KS5 Curriculum Map – Physics:

Topic	Substantive Knowledge This is the specific, factual content for the topic, which should be connected into a careful sequence of learning.	Disciplinary Knowledge (Skills) This is the action taken within a particular topic in order to gain substantive knowledge.	Assessment Opportunities What assessments will be used to measure student progress?
Topics are taught in two strands in parallel (Strand A & Strand B)			
Strand A (Year 1)			
Matter and radiation	• List the components of an atom • Describe what happens when an unstable nucleus emits an alpha particle or a beta minus particle • Recall what is meant by a photon. • Calculate the energy of a photon. • Define antimatter. • Describe what happens when a particle and its antiparticle meet. • Describe what is meant by an interaction. • Name different types of interaction.	• Explain why some nuclei are stable and others unstable. • Estimate how many photons a light source emits every second. • Discuss whether anti-atoms are possible. • Explain what makes charged particles attract or repel each other. • Construct or complete Simple diagrams to represent the above reactions or interactions in terms of incoming and outgoing particles and exchange particles.	• Multiple choice test • Controlled Homework • Mini Formative tests • Summative end of unit tests

<table>
<tr><td>Quarks and leptons</td><td>

State whether we can predict new particles.
Describe strange particles.
Recognise hadrons.
Recognise leptons.
Distinguish between different types of neutrinos.
Define strange particles.
Define quarks and explain how we know they exist
State the conservation rules for particle interactions.
</td><td>

Explain how we can find new particles.
Identify different classifications of particles.
Consider whether leptons are elementary.
Evaluate the importance of lepton numbers.
Explain the quark changes that happen in beta decay
Explain why it could be said that there are no antimesons.
Explain what is sometimes conserved.
Explain what is never conserved
Use conservation rules to identify possible and impossible interactions.
</td><td>

Multiple choice test
Controlled Homework
Mini Formative tests
Summative end of unit tests
</td></tr>
<tr><td>Quantum phenomena</td><td>

Define a photon.
Discuss how the photon model was established.
Define a quantum.
Photoelectric equation:
$hf = \varphi + E_{Kmax}$.
Explain what is meant by ionisation of an atom.
Explain what is meant by excitation of an atom.
Explain what energy levels are.
Explain what happens when atoms de-excite.
Define a line spectrum.

$hf = E_1 - E_2$
Explain why we say photons have a dual nature.
</td><td>

Explain the photoelectric effect.
Explain why Einstein's photon model was revolutionary.
Explain why an electron can't absorb several photons to escape from a metal.
E_{Kmax} is the maximum kinetic energy of the photoelectrons.
Use the photoelectric experiment graph to determine and threshold frequency.
Explain how a fluorescent tube works.
Explain why atoms emit characteristic line spectra
Calculate the wavelength of light for a given electron transition.
Discuss why we can change the wavelength of a matter particle but not that of a photon.
</td><td>

Multiple choice test
Controlled Homework
Mini Formative tests
Summative end of unit tests
</td></tr>
</table>

	• Describe how we know that matter particles have a dual nature.	• Use the De Broglie equation to determine momentum of photons and velocity of electron waves.	
Waves	• Explain the differences between transverse and longitudinal waves. • Define a plane-polarised wave. • Explain what is meant by the amplitude of a wave. • Explain what is meant by the wavelength of a wave. • Calculate the frequency of a wave from its period. • Explain what we mean by diffraction. • Describe the necessary condition for the formation of a stationary wave. • Explain why nodes are formed in fixed positions. • Describe the simplest possible stationary wave pattern that can be formed. • Compare the frequencies of higher harmonics with the first harmonic frequency. • $c = f\lambda$ and $f = \frac{1}{2L}\sqrt{\frac{T}{\mu}}$	• Describe a physics test that can distinguish transverse waves from longitudinal waves. • Explain what causes waves to refract when they pass across a boundary. • Demonstrate the direction light waves bend when they travel out of glass and into air • Explain what we mean by diffraction. • Deduce whether a stationary wave is formed by superposition. • Explain what condition must be satisfied at both ends of the string. • Describe how an oscilloscope can be used. • Interpret waveforms on an oscilloscope to give peak voltage and wavelength. • '4.7 Practical: Speed of sound'	• Multiple choice test • Controlled Homework • Required practical assessments • Mini Formative tests • Summative end of unit tests
Optics	• Explain what we mean by rays. • State Snell's law. • Explain what happens to the speed of light waves when they enter a material such as water.	• Comment on whether refraction is different for a light ray travelling from a transparent substance into air. • Simple treatment of fibre optics including the function of the cladding.	• Multiple choice test • Controlled Homework • Required practical assessments • Mini Formative tests • Summative end of unit tests

