Year 12 Physics Curriculum Summary

YEAR GROUP: 12 **SUBJECT: Physics**

When?	Knowledge	Understanding	Assessment
Waves **Electric Current**	**waves** **Be able to:** • **Define a plane-polarised wave** • **Explain the amplitude of a wave** • **Calculate the frequency of a wave from its period** • **Explain what causes a wave to refract as it passes along a boundary** • **Explain diffraction** • **Explain what features of two waves must combine in order to produce reinforcement/ cancellation** • **Describe if a stationary wave is formed by superposition** • **Explain why nodes formed in fixed positions** • **Describe the simplest possible stationary wave pattern that can be formed** • **Describe how an oscilloscope can be used.** **Electric Current**	Students will carry out a range of practicals during the topic, some of which will be formally assessed for the practical endorsement qualification. **waves** • Students can investigate the factors that determine the speed of a water wave. • Students can investigate the factors that determine the frequency of stationary wave patterns of a stretched string. **Electric Current** • Students can construct circuits from the range of components.	**Waves Test** **Electric Current Test**

	Be able to: • **Stare what electric current is.** • **Calculate the charge flow in a circuit** • **Define potential difference** • **Calculate electrical power** • **State and explain the causes of electrical resistance.** • **Describe when we can use Ohm's law.** • **Describe a superconductor.** • **Describe how the current through a filament lamb vary with pd.** • **State the characteristics of a diode.** • **Describe what we can use a thermistor for.**		
Optics	**<u>Topic 5 Optics</u>** **Be able to:** • **What is Snell's law?** • **How is the refractive index related to the speed of light?** • **Explain why does a glass prism split light into the colours of the prism?** • **What are the conditions for total internal reflection?** • **How is the critical angle related to the refractive**	Students will carry out a range of practicals during the topic, some of which will be formally assessed for the practical endorsement qualification. **<u>Optics</u>** • Investigation of two-source interference with sound, light and microwave radiation. • Students are expected to understand the principles and consequences of pulse broadening and absorption. **<u>Direct current circuits</u>**	**Optics Test** **Direct current circuits Test**

Direct Current Circuits	**index?** • **Condition for the formation of a bright fringe** • **Describe factors should be increased/decreased to increase the fringe spacing** • **Define coherent sources** • **Explain the importance of diffraction of light in the design of optical instruments** • **Compare the single slit pattern on the brightness of Young's fringes** • **Explain why does the diffraction grating diffract monochromatic light in certain directions only** **<u>Direct current circuits</u>** **Be able to:** • **State the rules and principals for series and parallel circuits.** • **Calculate resistance in series or in parallel.** • **Explanation of what resistance heating is.** • **Calculate the current and pd for each component in a circuit.** • **Explain why the pd of a cell/battery in use is less than its emf.** • **Measure the internal**	• Investigation of the variation of resistance of a thermistor with temperature. • Students can construct circuits with various component configurations and measure currents and potential differences. • Students can investigate the behaviour of a potential divider circuit. • Students should design and construct potential divider circuits to achieve various outcomes.	

	resistance of a battery. • **Calculate how much power is wasted in a battery.** • **Calculate currents in circuits.** • **State what is a potential divider.** • **Describe how we can supply a variable pd from a battery.** • **Explain how we can design sensor circuits.**		
Matter and Radiation	**<u>Matter and Radiation</u>** **Be able to:** • **Describe what is inside an atom** • **State what keeps protons and neutrons in a nucleus together** • **Describe what happens when unstable nuclei emits alpha/beta minus particle** • **Calculate the energy of a photon** • **Define what antimatter is** • **Discuss the possibility of anti-atoms** • **Describe what is meant by an interaction** • **Describe what an exchange particle is**	Students will carry out a range of practicals during the topic, some of which will be formally assessed for the practical endorsement qualification. **<u>Matter and Radiation</u>** • Demonstration of the range of alpha particles using a cloud chamber, spark counter or Geiger counter. • Use of prefixes for small and large distance measurements. • Students could determine the frequency and wavelength of the two gamma photons produced when a 'slow' electron and a 'slow' positron annihilate each other. • Students must show appreciation that particle physics relies on the collaborative efforts of large teams of scientists and engineers to validate new knowledge	Matter and radiation Test Forces in Equilibrium Test

Forces in Equilibrium	**<u>Forces in Equilibrium</u>** **Be able to:** • **State what is a vector quantity** • **Represent vectors** • **Explain why we consider the direction in which a force acts** • **State under what conditions does a force produce a turning effect** • **Describe how the turning effect of a given force can be increased** • **State what can we say about the support force on a pivoted body** • **Describe what is meant by a couple** • **State what is stable/unstable equilibrium** • **Describe when is a tilted object going to topple** • **State what conditions must apply to the forces on an object in equilibrium** • **State what conditions must apply to the turning effects of the forces** • **Explain what are the important principles that always apply to a body in equilibrium**	**<u>Forces in Equilibrium</u>** • Conditions for equilibrium for two or three coplanar forces acting at a point. Appreciation of the meaning of equilibrium in the context of an object at rest or moving with constant velocity • Investigation of the conditions for equilibrium for three coplanar forces acting at a point using a force board	
	<u>Quarks and leptons</u>	Students will carry out a range of practicals during the topic,	

