Key Stage 5 Subject Timeline Year 12 to 13

Subject: Physics **Exam Board: Edexcel**

KS5 Physics - Year 12

	Autumn 1	Autumn 2	Spring 1	Spring 2	Summer 1	Summer 2
	Throughout the Course: **Topic 1 – Working as a Physicist** **Topic 1**- Section 1.1 – Working as a Physicist. This is a key feature of the Edexcel Physics AS and A level specification. Throughout the course, students will develop knowledge and understanding of what it means to work scientifically, including the ways in which the scientific community functions and how society uses scientific ideas. Additionally, students will develop confidence in key scientific skills, such as manipulating quantities and units and making estimates.					
Topics	**Topic 2.1:** Mechanics *Velocity and Acceleration, Motion graphs, adding forces, Moments, Newton's Laws of motion, Kinematics equations, Resolving vectors, Projectiles.* **Topic 3.1**: Electrical quantities *Electric current, Current - voltage relationship, resistivity. Conduction, resistance, and semi-conductors.*	**Topic 2.2**: Energy *Gravitational Potential and Kinetic Energies. Work and Power.* **Topic 2.3-** Momentum. *Momentum, Conservation of linear momentum.* **Topic 3.2-** Complete electrical circuit. *Series and parallel circuits, circuit rules, potential dividers, emf and internal resistance. Power in circuits.*	**Topic 4.1**: Materials- Fluids- *Fluid density and Upthrust, Fluid movement, Drag act, Terminal velocity.* **Topic 5.1 & 5.2:** Waves and Particle nature of light- *Basic waves, The behaviour of waves.*		**Topic 4.2:** Solid Material properties- *Hooke's Law, stress- strain and Young modulus, Stress-strain graphs.* **Topic 5.3 &5.4:** Optics, Quantum Physics.	
Key skills and Concepts	**Topic 2** Key Concept – Mechanics-Definitions of and equations for speed, distance, displacement, time, velocity, acceleration. Graphs of motion over time, Classification of scalars and vectors, Newton's laws of motion, Kinematics, Moments (turning forces). Calculations of Ep and Ek, calculating exchanges between Ep and Ek based on energy conservation, Calculations of work and power. Efficiency and how to calculate it. Calculation of momentum. Principle of conservation of linear momentum and one-dimensional application. **Topic 3** Key Concept- Electric circuits- Atomic structure, Electrical charge, mathematical definition of current, voltage and resistance. Ohm's law, factors affecting resistance in different objects. Calculation of electrical energy and power and the efficiency of an electrical device. **Topic 3&4**- Supporting Practical Work – Finding acceleration due to gravity by free fall method. (CP01). Finding the centre of mass of an irregular rod. Newton's second law investigation. Finding g, from energy conservation. Investigating momentum change (CP09). Observing charge flow, Investigating I-V relationships, investigating the electrical resistivity of a material (CP02), Investigating conduction velocities of coloured ions. Determine the EMF and Internal Resistance of an Electrical cell (CP03), investigating efficiency.		**Topic 4 .1** Key Concept – Materials- Fluids- Density and Upthrust calculation, meanings of drag, viscosity, laminar and turbulent flow. Stoke's law, Terminal velocity and its effect. Stress -strain calculation, calculation of Young Modulus, interpretation of stress-strain graphs. Supporting practical work – Investigating flow rates, investigating how viscosity changes with temperature, Determine the viscosity of a liquid (CP04). Determine the Young Modulus of a material (CP05) **Topic 5.1, 5.2** Key Concept – Waves and Particle Nature of light. Definitions of frequency, wavelength, speed, wave phase, time period. Difference between transverse and longitudinal waves. Wave calculations in pulse-echo techniques and ultrasound scanning. How waves combine when they meet, properties of standing waves, diffraction, and interference. Supporting Practical Work – Determine the speed of sound in air (CP06), Investigating the factors affecting the fundamental frequency of a string (CP07), investigating diffraction with a laser, Investigating two source interferences. Determine the wavelength of light (CP08)	**Topic 4.2** Key Concept – Hooke's Law, Stress-strain and Young modulus calculation, Interpretation of stress-strain graphs. Supporting practical work – An experiment to investigate Hooke's Law, Investigating stress-strain relationships for metals. **Topic 5.3,5.4** Key Concept – Definition of refraction and refractive index calculation. Phenomenon of total internal reflection. Effects of lenses and calculation using lens formula. Formation of images in lenses and calculation of magnification. Polarisation and its implications and applications. Supporting Practical Work – Investigating refractive index, Investigating the power of a lens, Investigating the lens formula, Investigating structural stresses. Investigating photoelectrons, electron diffraction,and gas discharge spectra.	

