Curriculum Map Year 12: Physics AQA 7408 Astrophysics Option: Ten lessons per fortnight (5 with teacher A; 5 with teacher B)

Examination Papers – End of Yr 13	% of GCE	Question style
Paper 1: Sections 1–5 and 6.1 (Periodic motion)	34%	60 marks of short and long answer questions and 25 multiple choice questions on content.
Paper 2: Sections 6.2 (Thermal Physics), 7 and 8 Assumed knowledge from sections 1 to 6.1	34&	60 marks of short and long answer questions and 25 multiple choice questions on content.
Paper 3: Section A: Compulsory section: Practical skills and data analysis Section B: Students enter for one of sections 9, 10, 11, 12 or 13 (students will be entered for section 9 – Astrophysics)	32%	45 marks of short and long answer questions on practical experiments and data analysis. 35 marks of short and long answer questions on optional topic.

	Topic	Key Knowledge *What will students know by the end of this topic?*	Key Skills *What skills will students have developed by the end of this topic?*	Assessment Opportunities *How will student progress be measured?* *What are the key assessment pieces?*
Prior to beginning the course content, students will be shown how to organise their folders efficiently for the term ahead. Staff will also explain how to approach annotation of notes and the need for pre -reading of theory before the lesson and revisiting after the lesson. Students will be encouraged to be independent learners and tasks will lend themselves to this approach where applicable. Students will be encouraged to develop their VESPA study skills throughout the course. • Vision – goal setting after each main piece of assessed work • Effort – additional & extension past paper questions are made available and students are pointed to these to do in their own time and especially where a weakness is noted • Systems – organisation of their folders and use of Teams as an example of organisation to refer back to class materials • Practice – much use of part paper questions (see reference to additional & extension past paper questions being made available) • Attitude – discussion with students after set-backs and pointing back to the above 4 essential skills in order to improve performance				
Half Term 1 teacher A	Baseline test (covers parts of 3.1.1)	• 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.	Baseline test NOTE that following all tests students will have time to reflect on their attainment and write targets for future learning/tests

	Topic	Key Knowledge *What will students know by the end of this topic?*	Key Skills *What skills will students have developed by the end of this topic?*	Assessment Opportunities *How will student progress be measured?* *What are the key assessment pieces?*
	3.3.1.1 Progressive waves 3.3.1.2 Longitudinal & transverse waves 3.3.2.3 Refraction 3.3.1.3 Stationary 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 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 microwaves and with sound wave	• Independent study skill of reflection on performance and setting targets for improvement • 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 • 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	Required Practical 1 PPQs Timed task (Waves basics & refraction) NOTE that timed tasks are given ahead of an assessment to help students learn to manage their time better in an exam context.
Half Term 1 teacher B	Transition work (covers parts of 3.1.1) 3.2.1 Particles	• 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.		Transition work questions Timed task (Introduction to particle physics) Particles assessment 1 (Introduction to particle physics)

	Topic	Key Knowledge *What will students know by the end of this topic?*	Key Skills *What skills will students have developed by the end of this topic?*	Assessment Opportunities *How will student progress be measured?* *What are the key assessment pieces?*
		• 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 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 $\beta-$ and in $\beta+$ decay. • Application of the conservation laws for charge, baryon number, lepton number and strangeness to particle interactions.		
Half Term 2 teacher A	3.3.2.1 Interference	• 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 lasers	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	Waves assessment 1 (Waves basics & refraction) Required practical 2 PPQs

	Topic	Key Knowledge *What will students know by the end of this topic?*	Key Skills *What skills will students have developed by the end of this topic?*	Assessment Opportunities *How will student progress be measured? What are the key assessment pieces?*
	3.3.2.2 Diffraction 3.4.1.1 Scalars & vectors	• 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 • 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	• Drawing linear graphs • Determine a gradient • Use a scale drawing to determine a missing vector	
Half Term 2 teacher B	3.2.2 EM radiation & quantum effects	• 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. $hf = E1 - E2$ • Electron diffraction suggests that particles possess wave properties and the photoelectric effect suggests that electromagnetic waves have a particulate nature.	• Conversion between different units of the same quantity, eg J and eV	Timed task (Quantum physics) Particles assessment 2 (Quantum physics)

