Croxley Danes School : Key Stage 4 Curriculum Map

Subject: Physics **Exam Board: AQA**

Key Concepts

Energy	Electricity	Particle model of matter	Atomic structure & radioactivity	Forces	Waves	Magnetism & electromagnetism	Space (Triple only)
Types of energy stores (kinetic, gravitational potential, elastic, thermal, etc.) Energy transfers (mechanical, electrical, heating, radiation) Conservation of energy Calculating work done (W = F × s) Calculating energy in kinetic and potential stores Power (P = E/t and P = W/t) Efficiency and how to improve it Renewable and non-renewable energy resources Environmental impact of energy use	Current, potential difference, and resistance in circuits Series vs parallel circuits Calculating current, voltage, and resistance (V = IR) IV characteristics of resistors, lamps, and diodes Required practicals: resistance and IV characteristics Mains electricity – AC and DC UK mains features (230V, 50Hz, 3-pin plug structure) Electrical power and energy (P = IV, E = Pt) National Grid – efficiency and step-up/down transformers Static electricity and electric fields (Physics only)	States of matter and particle arrangement Density equation (ρ = m/V) Required practical: measuring density Internal energy and temperature Specific heat capacity (Physics only) Specific latent heat (Physics only) Changes of state and energy Particle motion in gases and gas pressure (Physics only)	Structure of the atom – protons, neutrons, electrons Isotopes and ionising radiation Types of nuclear radiation (alpha, beta, gamma, neutron) Penetration, range, ionising power, and safety Half-life and radioactive decay Required practical: half-life simulation Uses of radiation (tracers, radiotherapy, etc.) Nuclear equations Nuclear fission and fusion (Physics only) Background radiation and radiation dose	Scalar vs vector quantities Contact and non-contact forces Free body diagrams and resultant forces Work done and energy transfer (W = F × d) Hooke's law and elastic potential energy (Physics only) Moments, levers, and gears (Physics only) Pressure in fluids (Physics only) Atmospheric pressure and depth effects (Physics only) Distance, speed, velocity, acceleration Motion graphs and calculations (s = vt, a = Δv/t) Newton's Laws of motion Stopping distance and braking factors Momentum and its conservation (Physics only) Safety features and deceleration	Transverse and longitudinal waves Wave properties: amplitude, wavelength, frequency, period Wave speed equation (v = fλ) Required practical: measuring wave speed Reflection, refraction, absorption Electromagnetic spectrum and wave uses Dangers of EM waves (UV, X-rays, gamma) Properties and uses of different EM waves Lenses, ray diagrams, and image formation (Physics only) Colour and the visible spectrum (Physics only) Sound waves and ultrasound (Physics only) Seismic waves and Earth's structure (Physics only)	Permanent and induced magnets Magnetic fields and field lines The motor effect (F = BIL) and applications Electromagnets and their uses Flemings Left-Hand Rule (Physics only) Electromagnetic induction and the generator effect (Physics only) Transformers (Physics only) Transformer equations and efficiency (Physics only) National Grid link to transformers (Physics only)	The solar system: planets, moons, natural/artificial satellites Orbits and gravitational field strength Life cycle of stars (nebula → black hole/neutron star) Red-shift and evidence for the Big Bang Expansion of the universe and dark matter/energy

What is the Croxley vision for this subject at Key Stage 4?

Our vision for Science at Key Stage 4 is to inspire learners to be active, curious, and creative, building on a broad and balanced foundation from Key Stage 3. We aim to develop confident students who can apply scientific knowledge beyond the classroom. By encouraging questions about the world around them, and using experiments to test ideas, students gain a deeper understanding of science in action. The GCSE curriculum focuses on key concepts needed for success in exams while maintaining links to real-world applications and other subjects. Throughout, we embed 'how science works' to help learners understand the evolving nature of science, interpret data, and develop independent thinking—preparing them to ask and answer questions with increasing confidence.

Links to Key Stage 3 National Curriculum

The AQA GCSE Physics specification builds directly on the Key Stage 3 (KS3) science curriculum. Many core concepts introduced at KS3 are revisited, deepened, and extended at GCSE, both in content and in Working Scientifically skills.