	• Relate refractive index to the speed of light waves. • State the conditions for total internal reflection. • • $n_1 \sin \vartheta_1 = n_2 \sin \vartheta_2$. • Total internal reflection $\sin \vartheta_c = \frac{n_2}{n_1}$. • Path difference. Coherence. • Interference using a laser as a source of monochromatic light. • Fringe spacing • $w = \frac{\lambda D}{s}$ • State the general condition for the formation of a bright fringe. • Describe the Young's double slit experiment. • Describe which factors could be (i) increased or (ii) decreased, to increase the fringe spacing. • Identify coherent sources. • Derivation of • $d \sin \vartheta = n \lambda$. • Applications of diffraction gratings.	• Explain why a glass prism splits white light into the colours of a spectrum. • Relate the critical angle to refractive index. • Explain why diamonds sparkle • 5.3 Practical • Explain why slits, rather than two separate light sources, are used in Young's double slit experiment. • Describe the roles of diffraction and interference when producing Young's fringes. • Practical – finding the wavelength by double slit diffraction. • Explain why diffraction of light is important in the design of optical instruments. • Compare the single slit diffraction pattern with the pattern of Young's fringes. • Describe and explain the effect of the single slit pattern on the brightness of Young's fringes. • Explain why a diffraction grating diffracts • monochromatic light in certain directions only.	

Strand B (Year 1)			
Electric current	• Electric current as the rate of flow of charge; potential difference as work done per unit charge. • $I = \frac{\Delta Q}{\Delta t}$ • Energy and power equations: • $E = I\,V\,t$ • $P = I\,V$ • $V = \frac{W}{Q}$ • Resistance defined as • $R = \frac{V}{I}$. • Ohm's law as a special case where $I \propto V$ under constant physical conditions*3.5.1.3* • Resistivity, $\rho = \frac{RA}{L}$. • Superconductivity • Applications of superconductors • Current–voltage characteristics for an ohmic conductor, semiconductor diode, and filament lamp.	• Calculate the charge flow in a circuit. • Calculate electrical power. • Explain how energy transfers take place in electrical devices • Describe what causes electrical resistance. • Discuss when Ohm's law can be used. • Explain what a superconductor is • Make calculations relating power current pd time resistance and energy. • 12 Support: Electricity • 12.3 Support: Resistance and resistivity • 12.3 Practical: Investigating resistivity • 12.4 Practical: *I–V* characteristics • 12.4 Practical: Characteristics of light-emitting diodes • 12.4 Practical: Investigating the characteristics of a thermistor • 13 Revision podcast: Electric current	• Multiple choice test • Controlled Homework • Required practical assessments • Mini Formative tests • Summative end of unit tests
DC circuits	• Energy and power equations: • $P = I^2 R = \frac{V^2}{R}$.	• 13.4 Practical: Conservation of energy in a circuit • Describe how we use the rules in circuits. • Calculate the current and pds for each component in a circuit. • 13.2 Practical: Investigating resistors	• Multiple choice test • Controlled Homework • Required practical assessments • Mini Formative tests • Summative end of unit tests

	• State the rules for series and parallel circuits. • and the principles behind these rules. • Calculate resistances in series and in parallel. • Define resistance heating. • 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 • $\varepsilon = \frac{E}{Q}$, $\varepsilon = I(R + r)$. • Terminal pd; emf.	• 13 Support: Direct current circuits • Explain why the pd of a battery (or cell) in use is less than its emf. • Measure the internal resistance of a battery. • Describe how much power is wasted in a battery. • 13.3 Practical: Internal resistance and electromotive force • 13.3 Calculation sheet: Emf and pd • 13 Support: Cells, electromotive force, and internal resistance • 13.4 Practical: Investigating cell combinations • Calculate currents in circuits with: • resistors in series and parallel • more than one cell • diodes in the circuit. • Describe a potential divider. • Explain how we can supply a variable pd from a battery • Explain how we can design sensor circuits. • 13 Stretch and challenge teacher sheet: Direct current circuits • 13.5 Calculation sheet: Potential dividers • 13.5 Practical: Application of potential dividers and sensor circuits	
Forces in equilibrium	• Define a vector quantity. • Describe how we represent vectors. • Demonstrate when two (or more) forces have no overall effect on a point object. • Explain the parallelogram of forces. • Resolution of vectors into two components at right angles to each other. Examples	• Explain how we add and resolve vectors • Explain why we have to consider the direction in which a force acts. • Explain how the turning effect of a given force can be increased. • Assess when a tilted object will topple over.	• Multiple choice test • Controlled Homework • Required practical assessments • Mini Formative tests • Summative end of unit tests