	Topic	Key Knowledge *What will students know by the end of this topic?*	Key Skills *What skills will students have developed by the end of this topic?*	Assessment Opportunities *How will student progress be measured?* *What are the key assessment pieces?*
		• 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.		
	3.5.1.1 Current electricity	• Electric current as the rate of flow of charge; potential difference as work done per unit charge; resistance.		
	3.5.1.2 Current - voltage characteristics	• 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		
	3.5.1.3 Resistivity	• 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	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	
Half Term 3 teacher A	3.4.1.2 Moments	• 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 coplanar forces and moment of couple • Principle of moments.		Timed task (Superposition, interference & diffraction)

	Topic	Key Knowledge *What will students know by the end of this topic?*	Key Skills *What skills will students have developed by the end of this topic?*	Assessment Opportunities *How will student progress be measured?* *What are the key assessment pieces?*
	3.4.1.3 Motion along a straight line 3.4.1.4 Projectile motion	• The centre of mass of uniform regular solid is at its centre • 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.	• Use of tangents to determine instantaneous speeds and velocities • Use of area under a graph	Waves assessment 2 (Superposition, interference & diffraction)+ Re-call uncertainty in measurements Mini Mock (Similar structure to AS papers) Covering all topics so far (Teacher A &B)
Half Term 3 teacher B	3.5.1.4 Circuits	• 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	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	Required practical 5 PPQs Timed task (circuits) Electricity assessment 1 (circuits)+ Re-call Quantum Required practical 6 PPQs

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	3.5.1.6 Emf & internal resistance	• The meaning of terminal pd and electromotive force	use gradient and intercept to determine unknown values	
Half Term 4 teacher A	3.4.1.5 Newton's laws of motion	• Knowledge and application of Newton's three laws of motion in appropriate situations. • F = ma for situations where the mass is constant	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	Timed task (Vectors & moments) Mechanics assessment 1 (Vectors & moments) Required practical 3 PPQs Timed task (Motion & Newton's Laws) Mechanics assessment 2 (Motion & Newton's Laws) + Re-call Waves
Half Term 4 teacher B	3.5.1.5 Potential divider 3.4.2.1 Bulk properties of solids	• Use of the potential divider to supply constant or variable potential difference from a power supply. • 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	• Be able to interpret simple stress–strain curves. • Apply energy conservation to examples involving elastic strain energy and energy to deform.	Timed task (Emf, internal resistance & potential divider) Electricity assessment 2 (Emf, internal resistance & potential divider)+ Re-call Particle

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Half Term 5 teacher A	3.4.1.6 Momentum	• 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	Independent study skills will be reinforced at this time • Revision technique • Exam technique • Review of own work and performance in examination • Reflective practice & goal setting for improvement • Interpret force-time graphs • Independent study –pre-work needed here for those who took Combined Science. Use of workbook to catch up material not covered at GCSE • Independent study - investigate ethical transport design	Assessment Mechanics- Forces and motion + Re-call Waves interference
Half Term 5 teacher B	3.4.2.2 Young's modulus	• Young modulus	Independent study skills will be reinforced at this time • Revision technique • Exam technique • Review of own work and performance in examination • Reflective practice & goal setting for improvement • Use of stress–strain graphs to find the Young modulus. •	Assessment Material + Re-call SI units and Uncertainty Required practical 4 PPQs

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			During completion of Required Practical 4: • 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	
Half Term 6 teacher A	3.4.1.7 Work, energy & power 3.4.1.8 Conservation of energy 3.7.1 Fields 3.7.2 Gravitational fields	• 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 • Concept of a force field as a region in which a body experiences a non-contact force. • Students should recognise that a force field can be represented as a vector, the direction of which must be determined by inspection. • Gravity as a universal attractive force acting between all matter. • Newton's law of universal gravitation • Representation of a gravitational field by gravitational field lines. • Gravitational potential as force per unit mass • Magnitude of g in a radial field	• Conversion between different units of the same quantity, eg J and kW h. • Use of percentages	Timed task (Work, energy power & conservation of energy) Mechanics assessment 3 (Work, energy power & conservation of energy) Year 12 end of year assessment (2 hours)

