Science Curriculum Map

Year 7 - Science

		Autumn term	Spring Term	Summer Term
Biology	**Unit of Work**	**Life and Cells**	**Tissues and Organs**	**Reproduction and Variation**
	Fertile Questions	How can you decide if something is living?	How are the heart and the lungs dependent on each other?	How was I made?
	Threshold Concepts / Key Knowledge	• All living things are made from cells. • Life is defined by seven essential processes.	• All organs are comprised of tissues which, in turn, are comprised of cells. • Blood transports oxygen around the body and removes carbon dioxide.	• We were made from the fusion of two cells. • Mammals, including humans, develop their offspring internally. • Variation happens because of genetics and environmental factors.
	Assessment	Extended writing GCSE style 6 mark questions: How can you decide if something is living? 50 multiple choice recall questions marked with ZipGrade.	Extended writing GCSE style 6 mark questions: How are the heart and the lungs dependent on each other? 50 multiple choice recall questions marked with ZipGrade.	Extended writing GCSE style 6 mark questions: How was I made? Describe the process of fertilisation and gestation. 50 multiple choice recall questions marked with ZipGrade.
	Experiences/ Purposeful Fun	• Using a microscope • Making tissue sample for examination • Making models of an animal and plant cell	• Building a model of the lungs • Lung dissection • Measuring lung volume • Explaining why exercise causes an increase in heart and breathing rate • Measuring muscle strength	• Plant dissection • Modelling seed dispersal • Observing a model of a gestating embryo and foetus • Observing variation in individuals
	Skills	• The calculation: image size = actual size x magnification • Changing the magnification of a microscope • Adjusting resolution • Microscope cell drawings	• Identifying variables in an experiment • Taking a pulse • Concluding based on evidence	• Plotting continuous and discontinuous variation on a bar graph • Justifying whether a factor is environmental or inherited
	Has links to... (prior and future)	• Prior: KS2 living things and their habitats. • Future: GCSE cell biology, transport systems, and specialized exchange surfaces.	• Prior: KS2 basic human anatomy and circulatory system. • Future: GCSE organisation, non-communicable diseases, and gas exchange mechanisms.	• Prior: KS2 life cycles of plants and animals, human development. • Future: GCSE inheritance, variation, evolution, and hormone control systems.

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	Cultural/ contextual knowledge	• The history of the microscope (Robert Hooke and Antonie van Leeuwenhoek) and how technology drives biological discovery.	• Understanding modern healthcare challenges, such as coronary heart disease, and the impact of lifestyle choices (smoking, exercise) on lung and heart health.	• Exploring the history of genetics (Gregor Mendel) and the ethical considerations surrounding modern reproductive technologies and IVF.
	Careers links	• Microbiologist, Laboratory Technician, Biomedical Scientist, Histologist.	• Cardiologist, Pulmonologist, Physiotherapist, Fitness Instructor, Nurse.	• Embryologist, Genetic Counsellor, Vet, Agricultural Scientist, Midwife.
	Literacy elements	• Key vocabulary: Organelle, Magnification, Resolution, Respiration, Excretion.	• Key vocabulary: Tissue, Organ, Circulatory, Capillary, Alveoli, Diffusion.	• Key vocabulary: Gamete, Fertilisation, Gestation, Continuous, Discontinuous.
		• Structuring evaluative scientific arguments (MRS GREN).	• Writing sequential explanations of biological pathways.	• Constructing analytical arguments comparing nature vs. nurture.
Chemistry	**Unit of Work**	**Particles**	**Separating Mixtures**	**Chemical Reactions**
	Fertile Questions	How does temperature affect the particles in a substance?	How would you obtain clean drinking water if stranded on a desert island?	How can combustion affect the mass of a substance?
	Threshold Concepts / Key Knowledge	• All matter is made of atoms. • Atoms contain smaller particles: protons, neutrons and electrons, these all have unique properties. • States of matter are interchangeable depending on the energy of the particles.	• When elements combine their properties change. • When solvents are evaporated from a solution the solid solute remains.	• Conservation of mass.
	Assessment	Extended writing GCSE style 6 mark questions: How does temperature affect the particles in a substance? 50 multiple choice recall questions marked with ZipGrade.	Extended writing GCSE style 6 mark questions: How would you obtain clean drinking water if stranded on a desert island? 50 multiple choice recall questions marked with ZipGrade.	Extended writing GCSE style 6 mark questions: How can combustion affect the mass of a substance? 50 multiple choice recall questions marked with ZipGrade.
	Experiences/ Purposeful Fun	• Heating to boiling point • Condensing steam • Observing the definite melting point of stearic acid • Using molymods to represent states of matter	• Filtration using different sized filters • Evaporation to crystallization • Distillation using C1 knowledge of evaporation and condensation	• Heating magnesium ribbon • Observing the conservation of mass and MgO • Balancing symbol equations to demonstrate the conservation of mass • Observing the formation of iron oxide
	Skills	• Reading a thermometer • Drawing line graphs • Recording live experimental data in a table • Safely heating water on a Bunsen burner	• Heating water and measuring temperature accurately and safely • Reading bar charts • Measuring mass using a balance	• Identifying variables in an experiment • Calculating the mean • Identifying anomalies and strategies to deal with them • Assess risk in experimental science

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	Has links to... (prior and future)	• Prior: KS2 properties and changes of materials, states of matter. • Future: GCSE atomic structure, quantitative chemistry, and bonding structures.	• Prior: KS2 separating mixtures through filtering, sieving, and evaporating. • Future: GCSE chemical analysis, chromatography, and industrial water purification.	• Prior: KS2 reversible and irreversible chemical changes. • Future: GCSE energy changes, chemical changes, rates of reaction, and stoichiometry.
	Cultural/contextual knowledge	• Exploring the historical evolution of the atomic model (Democritus to Dalton and Rutherford) and how scientific paradigms shift with evidence.	• Global context: Evaluating water scarcity, desalination infrastructure in arid regions, and the deployment of field filtration during humanitarian crises.	• The industrial revolution, the chemistry of fossil fuels, and understanding the atmospheric impact of combustion products on global climate cycles.
	Careers links	• Materials Scientist, Nanotechnologist, Nuclear Engineer, Research Chemist.	• Chemical Engineer, Water Quality Analyst, Environmental Consultant, Pharmacist.	• Analytical Chemist, Forensic Scientist, Metallurgist, Geochemist, Sustainability Consultant.
	Literacy elements	• Key vocabulary: Sublimation, Condensation, Subatomic, Electron, Kinetic Theory. • Writing descriptive accounts of particle movement during phase changes.	• Key vocabulary: Solute, Solvent, Solution, Filtrate, Distillate, Miscible. • Formulating precise, step-by-step methodology instructions for a practical report.	• Key vocabulary: Combustion, Conservation, Reactant, Product, Oxide, Exothermic. • Constructing formal scientific justifications using chemical word equations.
Physics	**Unit of Work**	**Energy**	**Forces**	**Space**
	Fertile Questions	How can heat be transferred?	Can you drop an egg without breaking it?	Why do we have seasons?
	Threshold Concepts / Key Knowledge	• Energy can be stored or transferred. • Energy cannot be destroyed. • Heat transfers via conduction, convection and radiation.	• Forces influence objects yet cannot be seen. • Gravity is constantly acting on all objects. • Forces do not have to be in contact to influence an object.	• The size of space. • The nature of orbits. • Why we have seasons.
	Assessment	Extended writing GCSE style 6 mark questions: How can heat be transferred? 50 multiple choice recall questions marked with ZipGrade.	Extended writing GCSE style 6 mark questions: Can you drop an egg without breaking it? 50 multiple choice recall questions marked with ZipGrade.	Extended writing GCSE style 6 mark questions: Why do we have seasons? 50 multiple choice recall questions marked with ZipGrade.
	Experiences/ Purposeful Fun	• Convection and conduction demonstrations • Transfer of different energies • Releasing the chemical store as heat	• Designing a way to drop an egg without breaking it • Look at the magnetic field lines when using iron filings • Observe the relationship between force and the distance a spring is stretched	• Scale of the universe software • Modelling solar and lunar eclipses • Mini-observatory • Seeing and trying a telescope • Modelling orbits

