Physics	Working towards expected outcomes Your child is not yet making the expected progress within this course.	Working at expected outcomes Your child is achieving the expected progress for this point within the course.	Working beyond expected outcomes Your child is exceeding the expected progress.
Topics are listed in the order they are taught. **Electromagnetic Waves**	Students working **towards** expected outcomes in Y10 can: • Describe the difference between transverse and longitudinal waves and give examples of each. • Identify wavelength and amplitude from diagrams. • Apply the wave speed equation v=fλ. • Describe how waves can be reflected or refracted and recognise how light changes direction at different surfaces. • Know that electromagnetic waves transfer energy and give examples of their everyday uses (e.g. cooking, communication). • Understand that different surfaces absorb or reflect radiation differently and describe how colour affects heating by infrared. • Recognise that objects emit radiation and describe that hot objects emit more radiation than cooler ones.	Students working **at** expected in Y10 can: • Describe waves using wavelength, frequency, amplitude, and period. • Apply the equations v=fλ and T=1/f to solve problems. • Construct accurate ray diagrams to show reflection and refraction and describe how materials affect how waves behave at boundaries. • Explain the use and effects of lenses, including the difference between convex and concave shapes. • Apply the magnification equation. • Explain how electromagnetic waves transfer energy and describe risks associated with each. • Interpret results from the infrared radiation practical to compare how surfaces emit and absorb heat. • Describe how light filters affect colour and why objects appear certain colours based on absorption and reflection.	Students working **beyond** expected in Y10 can: **In addition to all the skills listed under 'Working At' for this topic, students working beyond expected outcomes can:** • Solve multi-step problems using wave equations in unfamiliar contexts with conversions to standard units. • Evaluate and improve wave speed measurements, identifying and explaining sources of error in practicals. • Analyse how material and surface type affect reflection, refraction and absorption, using ray diagrams and energy reasoning. • Use ray diagrams to compare lenses and explain their use in real applications (e.g. glasses, telescopes). • Evaluate the use of different electromagnetic waves for specific purposes, considering energy, frequency, and potential harm. • Explain how radiation balance affects temperature in objects. • Apply knowledge of colour and filters to explain absorption, reflection and transmission of light across a range of contexts.

Electricity	Students working **towards** expected outcomes in Y10 can: • Draw and interpret basic circuit diagrams using standard symbols. • Describe the difference between series and parallel circuits. • Measure current and potential difference to calculate resistance using V = IR. • Recognise that long wires increase resistance and that adding resistors in parallel reduces the overall resistance. • State the function of live, neutral and earth wires and describe a basic risk of live wires being connected incorrectly. • Identify examples of static electricity and explain them as a build-up of charge. • Describe that sparks can happen when charged objects discharge, and that this can be dangerous near flammable substances. • Draw simple electric field diagrams around a charged object and describe how this relates to forces of attraction or repulsion.	Students working **at** expected in Y10 can: • Construct and explain series and parallel circuits, including voltmeters and ammeters, and predict current and voltage values at key points. • Use a range of equations including: $V = IR$, $P = IV$, $P = I^2R$, $E = Pt$ and $Q = It$ • Describe and explain I-V characteristics for diodes, lamps and resistors. • Compare the behaviour of circuits with different arrangements of resistors, including how resistance changes in series or parallel combinations. • Describe how the National Grid reduces energy loss using high voltage and low current and explain its use of transformers. • Explain how domestic appliances use energy from batteries or the mains, linking this to their power ratings and efficiency. • Describe how static electricity builds up through electron transfer and how this causes attraction, repulsion or sparking. • Draw electric field diagrams for isolated charges and explain how the strength and shape of the field affects electrostatic forces.	Students working **beyond** expected in Y10 can: **In addition to all the skills listed under 'Working At' for this topic, students working beyond expected outcomes can:** • Design and analyse more complex circuits, explaining how changes to components affect current, resistance and power in real systems. • Use experimental results to evaluate the effectiveness of methods for measuring resistance and I–V characteristics. • Solve multi-step problems involving circuit calculations, including conversions and rearranged equations, using data from unfamiliar contexts. • Explain why adding resistors in parallel reduces total resistance and apply this to real-world design challenges. • Compare and evaluate different electrical appliances for energy efficiency and cost-effectiveness using detailed power and energy calculations. • Explain the role of fuses and earth wires in preventing harm in household circuits and analyse mains safety risks. • Use electric field diagrams and concepts like force direction and field strength to explain electrostatic phenomena in detail.