	Topic	Key Knowledge *What will students know by the end of this topic?*	Key Skills *What skills will students have developed by the end of this topic?*	Assessment Opportunities *How will student progress be measured?* *What are the key assessment pieces?*
		• Definition of gravitational potential, including zero value at infinity. • Use of gravitational potential difference. • Work done in moving a mass m within a gravitational field • Equipotential surfaces • Gravitational potential in a radial field • Graphical representations of variations of gravitational field strength and gravitational potential with distance from the centre of mass of a body • Orbital period and speed related to radius of circular orbit • Derivation of Kepler's Law • Energy considerations for an orbiting satellite. • Escape velocity. • Synchronous orbits. • Use of satellites in low orbits and geostationary orbits	• Interpret g-r and V-r graphs • Use of log scales when plotting data • Use of log paper	
Half Term 6 teacher B	3.4.2.2 Young's modulus (continued) 3.6.1.1 Circular motion	• A simple method to measure Youngs modulus • 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	• Use of stress–strain graphs to find the Young modulus • Use of radians as a measure of angle	Year 12 end of year assessment (2 hours)

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Paper 1: Sections 1–5 and 6.1 (Periodic motion)	34%	60 marks of short and long answer questions and 25 multiple choice questions on content.
Paper 2: Sections 6.2 (Thermal Physics), 7 and 8 Assumed knowledge from sections 1 to 6.1	34&	60 marks of short and long answer questions and 25 multiple choice questions on content.
Paper 3: Section A: Compulsory section: Practical skills and data analysis Section B: Students enter for one of sections 9, 10, 11, 12 or 13 (students will be entered for section 9 – Astrophysics)	32%	45 marks of short and long answer questions on practical experiments and data analysis. 35 marks of short and long answer questions on optional topic.

	Topic	**Key Knowledge** *What will students know by the end of this topic?*	**Key Skills** *What skills will students have developed by the end of this topic?*	**Assessment Opportunities** *How will student progress be measured?* *What are the key assessment pieces?*
Students will be encouraged to organise their folders efficiently. There will remain topics where pre -reading of theory is necessary before the lesson and revisiting after the lesson. Students will be encouraged to be independent learners and tasks will lend themselves to this approach where applicable. Students will be encouraged to develop their VESPA study skills throughout the course. • Vision – goal setting after each main piece of assessed work • Effort – additional & extension past paper questions are made available and students are pointed to these to do in their own time and especially where a weakness is noted • Systems – organisation of their folders and use of Teams as an example of organisation to refer back to class materials • Practice – much use of part paper questions (see reference to additional & extension past paper questions being made available) • Attitude – discussion with students after set-backs and pointing back to the above 4 essential skills in order to improve performance				
Half Term 1 teacher A	3.7.1 Fields 3.7.2 Gravitational fields	• Concept of a force field as a region in which a body experiences a non-contact force. • Students should recognise that a force field can be represented as a vector, the direction of which must be determined by inspection. • Gravity as a universal attractive force acting between all matter. • Newton's law of universal gravitation	• Interpret g-r and V-r graphs • Use of log scales when plotting data • Use of log paper	Timed task (Yr 12 Waves basics & refraction) NOTE that timed tasks are given ahead of an assessment to help students learn to manage their time better in an exam context.

	Topic	Key Knowledge *What will students know by the end of this topic?*	Key Skills *What skills will students have developed by the end of this topic?*	Assessment Opportunities *How will student progress be measured?* *What are the key assessment pieces?*
	  3.7.3 Electric fields	• Representation of a gravitational field by gravitational field lines. • Gravitational potential as force per unit mass • Magnitude of g in a radial field • Definition of gravitational potential, including zero value at infinity. • Use of gravitational potential difference. • Work done in moving a mass m within a gravitational field • Equipotential surfaces • Gravitational potential in a radial field • Graphical representations of variations of gravitational field strength and gravitational potential with distance from the centre of mass of a body • Orbital period and speed related to radius of circular orbit • Derivation of Kepler's Law • Energy considerations for an orbiting satellite. • Escape velocity. • Synchronous orbits. • Use of satellites in low orbits and geostationary orbits • Force between point charges in a vacuum: • Permittivity of free space • Appreciation that air can be treated as a vacuum when calculating force between charges & that for a charged sphere, charge may be considered to be at the centre. • Comparison of magnitude of gravitational and electrostatic forces between subatomic particles.	• Working with inter-related quantities such as field strength and potential • Interpretation of area under graphs and gradient of graphs using unit analysis • Use of infinity as a zero reference point	Timed task (Yr 13 Gravitational fields) Fields 1 assessment (Gravitational) + Re-call SUVAT

