Physics Autumn Term Year 12 **Summative Comment**		***Curriculum Checkpoints: What do students know and what can they do?***				***YT Clips***	Further guidance
		Developing	**Securing**	**Mastering**	**Excelling**		
Electromagnetic Radiation and Quantum Phenomena	**Substantive Knowledge**	● To be able to define threshold frequency and work function in relation to a metal surface and liberating photoelectrons. ● To appreciate that a photon is a discrete packet of energy (quantum). ● To be able to explain how an atom can become ionised in terms of electron excitation. ● To know photons are absorbed or released when electrons move energy levels. ● To know that electron diffraction is evidence for the wave nature of particles, and that the photoelectric effect suggests waves have a particulate nature.	● To be able to use and manipulate the photoelectric equations, including contexts where you are given wavelength of photons rather than frequency. ● To explain the gold leaf electroscope demonstration in terms of electron movement. ● To be able to calculate the energy released/ required when electrons relax/ become excited. ● To be able to explain the difference between an emission spectrum and an absorption spectrum. ● To be able to use de Broglie's formula to calculate the wavelength of matter particles.	● To be able to link the stopping potential to the work done on an electron, and appreciate that QV is equal to the kinetic energy of the most energetic electrons. ● To be able to explain why energy levels in an atom are negative. ● To be able to explain why atomic energy levels give rise to unique line spectra. ● To be able to explain how a fluorescent tube works. ● To be able to deduce the quark structure of unfamiliar/ unknown particles based on decays. ● To be able to explain how and why the diffraction patterns change when the momentum of a particle is changed. ● To be able to qualitatively and quantitatively describe what happens to a diffraction pattern when properties of the particle are changed.	● To be able to explain why the photoelectric effect is evidence for the particulate nature of light, and link this to what would be observed if light had a wave nature. ● To investigate how line spectra are used in the analysis of the chemical composition of stars. Further reading around the topic might include the following ideas: **● To research how the photoelectric effect is used in everyday life (e.g. CAT scans, spectroscopy, PMTs etc).** **● To know about the experimental determination of stopping potential.** **● To research the Rydberg formula.** **● To investigate how electron microscopes use the principle of wave-particle duality to resolve to smaller orders of magnitude than a light microscope.**	https://www.youtube.com/watch?v=I_7ZfMIIKhk&list=PLJqzjKfk3j1m7XrZKRq3C98KxRfRQV7Kb	https://www.physicsandmathstutor.com/physics-revision/a-level-aqa/particles-and-radiation/
Electromagnetic Radiation and Quantum Phenomena	**Disciplinary Knowledge**		● To be able to convert between J and eV, MeV, GeV				
Physics Autumn Term Year 12 **Summative Comment**		***Curriculum Checkpoints: What do students know and what can they do?***				***YT Clips***	Further guidance
		Developing	**Securing**	**Mastering**	**Excelling**		

Mechanics	**Substantive Knowledge**	● To be able to define a vector and a scalar. ● To be able to state examples of vectors and scalars. ● To be able to define a moment. ● To be able to recall formulae for velocity and acceleration from GCSE. ● To be able to define projectile motion. ● To be able to know the three principles that apply to all projectiles. ● To be able to state Newton's three laws of motion. ● To be able to explain why weight and mass are different. ● To be able to define terminal velocity. ● To be able to use the formula for momentum. ● To be able to define impulse. ● To be able to state what is meant by conservation of momentum. ● To be able to use formulae from GCSE to calculate work, energy, power and other associated quantities. ● To be able to state what is meant by energy conservation.	● To be able to add vectors by calculation or scale drawings. ● To be able to label forces on a force diagram, including objects on a slope. ● To know that the position of the centre of mass of a regular uniform solid is at its centre. ● To be able to apply the three principles of projectile motion to projectile problems. ●To be able to state and explain where Newton's three laws are applicable in a given problem. ● To be able to state what happens to air resistance as speed increases. ● To appreciate force as the rate of change of momentum is a restatement of Newton's Second Law. ● To be able to state the difference between an elastic and inelastic collision. ● To be able to describe the energy transfers that take place within a system. ● To be able to complete calculations involving transfers between kinetic and gravitational potential energy stores.	● To be able to state the conditions for equilibrium of two or three coplanar forces acting at a point. ● To know to account for the weight of uniform objects in moments problems. ● To be able to find a resultant moment, choosing a sensible point to take moments around (usually the pivot). ● To be able to use and manipulate the SUVAT equations. ● To be able to manipulate quadratic equations in projectile motion problems. ● To be able to complete two step calculations involving Newton's Laws. ● To be able to link impact forces to the length of contact times. ● To be able to calculate impact forces. ● To be able to suggest where energy is dissipated in a system, and how to make a system more efficient. ● To be able to complete calculations that involve energy being transferred to the surroundings due to work done against friction.	● To be able to resolve vectors into components at right angles to each other. ● To consider the conditions for tilting and toppling objects. ● To be able to consider problems such as cars on banked slopes. ● To be able to apply ideas about projectile motion in a range of scenarios (e.g. an electron between parallel plates, an inclined board with a ball rolling down etc) ● To be able to complete calculations involving lifts. ● To be able to complete calculations involving pulleys. ● To be able to state and explain what happens to resistive forces acting on a system when changes take place (e.g. changes to air resistance at the top of a mountain, max speed of boat with drag systems enabled) ● To be able to complete momentum calculations where objects have components of velocity parallel and perpendicular to the normal to a surface. ● To be able to state and explain how and why energy transfers change with speed.	https://www.youtube.com/watch?v=-XmcYg43o_U&list=PL6oD4amsJKZ_OwO6IkaecP6dxpScw5Cf2	https://www.physicsandmathstutor.com/physics-revision/a-level-aqa/mechanics-and-materials/
Mechanics	**Disciplinary Knowledge**		● To be able to explain the significance of velocity-time and acceleration-time graphs. ● To be able to explain the significance of the gradients of displacement-time and velocity-time graphs. ● To be able to determine g by a freefall method. ● To be able to interpret force-displacement graphs.	● To be able to sketch motion graphs to represent uniform and non-uniform motion e.g. a bouncing ball. ● To be able to suggest sources of error when determining g by a free fall method. ● To be able to plot graphs accurately and calculate gradients. ● To be able to sketch a v-t graph for terminal velocity/ parachute, and explain each section of the graph.	●To be able to calculate errors and find a total percentage error of the determined value of g compared to the accepted value of g.		
Physics Autumn Term Year 12		***Curriculum Checkpoints: What do students know and what can they do?***				***YT Clips***	Further guidance
Summative Comment		**Developing**	**Securing**	**Mastering**	**Excelling**		