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	Skills	• Producing Sankey diagrams • Calculating efficiency • Calculating gravitational potential energy	• Produce a line graph showing the elastic limit of proportionality • Describe the variables in a friction dragging experiment • Accurately read a Newton metre • Draw force arrows proportional to the size of the force	• Solar system presentation • Calculating weight on different planets • Produce a graph to show orbit durations and distance from the centre point
	Has links to... (prior and future)	• Prior: KS2 light, electricity, and basic heating/cooling concepts. • Future: GCSE energy stores and transfers, national grid infrastructure, and thermal insulation metrics.	• Prior: KS2 basic forces, friction, magnetic attraction, and gravity effects. • Future: GCSE Newton's laws of motion, vector diagrams, momentum, and Hooke's Law equations.	• Prior: KS2 Earth and space, movement of the planets, night and day. • Future: GCSE life cycle of stars, red-shift, big bang theory, and orbital mechanics.
	Cultural/contextual knowledge	• Evaluating the global shift towards renewable energy grids and examining historical figures like James Joule and Lord Kelvin.	• The mechanics behind modern safety engineering, such as crumple zones and airbags in cars, alongside Galileo's experiments on gravity.	• Tracking how ancient civilizations utilized astronomy for agriculture, the space race era, and the modern international pursuit of Mars exploration.
	Careers links	• Renewable Energy Consultant, Building Services Engineer, Grid Analyst, HVAC Engineer.	• Structural Engineer, Automotive Safety Designer, Aerospace Engineer, Ergonomist.	• Astrophysicist, Satellite Systems Engineer, Data Scientist, Astronomer, Optical Technician.
	Literacy elements	• Key vocabulary: Conduction, Convection, Radiation, Dissipation, Kinetic, Potential. • Structuring comparative essays detailing thermal transfer mediums.	• Key vocabulary: Proportionality, Friction, Vector, Resultant, Tension, Equilibrium. • Describing spatial movements and writing precise variable definitions for practicals.	• Key vocabulary: Orbit, Axis, Solstice, Equinox, Gravitational, Satellite. • Synthesizing complex multi-step spatial processes into chronological descriptive text.

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Year 8 – Science

		Autumn term	Spring Term	Summer Term
Biology	Unit of Work	B4 Respiration and Photosynthesis	B5 Health and Disease	B6 Interdependence and Evolution
	Fertile Questions	Why do plants and animals need each other for survival?	How is disease spread and how can the transmission of disease be prevented?	Why do some species become extinct?
	Threshold Concepts	• The waste product of photosynthesis is vital in respiration. • Photosynthesis produces glucose.	• Pathogens are microorganisms that cause harm. • The body has an immune system that prevents disease. • Disease can be transmitted or brought on by lifestyle or genetic factors.	• There is variation within species. • The environment determines the advantage or disadvantage of the variation. • All food chains are dependent on a producer (plant).
	Assessment	Extended writing GCSE style 6 mark questions: *Why do plants and animals need each other for survival?* 50 multiple choice recall questions marked with ZipGrade.	Extended writing GCSE style 6 mark questions: *How is disease spread and how can the transmission of disease be prevented?* 50 multiple choice recall questions marked with ZipGrade.	Extended writing GCSE style 6 mark questions: *Why do some species become extinct?* 50 multiple choice recall questions marked with ZipGrade.
	Experiences	• Experimenting on limiting factors of photosynthesis • Observing leaves through a microscope • Increasing and decreasing rate of respiration with exercise • Demonstrate the products of anaerobic respiration	• Observing a smoking demonstration • Testing food for macronutrients	• Devise food webs • Use pooters in fieldwork • Use a variety of invertebrate traps • Collect plant species • Play sticky dogs (model of evolution)
	Skills	• Using a microscope • Controlling a light and photosynthesis experiment	• Calculating calories from food wrappers • Justifying environmental causes of disease • Persuade someone of the dangers of smoking and overeating	• Draw a food web • Present data in a graphical way • Sample species via transects and quadrats

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	Has links to... (prior and future)	• Prior: KS2 basic plant structures, requirements for plant growth, and human breathing. • Future: GCSE bioenergetics, metabolism, and global food security.	• Prior: KS2 nutrition, impact of drugs/smoking on body functions, and basic hygiene. • Future: GCSE infection and response, monoclonal antibodies, and cardiovascular disease treatments.	• Prior: KS2 food chains, adaptation, habitats, and fossil evidence. • Future: GCSE ecology, biodiversity, selective breeding, and genetic engineering.
	Cultural/contextual knowledge	• Global context: The role of global rainforests ("the lungs of the planet") and how deforestation impacts atmospheric carbon balance.	• Historical context: The discoveries of Louis Pasteur, Robert Koch, and Edward Jenner, alongside global vaccination programs and tackling antibiotic resistance.	• Environmental ethics: Human impact on modern mass extinctions, biodiversity crises, and the role of seed banks and conservation programs.
	Careers links	• Agriculturalist, Plant Scientist, Ecologist, Marine Biologist, Biochemist.	• Epidemiologist, Public Health Officer, Dietitian, Immunologist, Nurse.	• Conservationist, Field Zoologist, Environmental Consultant, Palaeontologist, Wildlife Officer.
	Literacy elements	• Key vocabulary: Photosynthesis, Respiration, Chloroplast, Mitochondria, Anaerobic, Limiting Factor. • Writing sequential, comparative descriptions of biochemical equations.	• Key vocabulary: Pathogen, Communicable, Antigen, Antibody, Phagocyte, Malnutrition. • Constructing evaluative and persuasive essays on public health policies.	• Key vocabulary: Interdependence, Quadrat, Transect, Invertebrate, Extinction, Adaptation. • Formulating data-driven conclusions from ecological field data summaries.
Chemistry	**Unit of Work**	**C4 Atoms and the Periodic Table**	**C5 Acids and Bases**	**C6 Earth Chemistry**
	Fertile Questions	How do the properties of elements change depending on where they are on the periodic table?	What happens if you mix an acid and an alkali, how can this be useful?	How do fossil fuels contribute to global warming?
	Threshold Concepts	• The structure of the atom determines the location on the periodic table. • All substances are made from the elements found on the periodic table.	• Differences in reactivity cause displacement reactions to occur. • The use of neutralization reactions to obtain neutral substances.	• The structure of the Earth. • The composition of the atmosphere. • The greenhouse effect and global warming.
	Assessment	Extended writing GCSE style 6 mark questions: *How do the properties of elements change depending on where they are on the periodic table?* 50 multiple choice recall questions marked with ZipGrade.	Extended writing GCSE style 6 mark questions: *What happens if you mix an acid and an alkali, how can this be useful?* 50 multiple choice recall questions marked with ZipGrade.	Extended writing GCSE style 6 mark questions: *How do fossil fuels contribute to global warming?* 50 multiple choice recall questions marked with ZipGrade.