	include components of forces along and perpendicular to an inclined plane. • Describe the conditions under which a force produces a turning effect. • Explain what is required to balance a force that produces a turning effect. • Explain why the centre of mass is an important idea. • Describe the support force on a pivoted body. • When a body in equilibrium is supported at two places, state how much force is exerted on each support. • Explain what is meant by a couple. • Explain the difference between stable and unstable equilibrium • Explain what condition must apply to the forces on an object in equilibrium. • Explain what condition must apply to the turning effects of the forces. • State the important principles that always apply to a body in equilibrium.	• Explain why a vehicle is more stable when its centre of mass is lower • Numerous calculations and problems are used here to develop and assess students' technique and understanding. • Describe how we can apply these conditions to deduce the forces acting on a body in equilibrium, create equations describing the relationships between the forces acting on static bodies and solve these for unknown forces and distances where needed.	
On the move	• Displacement, speed, velocity, acceleration. • Explain why uniform acceleration is a special case. • Explain why acceleration is considered a vector • $v = \frac{\Delta s}{\Delta t}$ • $a = \frac{\Delta v}{\Delta t}$ • Calculations include average and instantaneous speeds and velocities. • Equations for uniform acceleration: • Acceleration due to gravity, *g*. • Distinguish between *u* and *v*.	• Explain what else we need to know to calculate the acceleration of an object if we know its displacement in a given time. • Discuss if objects of different masses or sizes all fall with the same acceleration. • Calculate the motion of an object with constant acceleration if its velocity reverses. • Deduce whether the overall motion should be broken down into stages. • Application of the Suvat equations to a large number of typical situations.	• Multiple choice test • Controlled Homework • Required practical assessments • Mini Formative tests • Summative end of unit tests

	• Calculate the displacement of an object moving with uniform acceleration. • Define ‘free fall’. • Explain how the velocity of a freely falling object changes as it falls. • Distinguish between a distance–time graph and a displacement–time graph. • Describe what the gradient of a velocity–time graph represents. • Describe what the area under a velocity–time graph represents. • Explain how we use signs to work out if an object is moving forwards or backwards	• Numerous calculations and problems are used here to develop and assess students’ technique and understanding. • Practical to determine g by measuring the motion of a free-falling object. • Describe what would happen to the motion of a projectile if we could switch gravity off. • Describe where we meet projectile motion. • Explain the path of a projectile. With no drag • Describe how projectile motion is affected by the air it passes through.	
Newton’s laws of motion	• Describe what effect a resultant force produces. • Describe what would happen to a body that was already in motion if there was no resultant force acting on it. • Apply $F = m\,a$ when the forces on an object are in opposite directions. • Describe any situations in which $F = m\,a$ cannot be applied. • Explain what we mean by a drag force. • Explain what determines the terminal speed of a falling object or a vehicle. • Distinguish between braking distance and stopping distance. • Describe how road conditions affect these distances. • Explain what should be increased to give a smaller deceleration from a given speed. • State which design features attempt to achieve this in a modern vehicle.	• Explain how weight is different from mass • Explain why you experience less support as an ascending lift stops. • Explain why the speed of an object moving through a viscous fluid reaches a maximum when a driving force is still acting.	• Multiple choice test • Controlled Homework • Required practical assessments • Mini Formative tests • Summative end of unit tests

