	Year 12 Physics					
	Autumn Term 1	Autumn Term 2	Spring Term 1	Spring Term 2	Summer Term 1	Summer Term 2
BIG Q Content *(max 5)* Please log into Seneca to support your child to understand this learning	***How do progressive and stationary waves behave when they interact?*** Describe the key features of transverse and longitudinal waves and calculate their frequency, wavelength and speed. Explain how the interaction of progressive waves can generate stationary waves. Determine the frequency of first harmonic of stationary waves and compare that frequency with higher harmonics. Calculate the tension in a string oscillating at the n^{th} harmonic. Interpret waveforms on an oscilloscope to determine peak voltage and wavelength ***What are the forces that govern the interactions between particles and radiation?*** Describe the structure of atoms, protons and neutrons using the standard model of particle physics. Explain why some nuclei are stable and others are unstable and describe what happens when an unstable nucleus emits an alpha, beta plus or beta minus particle. Define a photon, calculate photon energy and estimate the number of	***How do optical effects change the behaviour of waves?*** Use Snell's Law to relate the refractive indices of transparent mediums to the angles of incidence and refraction of refracting rays. State the conditions necessary for total internal refraction to occur and determine the critical angle at which total internal refraction will occur for light rays incident on a boundary between two transparent mediums. State the general condition for the formation of bright fringes and describe the Young's double slit experiment. Compare single slit diffraction patterns with the fringes produced in the Young's double slit experiment and describe the factors that can affect fringe width and brightness. Explain why a diffraction grating only diffracts light in specific directions and determine the grating spacing or angle of diffraction of each order for a given grating. ***What are the properties of the particles that make our universe?*** Explain the discovery of strange particles.	***How does electric current behave in circuits?*** Explain how energy transfers occur in electrical circuits, defining electric current, potential difference, and resistance. Define the charge carriers in an electric circuit and calculate the total charge carried through a component. Calculate the electrical power of a device given a specific current, resistance or potential difference. Use Ohm's law to discuss the factors that affect electrical resistance in component and describe the features and uses of a superconductor. Explain why the current through a filament lamp varies with the potential difference across it and describe how this relationship differs for a diode and a fixed resistor. ***What are the quantum phenomena that act at the smallest scale of our universe?*** Explain how the photoelectric effect was used to develop the photon model of light and to define a quantum. Explain how electron collisions can cause excitation and ionisation of atoms.	***How can electrical components be used in real world applications?*** State the rules for current, potential difference and resistance in series and parallel circuits and describe how these rules can be applied practically. Calculate the total resistance in a series and parallel circuit as well as the current through and potential difference across each component. Explain why the terminal potential difference of a cell is less than the EMF of that cell. Calculate the internal resistance and EMF of a cell and infer information from graphs of terminal PD against current. Explain how potential dividers can be used to supply a variable potential difference from a battery and design sensor circuits. ***What is required to maintain a system of forces in equilibrium?*** Demonstrate when two or more forces have no overall effect on a point and explain the parallelogram of forces. Describe the conditions under which a force produces a turning effect and calculate the size of the moment produced. Describe the support sources of a pivot and	***Which properties of materials determine their suitability for practical applications?*** Determine the density of regular and irregular objects made of single elements or compounds. Define spring constant and calculate the amount of energy stored in a stretched or compressed elastic object. Use the Young's Modulus of a material to relate stress, strain and extension caused by a tensile force. Compare the deformation of brittle and ductile solids. Predict whether a metal wire will be stretched beyond its elastic limit or return to its original shape after being stretched by a tensile force. ***How do forces affect the motion of objects?*** Calculate the displacement of an object moving with uniform acceleration. Define free fall and explain how the velocity of an object changes as it is freely falling. Distinguish between distance-time graphs and displacement-time graphs and describe what the gradient of and area under a velocity-time graph represents. Calculate the motion of an object with constant	***How can we investigate the cosmos beyond Earth?*** Describe the construction of optical and non-optical telescopes and compare their resolution, magnification and uses. Define apparent and absolute magnitude and calculate a star's distance, surface temperature and surface area. Use spectral class to compare a star's temperature, colour and absorption spectra. Describe the life cycle of small and massive stars and explain how they will change positions on the Hertzsprung-Russel Diagram, including the cause of supernovas and formation of neutron stars and black holes. Explain the evidence supporting the Big Bang Theory and describe the origins and evolution of the expanding universe. ***How does momentum affect closed systems?*** Apply Newton's three laws of motion to objects and explain what determines the terminal speed of an object falling or a vehicle. Describe the forces that are acting on a moving body that is suddenly stopped and explain the factors that could decrease the deceleration of the object.