	Topic	Key Knowledge *What will students know by the end of this topic?*	Key Skills *What skills will students have developed by the end of this topic?*	Assessment Opportunities *How will student progress be measured?* *What are the key assessment pieces?*
		• Representation of electric fields by electric field lines. • Electric field strength. In uniform & radial fields • Trajectory of moving charged particle entering a uniform electric field initially at right angles. • Definition of absolute electric potential, including zero value at infinity • Use of electric potential difference. • Work done in moving charge a charge through a potential difference • Equipotential surfaces & no work done moving charge along an equipotential surface. • Electric potential in a radial field • Graphical representations of variations of electric field strength and electric potential with distance from a point charge; use of these graphs • Relationship of electric field strength and electric potential		
Half Term 1 teacher B	3.6.1.2 Simple Harmonic Motion 3.6.1.3 Simple harmonic systems	• 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. • Mathematical study of mass-spring systems and simple pendulum • Variation of kinetic energy, gravitational potential energy and total energy with both displacement and time. • Effects of damping on oscillations.	• 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. From completing Required Practical 7 • How to reduce uncertainties • Using a fiducial point to reduce parallax error • How to increase accuracy with small measurements	Timed task (Yr 12 Introduction to particle physics) Circular motion & SHM assessment Required practical 7 PPQs

	Topic	**Key Knowledge** *What will students know by the end of this topic?*	**Key Skills** *What skills will students have developed by the end of this topic?*	**Assessment Opportunities** *How will student progress be measured?* *What are the key assessment pieces?*
	3.6.1.4 Forced vibrations & resonance 3.8 Nuclear Physics 3.8.1.1 Rutherford scattering 3.8.1.2 alpha, beta and gamma radiation	• Qualitative treatment of free and forced vibrations. • Resonance and the effects of damping on the sharpness of resonance. • Examples of resonance in mechanical systems and situations involving stationary waves. • Qualitative study of Rutherford scattering. • Appreciation of how knowledge and understanding of the structure of the nucleus has changed over time • Properties and experimental identification of alpha, beta and gamma radiation using simple absorption experiments and the relative hazards of exposure to humans. • Applications of alpha, beta and gamma radiation including thickness measurements of aluminium foil paper and steel. • Inverse-square law for gamma radiation and its application to safe handling of radioactive sources. • Background radiation; examples of its origins and experimental elimination from calculations. • Appreciation of balance between risk and benefits in the uses of radiation in medicine.	From completing Required Practical 12 • Work in a safe way with radioactive materials • Complete a risk assessment for working with radioactive materials • How to cite a reference • Use of background count rate • Reducing uncertainty in measurement of radioactive decay by counting over a longer time period • Compare a relationship to the equation for a straight line graph and use to demonstrate a mathematical relationship (in this case the inverse square law)	