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	Experiences	• Observations of group 1 metals reacting with water • Defining the properties of metals and non-metals • Halogen displacement reactions • Hydrogen and helium balloon observations	• Investigating indigestion tablets • Using indicators to determine pH • Making salts • Observing salt crystals under the microscope • Making indicators from red cabbage	• Describe how crystal size changes with speed of cooling • Making crystals • Making a sedimentary rock cycle • Modelling the rock cycle
	Skills	• Predicting properties based on the location on the periodic table • Managing risks associated with group 1 metals	• Use a pipette and universal indicator to make a neutral solution • Use a range of indicators • Devise a method for experimentation • Use imperative verbs when writing a method	• Calculating carbon footprints • Drawing and interpreting pie charts • Debating climate change
	Has links to... (prior and future)	• Prior: KS2 basic states of matter and material properties. • Future: GCSE chemical bonding, transition metals, and quantitative chemistry structures.	• Prior: KS2 safe handling of household materials and basic solutions. • Future: GCSE chemical changes, electrolysis, titration methodology, and strong vs weak acids.	• Prior: KS2 rock classifications, soils, and fossil formation basics. • Future: GCSE atmospheric chemistry, sustainable resources, life cycle assessments, and organic chemistry.
	Cultural/contextual knowledge	• Exploring Dmitri Mendeleev's regular patterns and predictions, illustrating how global collaboration shapes modern scientific consensus.	• Investigating the real-world impact of ocean acidification on marine ecosystems and managing historical industrial environmental issues like acid rain.	• Evaluating the global political challenges of carbon emission targets, international climate accords, and the development of sustainable green alternatives.
	Careers links	• Materials Analyst, Metallurgist, Nuclear Physicist, Analytical Chemist.	• Pharmacologist, Chemical Process Engineer, Wastewater Technician, Cosmetic Scientist.	• Volcanologist, Geochemist, Environmental Consultant, Climate Modeller, Petroleum Engineer.
	Literacy elements	• Key vocabulary: Periodicity, Halogen, Alkali, Subatomic, Isotope, Period, Group. • Formulating structured comparative evaluations of element reactivity trends.	• Key vocabulary: Neutralization, Indicator, Alkali, Acid, Pipette, Burette, Salt. • Writing concise experimental procedures using active, imperative command verbs.	• Key vocabulary: Greenhouse, Carboniferous, Sedimentary, Igneous, Metamorphic, Lithosphere. • Developing formal, persuasive arguments evaluating anthropogenic climate factors.
	Unit of Work	**P4 Electricity and Work**	**P5 Movement and Pressure**	**P6 Waves**
	Fertile Questions	How are potential difference and current related?	Why do snowshoes work?	What is a wave and are there different types?

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Physics

Threshold Concepts	• Current is the flow of charge in a circuit. • Electrical energy is converted into other useful energy types.	• Pressure depends on force and surface area.	• Light travels in waves. • Sound travels in waves. • Waves transfer energy but not matter.
Assessment	Extended writing GCSE style 6 mark questions: *How are potential difference and current related?* 50 multiple choice recall questions marked with ZipGrade.	Extended writing GCSE style 6 mark questions: *Why do snowshoes work, give an example using the pressure calculation to explain this?* 50 multiple choice recall questions marked with ZipGrade.	Extended writing GCSE style 6 mark questions: *What is a wave and are there different types?* 50 multiple choice recall questions marked with ZipGrade.
Experiences	• Building a series and parallel circuit • Using PhET simulators to build virtual circuits • Increase resistance of a circuit • Build a circuit that could be used in a house	• Timing a runner over a distance to calculate speed • Watching a ballet dancer and a tank go over polystyrene • Observe the effects of depth on pressure • Use a spanner to experience moments	• Use a slinky to model transverse and longitudinal waves • Use a slinky to help define amplitude, frequency and wavelength • Experiment with colour absorption • Refract and reflect light
Skills	• Measure current and potential difference • Check the connections of a circuit	• Calculate speed • Calculate pressure	• Calculate the speed of sound • Use ray boxes to demonstrate reflection and refraction
	• Add multiple components in series and parallel	• Produce a distance-time graph to show a journey	• Use filters to explain the absorption of colour • Produce diagrams of longitudinal and transverse waves
Has links to... (prior and future)	• Prior: KS2 basic series circuits, switches, lamps, buzzers, and conductors. • Future: GCSE electricity, static charge, domestic uses of electricity, and mains distribution.	• Prior: KS2 simple forces, balanced and unbalanced forces, and measuring mass. • Future: GCSE forces and motion, acceleration calculations, vector mathematics, and atmospheric pressure dynamics.	• Prior: KS2 light paths, reflections, shadows, hearing mechanisms, and pitch variations. • Future: GCSE wave properties, electromagnetic spectrum, lenses, black body radiation, and seismic tracking.
Cultural/contextual knowledge	• Exploring the history of electrical development (Thomas Edison vs. Nikola Tesla) and how global grids supply power equitably to civilizations.	• Real-world engineering applications: How hydraulic systems work in machinery, and the structural physics built into deep-sea diving suits and submersibles.	• Communications revolution: Understanding how the manipulation of EM waves (radio, fibre optics) enabled global digital connectivity and modern medical imaging.

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	Careers links	• Electrical Engineer, Grid Infrastructure Manager, Appliance Designer, Electronics Technician.	• Mechanical Engineer, Automotive Performance Analyst, Ergonomic Product Designer, Civil Engineer.	• Acoustic Consultant, Telecommunications Specialist, Radiographer, Optometrist, Audio Engineer.
	Literacy elements	• Key vocabulary: Ammeter, Voltmeter, Component, Resistance, Potential Difference, Parallel. • Writing structured technical diagnostics for malfunctioning electrical loops.	• Key vocabulary: Velocity, Acceleration, Pascal, Surface Area, Moment, Pivot, Perpendicular. • Formulating explicit, step-by-step descriptive solutions for mechanical word problems.	• Key vocabulary: Longitudinal, Transverse, Amplitude, Frequency, Wavelength, Refraction. • Constructing analytical descriptions comparing structural behaviours of energy mediums.

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Year 9 - Science

		Autumn Term	Spring Term	Summer Term
Biology	Unit of Work	Cell Biology	Organisation	Infection and Response
	Fertile Questions	How do sub-cellular structures dictate the complexity of an organism?	How does a breakdown in cellular organization or enzyme function lead to systemic failure in an organism?	How do pathogens wage war on the human body, and how do our internal defences fight back?
	Threshold Concepts / Key Knowledge	• Cells are the basic unit of all life, categorised into prokaryotes and eukaryotes. • Specialized cells differentiate to perform specific physiological functions. • Materials move across cell membranes via diffusion, osmosis, and active transport.	• Organ systems are groups of organs working together to form cohesive organisms. • Enzymes are biological catalysts with specific active sites affected by temperature and pH. • The heart, blood vessels, and blood form a transport system, where lifestyle choices can cause non-communicable diseases.	• Pathogens (viruses, bacteria, fungi, protists) cause communicable diseases. • The human body has non-specific defences and an immune system that destroys pathogens. • Vaccination, antibiotics, and painkillers are used to treat or prevent disease, but antibiotic resistance is growing.
	Assessment	Extended writing GCSE style 6 mark questions: *Compare the structure of a prokaryotic cell with a eukaryotic cell, explaining how their sub-cellular structures relate to their functions.* 50 multiple choice recall questions marked with ZipGrade.	Extended writing GCSE style 6 mark questions: *Explain how the human digestive system is organized to break down food, including the specific role of enzymes and how they are affected by internal conditions.* 50 multiple choice recall questions marked with ZipGrade.	Extended writing GCSE style 6 mark questions: *Describe how the human immune system defends the body against a bacterial pathogen once it has entered the bloodstream.* 50 multiple choice recall questions marked with ZipGrade.
	Experiences/ Purposeful Fun	• Using a light microscope to observe plant (onion) and animal (cheek) cells. • Carrying out a scientific drawing of a cell and calculating actual size using magnification formulas. • Investigating osmosis in potato cylinders using different salt/sugar concentrations.	• Performing chemical food tests for carbohydrates (Benedict's/Iodine), lipids (Ethanol), and proteins (Biuret). • Investigating the effect of pH on the rate of reaction of amylase enzyme. • Dissecting a mammalian heart to observe ventricles, atria, and valves.	• Culturing non-pathogenic bacteria on agar plates using aseptic techniques to test antiseptics/antibiotics. • Modelling the spread of an epidemic using indicator solutions in class chemical exchanges. • Analysing historical data on disease mortality rates pre- and post-vaccine introduction.
	Skills	• Accurate use of a microscope stage micrometre and eyepiece graticule. • Rearranging the magnification equation (Image = Actual x Magnification). • Plotting percentage change in mass graphs and identifying the isotonic point.	• Using a water bath to control temperature variables precisely. • Calculating rates of enzyme-controlled reactions (Rate = product/time. • Interpreting data plots of enzyme activity against pH and temperature.	• Measuring and calculating zones of inhibition using pir^2 to assess antibiotic efficacy. • Evaluating the validity of medical claims in media regarding disease risks. • Interpreting graphical trends of antibody concentrations over time following a vaccine.

