Curriculum Map: Year 12 Subject: A-level Physics Exam Board: AQA

Topic	Key Knowledge *What will all students KNOW by the end of the topic?*	Key Skills *What key skills will be learnt/developed by the end of the topic? What will all students be able to DO by the end of the topic?*	Assessment Opportunities *What are the key pieces of assessment? How will students be assessed?*
Introduction to Experimental Physics	• Fundamental (base) units for mass, length, time, amount of substance, temperature, electric current and their associated SI units. • Knowledge and use of the SI prefixes, values and standard form • Identification of random and systematic errors. • Use of the terms precision, repeatability, reproducibility, resolution and accuracy	• Use of the prefixes: T, G, M, k, c, m, μ, n, p, f • Be able to calculate absolute, fractional and percentage uncertainties and represent uncertainty in the final answer for a quantity. • Combine absolute and percentage uncertainties.	Past ISA Questions Questioning in class AFL in class PPQ Targeted Worksheets
Particle Physics	• Simple model of the atom • Charge and mass of the proton, neutron and electron in SI units and relative units. • Nuclide notation and isotopes • The strong nuclear force and its role in keeping the nucleus stable • Unstable nuclei; alpha and beta decay & the existence of the neutrino • Particles & antiparticle. Photon model of electromagnetic radiation • Four fundamental interactions: gravity, electromagnetic, weak nuclear & strong nuclear. • The concept of exchange particles to explain forces between elementary particles. • Simple diagrams to represent particle reactions • Classification of particles (hadrons, baryons, antibaryons & mesons (pion, kaon) • Baryon number & its conservation • Lepton number & its conservation for muon leptons and for electron leptons. • Strangeness & conservation of strangeness in strong interactions. • Appreciation that particle physics relies on the collaborative efforts of	Classification of particles Be able to apply knowledge of prefixes on a small scale Conversion between different units of the same quantity, eg J and eV	Questioning in class AFL in class PPQ Targeted Worksheets inc PhysSheets

	large teams of scientists and engineers to validate new knowledge. • Properties of quarks and antiquarks and their combination to form baryons, antibaryons and mesons • The decay of the neutron • Change of quark character in β− and in β+ decay. • Application of the conservation laws for charge, baryon number, lepton number and strangeness to particle interactions. Threshold frequency; photon explanation of threshold frequency. • Work function, stopping potential and the photoelectric equation • Ionisation and excitation including fluorescent tube. • Line spectra as evidence for transitions between discrete energy levels in atoms. h f = E1 − E2 • Electron diffraction suggests that particles possess wave properties and the photoelectric effect suggests that electromagnetic waves have a particulate nature. de Broglie wavelength • How and why the amount of diffraction changes when the momentum of the particle is changed • Appreciation of how knowledge and understanding of the nature of matter changes over time. • Appreciation that such changes need to be evaluated through peer review and validated by the scientific community.		
Materials	• Calculation of density • Hooke's law, elastic limit, meaning of the spring constant • Tensile strain and tensile stress. • Elastic strain energy, breaking stress & calculation of the energy stored • Description of plastic behaviour, fracture and brittle behaviour linked to force–extension graphs. • Appreciation of energy conservation issues in the context of ethical transport design Young modulus	Be able to interpret simple stress–strain curves. • Apply energy conservation to examples involving elastic strain energy and energy to deform. Determine Young's Modulus of a material. During completion of Required Practical 4: • Use of a micrometer • Use of vernier callipers • Record measurements to appropriate decimal places for	Questioning in class AFL in class PPQ Targeted Worksheets inc PhysSheets

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		the resolution of the instrument • Use of repeats to reduce the effect of random errors	
Current Electricity	• Electric current as the rate of flow of charge; potential difference as work done per unit charge; resistance. • Current – p.d. characteristics for an ohmic conductor, semiconductor diode, and filament lamp. • Ohm's law as a special case where $I \propto V$ under constant physical conditions • Meaning and use of equation for resistivity • Qualitative effect of temperature on the resistance of metal conductors and thermistors. • Applications of thermistors • Superconductivity as a property of certain materials which have zero resistivity at and below a critical temperature which depends on the material. • Applications of superconductors• Determine the effective resistance of resistors: in series & in parallel • Energy and power equations for electrical circuits • The relationships between currents, voltages and resistances in series and parallel circuits, including cells in series and identical cells in parallel. • Conservation of charge and conservation of energy in dc circuits The meaning of terminal pd and electromotive force Use of the potential divider to supply constant or variable potential difference from a power supply.	During completion of Required Practical 5: • Use of a micrometer • Use of vernier callipers • Record measurements to appropriate decimal places for the resolution of the instrument • Use of repeats to reduce the effect of random errors During completion of Required Practical 6: • Use of a ammeters and voltmeters • Drawing linear graphs • Determine a gradient Compare a relationship to the equation for a straight line graph and use gradient and intercept to determine unknown values	Questioning in class AFL in class PPQ Targeted Worksheets inc PhysSheets
Waves	• Oscillation of the particles of the medium; amplitude, frequency, wavelength, speed, phase, phase difference, • Longitudinal and transverse waves • All electromagnetic waves travel at the same speed in a vacuum. • Polarisation as evidence for the	Use of radians and degrees as a measure of angle During completion of Required Practical 1: • Record measurements to appropriate decimal places for the resolution of the instrument • How to reduce uncertainties in measurements •	Questioning in class AFL in class PPQ Targeted Worksheets inc PhysSheets