Key Stage 4 / Year Group:9

	Spring 2	Summer 1	Summer 2
Key Concept			
Content: **(Know what…)**		**ENERGY** ● Define a system as an object or group of objects and state examples of changes in the way energy is stored in a system ● Describe how all the energy changes involved in an energy transfer and calculate relative changes in energy when the heat, work done or flow of charge in a system changes ● Use calculations to show on a common scale how energy in a system is redistributed ● Calculate the kinetic energy of an object by recalling and applying the equation: [Ek = ½mv2] ● Calculate the amount of elastic potential energy stored in a stretched spring by	**ENERGY** ● Explain that only some of the energy in a system is usefully transferred, with the rest 'wasted', giving examples of how this wasted energy can be reduced ● Explain ways of reducing unwanted energy transfers and the relationship between thermal conductivity and energy transferred ● Describe how the rate of cooling of a building is affected by the thickness and thermal conductivity of its walls ● Required practical 2: investigate the effectiveness of different materials as thermal insulators and the factors that may affect the thermal insulation properties of a material

		applying, but not recalling, the equation: [Ee= ½ke2] ● Calculate the amount of gravitational potential energy gained by an object raised above ground level by recalling and applying, the equation: [Ee = mgh] ● Calculate the amount of energy stored in or released from a system as its temperature changes by applying, but not recalling, the equation: [ΔE = mcΔθ] ● Define the term 'specific heat capacity' ● Required practical 1: investigation to determine the specific heat capacity of one or more materials. ● Define power as the rate at which energy is transferred or the rate at which work is done and the watt as an energy transfer of 1 joule per second ● Calculate power by recalling and applying the equations: [P = E/t & P = W/t] ● Explain, using examples, how two systems transferring the same amount of energy can differ in power output due to the time taken ● State that energy can be transferred usefully, stored or dissipated, but cannot be created or destroyed and so the total energy in a system does not change	● Calculate efficiency by recalling and applying the equation: [efficiency = useful power output / total power input]. ● HT ONLY: Suggest and explain ways to increase the efficiency of an intended energy transfer ● List the main renewable and non-renewable energy resources and define what a renewable energy resource is ● Compare ways that different energy resources are used, including uses in transport, electricity generation and heating ● Explain why some energy resources are more reliable than others, explaining patterns and trends in their use ● Evaluate the use of different energy resources, taking into account any ethical and environmental issues which may arise ● Justify the use of energy resources, with reference to both environmental issues and the limitations imposed by political, social, ethical or economic considerations
Skills: (Know how to…)		Calculate energy transfers and efficiency using formulae Apply conservation of energy in real-world scenarios Interpret and analyse energy flow diagrams Evaluate the environmental impact of energy sources Use mathematical reasoning in energy calculations (e.g. power, work done)	Calculate energy transfers and efficiency using formulae Apply conservation of energy in real-world scenarios Interpret and analyse energy flow diagrams Evaluate the environmental impact of energy sources Use mathematical reasoning in energy calculations (e.g. power, work done)

Key vocabulary (5- 10 words)		**Energy store** **Energy transfer** **Kinetic** **Gravitational potential** **Conservation** **Power** **Specific heat capacity**	**Efficiency** **Renewable** **Hydroelectric** **Dissipated** **Wasted**
End of Half term assessment	AP1 assessment (2 x 40 min tests) + RIT		End of topic test (30 minutes) + RIT task AP2 assessment (2x 40 minutes tests) + RIT task
Planned trips / Clubs / links		Science drop-in clinic every Thursday lunchtime	Science drop-in clinic every Thursday lunchtime