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	Has links to... (prior and future)	• Prior: KS3 Life and cells unit, standard microscope use, and basic organ systems.	• Prior: KS3 Tissues and Organs unit, basic human anatomy, gas exchange, and digestive organs.	• Prior: KS3 Health and disease unit, basic hygiene, and historical pathogen tracking.
		• Future: Year 10/11 complex inheritance, protein synthesis, and advanced transport across membranes.	• Future: Year 10/11 plant transport (xylem/phloem), photosynthesis limits, and respiration tracking.	• Future: Year 10/11 Monoclonal antibodies, plant disease identification, and advanced genetics.
	Cultural/ contextual knowledge	• Evaluating the ethical debates surrounding human embryonic stem cell research vs. adult stem cells in modern regenerative medicine.	• Investigating the impact of coronary heart disease on a global scale and how socio-economic factors influence food choices and cardiovascular health.	• Investigating the historical discovery of penicillin by Alexander Fleming and the modern global crisis of antibiotic-resistant superbugs like MRSA.
	Careers links	• Stem Cell Researcher, Histologist, Electron Microscopist, Clinical Geneticist.	• Gastroenterologist, Cardiologist, Heart-Lung Technician, Food Scientist, Nutritionist.	• Epidemiologist, Immunologist, Pharmacologist, Virologist, Public Health Officer.
	Literacy elements	• Key vocabulary: Prokaryote, Eukaryote, Mitochondria, Differentiation, Osmosis, Active Transport, Turgid. • Writing explicit definitions and structural comparisons between distinct cell domains.	• Key vocabulary: Catalyst, Denatured, Substrate, Amylase, Protease, Lipase, Pericardium. • Formulating precise step-by-step methodologies for enzyme practical procedures.	• Key vocabulary: Pathogen, Communicable, Phagocytosis, Lymphocyte, Antigen, Antibody, Resistant. • Constructing analytical arguments detailing sequential immune response pathways.
Chemistry	**Unit of Work**	**Atomic Structure**	**The Periodic Table**	**Structure and Bonding**
	Fertile Questions	How did our understanding of an invisible particle evolve from a solid sphere to a complex cloud of subatomic components?	How does the arrangement of electrons within an atom dictate the predictable behaviour of an entire chemical group?	How do the invisible electrostatic forces between atoms determine the tangible, physical properties of materials around us?
	Threshold Concepts / Key Knowledge	• Atoms consist of a central nucleus (protons and neutrons) surrounded by electrons in shells. • Elements are defined by their proton number; isotopes have the same proton number but different neutron numbers. • Compounds are formed by chemical reactions and have different properties from their constituent elements.	• The modern periodic table arranges elements by atomic number so that elements with similar properties are in columns (groups). • Group 1 elements (alkali metals) increase in reactivity down the group; Group 7 elements (halogens) decrease in reactivity down the group. • Group 0 elements (noble gases) are unreactive due to a full outer shell of electrons.	• Chemical bonding involves transferring (ionic) or sharing (covalent) electrons to achieve a stable outer shell. • Ionic compounds form giant lattices with high melting points; simple molecular structures have weak intermolecular forces. • Metals consist of giant structures of atoms arranged in a regular pattern with a sea of delocalised electrons.

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	Assessment	Extended writing GCSE style 6 mark questions: *Describe the differences between the plum pudding model of the atom and the nuclear model, explaining the experimental evidence that led to the change.* 50 multiple choice recall questions marked with ZipGrade.	Extended writing GCSE style 6 mark questions: *Explain the trend in reactivity as you go down Group 1 (Alkali Metals) and compare it to the trend observed as you go down Group 7 (Halogens), referencing electronic configurations.* 50 multiple choice recall questions marked with ZipGrade.	Extended writing GCSE style 6 mark questions: *Explain why sodium chloride (an ionic compound) has a high melting point and conducts electricity when molten, whereas carbon dioxide (simple covalent) has a low boiling point and does not conduct.* 50 multiple choice recall questions marked with ZipGrade.
	Experiences/ Purposeful Fun	• Modelling the Rutherford alpha scattering experiment using marbles and barriers. • Constructing 3D atomic models of isotopes using color-coded tokens.	• Observing the reactions of Lithium, Sodium, and Potassium with water behind a safety screen. • Performing halogen displacement reactions in test tubes to deduce reactivity orders.	• Testing the electrical conductivity of various materials (copper, graphite, salt solution, solid wax). • Growing giant copper sulfate crystals to observe structural regularity.
		• Carrying out a fractional distillation of a simple model crude oil mixture.	• Investigating the properties of transition metals vs. group 1 metals.	• Building giant covalent lattice models (diamond and graphite) using molecular model kits.
	Skills	• Deducing the number of protons, neutrons, and electrons from mass and atomic numbers. • Calculating the relative atomic mass (Ar) of an element from isotopic abundances. • Balancing complex chemical symbol equations.	• Writing electronic structures/configurations for the first 20 elements (e.g., Sodium = 2,8,1). • Predicting the properties of unknown elements based on group trends. • Writing ionic half-equations for halogen displacement reactions.	• Drawing dot-and-cross diagrams to represent ionic and covalent bonding arrangements. • Predicting structural properties (melting point, conductivity) based on bonding classifications. • Interpreting 2D and 3D material structural diagrams.
	Has links to... (prior and future)	• Prior: KS3 Particles, element symbols, and basic chemical reactions. • Future: Year 10 Quantitative chemistry calculations, moles, and nuclear fission physics.	• Prior: KS3 Separating mixtures, element columns, and reactivity series benchmarks. • Future: Year 10/11 Rates of reaction, chemical equilibria, and transition metal chemistry deep-dives.	Prior: KS3 Properties of metals and non-metals, and basic chemical formula tracking. • Future: Year 10/11 Electrolysis mechanisms, polymer structures, and nanotechnology applications.
	Cultural/contextual knowledge	• Evaluating how the peer review process validated the shifts from Thomson's plum pudding model to Rutherford's and Bohr's structural models.	• Exploring the history of Dmitri Mendeleev leaving gaps in his periodic table, predicting undiscovered elements, and altering the course of scientific inquiry.	• Exploring the history and modern development of carbon materials, from graphite and diamond to the discovery of graphene and fullerenes.
	Careers links	• Nuclear Chemist, Radiologist, Analytical Analyst, Mass Spectrometrist.	• Industrial Chemical Engineer, Pharmacist, Materials Procurement Officer, Extraction Metallurgist.	• Nanotechnologist, Materials Scientist, Semiconductor Developer, Structural Polymer Chemist.