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Endpoints	-Explain distinction between scalars and vector quantities, distinguish between speed, velocity, and acceleration, interpret displacement, velocity-time graphs and make calculations from graphs. -Add two perpendicular vectors by calculation, apply principle of moments, find centre of gravity of an object. -Make calculations of electric current, voltage, and energy transfer in components. Explain I-V characteristics of components. Calculate drift velocity, explain conduction in semiconductors.	- Make calculations using Newton's Laws. Explain that any vector can be split into two components at right angles to each other and calculate values of the component vectors. Combine horizontal and vertical motion to calculate the movements of projectiles. Calculate work done and efficiency and linear momentum. - Derive equations for resistance in series and parallel. Make calculations based on current and voltage circuit rules. Explain uses for potential divider circuits. Make calculations of internal resistance. Explain efficiency and make calculations of it within electric circuits.	**Topic 4.1** - Calculate upthrust and density, know the differences between laminar and turbulent flow, what is viscosity and its relationship with temperature. Use the equation of viscous drag.	**Topic 5.1.5.2** - Define wave speed, measure speed of sound in air, describe longitudinal and transverse waves, explain examples of superposition of waves, use equation of speed of transverse waves on a string. Describe an experiment to describe diffraction effects. Describe difference between wave difference and path difference.	**Topic 4.2** Use Hooke's law equation in calculation. Calculate Young's modulus, Interpret stress-strain graphs	**Topic 5.3, 5.4** -Understand refraction, use Snell's law equation, understand critical angle and predict whether total internal reflection will occur. Explain focal length and power of a lens, use equation for power of a lens and combination of twin lenses. Use lens formula to calculate image magnification. Describe polarisation.
Assessment	Topic 2 and 3 Midpoint Assessments	Topic 2 and 3 End of Chapter Assessment Year 12 PPE's	Topic 4 &5 Midpoint Assessments.		Revision End of Year 12 PPE's (AS Exams)	

KS5 Physics - Year 13

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Topics	**Topic 6.1 &6.2:** Further Mechanics- Further momentum. *Energy in collisions, More collisions* Circular motion- *Circular motion basics, Centripetal force.* **Topic 7.1 &7.2:** Electric and Magnetic Fields *Electric fields, Capacitors, Electromagnetic effects.* **Topic 8:** Nuclear and Particle physics- *Probing matter, Particle Accelerators and detectors, The Particle Zoo.* **Topic 10**- Nuclear radiation- *Radioactivity*		**Topic 9:** Thermodynamics-Heat and Temperature. *internal energy, Heat transfer, Ideal gas behaviour, Kinetic theory equations.* **Topic 11**: Gravitational fields- *Gravitational forces, Gravitational fields* **Topic: 12** Space: *Star shine, stellar classifications, distances to stars, age of the universe, fate of the universe.* **Topic 13:** Oscillations*: SHM and SHM mathematics, SHM energy, Resonance, and damping.*		Revision Core Practical (CP) Repeats/Catch-up	Exams