Key Stage 4 /	**Year Group: 10**		
	Autumn Term 1	**Autumn Term 2**	**Spring Term 1**
key concept	What is the structure of matter at the particle level, and how do changes in energy affect the state, density, and behaviour of substances?	What is the structure of the atom, how does radioactive decay work, and how is nuclear radiation used and managed safely?	How do electric circuits work, how do we calculate current, voltage, and resistance, and how is electricity generated, transmitted, and used safely?
Content: (Know what…)	**PARTICLE MODEL OF MATTER** ● Calculate the density of a material by recalling and applying the equation: [ρ = m/V] ● Recognise/draw simple diagrams to model the difference between solids, liquids and gases ● Use the particle model to explain the properties of different states of matter and differences in the density of materials ● Required practical 5: use appropriate apparatus to make and record the measurements needed to determine the densities of regular and irregular solid objects and liquids ● Recall and describe the names of the processes by which substances change state ● Use the particle model to explain why a change of state is reversible and affects the properties of a substance, but not its mass ● State that the internal energy of a system is stored in the atoms and molecules that make up the system ● Explain that internal energy is the total kinetic energy and potential energy of all the particles in a system	**ATOMIC STRUCTURE AND RADIOACTIVITY** ● Describe the basic structure of an atom and how the distance of the charged particles vary with the absorption or emission of electromagnetic radiation ● Define electrons, neutrons, protons, isotopes and ions ● Relate differences between isotopes to differences in conventional representations of their identities, charges and masses ● Describe how the atomic model has changed over time due to new experimental evidence, inc discovery of the atom and scattering experiments (inc the work of James Chadwick) ● Describe and apply the idea that the activity of a radioactive source is the rate at which its unstable nuclei decay, measured in Becquerel (Bq) by a Geiger-Muller tube ● Describe the penetration through materials, the range in air and the ionising power for alpha particles, beta particles and gamma rays ● Apply knowledge of the uses of radiation to evaluate the best sources of radiation to use in a given situation ● Use the names and symbols of common nuclei and particles to complete balanced nuclear	**ELECTRICITY *electric circuits*** ● Draw and interpret circuit diagrams, including all common circuit symbols ● Define electric current as the rate of flow of electrical charge around a closed circuit ● Calculate charge and current by recalling and applying the formula: [Q = It] ● Explain that current is caused by a source of potential difference and it has the same value at any point in a single closed loop of a circuit ● Describe and apply the idea that the greater the resistance of a component, the smaller the current for a given potential difference (p.d.) across the component ● Calculate current, potential difference or resistance by recalling and applying the equation: [V = IR] ● Required practical 3: Use circuit diagrams to set up and check circuits to investigate the factors affecting the resistance of electrical circuits ● Define an ohmic conductor ● Explain the resistance of components such as lamps, diodes, thermistors and LDRs and sketch/interpret IV graphs of their characteristic electrical behaviour ● Explain how to measure the resistance of a component by drawing an appropriate circuit diagram using correct circuit symbols

	• Calculate the change in thermal energy by applying but not recalling the equation [$\Delta E = m\ c\ \Delta\theta$] • Calculate the specific latent heat of fusion/vaporisation by applying, but not recalling, the equation: [E = mL] • Interpret and draw heating and cooling graphs that include changes of state • Distinguish between specific heat capacity and specific latent heat • Explain why the molecules of a gas are in constant random motion and that the higher the temperature of a gas, the greater the particles' average kinetic energy • Explain, with reference to the particle model, the effect of changing the temperature of a gas held at constant volume on its pressure • Calculate the change in the pressure of a gas or the volume of a gas (a fixed mass held at constant temperature) when either the pressure or volume is increased or decreased • PHY ONLY: Explain, with reference to the particle model, how increasing the volume in which a gas is contained can lead to a decrease in pressure when the temperature is constant • PHY ONLY: Calculate the pressure for a fixed mass of gas held at a constant temperature by applying, but not recalling, the equation: [pV = constant] • PHY & HT ONLY: Explain how work done on an enclosed gas can lead to an increase in	equations, by balancing the atomic numbers and mass numbers • Define half-life of a radioactive isotope • HT ONLY: Determine the half-life of a radioactive isotope from given information and calculate the net decline, expressed as a ratio, in a radioactive emission after a given number of half-lives • Compare the hazards associated with contamination and irradiation and outline suitable precautions taken to protect against any hazard the radioactive sources may present • Discuss the importance of publishing the findings of studies into the effects of radiation on humans and sharing findings with other scientists so that they can be checked by peer review • PHY ONLY: State, giving examples, that background radiation is caused by natural and man-made sources and that the level of radiation may be affected by occupation and/or location • PHY ONLY: Explain the relationship between the instability and half-life of radioactive isotopes and why the hazards associated with radioactive material differ according to the half-life involved • PHY ONLY: Describe and evaluate the uses of nuclear radiation in exploration of internal organs and controlling or destroying unwanted tissue • PHY ONLY: Evaluate the perceived risks of using nuclear radiation in relation to given data and consequences • PHY ONLY: Describe nuclear fission	• Required practical 4: use circuit diagrams to construct appropriate circuits to investigate the I–V characteristics of a variety of circuit elements • Show by calculation and explanation that components in series have the same current passing through them • Show by calculation and explanation that components connected in parallel have the same the potential difference across each of them • Calculate the total resistance of two components in series as the sum of the resistance of each component using the equation: [R total = R1 + R2] • Explain qualitatively why adding resistors in series increases the total resistance whilst adding resistors in parallel decreases the total resistance • Solve problems for circuits which include resistors in series using the concept of equivalent resistance

