change of state. The gas laws from GCSE are developed into the mathematical model for ideal gases and the kinetic theory model for gases.	An understanding of thermal properties of materials, the properties and nature of ideal gases, and the molecular kinetic theory is key for understanding climate and weather models, material science, energy supply and refrigeration.
Fields	The behaviour of gravitational, electric and magnetic fields are studied along with some applications	This has wide reaching conclusions that lead to explaining how circuits work, how electricity is generated and all the way to cosmology and the patterns of stars in galaxies or galaxies in the universe.
Practical techniques, measurement & error	Be able to confidently use a range of physics practical equipment and be competent in a range of practical techniques including common procedures and standard expectations for data collection and recording as well as error analysis across a range of scientific and engineering fields.	To go further in Physics or engineering this covers the basic equipment that you would be expected to be confident in using.

3. Powerful Knowledge

Powerful Knowledge Area	Why It Matters	Evidence of Understanding
Forces and motion built around the modelling of vector systems, equations of uniform motion, conservation of momentum, circular motion, simple harmonic motion and resonance.	Builds upon the simple beginnings of each at GCSE level to give a series of models and techniques that could be applied to analyse and draw conclusions about forces or motion within any mechanical system.	Predictions and calculations can be made for any system whether it is static, in linear motion, in parabolic motion, in circular motion or in harmonic motion or even a driven harmonic system.
Mathematical models for exponential changes are studied in terms of the decay of radioisotopes and discharge of capacitors as well as the charging of capacitors.	Seeing how the same mathematical model (albeit with minor tweeks) can be applied to explain completely different phenomena is another of the most powerful tools in Physics enabling a complex system to be made simpler by adapting a previously defined model to explain it.	Given data that shows an exponential change you would be able to infer conclusions and make predictions even for an unfamiliar situation such as those found as part of paper 3 section A.
Inverse square laws are mathematical models where a quantity decreases by the inverse of it's distance from the source squared. This is first seen with respect to how the intensity of radiation varies with how far away you are from the source and is also the basis to the models accounting for the gravitational force experience between two masses and the electrical force experience between two charges.	Another of the very powerful all encompassing mathematical models in Physics that can be applied to waves, quantum Physics, nuclear physics as well as forming the basis of the models that describe gravitational and electric fields	Given data that shows an inverse square relationship you would be able to infer conclusions and make predictions even for an unfamiliar situation such as those found as part of paper 3 section A.
Electromagnetic induction including motor effect, Fleming's left and right hand rules as well as Farraday's law and Lenses law.	A set of laws that encompasses ideas from the inverse square law related to fields along with some knowledge of electric circuits and even circular and simple harmonic motion and ultimately enable you to explain everything from electric motors and electricity generation to particle accelerators and mass spectrometry.	You will be able to solve a wide range of problems involving magnetic fields and their applications.
Astrophysics	This demonstrates that you can not only use the various skills and models from the rest of the course but with only minimal extra knowledge you can apply it in a very different context.	Able to describe a range of telescopes and what applications they are best suited to as well as the classification systems for stars key steps in the life cycle of stars and the key ideas from cosmology. Able to answer questions on these topics as found in paper 3 section B.

Analysing data to draw conclusions	Whether you are a research scientist, an engineer testing a design or a stock market trader, your ability to analyse data and draw conclusions matters.	Able to mathematically analyse data (choosing the best techniques to apply) and draw conclusions from that analysis. Able to answer the types of questions found in paper 3 section A.
Evaluating data and techniques	Whatever field you are working in again when presented with analysed data and conclusions, you need to be able to evaluate not just the data and conclusions but how the data was collected to decide if the conclusions are worth acting upon.	Able to consider resolution, accuracy and precision of data as well as techniques used to obtain the data in order to decide the strength of any conclusions drawn or make suggestions for improvement. Able to answer the types of questions found in paper 3 section A.
STEM Club	Being able to apply your knowledge and skills to unfamiliar areas is a major skill that particularly assists with the questioning in parts of paper 3 section A. STEM activities help to develop and secure this.	You have a better understanding of some of the Physics that you have studied as a result of looking beyond the specification at some areas and applications. You are a more rounded Scientist being able to see where parts of Biology and Chemistry also fit into Physics and appreciate that they are not completely independent of each other.