	Topic	Key Knowledge *What will students know by the end of this topic?*	Key Skills *What skills will students have developed by the end of this topic?*	Assessment Opportunities *How will student progress be measured?* *What are the key assessment pieces?*
			• Use of intercept to determine a zero error	
Half Term 2 teacher A	3.7.4 Capacitors 3.5.7 Magnetic Fields 3.7.5.1 Magnetic flux density	• Definition of capacitance: • Dielectric action in a capacitor including the action of a simple polar molecule that rotates in the presence of an electric field. • Relative permittivity and dielectric constant. • Graphical representation of charging and discharging of capacitors through resistors. Corresponding graphs for Q, V and I against time for charging and discharging. • Time constant RC. • Calculation of time constants including their determination from graphical data. • Half life of a capacitor • Quantitative treatment of capacitor charging and discharging for charge, potential difference and current • Force on a current-carrying wire in a magnetic field when field is perpendicular to current. • Fleming's left hand rule. • Magnetic flux density and definition of the tesla.	• Interpretation of gradients and areas under graphs where appropriate. From completing Required Practical 9 • Work in a safe way with capacitors • Complete a risk assessment for working with capacitors • How to cite a reference • Use of a log-linear graph to demonstrate a mathematical relationship (in this case exponential decay) • Use of log-linear graph and of linear decay curve to determine time constant • Use of data logging equipment as a time-saving method to determine time constant From completing Required Practical 10 • Use of set square to reducing uncertainty in measurement of length or wire and to ensure magnetic field is perpendicular to the current. • Plotting a straight line graph and sing the gradient to determine a value for the magnetic field strength	Timed task (Yr 12 Superposition, interference & diffraction) Timed task (Yr 13 Electric fields) Fields 2 assessment (Electrical) Timed task (Yr 13 Capacitors) Fields 3 assessment (Capacitors Required practical 9 PPQs
Half Term 2 teacher B	3.8.1.3 Radioactive decay	• Random nature of radioactive decay; constant decay probability of a given nucleus; • Use of activity • Modelling with constant decay probability.	• Use of molar mass or the Avogadro constant. • Use of log graphs • Use of nuclear energy level diagrams. • Conversion of units; 1 u = 931.5 MeV. • Converting degrees to acr seconds • Converting degrees to radians and vice versa	Timed task (Yr 12 Quantum physics) Required practical 12 PPQs

	Topic	Key Knowledge *What will students know by the end of this topic?*	Key Skills *What skills will students have developed by the end of this topic?*	Assessment Opportunities *How will student progress be measured?* *What are the key assessment pieces?*
	3.8.1.4 Nuclear instability	• Half-life including determining of half-life from graphical decay data including decay curves and log graphs. • Application of half life e.g. relevance to storage of radioactive waste, radioactive dating etc. • Graph of neutron number (N) against atomic number (Z) for stable nuclei. • Possible decay modes of unstable nuclei including α, β+, β− and electron capture. • Changes in N and Z caused by radioactive decay and representation in simple decay equations. • Existence of nuclear excited states; γ ray emission and its application e.g. use of technetium-99m in medical diagnosis.	• Use of small angle approximation	Nuclear Physics Time task Nuclear Physics assessment+ Re-call Particle
	3.8.1.5 Nuclear radius	• Estimate of radius from closest approach of alpha particles and determination of radius from electron diffraction. • Knowledge of typical values for nuclear radius. • Dependence of radius on nucleon number • $R = R_0A_{1/3}$ derived from experimental data and its interpretation evidence for constant density of nuclear material. • Calculation of nuclear density. • Graph of intensity against angle for electron diffraction by a nucleus.		
	3.8.1.6 Mass & energy	• Appreciation that $E = mc^2$ applies to all energy changes		

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		• Simple calculations involving mass difference and binding energy. • Use of the atomic mass unit, u. • Fission and fusion processes. • Simple calculations from nuclear masses of energy released in fission and fusion reactions. • Graph of average binding energy per nucleon against nucleon number & interpretation of regions where nuclei will release energy when undergoing fission/fusion. • Appreciation that knowledge of the physics of nuclear energy allows society to use science to inform decision making.		
	3.8.1.7 Induced fission	• Fission induced by thermal neutrons and the; possibility of a chain reaction; critical mass. • The functions of the moderator, control rods, and coolant in a thermal nuclear reactor. • Simple mechanical model of moderation by elastic collisions. • Factors affecting the choice of materials for the moderator, control rods and coolant. Examples of materials used for these functions.		
	3.8.1.8 Safety aspects	• Fuel used, remote handling of fuel, shielding and emergency shut-down. • Production, remote handling and storage of radioactive waste materials. • Appreciation of balance between risk and benefits in the development of nuclear power.		