	the temperature of the gas, as in a bicycle pump	• PHY ONLY: Draw/interpret diagrams representing nuclear fission and how a chain reaction may occur • PHY ONLY: Describe nuclear fusion	
Skills: (know how to…)	Use particle theory models to explain changes of state and density Plan and conduct experiments with accurate measurements (e.g. density practical) Analyse data on temperature, pressure, and volume using graphs Apply mathematical relationships to physical changes in matter Interpret data to support or challenge particle-based explanations	Understand and apply models of atomic and nuclear structure Interpret data from radioactive decay, including half-life graphs Use symbolic representation to communicate nuclear processes (e.g. equations) Evaluate risks and benefits of radiation in scientific and societal contexts Apply critical thinking to real-world uses of radioactivity	Plan and carry out circuit investigations using scientific apparatus Collect and interpret primary and secondary data (e.g. IV graphs) Apply mathematical models to understand relationships between current, voltage, and resistance Evaluate the reliability and limitations of practical data Use circuit symbols and diagrams to communicate scientific understanding
Key vocabulary (5- 10 words)	**Density** **Specific latent heat** **Internal energy** **Change of state** **Pressure** **Temperature** **Kinetic theory**	**Ionising radiation** **Contamination** **Irradiation** **Isotope** **Half-life** **Alpha** **Beta** **Gamma** **Nuclear decay**	**Current** **Potential difference (Voltage)** **Resistance** **Ohm's Law** **Series** **Parallel** **Power**
End of Half term assessment		End of topic test (30 minutes) + RIT task AP1 assessment (40 minutes test) + RIT task	End of topic test (30 minutes) + RIT task
Planned trips / Clubs / links	Science drop-in clinic every Thursday lunchtime	Science drop-in clinic every Thursday lunchtime	Science drop-in clinic every Thursday lunchtime

Key Stage 4 / **Year Group:10**			
	Spring 2	**Summer 1**	**Summer 2**
Key Concept	How do electric circuits work, how do we calculate current, voltage, and resistance, and how is electricity generated, transmitted, and used safely?	How do forces affect motion, shape, and pressure in objects?	How do forces affect motion, shape, and pressure in objects?
Content: **(Know what…)**	*Domestic elec and power* ● Explain the difference between direct and alternating voltage and current, stating what UK mains is Identify and describe the function of each wire in a three-core cable connected to the main ● State that the potential difference between the live wire and earth (0 V) is about 230 ● V and that both neutral wires and our bodies are at, or close to, earth potential (0 V) ● Explain that a live wire may be dangerous even when a switch in the mains circuit is open by explaining the danger of providing any connection between the live wire and earth ● Explain how the power transfer in any circuit device is related to the potential difference across it and the current through it ● Calculate power by recalling and applying the equations: [P = VI] and [P = I2 R] ● Describe how appliances transfer energy to the kinetic energy of motors or the thermal energy of heating devices	**FORCES (Statics)** ● Identify and describe scalar quantities and vector quantities ● Identify and give examples of forces as contact or non-contact forces ● Describe the interaction between two objects and the force produced on each as a vector ● Describe weight and explain that its magnitude at a point depends on the gravitational field strength ● Calculate weight by recalling and using the equation: [W = mg] ● Represent the weight of an object as acting at a single point which is referred to as the object's 'centre of mass' ● Calculate the resultant of two forces that act in a straight line ● HT ONLY: describe examples of the forces acting on an isolated object or system ● HT ONLY: Use free body diagrams to qualitatively describe examples where several forces act on an object and explain how that leads to a single resultant force or no force ● HT ONLY: Use free body diagrams and accurate vector diagrams to scale, to resolve multiple	**FORCES (Statics)** ● Describe examples of the forces involved in stretching, bending or compressing an object ● Explain why, to change the shape of an object (by stretching, bending or compressing), more than one force has to be applied – this is limited to stationary objects only ● Describe the difference between elastic deformation and inelastic deformation caused by stretching forces ● Describe the extension of an elastic object below the limit of proportionality and calculate it by recalling and applying the equation: [F = ke] ● Explain why a change in the shape of an object only happens when more than one force is applied ● Describe and interpret data from an investigation to explain possible causes of a linear and non-linear relationship between force and extension ● PHY ONLY: Describe and apply Hooke's Law (force = spring constant × extension). ● PHY ONLY: Interpret and draw force-extension graphs. ● Calculate work done in stretching (or compressing) a spring (up to the limit of proportionality) by applying, but not recalling, the equation: [$E = ½ \times k \times e^2$]