4. Curriculum Implementation

Term / Unit	Key Content	Foundational Knowledge	Powerful Knowledge	Assessment Opportunities
Yr 12 - Autumn Term Topic 1: Mechanics (Force energy and momentum)	Scalars & vectors & equilibrium, Moments, Motion in a straight line, Projectile motion, Newton's laws of motion, Momentum, Work, energy power & energy conservation.	Fundamental (base) units, SI units, prefixes, unit conversions & standard form. Difference between scalars and vectors, resolving vectors by scale diagram as well as using pythagoras theorem, trigonometry, sine rule and cosine rule. Splitting vectors into their perpendicular components. Definition of moments and the principle of moments. The idea of forces in equilibrium when the vectors complete an enclosed triangle and there is no resultant force or change in motion. Definitions of velocity and acceleration, interpretation of motion graphs. Use the equations of uniform acceleration. Newton's 3 laws of motion, definition of momentum, conservation of momentum and impulse. Interpretation of force-time graphs including the significance of the area under the graph.	Resolution and uncertainty applied to making measurements of quantities such as displacement. Free body diagrams to describe forces. Calculating the area under a graph including a curve. Vectors and equilibrium applied to resolving systems of forces and moments. Motion equations can be split between perpendicular components to interpret and solve problems involving parabolic motion. How the motion would change if resistance to motion was taken into account. RP3 measuring g by freefall. Use of data logging and timing equipment (light gates, ticker timers, etc). Data analysis and graphing. Recognising that Newton's laws of motion can be reinterpreted in terms of momentum and change in momentum which makes them easier to explain as well as opening other ways to solve problems.	Physics induction tasks. Weekly 3,2,1 summary homeworks. Vector and free body diagram Problems Equilibrium problems Moments problems Equations of uniform motion problems applied linearly. Parabolic motion problems.

		Elastic and inelastic collisions, work, energy, power and the principle of conservation of energy.	Momentum, impulse, energy and power applied to a range of problems ranging from road safety to power generation.	Required Practical 3: Determination of g by a freefall method
				Newton's laws of motion problems.
		The development of the simple model for the atom and standard nuclide notation, definition of isotopes and the definition of specific charge. Know the behaviour of the strong nuclear force and explain how it keeps the nucleus stable. Construct nuclear equations for and describe the properties of alpha, beta plus, beta minus and gamma radiation. Know of the existence of antimatter, especially positrons and anti-neutrinos. Know and be able to use the photon model for electromagnetic radiation (E=hf). Explain pair production and annihilation in terms of conservation of energy. Know the fundamental interactions and their exchange particles as well as being able to interpret and represent particle interactions using Feynmann diagrams. Definitions of Hadrons, baryons, mesons and leptons as well as quoting charge, baryon, lepton and strange quantum numbers for key particles and anti-particles. Can quote quark/anti-quark combinations for key hadrons. Describing the weak force as involved with quarks changing flavour, can describe strangeness and the association of k meson production with the strong force.	Can explain what makes a nucleus unstable leading to alpha, beta or gamma emission. Appreciate that matter is just a small part of the concept of energy (rest energy). PET scanner as an application of annihilation.	Momentum and impulse problems Energy, work and power problems End of topic assessment for mechanics. Structure of the atom and specific charge problems.

Topic 2: Particle Physics	The atom, SNF & stable & unstable nuclei, particles, antiparticles & photons, Particle interactions, particle classification, Quarks & antiquarks, Conservation laws.		A new interpretation of forces as being interactions where energy, momentum and sometimes charge is exchanged between particles. Can use conservation rules for quantum numbers analysis to determine whether an interaction is possible or what particles may be produced within an interaction.	Strong nuclear force and unstable isotopes problems Pair production and annihilation problems. Feynman diagram and particle interaction problems.