Force and momentum	• *momentum* = *mass* × *velocity*. • Force as the rate of change of momentum, • $F = \frac{\Delta(m v)}{\Delta t}$. • Impulse = change in momentum. • $F \Delta t = \Delta(m v)$, where F is constant. • Significance of the area under a force–time graph. • Quantitative questions may be set on forces that vary with time. Impact forces are related to contact times (e.g., kicking a football, crumple zones, packaging). • Conservation of linear momentum • Distinguish between an elastic collision and an inelastic collision. • Describe what is conserved in a perfectly elastic collision. • Discuss whether any real collisions are ever perfectly elastic. • State what can always be said about the total momentum of a system that has exploded. • Describe the consequences when, after the explosion, only two bodies move apart.	• Describe what happens to the momentum of a ball when it bounces off a wall. • Principle applied quantitatively to problems in one dimension. • Elastic and inelastic collisions; explosions. • Appreciation of momentum conservation issues in the context of ethical transport design. • 9.3 Practical: Testing conservation of momentum' • Analysis of force-time graphs. • Describe the energy changes that take place in an explosion. • Use conservation of momentum in calculations about collisions and explosions.	• Multiple choice test • Controlled Homework • Required practical assessments • Mini Formative tests • Summative end of unit tests
Work, energy and power	• Define energy and describe how we measure it. • Define work (in the scientific sense). • $W = F s \cos \theta$. • Principle of conservation of energy. • $\Delta E_p = m g \Delta h$ • and • $E_k = ½ m v^2$	• Discuss whether energy ever disappears • Quantitative questions may be set on variable forces • Quantitative and qualitative application of energy conservation to examples involving gravitational potential energy, kinetic	• Multiple choice test • Controlled Homework • Mini Formative tests • Summative end of unit tests

	• rate of doing work = rate of energy transfer, P = F v. • Significance of the area under a force–displacement graph. • $efficiency = \frac{useful\ output\ power}{output\ power}$. • Efficiency can be expressed as a percentage.	energy, and work done against resistive forces. • 10.2 Practical: Investigating the gravitational potential energy of a table tennis ball' • Exercises to identify and calculate the power of energy transfers and the efficiency of machines and processes.	

Materials	• Density, $\rho = \frac{m}{V}$. • Hooke's law, elastic limit, • $F = k\,\Delta L$, • *k* as stiffness and spring constant. • Spring energy transformed to kinetic and gravitational potential energy. • Tensile strain and tensile stress. • Elastic strain energy, breaking stress, *energy stored* = $\frac{1}{2} F\,\Delta L$ = *area under force–extension graph*. • Description of plastic behaviour, fracture, and brittle behaviour linked to force–extension graphs. • Quantitative and qualitative application of energy conservation to examples involving elastic strain energy and energy to deform. • Appreciation of energy conservation issues in the context of ethical transport design. • *Young modulus* = $\frac{\text{tensile stress}}{\text{tensile strain}} = \frac{F\,L}{A\,\Delta L}$ • Use of stress–strain graphs to find the Young modulus. • (One simple method of measurement is required.) • 'both involves aspects of:	• Measure the density of an object. • Discuss whether there is any limit to the linear graph of force against extension for a spring. • Define the spring constant and state its unit of measurement. • If the extension of a spring is doubled, calculate how much more energy it stores. • 11.2 Practical: Investigating springs • Make calculations of the effective spring constant of a 'network' of linked springs. • Interpretation of stress–strain curves • 11.3 Practical: Determining the Young modulus' and 11.4 Practical: Deforming strawberry laces'	• Multiple choice test • Controlled Homework • Required practical assessments • Mini Formative tests • Summative end of unit tests

Strand A (Year 2)

Motion in a Circle	• Uniform Circular motion • Magnitude of angular speed • Radian measure of angle • Motion in a circular path at constant speed implies there is an acceleration and requires a centripetal force • Centripetal acceleration • Centripetal force	• Recognise uniform motion in a circle • Describing what you need to measure to find the speed of an object moving in uniform circular motion • Defining angular displacement and angular speed Explain why velocity is not constant when an object is travelling uniformly in a circle • Determining the direction of the acceleration • Calculating the centripetal force • Describing scenarios where centripetal acceleration is experienced	• Multiple choice test • Required practical assessments • Mini Formative tests • Summative end of unit tests
Applications of Simple Harmonic Motion	• Analysis of characteristics of simple harmonic motion (SHM). • Condition for SHM: $a \propto -x$ • Defining equation: $a = -\omega 2x$ • Graphical representations linking the variations of x, v and a with time. • 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 Relevant formula • Energy and simple harmonic motion • Effects of damping on oscillations. • Qualitative treatment of free and forced vibrations. • Resonance and the effects of damping on the sharpness of resonance.	• Describing the phase difference between two oscillators that are out of step. • Stating the two fundamental conditions about acceleration that apply to simple harmonic motion • Describing how displacement, velocity, and acceleration vary with time • Calculating the velocity for a given displacement. Stating the circumstances in which resonance occurs • Distinguishing between free vibrations and forced vibrations • Explaining why a resonant system reaches a maximum amplitude of vibration	• Multiple choice test • Required practical assessments • Mini Formative tests • Summative end of unit tests