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	Astrophysics option 3.9.1: Telescopes	• Ray diagram to show the image formation in normal adjustment. • Angular magnification in normal adjustment. • Focal lengths of lenses. • Cassegrain arrangement using a parabolic concave primary mirror and convex secondary mirror. • Ray diagram to show path of rays through the telescope up to the eyepiece. • Relative merits of reflectors and refractors including a qualitative treatment of spherical and chromatic aberration. • Similarities and differences of radio telescopes compared to optical telescopes. Discussion should include structure, positioning and use, together with comparisons of resolving and collecting powers. • Minimum angular resolution of telescope. • Rayleigh criterion • Collecting power is proportional to diameter squared. • Students should be familiar with the rad as the unit of angle. • Comparison of the eye and CCD as detectors in terms of quantum efficiency, resolution, and convenience of use.		
Half Term 3 teacher A	3.7.5.2 Moving charges in a magnetic field 3.7.5.3 Magnetic	• Force on charged particles moving in a magnetic field when the field is perpendicular to velocity. • Direction of force on positive and negative charged particles causing a circular path; application in devices such as the cyclotron. • Magnetic flux and magnetic flux linkage	Independent study skills will be reinforced at this time • Revision technique • Exam technique • Review of own work and performance in examination • Reflective practice & goal setting for improvement	Timed task (Yr 12 Vectors & moments) Timed task (Yr 12 Motion & Newton's Laws)

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	flux & magnetic flux linkage	• Flux and flux linkage passing through a rectangular coil rotated in a magnetic field		Year 13 mock examination Required practical 10 PPQs
Half Term 3 teacher B	3.9.2 Classification of stars	• Apparent magnitude • The Hipparcos scale • Dimmest visible stars have a magnitude of 6. • Relation between brightness and apparent magnitude. • Difference of 1 on magnitude scale is equal to an intensity ratio of 2.51. • Brightness is a subjective scale of measurement. • Parsec and light year. • Definition of absolute magnitude • Stefan's law and Wien's displacement law. • General shape of black-body curves • Assumption that a star is a black body. • Inverse square law and assumptions in its application. • Use of Stefan's law to compare the power output, temperature and size of stars • Description of the main stella spectral classes	Independent study skills will be reinforced at this time • Revision technique • Exam technique • Review of own work and performance in examination • Reflective practice & goal setting for improvement • Use of log scales • Use of Wien's displacement law to estimate black-body temperature of sources.	Timed task (Yr 12 circuits) Year 13 mock examination
Half Term 4 teacher A	3.7.5.4 Electro-magnetic induction	• Magnetic induction in simple experimental phenomena. • Faraday's and Lenz's laws. • Magnitude of induced emf = rate of change of flux linkage • Applications such as a straight conductor moving in a magnetic field.	• Independent study –pre-work needed here for those who took Combined Science. Use of workbook to catch up material not covered at GCSE From completing Required Practical 11 • How to control difficult to control variables (such as the position of the search coil in the magnetic	Required practical 11 PPQs Timed task (Yr 12 Work, energy power & conservation of energy)

	Topic	Key Knowledge *What will students know by the end of this topic?*	Key Skills *What skills will students have developed by the end of this topic?*	Assessment Opportunities *How will student progress be measured?* *What are the key assessment pieces?*
	3.7.5.5 Alternating current 3.7.5.6 The operation of a transformer 3.6.2.1 Thermal energy transfer	• Equation for the emf induced in a coil rotating uniformly in a magnetic field • Sinusoidal voltages and currents; root mean square, peak and peak-to-peak values and application to mains electricity • Use of an oscilloscope as a dc and ac voltmeter, to measure time intervals and frequencies, and to display ac waveforms. • The transformer equation: Ns Np = Vs Vp • Transformer efficiency • Production of eddy currents. • Causes of inefficiencies in a transformer. • Transmission of electrical power at high voltage including calculations of power loss in transmission lines. • Internal energy is the sum of the randomly distributed kinetic energies and potential energies of the particles in a body. • The internal energy of a system is increased when energy is transferred to it by heating or when work is done on it (• Qualitative treatment of the first law of thermodynamics. • During a change of state the potential energies of the particle ensemble are changing but not the kinetic energies. • Calculations involving specific heat capacity and specific latent heat.	fields whilst changing the angle between the coil normal and the magnetic field). • Use of a Cathode Ray Oscilloscope • Calculations involving transfer of energy. • Calculations including continuous flow.	Required practical 8 PPQs Magnetic field assessment + Re-call Uncertainty in measurements