				Can quote correct combinations for mesons. Conservation of charge, baryon, lepton and strangeness number problems.
Yr 12 - Spring Term Topic 3: Quantum Physics	Photoelectric effect, electrons colliding with atoms, excitation & deexcitation, energy levels & photon emission, wave-particle duality.	Explain the photo-electric effect in terms of energy being absorbed from photons in order to release delocalised electrons from a metal. Define threshold frequency, work function, stopping potential and maximum kinetic energy for photoelectric effect. Define the electron volt and be able to convert between eV and J. Explain how electrons can absorb energy from either collision or an appropriate frequency photon. Explain the terms ionisation, excitation and deexcitation in terms of what is happening with orbital electrons. Interpret electron energy level diagrams and explain the negative energy values. Explain the significance of DeBroglie wavelengths and be able to calculate them	Compare the predictions expected if light was behaving as a wave to what is observed and explain how photoelectric effect provides evidence for the particle behaviour of light. Explain the significance of threshold frequency and electrons being released with a range of kinetic energies. Apply excitation and deexcitation to explain fluorescence. Calculate appropriate frequencies needed to cause specific excitations or released from specific deexcitations. Explain the significance of waves behaving like particles in some circumstances and matter behaving like waves in some circumstances. Appreciate the dilemma of wave-particle duality and the fact that it does not nullify the Physics but is just a good example of our understanding of nature changing over time and this being how the scientific method works via constant evaluation and peer review. Use and change the subject of formulas as well as combining them to solve problems. Graphing & interpretation of graphs to explain observed behaviour of resistors. Appreciate the use for resistivity which allows you to compare the resistance of	Electron photocell computer model practical. Photoelectric effect problems Excitation and deexcitation problems DeBroglie Wavelength Problems.

Topic 4: Electricity	Definitions of I V & R, I-V characteristics, Resistivity, Series & parallel circuits & resistors, potential divider, Emf & internal resistance.	Recap definitions of current charge, potential difference and resistance. Review Ohm's law and investigate the IV characteristics for various components. Know the definition of resistivity and be able to use the formula. Can describe the effect of temperature on the resistance of metal conductors compared to thermistors. Describe superconductivity, it's uses and limitations. Know and use the formulas for combining resistors in series and parallel. Apply these ideas to be able to work out the total resistance for different combinations of resistors. Know and be able to use Kirchoff's 2 laws (based on charge and energy conservation around a circuit). Understand the idea of the potential divider and can go on to apply this to emf and internal resistance. Review wave ideas and definitions of frequency, wavelength, amplitude, wavespeed, longitudinal, transverse, mechanical and electromagnetic from GCSE. Understand and can explain the ideas of polarisation as well as uses in polarising filters and the alignment of aerials for transmission and reception. Understand the idea of phase relating to how far through a wave cycle is based on a rotating phaser arrow and be able to convert between degrees and radians as well as use the idea of phase difference and its results for superposition and interference. Explain how stationary waves form and the idea of harmonics and use of the equation for determining the frequency of the first harmonic.	different materials without having to worry about their dimensions. Appreciate that not all conductors behave the same as a metal conductor and properties such as superconductivity allows for supercomputers. Can use the rules around resistor combinations and Kirchhoff's laws to solve complex circuit problems including potential divider circuits, sensor circuits and circuits involving combining batteries with internal resistance. Appreciate the differences between a progressive and a stationary wave. Can explain why polarisation can only occur in transverse waves. The idea of phase being an angle based on how far a rotating arrow has spun and the position of it's tip indicating the displacement of the wave at each point in time is a model used throughout Physics to simplify the maths in SHM as well as electromagnetic induction. Can show where the frequency formula for stationary waves first harmonic comes from and use it to solve practical problems.	End of topic assessment for Particles and quantum Physics. Basic circuits, Ohm's law and IV characteristic problems. Resistivity problems. Required Practical 5: Measuring Resistivity Combining resistors problems. Kircheff's laws problems Potential divider problems Emf and internal resistance problems Required Practical 6: Measuring emf & internal resistance of a cell

