



Biology units are grouped into these key areas of study:

BBL (Building blocks of life)

THB (The human body)

IOL (Interaction of life)

Chemistry units are grouped into these key areas of study:

BOM (Behaviour of matter)

CR (Chemical reactions)

OE (Our Earth)

Physics units are grouped into these key areas of study:

BOE (Behaviour of energy)

OEOO (Objects' effects on other objects)

BE (Beyond Earth)

	Unit	Overview of learning intent
Autumn	Building blocks of life (BBL7): Digestion and respiration	- Diffusion across cell membranes and factors affecting the rate of diffusion; surface area to volume ratio and the need for exchange surfaces. - Adaptations of exchange surfaces: small intestine, lungs, gills, roots and leaves. - Enzymes and the lock and key model; amylase, protease and lipase; the production and function of bile. - Aerobic and anaerobic respiration: equations and comparison. - Metabolism, including the synthesis and breakdown of carbohydrates, lipids and proteins. - The response to exercise: heart rate, breathing rate and oxygen debt; (HT) the role of the liver in removing lactic acid.
	Behaviour of matter (BOM12): Types of bonding	- Ionic, covalent and metallic bonding in terms of electron transfer, sharing and delocalisation. - Representing bonding with dot and cross diagrams. - The structure of ionic compounds as giant lattices (e.g. sodium chloride). - Small molecules, polymers and giant covalent structures (diamond, silicon dioxide). - The structure of metals and the role of delocalised electrons.
	Objects' effects on other objects (OEOO12): Electricity: IV relationships	- Standard circuit symbols; potential difference needed for current to flow; current as the rate of flow of charge ($Q = It$). - Current and potential difference rules for series and parallel circuits; $V = IR$. - Ohmic and non-ohmic components: I-V characteristics of resistors, filament lamps and diodes. - Thermistors and LDRs and their applications. - Designing circuits to measure resistance; calculating total resistance in series and parallel.
	Behaviour of matter (BOM13): Quantitative chemistry	- The law of conservation of mass and balanced chemical equations. - Relative formula mass (M_r) and percentage by mass calculations. - Explaining apparent mass changes in non-enclosed systems; uncertainty in measurement. (HT) Moles and the Avogadro constant; converting between mass and moles; using masses to balance equations; limiting reactants. - Concentration of solutions in g/dm^3.

	Interaction of life (IOL14): Human health	- Chromosomes, mitosis and the cell cycle; cancer as uncontrolled cell division (benign and malignant tumours) and its risk factors. - Communicable diseases caused by viruses, bacteria, protists and fungi, including named examples, and how they spread. - Non-specific human defence systems and the immune system: phagocytosis, antibodies and antitoxins. - Vaccination, antibiotics and antibiotic resistance; painkillers. - The discovery and development of drugs: preclinical and clinical trials, double-blind trials and placebos.
Spring	Chemical reactions (CR7): Trends and patterns in the reactivity series	- Oxidation and reduction in terms of oxygen; (HT) in terms of electrons. - The reactivity series of metals, including hydrogen and carbon; displacement reactions. - Extraction of metals by reduction with carbon. - Reactions of acids with metals, bases, alkalis and carbonates to make salts; naming salts; preparing a pure, dry soluble salt. - The pH scale and neutralisation; (HT) strong and weak acids and the relationship between pH and H^+ concentration.
	Objects' effects on other objects (OEO13): Forces 2: velocity and acceleration	- Speed and velocity as scalar and vector quantities; typical speeds of everyday motion and of sound. - Distance-time graphs: gradient as speed; (HT) tangents for speed of an accelerating object. - Acceleration; velocity-time graphs: gradient as acceleration, area under the graph as distance travelled (HT). - Uniform acceleration ($v^2 - u^2 = 2as$); acceleration in free fall ($\approx 9.8 \text{ m/s}^2$). - Terminal velocity of objects falling through a fluid.
	The human body (THB10): Homeostasis	- The importance of homeostasis in maintaining optimal internal conditions: blood glucose, body temperature and water levels. - The structure and function of the nervous system; the reflex arc; reaction time. - The endocrine system and the role of the pituitary gland. - Control of blood glucose by insulin and (HT) glucagon; Type 1 and Type 2 diabetes. - Hormones in human reproduction and the menstrual cycle; hormonal and non-hormonal contraception; (HT) IVF, adrenaline and thyroxine.
	Our Earth (OE5): Carbon	- Crude oil as a finite resource; hydrocarbons and alkanes (first four members and general formula). - Fractional distillation and the uses of fractions; properties of hydrocarbons by chain length. - Complete combustion of hydrocarbon fuels. - Cracking to produce alkenes; the bromine water test for alkenes. - The evolution of Earth's atmosphere; greenhouse gases and the greenhouse effect.
	Behaviour of energy (BOE15): Principles of waves	- Transverse and longitudinal waves; amplitude, wavelength, frequency and period. - Wave speed ($v = f\lambda$) and methods for measuring the speed of sound and of ripples on water. - The electromagnetic spectrum: order by wavelength and frequency; practical applications of each type of EM wave. (HT) Refraction and wave front diagrams; absorption and transmission varying with wavelength; production of radio waves. - Hazards of ultraviolet, X-rays and gamma rays; radiation dose in sieverts.
Summer	Building blocks of life (BBL8): Transport in plants	- Osmosis and active transport. - Plant tissues and the structure of a leaf; adaptations of root hair cells, xylem and phloem. - Transpiration and translocation; factors affecting the rate of transpiration; stomata and guard cells. - Photosynthesis and the factors affecting its rate; limiting factors; (HT) inverse square law and the economics of greenhouses. - Uses of glucose made in photosynthesis.

	Behaviour of matter (BOM14): Atoms and nuclear radiation	- Radioactive decay, activity (Bq) and count-rate. - Properties of alpha, beta, gamma and neutron radiation: penetration, range in air and ionising power. - Nuclear equations for alpha and beta decay and the effect of decay on mass and charge. - Half-life and the random nature of decay; (HT) net decline calculations. - Radioactive contamination and irradiation; precautions and the importance of peer review.
	Chemical reactions (CR8): Energy in reactions	- Exothermic and endothermic reactions and their everyday uses. - Reaction profiles (energy level diagrams) and activation energy. (HT) Bond energies and calculating the overall energy change of a reaction.
	Objects' effects on other objects (OEOO14): Generating electricity	- Direct and alternating potential difference; UK mains supply (230 V, 50 Hz). - Three-core cables: live, neutral and earth wires and why the live wire is dangerous. - Electrical power and energy transfers in appliances ($P = IV$, $P = I^2R$, $E = Pt$, $E = QV$). - The National Grid and the role of step-up and step-down transformers. - Energy dissipation and reducing unwanted energy transfers (lubrication, insulation, thermal conductivity).
	Our Earth (OE6): Resources	- Using the Earth's resources sustainably: finite and renewable resources. - Producing potable water (filtration, sterilisation, desalination) and treating waste water. (HT) Alternative methods of extracting metals: phytomining and bioleaching. - Life cycle assessments; reducing the use of resources by reducing, reusing and recycling. - Energy resources (fossil fuels, nuclear, biofuel, wind, hydroelectric, geothermal, tidal, solar, wave) and their environmental and reliability trade-offs.
	Our Earth (OE7): Human impact	- Atmospheric pollutants from fuel combustion (carbon monoxide, soot, sulfur dioxide, oxides of nitrogen, particulates) and their effects. - Greenhouse gases and evidence for climate change, including uncertainty and peer review. - Carbon footprint and ways of reducing emissions. - Deforestation and the biological consequences of global warming.