	• Calculate and explain the amount of energy transferred by electrical work by recalling and applying the equations: [E = Pt] and [E = QV] • Explain how the power of a circuit device is related to the potential difference across it, the current through it and the energy transferred over a given time. • Describe, with examples, the relationship between the power ratings for domestic electrical appliances and the changes in stored energy when they are in use • Identify the National Grid as a system of cables and transformers linking power stations to consumers • Explain why the National Grid system is an efficient way to transfer energy, with reference to change in potential difference reducing current *Electrical fields* • PHY ONLY: Describe the production of static electricity by the rubbing of insulating surfaces • PHY ONLY: Describe evidence that charged objects exert forces of attraction or repulsion on one another when not in contact • PHY ONLY: Explain how the transfer of electrons between objects can explain the • phenomenon of static electricity, including how insulators are charged and sparks are created • PHY ONLY: Draw the electric field pattern for an isolated charged sphere	forces and show magnitude and direction of the resultant force • HT ONLY: Use vector diagrams to illustrate resolution of forces, equilibrium situations and determine the resultant of two forces, to include both magnitude and direction • Describe energy transfers involved when work is done and calculate the work done by recalling and using the equation: [W = Fs] • Describe what a joule is and state what the joule is derived from • Convert between newton-metres and joules. • Explain why work done against the frictional forces acting on an object causes a rise in the temperature of the object	• Required practical 6: investigate the relationship between force and extension for a spring. • PHY ONLY: State that a body in equilibrium must experience equal sums of clockwise and anticlockwise moments, recall and apply the equation: [M = Fd] • PHY ONLY: Apply the idea that a body in equilibrium experiences an equal total of clockwise and anti-clockwise moments about any pivot • PHY ONLY: Explain why the distance, d, must be taken as the perpendicular distance from the line of action of the force to the pivot • PHY ONLY: Explain how levers and gears transmit the rotational effects of forces • PHY ONLY: Describe a fluid as either a liquid or a gas and explain that the pressure in a fluid causes a force to act at right angles (normal) to the surface of its container • PHY ONLY: Recall and apply the equation: [p = F/A] • PHY & HT ONLY: Explain why the pressure at a point in a fluid increases with the height of the column of fluid above and calculate differences in pressure in a liquid by applying [p = h ρ g] • PHY & HT ONLY: Describe upthrust an object and explain why the density of the fluid has an effect on the upthrust experienced by an object submerged in it • PHY & HT ONLY: Explain why an object floats or sinks, with reference to its weight, volume and the upthrust it experiences • PHY ONLY: Describe a simple model of the Earth's atmosphere and of atmospheric pressure, explaining why atmospheric pressure varies with height above a surface

	• PHY ONLY: Explain the concept of an electric field and the decrease in its strength as the distance from it increases • PHY ONLY: Explain how the concept of an electric field helps to Explain the non-contact force between charged objects as well as other electrostatic phenomena such as sparking		
Skills: (Know how to…)	Plan and carry out circuit investigations using scientific apparatus Collect and interpret primary and secondary data (e.g. IV graphs) Apply mathematical models to understand relationships between current, voltage, and resistance Evaluate the reliability and limitations of practical data Use circuit symbols and diagrams to communicate scientific understanding	Identify and represent forces acting on an object using accurate free-body diagrams. Resolve a force into horizontal and vertical components using a scale diagram or trigonometry. Calculate the resultant force acting on an object in equilibrium. Apply the condition that an object is in equilibrium when the resultant force is zero. Use vector diagrams to calculate the magnitude and direction of a resultant force.	Apply Hooke's Law ($F = k \times e$) to calculate the force, extension, or spring constant for an object within the limit of proportionality. Interpret and analyse force–extension graphs, distinguishing between elastic and inelastic deformation. Conduct and evaluate an investigation to explore the relationship between force and extension, ensuring accurate measurements and valid conclusions. Explain and apply the principle of moments. Calculate the moment of a force using the equation: moment = force × perpendicular distance from pivot. Use and interpret data involving levers and gears to explain force magnification. Describe how levers and gears transmit the turning effect of forces to gain a mechanical advantage.
Key vocabulary (5- 10 words)	**Directly proportional** **Gradient** **Power rating** **National Grid** **Earth wire** **Fuse** **Insulation**	**Scalar** **Vector** **Resultant force** **Mass** **Weight**	**Extension** **Compression** **Equilibrium** **Deformation**
End of Half term assessment	End of topic test (30 minutes) + RIT task	Paper 1 Mock exam (Combined 1 hour 15) (Phy only 1 hour 45)	End of topic test (30 minutes) + RIT task