Topic 5: Waves	Progressive waves, longitudinal & transverse waves, superposition and	Relate the frequency of other harmonics to multiples of the first harmonic. Know the definitions of path difference and coherence and relate these back to superposition and interference to explain 2 source interference, double (Young's) slits diffraction, single slit diffraction and diffraction gratings. Recap of refraction form GCSE. Know the definition of refractive index and be able to use Snell's law for refraction. KNow what critical angle is and be able to determine it for materials of known refractive index. Apply the ideas of total internal reflection to it's uses in fiber optic cables explaining the function of the cladding, step index cables, material dispersion, modal dispersion, pulse broadening and absorption.	Can not just use the various diffraction formulas but show how they are derived and use them to make comparisons between the patterns on the screen when various factors are changed or different numbers of slits are used. Able to make judgements about parameters for various applications of diffraction. Recognise that diffraction gratings are used to produce the emission and absorption spectra studied in the quantum Physics topic. Able to relate refraction and total internal reflection to every day uses and make judgments regarding the parameters involved for various uses. All the optics ideas are also used again heavily in the astrophysics unit.	End of topic assessment for electricity. Basic wave ideas problems Polarisation problems Progressive wave problems

	stationary waves, Refraction, diffraction & interference			Stationary wave problems Required Practical 1: Stationary waves Interference, superposition and diffraction problems. Required Practical 2: Diffraction Refraction and total internal reflection problems

				End of topic assessment for waves.
Year 12 - Summer Term Topic 6: Materials	Density, Hooke's law & elastic energy, The Young Modulus.	Review GCSE ideas density and apply to combining materials of different density to predict what the combined density of an alloy would be. Review the GCSE idea of Hooke's law and check definitions of limit of proportionality, elastic limit and stiffness constant. Relate the elastic strain energy to the energy stored in the stretched material and the area under a force vs extension graph. Define tensile stress, tensile strain, breaking stress and Young modulus. Be describe plastic and brittle behaviour of materials and link back to the shapes of force-extension and stress-strain graphs. Describe the model for an object in circular motion including the definitions of linear velocity, angular velocity, centripetal force and centripetal acceleration. Can describe how to apply circular motion ideas and formulas to applications such as driving over	Appreciate the importance of these ideas related to stretching more than just springs but for construction of building, aircraft design and most engineering and manufacturing. Recognise that elastic strain energy is just another example of potential energy or work (Force applied multiplied by distance moved) and understand that energy is always conserved and relate this back to the different shapes of graphs for loading and unloading materials. Young modulus recognised as analogous to stiffness constant & being more useful for comparing materials again due to it being without dimensions. Recognises how this all relates back to vectors and Newton's second law of motion from the mechanics topic as well as some key ideas from the waves topic. Can use the various formulas to solve problems including application to different situations. These ideas will also be used later to derive one of Kepler's laws in gravitational fields and astrophysics. Appreciate the model can be used to construct graphs of displacement,	Density problems Hooke's law problems Force - extension graph problems Stress - strain graph problems Required Practical 4: Measuring Young Modulus End of topic assessment for materials.