	Topic	Key Knowledge *What will students know by the end of this topic?*	Key Skills *What skills will students have developed by the end of this topic?*	Assessment Opportunities *How will student progress be measured?* *What are the key assessment pieces?*
	3.6.2.2 Ideal gases 3.6.2.3 Molecular kinetic theory model	• Gas laws as experimental relationships between pressure, volume, temperature and the mass of the gas. • Concept of absolute zero of temperature. • Ideal gas equation • Work done on a gas = $p\Delta V$ • Avogadro constant, molar gas constant & the Boltzmann constant • Use of molar mass and molecular mass. • Brownian motion as evidence for existence of atoms. • Explanation of relationships between pressure, volume & temperature in terms of a simple molecular model. • The gas laws are empirical in nature whereas the kinetic theory model arises from theory. • Assumptions leading to $pV = \frac{1}{3}Nm(c_{rms})^2$ • For an ideal gas internal energy is kinetic energy of the atoms. • Use of the equation for average molecular kinetic energy • Appreciation of how knowledge and understanding of the behaviour of a gas has changed over time.	From completing Required Practical 8 • Safely using practical equipment • Identifying hazards • Derivation of $pV = \frac{1}{3}Nm(c_{rms})^2$ • Use of this equation	
Half Term 4 teacher B	3.9.2 Classification of stars	• General shape of the Hertzsprung-Russell (HR) diagram: main sequence, dwarfs and giants. • Position of the Sun on the HR diagram.		Timed task (Yr 12 Emf, internal resistance & potential divider)

	Topic	Key Knowledge *What will students know by the end of this topic?*	Key Skills *What skills will students have developed by the end of this topic?*	Assessment Opportunities *How will student progress be measured?* *What are the key assessment pieces?*
	3.9.2 Cosmology	• Stellar evolution: path of a star similar to our Sun on the HR diagram from formation to white dwarf. • Defining properties of supernovae, neutron stars and black holes • Gamma ray bursts due to the collapse of supergiant stars to form neutron stars or black holes. • Comparison of energy output with total energy output of the Sun. • Use of type 1a supernovae as standard candles to determine distances. Controversy concerning accelerating Universe and dark energy. • The light curve of typical type 1a supernovae. • Supermassive black holes at the centre of galaxies. • Calculation of the radius of the event horizon for a black hole • Schwarzschild radius • Doppler effect applied to optical and radio frequencies. • Calculations on binary stars viewed in the plane of orbit. • Galaxies and quasars. • Red shift and its simple interpretation as expansion of the universe; estimation of age of universe, assuming the Hubble constant is indeed constant • Qualitative treatment of Big Bang theory including evidence from cosmological microwave background radiation, and relative abundance of hydrogen and helium. • Quasars as the most distant measurable objects. • Discovery of quasars as bright radio sources.		Astrophysics Telescopes Time tasks Astrophysics assessment 1 (Telescopes) + Re-call Electricity Potential dividers

	Topic	Key Knowledge *What will students know by the end of this topic?*	Key Skills *What skills will students have developed by the end of this topic?*	Assessment Opportunities *How will student progress be measured?* *What are the key assessment pieces?*
		• Quasars show large optical red shifts; estimation involving distance and power output. • Formation of quasars from active supermassive black holes. • Detection techniques for exoplanets and difficulties in the direct detection of them • Typical light curve.		
Half Term 5 teacher A	Preparation for external examinations	- Remaining time to be spent on preparation for external examinations.	Previously learnt skills to be revisited prior to external examinations. Particular focus is usually on: - Practical questions - Estimating Any of the following material not yet used can be utilised during this time - Re-tests for end of topic tests - Year 12 material Timed Tasks	Timed task (Yr 13 Magnetic fields) Timed task (Yr 13 Thermal physics) Thermal physics assessment+ Re-call Errors in measurements
Half Term 5 teacher B	Preparation for external examinations	- Remaining time to be spent on preparation for external examinations.	Previously learnt skills to be revisited prior to external examinations. Particular focus is usually on: - Practical questions - Estimating Any of the following material not yet used can be utilised during this time - Re-tests for end of topic tests - Year 12 material Timed Tasks	Timed task (Yr 12 Materials) Astrophysics assessment 2 (Classification of stars)
Half Term 6 teacher A				External examinations

	Topic	Key Knowledge *What will students know by the end of this topic?*	Key Skills *What skills will students have developed by the end of this topic?*	Assessment Opportunities *How will student progress be measured?* *What are the key assessment pieces?*
Half Term 6 teacher B				External examinations