	nature of transverse waves. • Applications of polarisers • Refractive index of a substance • The refractive index of air is approximately 1. • Snell's law of refraction • Total internal reflection • Fibre optics including the function of the cladding, pulse broadening and absorption. • The formation of stationary waves on a string, with mic rowaves and with sound wave Path difference & coherence. • Interference and diffraction using a laser as a source of monochromatic light. • Young's double-slit experiment • Production of interference pattern using white light. • Safety issues associated with using laser Appreciation of how knowledge and understanding of nature of electromagnetic radiation has changed over time. Diffraction pattern from a single slit using monochromatic and white light. • Effect of variation of the width of the central diffraction maximum when wavelength and slit width are changed. • Plane transmission diffraction grating at normal incidence. • Derivation of the diffraction grating equation • Applications of diffraction gratings	Drawing linear graphs • Determine a gradient • Compare a relationship to the equation for a straight line graph and use gradient and intercept to determine unknown values During completion of Required Practical 2: • Work in a safe way with lasers • Complete a risk assessment for working with lasers • How to cite a reference • Record measurements to appropriate decimal places for the resolution of the instrument • How to reduce uncertainties in measurements Drawing linear graphs • Determine a gradient	
Mechanics	Examples of scalars and vectors. • Addition of vectors by calculation or scale drawing. • Resolution of vectors into two components at right angles to each other. • Conditions for equilibrium for two or three coplanar forces acting at a point. • The meaning of equilibrium in the context of an object at rest or moving with constant velocity• Moment of a force about a point defined as force × perpendicular distance from the point to the line of action of the force. • Couple as a pair of equal and opposite	Use a scale drawing to determine a missing vector • Use of tangents to determine instantaneous speeds and velocities • Use of area under a graph During completion of Required Practical 3: • Determine the uncertainties in the gradient and intercept of a straight-line graph • Interpret non-zero intercepts in relation to a systematic or zero error	Questioning in class AFL in class PPQ Targeted Worksheets inc PhysSheets

	coplanar forces and moment of couple • Principle of moments. Calculation of displacement, speed, velocity, acceleration. • Representation by graphical methods of uniform and nonuniform acceleration. • Significance of areas of velocity–time and acceleration–time graphs and gradients of displacement–time and velocity–time graphs for uniform and non-uniform acceleration • Independent effect of motion in horizontal and vertical directions of a uniform gravitational field. • Qualitative treatment of friction. • Qualitative treatment of lift and drag forces. • Air resistance increases with speed & its application to reaching a terminal speed. • Qualitative understanding of the effect of air resistance on the trajectory of a projectile and on the factors that affect the maximum speed of a vehicle Knowledge and application of Newton's three laws of motion in appropriate situations. • F = ma for situations where the mass is constant Conservation of linear momentum. • Force as the rate of change of momentum • Impulse as the change in momentum • Significance of the area under a force–time graph. • Application of impact forces and the relationship to contact times • Elastic and inelastic collisions; explosions. • Appreciation of momentum conservation issues in the context of ethical transport design • Energy transferred and work done by a force • Power as rate of energy transfer • Significance of the area under a force–displacement graph. • Calculations involving efficiency • Principle of conservation of energy. • Quantitative and qualitative application of energy conservation to examples		

	involving gravitational potential energy, kinetic energy, and work done against resistive forces		
Further Mechanics	Motion in a circular path at constant speed implies there is an acceleration and requires a centripetal force. • Magnitude of angular speed • Centripetal acceleration and centripetal force Analysis of characteristics of simple harmonic motion (SHM). • Condition for SHM and related equations • Graphical representations linking the variations of displacement, velocity and acceleration with time.	• Use of radians as a measure of angle • Appreciation that the v − t graph is derived from the gradient of the x − t graph and that the a − t graph is derived from the gradient of the v − t graph.	Targeted Worksheets inc PhysSheets Questioning in class AFL in class PPQ
Option	Students choose which option to study depending on their interests: Astronomy, Medical Physics, Engineering, Turning Points	As a bridge to becoming independent students after Sixth Form students to follow the Specification of their chosen option. Notes will be provided but students to use their initiative to find other sources of information and tools to study with.	