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	Literacy elements	• Key vocabulary: Subatomic, Nucleus, Isotope, Abundance, Distillation, Formulation, Compound. • Writing structured chronological summaries tracking historical model advancements.	• Key vocabulary: Configuration, Reactivity, Halogen, Alkali, Noble, Periodicity, Shielding. • Developing formal comparative arguments detailing trends down specific elemental columns.	• Key vocabulary: Electrostatic, Delocalised, Intermolecular, Lattice, Covalent, Ionic, Allotrope. • Constructing extended explanations linking microscopic atomic structures to macroscopic properties.
Physics	**Unit of Work / Row Type**	**Particle Model of Matter**	**Energy Resources**	**Energy**
	Fertile Questions	How does the kinetic energy of individual particles explain the bulk physical traits of density, pressure, and state changes?	How can a society balance its increasing demand for electrical power with the finite environmental constraints of our planet?	If the total energy in the universe is a fixed constant, why do we constantly hear about the risk of running out of it?
	Threshold Concepts / Key Knowledge	• Density depends on the mass of a substance and how much space it takes up p = m/V • Matter changes state when energy is added or removed; internal energy is the total kinetic and potential energy. • A gas exerts pressure due to the random motion of its particles colliding with the walls of its container.	• Energy resources are categorised into renewable (wind, solar, tidal, biofuel) and non-renewable (fossil fuels, nuclear). • Different energy resources have varying environmental impacts, reliabilities, and economic costs. • Most electricity is generated by turning a turbine linked to a generator.	• Energy can be stored or transferred but cannot be created or destroyed (Conservation of Energy). • Systems change when energy transfers occur, moving energy between mechanical, electrical, thermal, and kinetic stores. • In all system transformations, some energy is dissipated as wasteful thermal energy.
	Assessment	Extended writing GCSE style 6 mark questions: *Describe an experimental procedure to determine the density of an irregularly shaped solid object, including calculations and error mitigation.*	Extended writing GCSE style 6 mark questions: *Evaluate the environmental, economic, and reliability factors associated with replacing a coal-fired power station with a wind farm.*	Extended writing GCSE style 6 mark questions: *An electric motor lifts a mass. Describe the useful and wasteful energy transfers taking place, explaining how the efficiency of the motor can be calculated and improved.*
		50 multiple choice recall questions marked with ZipGrade.	50 multiple choice recall questions marked with ZipGrade.	50 multiple choice recall questions marked with ZipGrade.
	Experiences/ Purposeful Fun	• Measuring the density of regular and irregular solids using displacement (Eureka) cans. • Measuring the heating/cooling curve of stearic acid or ice to plot state transitions. • Demonstrating gas pressure changes using a bell jar vacuum pump or crushing can practical.	• Constructing a mini model wind turbine and measuring voltage output at different wind speeds. • Using solar cells to power small motors under variable light conditions. • Mapping national grid electrical generation trends using live data trackers.	• Dropping a bouncy ball from different heights to investigate energy dissipation into the surroundings. • Measuring the temperature rise of different insulated blocks to investigate specific heat capacity. • Testing the power and efficiency of electric kettle systems.

Science Curriculum Map

	Skills	• Calculating volume for regular shapes (l x w x h) and measuring fluid displacement volumes accurately. • Using p = m/V and rearranging for mass or volume. • Interpreting flat plateaus on heating/cooling graphs as latent heat points.	• Extracting data from pie charts and bar graphs detailing global energy mixes. • Comparing power outputs and load factors across diverse generating systems. • Distinguishing between political/ethical issues and objective scientific facts.	• Rearranging and calculating Kinetic Energy (E = 0.5mv^2 and Gravitational Potential Energy (E = mgh) • Calculating efficiency using the standard formula Efficiency = useful/total • Drawing accurate Sankey diagrams scaled to input values.
	Has links to... (prior and future)	• Prior: KS3 Particles unit, states of matter, and basic pressure rules. • Future: Year 10/11 Gas laws, Boyle's Law calculations, and nuclear structure physics.	• Prior: KS3 Energy unit, global fuel introductions, and electrical generation models. • Future: Year 10/11 Mains electricity, alternating current frequencies, transformers, and power transmission equations.	• Prior: KS3 Energy unit, Sankey diagrams, basic efficiency, and heat transfer mechanisms. • Future: Year 10/11 Work done equations, advanced power calculations, and non-renewable emissions dynamics.
	Cultural/contextual knowledge	• Exploring the historical Archimedes principle story regarding the King's crown and understanding the mathematical formulation of modern material sorting plants.	• Investigating global carbon emission reduction targets, international treaties like the Paris Agreement, and the socio-economic challenges faced by developing nations transitioning away from coal.	• Analysing the legacy of James Joule in establishing the principle of conservation of energy, and exploring modern sustainable architectural designs focused on reducing thermal dissipation.
	Careers links	• Materials Testing Engineer, Metrologist, Fluid Dynamics Analyst, Refrigeration Architect.	• Grid Operations Manager, Environmental Consultant, Nuclear Safety Engineer, Wind Turbine Specialist.	• Energy Auditor, Mechanical Systems Designer, Sustainability Engineer, Automotive Powertrain Technician.
	Literacy elements	• Key vocabulary: Density, Displacement, Internal Energy, Latent Heat, Fusion, Vaporization, Kinetic Theory. • Formulating precise procedural text for volumetric displacement measurements.	• Key vocabulary: Renewable, Finite, Biofuel, Nuclear, Infrastructure, Reliability, Intermittent. • Constructing balanced, objective comparative arguments balancing cost vs. green benefits.	• Key vocabulary: Conservation, Dissipation, Kinetic, Gravitational, Efficiency, Sankey, Work Done. • Transforming visual numeric Sankey data streams into written summary descriptions.

Science Curriculum Map

Year 10 - Science

		Autumn Term	Spring Term	Summer Term
Biology	**Unit of Work**	**Bioenergetics**	**Ecology (Part 1)**	**Ecology (Part 2)**
	Fertile Questions	How do cells harness and convert light or chemical energy to fuel the processes of life?	How do interactions between organisms and their physical environment determine the structure of an ecosystem?	How do human activities and resource management choices impact global biodiversity and ecosystem sustainability?
	Threshold Concepts / Key Knowledge	• Photosynthesis is an endothermic reaction that converts light energy into chemical energy (glucose). • Cellular respiration is an exothermic reaction that continuously occurs in all living cells to release energy. • Anaerobic respiration occurs without oxygen, producing lactic acid in animals or ethanol/CO2 in yeast.	• Communities contain interdependent populations of species interacting with abiotic and biotic factors. • Producers transfer biomass through food chains, webs, and trophic levels. • Carbon and water are continuously recycled through ecosystems to sustain life.	• Decomposition by microorganisms recycles nutrients; decay rates depend on temperature, moisture, and oxygen. • Human activities (deforestation, waste, peat bog destruction) reduce biodiversity and increase greenhouse gases. • Sustainable management is required to maintain biodiversity and secure future food production.
	Assessment	Extended writing GCSE style 6 mark questions: *Describe an experiment to investigate how light intensity affects the rate of photosynthesis, explaining how you would control other limiting factors.* 50 multiple choice recall questions marked with ZipGrade.	Extended writing GCSE style 6 mark questions: *Explain how you would estimate the total population size of a plant species in a field using random sampling with quadrats.* 50 multiple choice recall questions marked with ZipGrade.	Extended writing GCSE style 6 mark questions: *Evaluate the environmental and socio-economic impacts of large-scale deforestation and explain how modern conservation programs help protect biodiversity.* 50 multiple choice recall questions marked with ZipGrade.
	Experiences/ Purposeful Fun	• Investigating the rate of photosynthesis in pondweed by counting bubbles or collecting gas at varying distances from a lamp. • Testing a variegated leaf for starch using iodine solution. • Measuring changes in heart rate and breathing rate during physical exertion.	• Sampling plant distribution across a school field using random quadrats. • Using a line transect to investigate how shade from a tree affects species distribution. • Simulating a simple carbon cycle using online interactive ecosystem modules.	• Investigating the effect of temperature on the rate of decay of milk (using lipase and indicator solutions). • Constructing a mini-compost column or terrarium to track decomposition. • Analysing data sets from global temperature anomalies and greenhouse gas concentrations.