– Quarks and leptons **– On the Move**	**Be able to:** • **Explain how we can find/predict new particles** • **Describe what strange particles are** • **Recognise what hadrons are** • **Recognise what are leptons are** • **Explain the importance of lepton numbers** • **Define what quarks are and explain how do we know they exist** • **Explain why there are no antimesons** • **State and explain what is always/sometimes/never conserved in particle interactions** **<u>– On the Move</u>** **Be able to:** • **Describe how displacement differs from distance** • **Describe the importance of uniform acceleration** **at constant acceleration** • **Calculate the displacement of an object** • **Define "free fall"** • **Explain how the velocity of a free falling object changes as it falls**	some of which will be formally assessed for the practical endorsement qualification. **<u>Topic 2 Quarks and leptons</u>** • Cosmic ray showers as a source of high energy particles including pions and kaons; observation of stray tracks in a cloud chamber; use of two Geiger counters to detect a cosmic ray shower • Application of the conservation laws for charge, baryon number, lepton number and strangeness to particle interactions. The necessary data will be provided in questions for particles outside those specified. • Students should recognise that energy and momentum are conserved in interactions **<u>– On the Move</u>** • Distinguish between instantaneous velocity and average velocity. • Measurements and calculations from displacement–time, velocity–time and acceleration–time graphs. • Calculations involving motion in a straight line. • Investigation of the factors that determine the motion of an object through a fluid. • 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	Quarks and leptons Test On the Move Test

	• **State the difference between distance-time graph and displacement-time graph along a straight line** • **Calculate the motion of an object with constant acceleration if its velocity reverse** • **To explain why the acceleration of a projectile is always downwards** • **To state what the horizontal component of a vertical vector is** • **To describe where else we meet projectile motion**		
– Quantum phenomena	**<u>Quantum phenomena</u>** **Be able to:** • **Explain what the photoelectricity is** • **Discuss how the photon model was established** • **Define what is a quantum** • **Explain why can't an electron absorb several photons to escape from a metal** • **Explain ionisation/excitation of an atom** • **Explain what**	Students will carry out a range of practicals during the topic, some of which will be formally assessed for the practical endorsement qualification. **<u>Quantum phenomena</u>** • Demonstration of the photoelectric effect using a photocell or an electroscope with a zinc plate attachment and UV lamp. • Students will be expected to be able to convert eV into J and vice versa • Students should be able to explain how and why the amount of diffraction changes when the momentum of the particle is changed **<u>Motion and force</u>**	Quantum phenomena Test Motions and forces Test Forces and momentum Test

Motion and force	**happens when excited atoms 'de-excite'** • **Explain how a fluorescent tube works** • **Explain why do atoms emit characteristic line spectra?** • **Calculate the wavelength of light for a given electron transition?** • **Explain why do we say photons have a dual nature?** • **Describe how do we know that matter particles have a dual nature?** • **Discuss why can we only change the wavelength of a matter particle?** **<u>– Motion and force</u>** **Be able to:** • **State what a resultant force always produces** • **Apply F = ma when the forces on an object are in opposite directions** • **Explain why speed reaches a maximum**	• Students can verify Newton's second law of motion. • Students can use free-body diagrams. **<u>Forces and momentum</u>** • Students can apply conservation of momentum and rate of change of momentum to a range of examples • Quantitative questions may be set on forces that vary with time. Impact forces are related to contact times (eg kicking a football, crumple zones, packaging)	

– Forces and momentum	• **Define drag force** • **Difference between braking distance and stopping distance** • **What should be increased to give smaller deceleration from a given speed?** **<u>Forces and momentum</u>** **Be able to:** • **Calculate force as a rate of change of momentum** • **Calculate Impulse** • **Significance of area under a force-time graph** • **Define principal conservation of linear momentum** • **Describe elastic and inelastic collisions; explosions**		
Materials	**<u>Topic 11 Materials</u>** **Be able to:** • **Define density** • **Measure the density of an object** • **Define spring constant** • **Describe the limit to the linear graph of force against extension for a**	Students will carry out a range of practicals during the topic, some of which will be formally assessed for the practical endorsement qualification. **<u>Materials</u>** • Students can compare the use of analogue and digital meters. • Estimate the volume of an object leading to an estimate of its density.	Materials Test Work, energy and power Test

-Work, energy and power	**spring** • **Explain how stress is related to force and strain to extension** • **Define tensile** • **Discuss what happens when a metal wire is stretched beyond its elastic limit and then unloaded** **<u>– Work, energy and power</u>** **Be able to:** • **What is energy and how do we measure it?** • **What is meant by work?** • **When an object is lifted, what happens to the work done on it?** • **If it then falls, what energy change then takes place?** • **Which physical quantities are involved in power?** • **What force is mainly responsible for energy 'loss' when mechanical energy is converted from one form to another?**	• Use of stress–strain graphs to find the Young modulus **<u>Work, energy and power</u>** • Investigate the efficiency of an electric motor being used to raise a mass through a measured height. Students should be able to identify random and systematic errors in the experiment and suggest ways to remove them. • Estimate the energy that can be derived from food consumption • Quantitative and qualitative application of energy conservation to examples involving gravitational potential energy, kinetic energy, and work done against resistive forces	