Waves	**Substantive Knowledge**	● To be able to label features of both longitudinal and transverse waves. ● To be able to define what a longitudinal wave and a transverse wave are. ● To be able to define what is meant by the term "progressive wave" ● To be able to state what is meant by the principle of superposition. ● To be able to sketch and label a stationary wave with nodes and antinodes. ● To be able to define path difference. ● To be able to state the conditions for coherent sources of light. ● To be able to calculate the number of slits in a diffraction grating. ● To be able to state the refractive index of air.	● To be able to state examples of transverse and longitudinal waves. ● To be able to state the difference between seismic P and seismic S waves. ● To be able to explain the formation of a stationary wave on a string, in a microwave and a sound wave. ● To know what is meant by the term harmonic. ● To be able to use Snell's Law for refraction. ● To be able to complete diagrams of a path of light entering/ exiting/ travelling through different mediums. ● To know what is meant by the term "critical angle" ● To know what is meant by the term "Total Internal Reflection"	● To be able to complete calculations involving frequency, time period, wavelength and wave speed. ● To be able to calculate the length of a pulse. ● To know what is meant by polarisation. ● To be able to explain how sound waves transmit energy from their source. ● To be able to predict what happens to intensity as polarising filters are rotated. ● To be able to manipulate the formula $f = \frac{n}{2L}\sqrt{\frac{T}{\mu}}$ and quantitatively describe the effects when one of the variable is changed. ● To be able to explain constructive and destructive interference in terms of path difference/ phase difference. ● To be able to predict what would happen to diffraction patterns when aspects of the apparatus are changed (e.g. different wavelength of light used). ● To be able to predict what would be observed for diffraction of polychromatic sources (e.g. white light). ● To be able to determine the highest order maximum produced by a given diffraction grating. ● To be able to describe the structure of a step index optical fibre. ● To be able to explain the function of lagging on an optical fibre.	● To be able to complete multistep calculations involving frequency, time period, wavelength and wave speed. ● To be able to explain why aerial rods need to be aligned properly to receive signals. ● To be able to state applications of polarisating filters and explain why they are used. ● To be able to suggest possible sources of error for the required practical and explain the potential effects they could have on results. ● To be able to suggest how to improve accuracy and precision. ● **To be able to derive** $\boldsymbol{n\lambda = d\sin\theta}$ ● To be able to describe different types of dispersion in an optical fibre and explain their cause. ● To be able to understand the principles and consequences of pulse broadening and absorption.	https://www.youtube.com/watch?v=fbAm5psmdKY	https://www.physicsandmathstutor.com/physics-revision/a-level-aqa/waves/

Waves	**Disciplinary Knowledge**		● To be able to convert between degrees and radians. ● To be able to take readings from scientific instruments (vernier calipers/ micrometers) ● To be able to safely carry out practical work using lasers. ● To be able to complete the Young's double slit experiment. ● To be able to manipulate formulae.	To be able to conduct an investigation to see how the fundamental frequency of a stretched string depends on the tension in the string.	● To be able to suggest possible sources of error for the required practical and explain the potential effects they could have on results. ● To be able to suggest how to improve accuracy and precision. ● To be able to propagate errors in Young's double slit experiment.		