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Key skills and Concepts	**Topics 6,7,8 and 10** Key Concept – Topic 6- Impulse, change in momentum, 2D collisions, Elastic, and inelastic collisions Ek of non-relativistic particle. Angular velocity, centripetal acceleration, centripetal force, and its calculation. Topic 7- Coulomb's Law, uniform, and radial electric fields. Calculation of field strength and electric potential. Lines of equipotential, Millikan's oil drop experiment and the charge on an electron. Energy stored by a capacitor. Exponential and logarithmic functions governing charge. Calculating induced emf, measuring AC and voltages. Topic 8- Alpha particle deflections, Rutherford's conclusions, Thermionic emissions, Electron diffraction and de- Broglie wavelength. Particle track interpretation, Circular particle accelerators, Standard model, and conservation laws for particle interactions. Large Hadron collider, fundamental forces of nature. Topic 10- Mass defect and binding energy, nuclear fission and fusion, nuclear reactions, radioactive half-life. Suggested practical work - Investigating impulse, elastic, and inelastic collisions, 2D collisions. Investigating centripetal force. Investigating electric fields, verifying coulomb's law. Investigating radioactive decay rates. Investigating stored charge, Investigating current flow through a capacitor. Investigating Fred= BeV. Investigating Faraday's law. Investigating AC with an oscilloscope. Investigating electron diffraction. Analyse the pd across a charging and discharging capacitor (CP 11).	**Topic 9, & 11** Key Concept -. Scales of temperature, Kinetic theory of gases, Ideal gas equation, Basic gas laws, Black body radiation. How gravitational forces follow inverse square relationship, what is meant by gravitational field and gravitational potential, Comparison of electric and gravitational field. Suggested practical work - Calibrate a thermistor in a potential divider circuit as a Thermostat. (CP 12) Investigating Specific Heat capacity and Latent Heat of fusion, Investigate the relationship between the pressure and volume of a gas(CP14) Determine the specific latent heat of a phase change (CP13). **Topic 12 &13** Topic 12-Key Concept Life cycle of stars, calculate the energy emitted by stars, stellar classification, measure the distances to stars and galaxies, Understand Red shift and Hubble's law, Development of galaxies and universes, Dark matter, and Dark energy. Topic 13 -Key Concept Basics of oscillatory motion, Simple Harmonic motion. How to calculate simple harmonic motion, representing SHM graphically, Free and forced oscillations, Resonance, and damping. Suggested practical work – Investigating a pendulum, investigating damping. Investigate the absorption of gamma radiation by lead (CP 15). Determine the value of an unknown mass using the Resonant frequencies (CP16).	Revision CP Repeats/Catch-up	Revision CP Repeats/Catch-up

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Endpoints	**Module 6&7** - Use the equation of the Ek of a non-relativistic particle. Derive and use the equation for centripetal acceleration and force. Describe the concept of uniform electric field, Use equations: E=F/Q and E=V/d for uniform and radial electric field. Verify Coulomb's law experimentally. Use equation for energy stored in a capacitor. Calculate flux density and linkage.	**Module 8 &10** - Explain how large angle alpha particle scattering gives evidence for a nuclear atom. Describe how electrons can be accelerated by electric and magnetic fields. Explain why high energies are required to investigate the structure of the nucleus. Write and interpret particle equations. Determine half-lives of isotopes graphically. Make calculations of nuclear mass, mass deficit and binding energy. Describe ways in which society uses science to inform decision making.	**Module 9&11** - Explain how a thermistor can be calibrated in a potential divider circuit. Use the equation: $1/2mc^2=3/2kT$. Describe what is meant by a black body radiator. Use the equation PV=NkT for an ideal gas. Derive and use the equation $V_{grav}= -GM/r$ for a radial gravitational field.	**Module 12&13** - Use the Stefan- Boltzmann law equation. Define Black body radiation in astronomy. Relate the Hertzsprung- Russel diagram to the life cycle of stars. Use the equation for the intensity of a star. Measure astronomical distances using standard candles. Use the equation for the red shift of light. Describe the controversy over the age and fate of the universe.		
Assessment	Topic 6&7 Midpoint Assessment Topic 8&10 Midpoint Assessment Year 13 PPE		Topic 6&7End of Chapter Assessment Topic 8&10 End of Chapter Assessment Topics 9,11,12,13 End of Topic Assessments.		Revision	Year 13 A Level Exams