Topic 7: Further mechanics	Circular motion, Simple harmonic motion & resonance	bridges, around bends, banked bends, and fairground rides. Can define simple harmonic motion and show for various systems how displacement, velocity acceleration and energy vary over time. Can use this to show where the various SHM formulas come from as well as using them. Can show where the formulas for a simple pendulum and a mass-spring pendulum come from along with their limitations. Be able to describe the effects of damping on SHM systems and define different types of damping. Define forced vibrations and relate to resonance and the factors that affect it. Apply this to various mechanical systems.	velocity, acceleration and energy against time and that the relationships between these quantities can be used to derive the equations from the formula sheet. Recognise how resonance and forces oscillations relate back to stationary waves.	End of year 12 assessment. Formal examination made up of an A level Physics paper 1 covering all the topics covered to this point. Circular motion problems Applications of circular motion problems SHM Graphs problems SHM equations problems Pendulum Problems Required Practical 7: Investigating SHM Damping, forces oscillations and resonance problems

				End of topic assessment for Further Mechanics
Yr 13 - Autumn Term Topic 8: Thermal Physics,	Specific heat capacity, Specific latent heat, Ideal Gas Laws & Kinetic theory.	Can define specific heat capacity and use the formula to explain differences in the way different substances heat up or cool down as well as solving numerical problems. Can define specific latent heat of fusion and evaporation and relate these back to explaining why a state change happens as well as why it happens at a constant temperature. Use the equations to solve numerical problems involving a change of state including those involving both changes of temperature and changes of state. Define an ideal gas and be able to state the conditions that make it ideal. Define the relationship between pressure, volume and temperature for a gas and recognise how to derive and use the ideal gas equation in terms of moles or number of molecules. Explain brownian motion and describe how kinetic theory leads to a model based on conservation of momentum and average kinetic energy being related to temperature. Know how to use the model and it's limitations. Define gravitation field lines and uniform versus radial fields. Define and can use Newton's law of gravitation. Define and use equations for gravitation field strength, gravitational potential, gravitational equipotential lines and gravitational potential energy.	Opportunity to use practical equipment to investigate these changes and measure numerical values related to them. Recognise that again this is another example of energy being conserved and accounting for all the energy is the key to solving the problems. Appreciate that simple ideas concerning pressure (force/area) and rate of change of momentum along with the behaviour of a contained gas can lead to quite sophisticated models that even encompass ideas from chemistry and although they have limitations still make good approximations for the behaviour of non-ideal gases.	SHC & SLH problems. Ideal gas law problems

Topic 9: Gravitational Fields,	Gravitational field lines, Newton's law of gravity, g, V, GPE & orbits linking back to circular motion.	Use Newton's law of gravitation combined with the centripetal force formulas from circular motion to derive the relationship between time period and radius of orbit and relate this to satellite motion. Review of ideas related to Rutherford scattering, alpha emission, beta (+ and -) emission, gamma emission, electron capture and the stability of the nucleus related to the graph of N against Z Estimate the radius of the nucleus from the closest approach of alpha particles in the Rutherford scattering experiment. Use electron diffraction to get another radius estimate. Look at Coulomb's law (related to gravitational formula) & show how a radius estimate can be obtained from this. Know and be able to use the inverse square law for the emission of radiation from a source and use it as a basis for limiting risks from ionising radiation. Know and can use the nuclear decay model. This is based around exponential decay and fundamentally comes out of the differential equation relating activity to the number of nuclei in a sample remaining. Define half life and decay constant and relate the formulas to graphs representing change over time. Understand the idea of energy and mass being equivalent and linked by Einstein's famous formula. Know what mass defect and binding energy are and be able to relate the binding energy per nucleon to nuclear fission and nuclear fusion. Explain the process of nuclear fission and how it is used and controlled within a nuclear reactor as well as the	Recognise that this is another example of an inverse square law. Be able to relate the shapes of field lines and equipotential lines to whether a field is uniform or radial. Recognise that there is no true uniform gravitational field but that close to the surface of earth it does approximate one making the uniform formula for GPE =mgh a good approximation close to the surface Apply ideas to different types of satellite motion, orbital speed and energy considerations as well as practical uses. Appreciate how this relates to our knowledge and understanding changing over time. See how ideas from the particle physics topic relate to later topics. Appreciate the amount of information that can be gained from simple estimations and the varied use of ideas from other topics that can enable estimations of the radius of a Nuceus. Appreciate just how often an inverse square law appears in Physics and how it is the same maths applied to different quantities. Appreciate that the risk of ionising radiation is best reduced with distance rather than shielding. Opportunity to use the ideas of differential equations, exponential function and natural logarithms from maths to solve real life problems.	Required Practical 8: Boyle's & Charles' Law Kinetic theory model problems. End of topic assessment for thermal physics. Field line problems. Newton's law of gravitation problems. Field strength problems. Potential and potential energy problems Satellite problems