Planned trips / Clubs / links	Science drop-in clinic every Thursday lunchtime	Science drop-in clinic every Thursday lunchtime	Science drop-in clinic every Thursday lunchtime

Key Stage 4 /	**Year Group: 11**		
	Autumn Term 1	**Autumn Term 2**	**Spring Term 1**
key concept	How can we describe and calculate interactions using Newton's Laws and momentum?	What are the properties and behaviours of waves, including light and sound, and how do they transfer energy and information through different media?	What are the properties and behaviours of waves, including light and sound, and how do they transfer energy and information through different media?
Content: (Know what…)	**FORCES and MOTION** ● Describe and explain motion in terms of distance, displacement, speed, velocity, and acceleration. ● Calculate speed, velocity, and acceleration using formulae: o speed = distance / time o acceleration = change in velocity / time ● Interpret and analyse distance–time and velocity–time graphs. ● Calculate gradients and areas under graphs to determine speed, acceleration, and distance. ● HT ONLY: Estimate the magnitude of acceleration for typical objects (e.g. cars, free fall). ● Explain the motion of objects when forces are balanced or unbalanced (Newton's First Law). ● Describe and apply Newton's Second Law (F = m × a).	**WAVES** ● Describe waves as either transverse or longitudinal, defining these waves in terms of the direction of their oscillation and energy transfer and giving examples of each ● Define waves as transfers of energy from one place to another, carrying information ● Define amplitude, wavelength, frequency, period and wave speed and Identify them where appropriate on diagrams ● Calculate wave speed, frequency or wavelength by applying, but not recalling, the equation: [v = f λ] and calculate wave period by recalling and applying the equation: [T=1/f] ● Describe a method to measure the speed of ripples on a water surface ● Required practical 8: make observations to identify the suitability of apparatus to measure the frequency, wavelength and speed of waves in a ripple tank and waves in a solid ● Identify amplitude and wavelength from given diagrams ● Describe a method to measure the speed of sound waves in air	**WAVES** ● PHY ONLY: Demonstrate how changes in velocity, frequency and wavelength are interrelated in the transmission of sound waves from one medium to another ● PHY ONLY: Discuss the importance of understanding both mechanical and electromagnetic waves by giving examples, such as designing comfortable and safe structures and technologies ● PHY ONLY: Describe a wave's ability to be reflected, absorbed or transmitted at the boundary between two different materials ● PHY ONLY: Draw the reflection of a wave at a surface by constructing ray diagrams ● Required practical 9 (physics only): investigate the reflection of light by different types of surface and the refraction of light by different substances. **EM WAVES** ● Describe what electromagnetic waves are and explain how they are grouped ● List the groups of electromagnetic waves in order of wavelength