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	Skills	• Applying the inverse square law to calculate relative light intensity changes. • Calculating the mean rate of reaction and identifying limiting factors from multi-variable graphs.	• Calculating the mean number of organisms per quadrat and scaling up to estimate total population size. • Presenting field data graphically using bar charts and kite diagrams.	• Calculating percentage changes in biodiversity metrics over time. • Interpreting data trends regarding food security, intensive farming, and fishing quotas.
		• Writing balanced symbol equations for aerobic respiration and photosynthesis.	• Differentiating between abiotic (temperature, moisture) and biotic (predators, pathogens) parameters.	• Calculating decay rates from experimental temperature slopes.
	Has links to... (prior and future)	• Prior: Year 9 B1 cell biology structures and specialized leaf anatomy. • Future: Year 11 plant hormone controls and global food production bio-efficiency.	• Prior: KS3 Interdependence, food chains, and basic habitat adaptations. • Future: Year 11 global food chains, biotechnology, and genetic variations.	• Prior: KS3 Reversible/irreversible cycles and human impacts on ecosystems. • Future: Year 11 biotechnology (mycoprotein production) and sustainable farming practices.
	Cultural/ contextual knowledge	• Evaluating how vertical farming and artificial lighting technologies are being deployed in urban centers to optimize global food production.	• Investigating the historical and cultural significance of local nature reserves and national parks in preserving native British ecosystems.	• Analysing international environmental treaties (like COP climate summits) and balancing economic development with global biodiversity conservation.
	Careers links	• Agricultural Agronomist, Plant Biochemist, Sports Physiologist, Biofuel Researcher.	• Field Ecologist, Conservation Officer, Marine Biologist, Environmental Surveyor.	• Waste Management Specialist, Sustainability Consultant, Climate Impact Analyst, Forester.
	Literacy elements	• Key vocabulary: Endothermic, Exothermic, Limiting Factor, Metabolism, Oxygen Debt, Fermentation. • Writing detailed, comparative analysis paragraphs describing biochemical path dynamics.	• Key vocabulary: Interdependence, Ecosystem, Abiotic, Biotic, Quadrat, Transect, Biomass. • Formulating explicit, step-by-step methodologies for field-sampling practical reports.	• Key vocabulary: Decomposition, Biodiversity, Deforestation, Eutrophication, Peat Bog, Sustainability. • Constructing balanced evaluative essays balancing global industrialization against ecosystem preservation efforts.
Chemistry	**Unit of Work**	**Chemical Changes**	**Quantitative Chemistry**	**Energy Changes**
	Fertile Questions	How does an element's relative reactivity dictate its behaviour in reactions and determine how we extract it from the Earth?	How can chemists use mathematics to track invisible atoms and predict the exact mass of products formed in a reaction?	How do chemical bonds act as energy stores, absorbing or releasing heat as they break and reform?

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	Threshold Concepts / Key Knowledge	• Acids react with metals and bases to form salts; the pH scale measures acidity and alkalinity. • Unreactive metals are found as elements; reactive metals are extracted from oxides using carbon reduction or electrolysis. • Oxidation is the gain of oxygen (or loss of electrons); reduction is the loss of oxygen (or gain of electrons).	• The law of conservation of mass states that no atoms are lost or made during a chemical reaction. • The mass of one mole of a substance in grams is numerically equal to its relative formula mass (Mr) • Chemical equations show the ratios of moles reacting; one reagent can be a limiting reactant.	• Chemical reactions are accompanied by energy changes; exothermic reactions release heat, endothermic reactions absorb heat. • Activation energy is the minimum energy needed for particles to react successfully. • Energy is required to break bonds (endothermic) and released when new bonds form (exothermic).
	Assessment	Extended writing GCSE style 6 mark questions: *Describe a method to make a pure, dry sample of a soluble salt (e.g., copper sulfate) from an insoluble oxide and a dilute acid.*	Extended writing GCSE style 6 mark questions: *Explain how you would calculate the mass of magnesium oxide produced when 12g of magnesium burns completely in oxygen, using relative atomic masses.*	Extended writing GCSE style 6 mark questions: *Explain the differences between exothermic and endothermic reactions, describing how a reaction profile diagram represents activation energy and overall energy change.*
		50 multiple choice recall questions marked with ZipGrade.	50 multiple choice recall questions marked with ZipGrade.	50 multiple choice recall questions marked with ZipGrade.
	Experiences/ Purposeful Fun	• Making a soluble salt by reacting copper(II) oxide with sulfuric acid, filtering, and evaporating. • Investigating the reactivity series of metals by adding distinct metals to acid or salt solutions. • Electrolyzing copper chloride solution to observe product formations at the electrodes.	• Determining the empirical formula of magnesium oxide by burning magnesium ribbon in a crucible. • Carrying out a chemical titration using a burette and indicator to find neutral volumes. • Measuring the mass change when a gas escapes from a carbonate/acid reaction.	• Measuring temperature changes when distinct metals react with acid (exothermic) or ammonium nitrate dissolves (endothermic). • Investigating the temperature change in a neutralization reaction. • Making a simple chemical hand-warmer or cool-pack model.
	Skills	• Writing ionic equations for displacement and neutralization reactions. • Predicting electrode products during the electrolysis of aqueous mixtures. • Identifying oxidation and reduction steps using the OILRIG acronym.	• Calculating relative formula masses (Mr) from atomic masses (Ar). • Using the core formula equation: Moles = Mass/Mr. • Calculating percentage yields and atom economy metrics for industrial outputs.	• Drawing and labelling comprehensive reaction profile coordinates for energy states. • Calculating overall energy changes for a reaction using bond energy data • Identifying variables to measure heat change accurately.

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	Has links to... (prior and future)	• Prior: Year 9 C1 atomic foundations, compound properties, and extraction rules. • Future: Year 11 dynamic equilibria, reversible reaction loops, and modern organic chemical processes.	• Prior: Year 9 C1 law of conservation of mass, formula weights, and balance checks. • Future: Year 11 analytical chemistry techniques, gas yield volumes, and chemical industry optimization.	• Prior: Year 9 Physics P1 conservation rules, temperature changes, and dissipation metrics. • Future: Year 11 rates of reaction parameters and dynamic equilibria adjustments.
	Cultural/contextual knowledge	• Exploring the historical impact of the Hall-Héroult process for aluminium extraction, turning an incredibly rare precious metal into an everyday building resource.	• Understanding the industrial importance of stoichiometry in manufacturing medicines safely, ensuring zero dangerous excess reactants remain.	• Evaluating the engineering behind green hydrogen fuel cells vs. traditional combustion engines as paths to zero-carbon transit systems.
	Careers links	• Extraction Metallurgist, Electroplating Technician, Corrosion Specialist, Geochemist.	• Pharmaceutical Quantitative Analyst, Process Chemist, Formulation Scientist, Quality Controller.	• Combustion Engineer, Thermodynamic Specialist, Battery Design Architect, Food Formulation Chemist.
	Literacy elements	• Key vocabulary: Electrolysis, Anode, Cathode, Electrolyte, Displaced, Neutralization, Soluble. • Formulating precise step-by-step methodology manuals for crystalline salt isolation.	• Key vocabulary: Stoichiometry, Avogadro, Mole, Formula Mass, Yield, Economy, Excess. • Writing logical, structured mathematical explanations showing sequential steps in multi-stage equations.	• Key vocabulary: Activation Energy, Exothermic, Endothermic, Bond Energy, Enthalpy, Profile. • Constructing clear technical explanations linking bond energy calculations to overall temperature changes.
Physics	**Unit of Work**	**Atomic Structure**	**Open / Revision Curriculum Track**	**P7: Magnetism & Electromagnetism**
	Fertile Questions	How can an unstable atomic nucleus transform into a completely different element, and why can its radiation be both deadly and life-saving?	*[Content open for custom curriculum alignment or core mock review]*	How can a current flowing through a wire generate an invisible magnetic force, and how does this enable the kinetic machinery of our modern world?
	Threshold Concepts / Key Knowledge	• Radioactive decay is a random process where unstable nuclei emit alpha, beta, or gamma radiation. • Half-life is the time taken for the number of radioactive nuclei in a sample to halve. • Radioactive contamination is the unwanted presence of radioactive atoms, while irradiation is exposure to radiation.	• Core principles review: consolidating key knowledge across energy, particles, and electrical principles. • Diagnostic mapping: targeting performance metrics across standard model components. • Quantitative preparation: drilling key equation rearrangements ahead of summer cycles.	• Permanent magnets have poles; magnetic fields flow from north to south. • An electric current flowing through a conductor creates an associated magnetic field around it. • The motor effect occurs when a current-carrying wire is placed in a magnetic field, experiencing a perpendicular force.