	photons emitted by a light source. Define antimatter and describe the interaction between matter and antimatter. Identify the four fundamental forces in particle interactions and explain why charged particles attract or repel each other.	Identify particle classifications and describe the properties of hadrons and leptons. Use lepton rules to describe particle interactions and identify types of neutrinos. Define quarks and antiquarks and explain the quark changes that occur during beta decay. State conservation rules and use them to determine the outcomes of particle interactions.	Define energy levels and explain the process of de-excitation. Explain why atoms emit characteristic line spectra and calculate the wavelength of light for a given electron transition. Describe the evidence for the dual wave-particle nature of photons and electrons and discuss why we can change the wavelength of matter particles but not photons.	calculate the force exerted at support point when a body is in equilibrium. Explain the difference between stable and unstable equilibrium and assess when tilted objects will topple. Explain what conditions must apply to the forces and turning effects on objects in equilibrium.	acceleration if its velocity reverses. Explain why the acceleration of a projectile is always vertically downwards and identify the horizontal and vertical components of a vector. Describe how projectile motion is affected by the medium the object is travelling through and by the effect of gravity.	Define momentum and its connection to Newton's first and second laws and calculate the impulse of a force from a force-time graph. Distinguish between elastic and inelastic collisions and describe what is conserved in elastic collisions. Discuss the dissipation of energy in mechanical systems and determine the force responsible and the efficiency of the system.
Vocabulary *(max 10)* Please use your child's knowledge notes to help them learn these definitions	Longitudinal Transverse Stationary Wave Harmonic Oscilloscope Nucleus Unstable Decay Antimatter Photon	Refraction Refractive Index Total Internal Refraction Critical Angle Diffraction Quark Hadron Meson Lepton Strangeness	Current Potential Difference Resistance Superconductor Ohm's Law Photoelectric effect De Broglie Wavelength Ionisation Line Spectra Excitation	Series Circuit Parallel Circuit Potential Divider Electromotive Force Internal Resistance Equilibrium Scalar Vector Pivot Moment	Tensile Stress Tensile Strain Density Youngs Modulus Elastic Limit Projectile Motion Distance-Time Graph Displacement-Time Graph Acceleration Velocity	Absolute Magnitude Resolution Supernova Neutron Star Black Hole Momentum Impulse Efficiency Terminal Speed Elastic Collision
Catholic Link	Life and Dignity of the Human Person: waves and imaging technology	Calls to Family, Community and Participation: electricity and the internet	Dignity of Work and Rights of Workers: mechanics and industrial safety	Options for the Poor and Vulnerable: efficient household appliances	Calls to Family, Community and Participation: energy use and telecommunications	Solidarity: international data sharing (CERN)
Careers Link	Waves – geophysicists, radiographer	Particle physics – Medical physicist, theoretical physicist	Mechanics – civil engineer, aeronautical/ automotive engineering	Electricity – renewable power/ nuclear power sector	Quantum mechanics - cryptographer	Cosmology - cosmologist

Ways to enrich the Y12 Physics curriculum at home:

- Try some online problem solving and masterclasses: https://www.youtube.com/@PhysicsOnline
- Use PhET - a project at the University of Colorado that provides free, interactive, research-based simulations. Try your hand at Quantum Measurements or Circuit Construction https://phet.colorado.edu/en/simulations/filter?subjects=physics&type=html
- Analyse Power Ratings: calculate the resistance and cost of running various household appliances (kettles, LED bulbs, electric showers) using their power ratings and electricity supply.