Topic 10: Nuclear Physics	Nuclear decay & decay model, inverse square law, mass defect, binding energy, fissions & fusion - including Nuclear power.	safety aspects associated with this and nuclear waste. Be able to use Coulomb's law and define field lines, uniform and radial electric fields. Define electric field strength, electric potential, electric equipotential lines and electric potential energy and be able to use the formulas for both uniform and radial fields. Define capacitance & describe both what a capacitor does as well as how it works and the factors affecting it's design. Understand and be able to use the energy stored formulas for the capacitor and relate them to relevant graphs. Be able to use the exponential decay model for capacitors discharging and the exponential growth model for capacitors charging. Define within this the time constant and it's significance.	Appreciate that a change is exponential if the rate of change is proportional to the amount of the changing quantity that is left. Appreciate that this was first encountered in particle physics with pair production and annihilation. Appreciate the immensity of what has come out of our understanding of this Physics (ultimately energy conservation again) from the huge benefits of the amount of energy available from nuclear fission (& potentially fusion at some point) to the risks from accidents and nuclear waste to the ethics of nuclear weapons. Appreciate this is an inverse square law again and actually almost identical to that for gravitational fields just based on a different quantity (charge not mass) and able to be both attractive and repulsive unlike gravity. Appreciate how a circuit can be approximated to the uniform field between parallel charged plates. Appreciate that air can be approximated to a vacuum where electric fields are concerned. Again the understanding of vectors and vector addition plays a big part. Appreciate that this is the same exponential model as for nuclear decay (for discharge) but with a different constant. The same maths is again being used here as for the nuclear decay model. There is also a requirement to be able to solve circuit problems using the techniques from the electricity topic with capacitors now included.	Particle interactions and nuclear model review problems. N-Z graph and nuclear stability problems Nuclear radius problems Inverse square law problems Required Practical 12: The inverse square law

				Nuclear decay model problems Mass defect and binding energy problems Nuclear fission and fusion problems Nuclear power and waste problems End of topic assessment for Nuclear Physics. November Mock examination Coulomb's law and field line problems. Electric field strength problems

Topic 11: Electric Fields	Electric field lines, Coulomb's law, E, V, EPE, capacitance, capacitor discharging & charging, time constant, energy stored by a capacitor.			Electrical potential and electrical potential energy problems. Uniform electric field problems (field between parallel plates) Capacitor problems Capacitor model problems (charging & discharging) Required Practical 9: Charging & discharging capacitors End of topic assessment for gravitational & electric fields.
Yr 13 - Spring Term Topic 12: Magnetic Fields	Lines of flux, Flux density B, Force on a current carrying conductor or motor effect, Force on a	Define lines of flux and flux density. Recognise the shapes of lines of flux around various shaped magnets and induced by moving charges. Use of motor effect and Fleming's left hand	Recognise that these are field lines and field strength given different names. Solve a variety of problems using Fleming's left hand rule and the motor	Magnetic field lines problems.