Gravitational fields	• Gravity as a universal attractive force acting between all matter. • Magnitude of force between point masses: Newton's Formula • Representation of a gravitational field by gravitational field lines. • Escape velocity. • Use of satellites in low orbits and geostationary orbits, to include plane and radius of geostationary orbit. • Orbital period and speed related to radius of circular orbit; derivation of T2 ∝ r3 • Energy considerations for an orbiting satellite. • Total energy of an orbiting satellite.	• Describing how gravitational attraction varies with distance • Explaining what is meant by an inverse-square law • Discussing whether spherical objects, for example planets, can be treated as point masses • Describing the shape of a graph of g against r for points outside the surface of a planet • Comparing this graph with the graph of V against r • Explaining the significance of the gradient of the V-r graph • State the condition needed for a satellite to be in a stable orbit • Describing what happens to the speed of a satellite if it moves closer to the Earth • Discussing why a geostationary satellite must be in an orbit above the equator.	• Multiple choice test • Mini Formative tests • Controlled questions • Summative end of unit tests
Electric fields	• Representation of electric fields by electric field lines • Electric field strength as force per unit charge with a knowledge of associated formulae • Understanding of definition of absolute electric potential, including zero value at infinity, and of electric potential difference. • Work done in moving charge Q given by Δ W = Q Δ Equipotential surfaces. • No work done moving charge along an equipotential surface. • Coulomb's law • Similarities and differences between gravitational and electrostatic forces:	• Describing what the direction of an electric field line shows concerning a test charge • Illustrating the strength of an electric field by using field lines. • Explaining why potential is defined in terms of the work done per unit + charge • Calculating the electric potential difference between two points • Describing how to find the change in electric potential energy from pd • Explaining why potential (and pd) is measured in V. • Calculations using Coulomb's formulae • Stating the similarities and the principal differences between electric and gravitational fields	• Multiple choice test • Required practical assessments • Mini Formative tests • Summative end of unit tests

Capacitors	• Definition of capacitance • Interpretation of the area under a graph of charge against pd • Time constants including their determination from graphical data. • Quantitative treatment of capacitor • Dielectric action in a capacitor • Relative permittivity and dielectric constant.	• Relating the potential difference (pd) across the plates of a capacitor to the charge on its plate • Discussing what capacitors are used for. • Describing the form of energy that is stored by a capacitor • Calculation of time constants including their determination from graphical data. • Defining the time constant of a capacitor-resistor circuit. • Defining relative permittivity and dielectric constant • Describing the action of a simple polar molecule rotating in an electric field	• Multiple choice test • Required practical assessments • Mini Formative tests • Summative end of unit tests
Magnetic fields	• The factors that the magnitude of the force on a current-carrying wire depends on. • What happens to charged particles in a magnetic field • What happens to the direction of the magnetic force when electrons are deflected by a magnetic field? • Why the moving charges move in a path that is circular • The factors that affect the radius of the circular path.	• Calculations for various scenarios for charges moving in electric and magnetic fields • Describing what happens to the direction of the magnetic force when electrons are deflected by a magnetic field • Explaining why the moving charges move in a path that is circular • Stating the factors that affect the radius of the circular path	• Multiple choice test • Required practical assessments • Mini Formative tests • Summative end of unit tests
Electromagnetic induction	• The laws of electromagnetic induction • Principles of the alternating current generator • Alternating current and power both numerical and qualitative analysis • Elements and function of Transformers	• Stating the factors that would cause the induced emf to be greater • Calculations using Faraday's law • Using Lenz's law to explain induction phenomena • Explaining what is meant by the rms value of an alternating current • Calculating the power supplied by an alternating current. • the energy changes that take place in a transformer	• Multiple choice test • Required practical assessments • Mini Formative tests • Summative end of unit tests