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	Assessment	Extended writing GCSE style 6 mark questions: *Compare the properties of alpha, beta, and gamma radiation in terms of their penetration, ionization, and range in air.* 50 multiple choice recall questions marked with ZipGrade.	Extended writing GCSE style 6 mark questions: *[Diagnostic review task evaluating multi-unit mechanics or equation selection strategies across mixed paper questions]* 50 multiple choice recall questions marked with ZipGrade.	Extended writing GCSE style 6 mark questions: *Explain how an electric motor works, describing how the motor effect generates continuous rotation and how its speed can be increased.* 50 multiple choice recall questions marked with ZipGrade.
	Experiences/ Purposeful Fun	• Modelling radioactive half-life using a large class set of flipped dice or coins. • Simulating background radiation levels using geographic maps and digital trackers. • Analysing historical cloud chamber video footage to visualize distinct particle tracks.	• Completing targeted cross-curricular practice workshops. • Running peer-led diagnostic correction workshops using sample grading marks. • Interactive equation-builder card races to establish automated recall patterns.	• Mapping magnetic fields using iron filings or small plotting compasses around bar magnets. • Building a functioning electromagnet using a wire coil, iron nail, and low-voltage supply. • Constructing a simple DC motor using copper wire, paperclips, and a ceramic magnet.
	Skills	• Completing and balancing nuclear decay equations for alpha and beta emissions. • Deducing the half-life of an isotope from graphical decay plots. • Calculating net decline ratios over a specific number of half-lives.	• Selecting the appropriate equation from variable sets. • Converting prefix units (e.g., mA to A, kJ to J) rapidly within problem tracks. • Structuring high-mark written responses logic patterns cleanly.	• Using Fleming's Left-Hand Rule to determine the direction of force, magnetic field, or current. • Calculating force using the motor effect equation: F = B I l. • Controlling variables to alter the magnetic strength of a solenoid.
	Has links to... (prior and future)	• Prior: Year 9 C1 atomic structures, subatomic numbers, and particle configurations.	• Prior: Consolidated Year 9/10 mechanical foundations.	• Prior: Year 9 Physics P4 electricity foundations, currents, and component loops.
		• Future: Year 11 nuclear fission/fusion dynamics, astronomical stars, and medical radiography tracking.	• Future: Transition paths into final year GCSE linear application fields.	• Future: Year 11 generator effects, transformer equations, and industrial grid distribution mechanisms.
	Cultural/ contextual knowledge	• Evaluating the historical legacy of Marie Curie's discovery of radium and comparing the cultural impact of nuclear power generation vs. the management of radioactive waste.	• Exploring how peer review structures validate scientific theories globally, keeping data isolated from personal or political bias.	• Investigating the diagnostic importance of MRI scanners in hospitals and exploring how Earth's magnetic field preserves life by shielding us from solar winds.
	Careers links	• Medical Radiographer, Nuclear Power Engineer, Dosimetry Analyst, Health Physicist.	• Data Analyst, Systems Modeller, Academic Researcher, Technical Consultant.	• Robotics Systems Design Engineer, Electromechanical Technician, Grid Systems Architect, Acoustician.

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	Literacy elements	• Key vocabulary: Decay, Ionizing, Irradiation, Contamination, Isotope, Activity, Becquerel. • Writing explicit comparative statements separating physical contamination from safe external irradiation.	• Key vocabulary: Equation, Variable, Variable Tracking, Conversions, Synthesis, Analysis. • Deciphering complex examiner command prompts to isolate core physical requirements.	• Key vocabulary: Solenoid, Induced, Electromagnet, Solenoid, Motor Effect, Flux Density, Perpendicular. • Writing clear sequential text descriptions explaining mechanical steps in automated systems.

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Year 11 - Science

		Autumn Term	Spring Term	Summer Term
Biology	**Unit of Work**	**Inheritance, Variation & Evolution**	**Advanced Ecology & Food Security**	**Summer Term GCSE Synthesis & Mastery**
	Fertile Questions	How does the genetic code ensure continuity while driving the variation that fuels natural selection?	How can humanity balance escalating global food demands with ethical, ecological, and sustainable constraints?	How do you seamlessly connect cellular mechanisms to global biomes under terminal exam pressure?
	Threshold Concepts / Key Knowledge	• DNA is a polymer forming a double helix, structured into chromosomes; genes code for specific amino acid sequences. • Mutations cause genetic variation; natural selection acts on phenotypes, leading to evolution or extinction. • Selective breeding and genetic engineering manipulate genomes for desired characteristics.	• Biomass is lost at each trophic level due to respiration, egestion, and excretion, limiting food chain length. • Food security depends on sustainable fishing quotas, intensive farming practices, and reduced food miles. • Biotechnology uses microorganisms (e.g., Fusarium for mycoprotein) to produce sustainable protein.	• Biological principles span from microscopic sub-cellular organelles up to macroscopic global ecosystems. • Required practical methods contain specific independent, dependent, and controlled control variables. • Mathematical data extraction requires parsing complex charts, calculations, and error checking.
	Assessment	Extended writing GCSE style 6 mark questions: *Explain how a mutation in a gene can result in an altered protein that impacts an organism's phenotype, and how this can drive natural selection.* 50 multiple choice recall questions marked with ZipGrade.	Extended writing GCSE style 6 mark questions: *Evaluate the advantages and disadvantages of intensive farming techniques versus free-range practices in meeting global food security demands.* 50 multiple choice recall questions marked with ZipGrade.	Extended writing GCSE style 6 mark questions: *[Synoptic Paper 1 and 2 Master Tasks] Link the processes of active transport in roots to transpiration rates and global carbon sequestration cycles.* 50 multiple choice recall questions marked with ZipGrade.
	Experiences/ Purposeful Fun	• Extracting DNA from a strawberry or kiwi fruit. • Simulating selective breeding and genetic drift using coloured bead populations. • Constructing genetic crosses (Punnett squares) to track cystic fibrosis or polydactyly inheritance patterns.	• Calculating biomass transfers using numerical pyramid data configurations. • Sampling cheese-making enzymes or exploring mycoprotein production methods. • Simulating global overfishing cycles using interactive multi-group resource games.	• Running a "Required Practical Carousel" to execute forgotten microscopy, microbiology, and osmosis trials. • Diagnostic marking marathons where students critique mock script anomalies. • Flashcard challenge races drilling terminal command terms (e.g., Describe vs. Evaluate).
	Skills	• Constructing and interpreting monohybrid inheritance crosses and pedigree charts. • Deducing phenotypic ratios from complex genetic data tables. • Evaluating the ethical and economic risks of genetically modified crops.	• Calculating the efficiency of biomass transfers between trophic levels • Interpreting charts detailing global agricultural land use. • Formulating balanced conclusions regarding food distribution networks.	• Applying all core biology equations rapidly under rigid timed mock test conditions. • Deciphering multi-layered command prompts to construct coherent answers. • Resolving math errors in standard form conversions.
	Has links to... (prior and future)	• Prior: Year 9 B1 cell division, mitosis, and specialized gamete mechanics. • Future: A-Level Biology molecular genetics, epigenetics, and advanced population dynamics.	• Prior: Year 10 B7 community structures, carbon cycles, and abiotic profiles. • Future: A-Level Biology agricultural productivity metrics and ecosystem management.	• Prior: Year 9/10 core concept sequences (B1 through B7). • Future: University level biological sciences and medical technical foundations.