	• Required practical 7: investigate the factors affecting acceleration (N's 2nd Law) • Interpret experimental data for investigating motion (e.g., light gates, trolleys). • Describe terminal velocity and explain it using forces acting on a falling object. • Explain and apply Newton's Third Law in different contexts (e.g. recoil, walking). • PHY ONLY: Calculate momentum (momentum = mass × velocity). • PHY ONLY: Describe conservation of momentum in collisions and explosions. • PHY ONLY: Apply the principle of conservation of momentum to solve problems. • PHY & HT ONLY: Explain the concept of inertia and its relation to mass. • Describe and explain factors affecting braking distance and stopping distance. • Calculate stopping distance using thinking and braking distances. • HT ONLY: Interpret graphs of braking distance vs speed and explain trends. • Explain the dangers of large decelerations and how safety features reduce force (F=m×a) • Evaluate the effectiveness of safety features (seatbelts, airbags, crumple zones). • Interpret and analyse graphs and data related to motion and forces.	• State examples of methods of measuring wave speeds in different media • PHY & HT ONLY: Describe, with examples, processes which convert wave disturbances between sound waves and vibrations in solids • PHY & HT ONLY: Explain why such processes only work over a limited frequency range and the relevance of this to the range of human hearing, which is from 20 Hz to 20 kHz • PHY & HT ONLY: Define ultrasound waves and explain how these are used to form images of internal structures in both medical and industrial imaging • PHY & HT ONLY: Compare the two types of seismic wave produced by earthquakes with reference to the media they can travel in and the evidence they provide of the structure of the Earth • PHY & HT ONLY: Describe how echo sounding using high frequency sound waves is used to detect objects in deep water and measure water depth	• Explain that because our eyes only detect a limited range of electromagnetic waves, they can only detect visible light • HT ONLY: Explain how different wavelengths of electromagnetic radiation are reflected, refracted, absorbed or transmitted differently by different substances and types of surface Illustrate the refraction of a wave at the boundary between two different media by constructing ray diagrams • HT ONLY: Describe what refraction is due to and illustrate this using wave front diagrams • Required practical activity 10: investigate how the amount of infrared radiation absorbed or radiated by a surface depends on the nature of that surface. • PHY ONLY: State that all bodies, no matter what temperature, emit and absorb infrared radiation and that the hotter the body, the more infrared radiation it radiates in a given time • PHY ONLY: Describe a perfect black body as an object that absorbs all the radiation incident on it and explain why it is the best possible emitter • PHY ONLY: Explain why when the temperature is increased, the intensity of every wavelength of radiation emitted increases, but the intensity of the shorter wavelengths increases more rapidly • PHY & HT ONLY: Explain and apply the idea that the temperature of a body is related to the balance between incoming radiation absorbed and radiation emitted • PHY & HT ONLY: Describe how the temperature of the Earth as dependent on the rates of absorption and emission of radiation and draw and interpret diagrams that show this • Explain that changes in atoms and the nuclei of atoms can result in electromagnetic waves being generated or absorbed over a wide frequency range

			• State examples of the dangers of each group of electromagnetic radiation and discuss the effects of radiation as depending on the type of radiation and the size of the dose • State examples of the uses of each group of electromagnetic radiation, explaining why each type of electromagnetic wave is suitable for its applications • HT ONLY: Explain how radio waves can be produced by oscillations in electrical circuits, or absorbed by electrical circuits
Skills: (know how to…)	Draw and interpret force diagrams to predict motion Use and evaluate mathematical models (e.g. F = ma, momentum) Design investigations to explore motion and stopping distances Analyse and interpret graphical data (distance-time and velocity-time graphs) Apply Newton's Laws to explain and predict physical phenomena	Model transverse and longitudinal wave behaviour Plan investigations to measure wave properties (e.g. speed, frequency) Use ray diagrams and wavefront models to explain reflection and refraction Interpret data and apply knowledge to evaluate wave behaviour Communicate understanding of EM waves and their applications using scientific terminology	Model transverse and longitudinal wave behaviour Plan investigations to measure wave properties (e.g. speed, frequency) Use ray diagrams and wavefront models to explain reflection and refraction Interpret data and apply knowledge to evaluate wave behaviour Communicate understanding of EM waves and their applications using scientific terminology
Key vocabulary (5- 10 words)	**Acceleration** **Terminal velocity** **Inertia** **Momentum** **Stopping distance**	**Transverse** **Longitudinal** **Amplitude** **Wavelength** **Frequency** **Time period** **Oscillation** **Rarefaction**	**Transmission** **Reflection** **Absorption** **Emission** **Refraction** **Electromagnetic**

End of Half term assessment	End of topic test (30 minutes) + RIT task	End of topic test (30 minutes) + RIT task Paper 1 Mock exam (Combined 1 hour 15) (Phy only 1 hour 45)	
Planned trips / Clubs / links	Science drop-in clinic every Thursday lunchtime	Science drop-in clinic every Thursday lunchtime	Science drop-in clinic every Thursday lunchtime
Key Stage 4 /	**Year Group:11**		
	Spring 2	**Summer 1**	**Summer 2**
Key Concept	What are the properties and behaviours of waves, including light and sound, and how do they transfer energy and information through different media?		
Content: **(Know what…)**	**LIGHT WAVES** ● PHY ONLY: State that a lens forms an image by refracting light and that the distance from the lens to the principal focus is called the focal length ● PHY ONLY: Explain that images produced by a convex lens can be either real or virtual, but those produced by a concave lens are always virtual ● PHY ONLY: Construct ray diagrams for both convex and concave lenses ● PHY ONLY: Calculate magnification as a ratio with no units by applying, but not recalling, the formula: [magnification = image height / object height]	**REVISION**	