		• Discussing how the efficiency of transformers is improved by better design.	
		Strand B (Year 2)	
Radioactivity	• Rutherford's experiment • Properties of alpha, beta & gamma • Dangers of radioactive decay • Radioactive decay • Usages of Radioactive isotopes • Nuclear decay modes • Nuclear radii and how to determine them	• Describing how the nucleus was discovered • Describing the properties of alpha, beta, and gamma radiation and their comparable dangers • Describing how the intensity of gamma radiation changes as it spreads out • Explaining how to represent the change in a nucleus when it emits alpha, beta, or gamma radiation. • Complete calculations using Nuclear Formulae • Describing how to do radioactive dating and complete appropriate calculations • Describe methods for ascertaining nuclear radii and completing calculations	• Multiple choice test • Required practical assessments • Mini Formative tests • Summative end of unit tests
Nuclear Energy	• Energy and mass • Binding Energy • Fission and Fusion • Thermal nuclear reactors	• Describing what happens to the mass of an object when it gains or loses energy • Calculating the energy released in a nuclear reaction. • Calculating how much energy is released in a fission or fusion reaction • Explaining how nuclear reactor works • Describing a thermal nuclear reactor • Explaining how a nuclear reactor is controlled.	• Multiple choice test • Controlled questions • Mini Formative tests • Summative end of unit tests

Thermal Physics	• Internal energy is the sum of the randomly distributed kinetic energies and potential energies of the particles in a body and a varies with work done • Concept of absolute zero of temperature. • Specific Heat capacity and Specific latent Heat	• Defining internal energy • Stating the lowest temperature that is possible • Complete calculations using appropriate thermal equations for latent heat and specific heat capacity. • and stating the experimental gas laws	• Multiple choice test • Required practical assessments • Controlled questions • Mini Formative tests • Summative end of unit tests
Gases	• Gas laws as experimental relationships between p, V, T and the mass of the gas. • Ideal gas equation its' derivation and application • Molar mass and molecular mass • Avogadro constant N_A, molar gas constant R, Boltzmann constant k	• Calculating the increase of the pressure of a gas when it is heated or compressed • Calculating the work done in an isobaric process. • Calculating the increase of the pressure of a gas when it is heated or compressed • Derive the ideal gas equation • Stating what is meant by an isothermal change. • Calculating the work done in an isobaric process • Use data to calculate the value of absolute zero	• Multiple choice test • Required practical assessments • Controlled questions • Mini Formative tests • Summative end of unit tests
Special Relativity	• Absolute motion and the ether • The Michelson–Morley experiment • Einstein's postulates • Time dilation • Length contraction • Relativistic mass: Mass and energy • Bertozzi's experiment	• Explaining what is meant by absolute motion and relative motion • Describing the experimental evidence that all motion is relative • Stating the assumptions made by Einstein in his theory of special relativity • Explaining what is meant by length contraction, time dilation, and relativistic mass and completing relativistic calculations	• Multiple choice test • Controlled questions • Mini Formative tests • Summative end of unit tests

Wave–particle duality	• Newton’s corpuscular theory of light • The significance of Young’s double slits experiment • Maxwell’s theory of electromagnetic waves • Hertz’s discovery of radio waves • How to demonstrate the transverse nature of radio waves • Fizeau’s determination of the speed of light The development of the photon theory of light Einstein’s explanation of photoelectric emission • Stopping potential and threshold frequency • Wave–particle duality Electron microscopes	• Describing Newton’s corpuscular theory of light • Explaining what Young’s double slits experiment tells you about the nature of light • Explain what Maxwell proved about the speed of electromagnetic waves • Describe how radio waves were first produced and detected • Describe how the speed of electromagnetic waves was first measured accurately • Explaining what the ultraviolet catastrophe is and • describing the significance of Einstein’s explanation of photoelectricity • Explaining the diffraction of matter	• Multiple choice test • Controlled questions • Mini Formative tests • Summative end of unit tests
The discovery of the electron	• Thermionic emission of electrons • The principle of thermionic emission • Deflection of an electron beam • Using a uniform electric field • Using a uniform magnetic field • Balanced fields • Use of electric and magnetic fields • to determine specific charge • The determination of the charge of the electron, • e, by Millikan’s method	• Explaining what cathode rays are and how they were discovered • Describing how a beam of electrons is produced in a vacuum tube • Explaining how electron beams can be controlled and deflected • Describing what happens to the deflection of an electron beam if the speed of the electrons is increase • Complete calculations for specific charge and charge • Explaining why Millikan’s determination of e was important	• Multiple choice test • Controlled questions • Mini Formative tests • Summative end of unit tests