	charge in a magnetic field, Electromagnetic induction, transformers, Particle accelerators & mass spectrometry - linked back to circular motion and electric fields.	rule to determine factors affect the force felt by a current in a magnetic field and determine direction. Use and explain the force felt by a charged particle in a magnetic field formula and relate it to Fleming's LH rule. Define magnetic flux linkage and relate this to the change in flux linkage felt by a coil and a field moving relative to each other. Describe alternating currents and potential differences and define peak and rms values. Define electromagnetic induction, Fleming's right hand rule, Farraday's law and lenz's law. Apply all this to generators and transformers. Review of some ideas in optics including refraction, reflection and diffraction. Define and use equations for focal length and magnification of lenses. Understand how to construct and interpret standard ray diagrams for lenses. Apply these ideas to reflecting and refracting telescopes. Define Rayleigh criteria for minimum optical resolution of a telescope. Use this, collecting power, spherical aberration and chromatic aberration to numerically and qualitatively compare different optical and non-optical telescopes. Describe how CCD's work compared to the eye and compare in terms of quantum efficiency, resolution and convenience. Define apparent magnitude and the hipparcos scale for comparing brightness of objects. Define the parsec and absolute magnitude in order contrast with apparent magnitude. Use Stefan's law and Wien's displacement law to contrast stars	effect equation applied to a large variety of situations and uses including electric motors. Appreciate that this is just a modification of the previous formula where the length of the wire is replaced by distance travelled in the field. Another chance to practice using the electric field conventions of defining everything in terms of a positive test charge. Recognise the dependence of all this on angle between factors. Appreciate the link of rms values to rms velocity from kinetic theory as a better estimate of true mean (which is not zero). Appreciate the application of circular motion and SHM ideas in this crossover. Optics used in a different setting. Compare and contrast based on a whole host of data and information to appreciate that there is no one best telescope just	Motor effect problems. Required practical 10: F=BIL. Electric motors problems. Charges in magnetic fields problems. Flux linkage problems. Ac circuits problems Electromagnetic induction problems. Generators and transformers problems. Required Practical 11: Induction using a search coil. End of topic assessment for magnetic Fields. February mock examination covering thermal physics, fields & nuclear physics from an A level Physics paper 2. Refraction, reflection and diffraction problems. Lenses problems

Topic 13: Astrophysics	Reflecting & refracting telescopes, non-optical telescopes, measuring distance & magnitude for stellar objects, stellar classification, the life cycle of a star & cosmology.	with how a black body behaves and compare the power output to the temperature and size of stars. Define the spectral classes of stars and compare colour, temperature and absorption lines from each. Describe the key features found on HR diagrams and use this to define the main classes of star and how different size stars follow different evolutionary paths and why. Define & fit to the evolutionary path of stars black holes and the various types of supernovae. Define Doppler shift and relate thai back to red shift observed in the spectra of stars and galaxies leading to the idea of the expansion of the universe and the big bang. Define the Hubble law & link it all in. Define and account for quasars. Describe the difficulties in detecting exoplanets and how this may be accomplished.	some are better for specific applications and it is always a trade off between the ideal and real world limitations. Appreciate that the universe is so big that the new scale of distance is hard to comprehend. Appreciate yet another use of the inverse square law. Putting it all together to get a complete comparison between stars even linked back to absorption spectra from quantum physics. Appreciate another tale of graphing data to produce a pictorial way of representing complex data that allowed Astronomers to see further patterns and group stars in a way to allow the story of stellar evolution to be summarised. Appreciate that just because something seems impossible to solve fully, it doesn't mean it cannot be broken down into bits and a lot of the answer put in place.	Optical telescope problems. Non-optical telescope problems Comparison of telescope problems. Measuring astronomical distances problems

				Stellar classification problems Stellar evolution and the HR diagram problems. Red shift problems Cosmology problems End of topic assessment for Astrophysics. A level paper 3 part B practice examination (astrophysics)

5. Assessment Strategy

Assessment Type	Purpose	Frequency
Diagnostic	A type of formative assessment tool used to evaluate strengths, weaknesses, knowledge, skills and misconceptions prior to further learning and give a	Every lesson

	base line or starting point in order to tailor learning to suit the learners.	
Formative	Formal and informal ongoing assessment used as a tool for learning to identify strengths and weaknesses and provide feedback to learners.	Every lesson
Summative	Assessment that takes place at the end of a topic to evaluate learning over a period of time.	Half termly
Synoptic	Assessment that evaluates learning over a number of topics or throughout the whole year or two years.	Once or twice a year.