	● PHY ONLY: Explain how the colour of an object is related to the differential absorption, transmission and reflection of different wavelengths of light by the object ● PHY ONLY: Describe the effect of viewing objects through filters or the effect on light of passing through filters and the difference between transparency and translucency ● PHY ONLY: Explain why an opaque object has a particular colour, with reference to the wavelengths emitted **MAGNETISM AND ELECTROMAGNETISM** ● Describe the attraction and repulsion between unlike and like poles of permanent magnets and explain the difference between permanent and induced magnets ● Draw the magnetic field pattern of a bar magnet, showing how field strength and direction are indicated and change from one point to another ● Explain how the behaviour of a magnetic compass is related to evidence that the core of the Earth must be magnetic ● Describe how to plot the magnetic field pattern of a magnet using a compass ● State examples of how the magnetic effect of a current can be demonstrated and explain how a solenoid arrangement can increase the magnetic effect of the current ● Draw the magnetic field pattern for a straight wire carrying a current and for a solenoid (showing the direction of the field)		

	● PHY ONLY: Interpret diagrams of electromagnetic devices in order to explain how they work ● HT ONLY: State and use Fleming's left-hand rule and explain what the size of the induced force depends on ● HT ONLY: Calculate the force on a conductor carrying a current at right angles to a magnetic field by applying, but not recalling, the equation: [F = BIL] ● HT ONLY: Explain how rotation is caused in an electric motor ● PHY & HT ONLY: Explain how a moving-coil loudspeaker and headphones work ● PHY & HT ONLY: Describe the principles of the generator effect, including the direction of induced current, effects of Lenz' Law and factors that increase induced p.d. ● PHY & HT ONLY: Explain how the generator effect is used in an alternator to generate a.c. and in a dynamo to generate d.c. ● PHY & HT ONLY: Draw/interpret graphs of potential difference generated in the coil against time ● PHY & HT ONLY: Explain how a moving-coil microphone works ● PHY & HT ONLY: Explain how the effect of an alternating current in one coil inducing a current in another is used in transformers ● PHY & HT ONLY: Explain how the ratio of the potential differences across the two coils depends on the ratio of the number of turns on each ● PHY & HT ONLY: Apply the equation linking the p.d.s and number of turns in the two		

	coils of a transformer to the currents and the power transfer ● PHY & HT ONLY: Apply but not recalling the equations: [Vs × Is = Vp × Ip] and [vp / vs = np / ns] for transformers **SPACE (SEPARATE SCIENCES ONLY)** ● PHY ONLY: List the types of body that make up the solar system and describe our solar system as part of a galaxy ● PHY ONLY: Explain how stars are formed ● PHY ONLY: Describe the life cycle of a star the size of the Sun and of a star which is much more massive than the Sun ● PHY ONLY: Explain how fusion processes lead to the formation of new elements and how supernovas have allowed heavy elements to appear in later solar systems ● PHY & HT ONLY: Explain that, for circular orbits, the force of gravity leads to a constantly changing velocity but unchanged speed ● PHY & HT ONLY: Explain that, for a stable orbit, the radius must change if the speed changes ● PHY ONLY: Explain, qualitatively, the red-shift of light from galaxies that are receding and how this red-shift changes with distance from Earth ● PHY ONLY: Explain why the change of each galaxy's speed with distance is evidence of an expanding universe ● PHY ONLY: Explain how scientists are able to use observations to arrive at theories, such as the Big Bang theory and discuss		

	that there is still much about the universe that is not understood		
Skills: **(Know how…)**	*E-Mags* Use field line diagrams to represent magnetic phenomena Explore cause and effect relationships in electromagnetic systems Apply models and rules (e.g. Left-Hand Rule) to make predictions Evaluate evidence from practical work (e.g. motors and generators) *Space* Explain technological applications using scientific principles and concepts Interpret astronomical data to understand motion and scale in the Universe Using models to describe the life cycle of stars and planetary motion Evaluate evidence for the Big Bang and red-shift apply gravitational concepts to real-life scenarios (e.g. satellites, orbits) Communicate scientific understanding of space through diagrams, models, and written explanations		

Key vocabulary (5- 10 words)	**Domains** **Repulsion** **Induced** **Solenoid** **Magnetic field**		
End of Half term assessment	End of topic test (30 minutes) + RIT task Paper 2 Mock exam (Combined 1 hour 15) (Phy only 1 hour 45)		
Planned trips / Clubs / links	Science drop-in clinic every Thursday lunchtime		