Atomic Structure	Students working **towards** expected outcomes in Y10 can:	Students working **at** expected in Y10 can:	Students working **beyond** expected in Y10 can:
	• Name the three main parts of the atom and describe their relative charge and mass. • State what an isotope is and recognise that it means atoms of the same element with different numbers of neutrons. • Describe alpha, beta, and gamma radiation in terms of penetration and basic use. • Know that radioactive decay is random and that half-life is the time it takes for radiation to reduce by half. • Identify simple risks of radiation and describe how to reduce them using shielding or limiting exposure.	• Compare models of the atom including the plum pudding and nuclear models and explain why the model changed over time. • Explain the properties of alpha, beta, and gamma radiation including penetration, range, ionising power and uses. • Recall and use the idea of half-life to interpret decay graphs and calculate remaining activity. • Write simple nuclear decay equations for alpha and beta decay using atomic and mass numbers. • Describe the differences between contamination and irradiation and suggest appropriate safety precautions. • Identify natural and man-made sources of background radiation and factors that affect dose. • Describe how radiation is used in medicine to diagnose or treat conditions and consider simple risks involved. • State that nuclear fusion involves light nuclei joining to release energy.	**In addition to all the skills listed under 'Working At' for this topic, students working beyond expected outcomes can:** • Explain how the Rutherford scattering experiment provided evidence against the plum pudding model and supported the nuclear model. • Write and interpret nuclear decay equations for alpha and beta decay with confidence, including balancing atomic and mass numbers. • Calculate net decline in radioactive emissions over several half-lives and evaluate the limitations of using half-life data. • Compare and evaluate the suitability of different types of radiation for specific medical or industrial uses based on ionising power, penetration, and half-life. • Analyse and compare the risks of contamination and irradiation, using real-world examples and applying appropriate safety recommendations. • Explain how background radiation varies with location and occupation and describe how radiation dose is measured and monitored in sieverts.

Particle Model of Matter	Students working **towards** expected outcomes in Y10 can: • Identify the particle arrangement in solids, liquids, and gases using diagrams and descriptions. • Use the density equation (ρ = m ÷ V) with numbers given clearly and label units. • Measure mass and volume using basic apparatus (e.g. ruler, balance) and use displacement to find volume of irregular objects. • State that changing state is a physical change and that the mass stays the same. • Recognise that heating increases the energy of particles and can raise temperature or change state. • Recall what SHC and SLH stand for and identify them from word equations. • Describe that as gas particles move faster, temperature and pressure increase.	Students working **at** expected in Y10 can: • Explain differences in density between solids, liquids, and gases based on how closely particles are packed. • Calculate density for regular and irregular solids and liquids using appropriate apparatus and explain the method. • Describe and explain what is happening during each section of a heating or cooling curve, including flat sections. • Use the specific heat capacity and specific latent heat equations to calculate energy changes in context. • Explain that heating increases internal energy and describe how this causes a rise in temperature or change of state. • Describe the motion of gas particles and explain how it links to pressure and temperature at constant volume. • Use the pressure × volume = constant equation to calculate how a gas behaves when compressed or expanded. • Describe how doing work on a gas (e.g. pushing a pump) increases temperature	• Evaluate nuclear fusion as an energy source and explain why it is difficult to replicate on Earth despite its potential benefits. Students working **beyond** expected in Y10 can: **In addition to all the skills listed under Working At for this topic, students working beyond expected outcomes can:** • Evaluate experimental methods used to determine density and suggest improvements. • Solve multi-step problems involving rearrangement and use of SHC and SLH equations in unfamiliar contexts. • Analyse heating and cooling graphs to estimate specific latent heat from flat regions. • Predict how changes in volume or temperature affect gas pressure using proportional reasoning. • Explain limitations in particle models and apply them to real-world examples such as refrigeration or weather balloons. • Evaluate the assumptions behind the gas model and discuss limitations of using ideal gases in practical situations.

		because energy is transferred to the particles.	