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	Cultural/contextual knowledge	• Evaluating the ethical framework of modern gene editing technologies like CRISPR and discussing historical contexts of selective breeding in agriculture.	• Analysing global humanitarian initiatives aimed at eradicating malnutrition, and tracking the socio-political impact of international fishing regulations.	• Developing resilient study frameworks, understanding the history of academic rigorous standards, and preparing for professional career pathways.
	Careers links	• Genetic Counsellor, Plant Breeder, Forensic Scientist, Evolutionary Biologist.	• Agricultural Policymaker, Sustainable Food Developer, Ecologist, Marine Conservator.	• Research Biochemist, Clinical Medical Doctor, Bioinformatician, Field Biologist.
	Literacy elements	• Key vocabulary: Genome, Heterozygous, Homozygous, Phenotype, Genotype, Allele, Speciation.	• Key vocabulary: Biomass, Eutrophication, Mycoprotein, Quota, Sustainability, Interdependent.	• Key vocabulary: Synoptic, Command Term, Validity, Reliability, Precision, Accuracy, Control.
		• Writing structured, logical arguments evaluating the use of genetic modification.	• Developing formal evaluative essays analysing resource management techniques.	• Structuring high-mark long-form responses with clear topic sentences and logical linkages.
Chemistry	**Unit of Work**	**Organic Chemistry & Analysis**	**Atmosphere & Resources**	**Summer Term GCSE Synthesis & Mastery**
	Fertile Questions	How can carbon atoms form an infinite array of molecular structures, and how do chemists identify them?	How do humans manipulate finite Earth reserves, and what are the long-term chemical footprints of our material demands?	How can a chemist integrate thermodynamic, structural, and quantitative data to solve unseen industrial synthesis problems?
	Threshold Concepts / Key Knowledge	• Crude oil is a finite resource consisting of hydrocarbons; alkanes are saturated, alkenes are unsaturated. • Cracking breaks down long-chain hydrocarbons into smaller, more useful molecules. • Pure substances have specific melting points; chromatography separates mixtures based on relative solubilities.	• The early atmosphere was formed by volcanic activity; photosynthesis altered it by increasing oxygen. • Greenhouse gases trap infrared radiation, driving global climate change. • Life Cycle Assessments (LCAs) evaluate the environmental impact of a product from extraction to disposal.	• Chemistry links atomic scale configurations directly to macro-scale physical traits and global processing lines. • Formulaic quantitative pathways underpin all physical chemical manufacturing sectors. • Experimental design hinges on minimizing contamination and optimizing yield outputs.
	Assessment	Extended writing GCSE style 6 mark questions: *Describe the process of fractional distillation of crude oil, explaining how the properties of fractions change with molecular size.* 50 multiple choice recall questions marked with ZipGrade.	Extended writing GCSE style 6 mark questions: *Evaluate the life cycle of a plastic shopping bag compared to a paper bag, referencing extraction, manufacturing, use, and disposal phases.* 50 multiple choice recall questions marked with ZipGrade.	Extended writing GCSE style 6 mark questions: *[Synoptic Chemistry Review Task] Outline an industrial production profile for a specific chemical, combining quantitative mass goals, energy inputs, and waste reduction methods.* 50 multiple choice recall questions marked with ZipGrade.
	Experiences/ Purposeful Fun	• Carrying out paper chromatography to identify unknown food colourings using Rf calculations. • Testing for unsaturation in hydrocarbons using bromine water (orange to colourless transition). • Performing chemical diagnostic tests to identify gases oxygen, hydrogen, carbon dioxide, chlorine	• Simulating the distillation of salty water to model desalination plants. • Constructing comparative Life Cycle Assessments for glass vs. plastic bottles. • Measuring the carbon footprint of daily school processes using online calculators.	• Troubleshooting bad practical setups to isolate where chemical contaminants or structural faults exist. • Completing timed "mole calculation races" across old Paper 1 and Paper 2 exam blocks. • Interactive equation balancing sprints.

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	Skills	• Drawing structural formulas for the first four alkanes, alkenes, alcohols, and carboxylic acids. • Calculating Rf values from chromatograms Rf =Distance moved by substance\Distance moved by solvent • Deducing molecular formulas from structural chain representations.	• Interpreting multi-line graphs tracking atmospheric CO2 concentration changes over centuries. • Interpreting complex numerical matrices within Life Cycle Assessment summaries. • Differentiating between sustainable recycling loops and linear waste pathways.	• Rearranging multi-variable chemistry equations under exam conditions. • Drawing structural maps across organic transition states. • Rapidly interpreting complex data layouts.
	Has links to... (prior and future)	• Prior: Year 9 C1 distillation setups and simple covalent bonding representations. • Future: A-Level Chemistry organic mechanisms, structural polymers, and spectroscopic analysis.	• Prior: Year 9 C6 rock cycles, atmospheric layers, and early planet structures. • Future: A-Level Chemistry green chemistry parameters, biochemistry, and atmospheric cycles.	• Prior: Year 9/10 core concept sequences (C1 through C10). • Future: University level chemical engineering and industrial material development fields.
	Cultural/contextual knowledge	• Evaluating how the petrochemical industry shaped modern consumer infrastructure, from plastic goods to global transport logistics.	• Investigating the international politics of carbon reduction targets and analysing how sustainable design protects vulnerable communities from climate instability.	• Cultivating critical reasoning paradigms, investigating how scientific breakthroughs clear regulatory hurdles, and building analytical competencies.
	Careers links	• Petrochemical Engineer, Forensic Chemist, Plastics Formulator, Analytical Consultant.	• Environmental Sustainability Officer, Climate Analyst, Water Treatment Manager, Recycling Architect.	• Pharmaceutical Synthesist, Industrial Chemist, Materials Scientist, Geochemist.
	Literacy elements	• Key vocabulary: Hydrocarbon, Homologous, Saturated, Viscosity, Flammability, Formulation, Chromatogram. • Writing systematic instructions for executing accurate qualitative chemical analyses.	• Key vocabulary: Anthropogenic, Greenhouse, Decarbonization, Sustainable, LCA, Desalination, Effluent. • Constructing complex evaluative essays comparing industrial lifecycle pathways.	• Key vocabulary: Synoptic, Quantitative, Stoichiometry, Yield, Accuracy, Repeatability, Systematic Error. • Structuring technical chemical justifications using clear cross-unit logical structures.
Physics	**Unit of Work**	**Forces**	**Waves & Space Physics**	**Summer Term GCSE Synthesis & Mastery**
	Fertile Questions	How do balanced and unbalanced forces govern everything from a stationary bridge to the acceleration of a rocket?	How do wave properties allow us to understand both local communication systems and the cosmic origins of our universe?	How can a physicist apply unified field and mechanical laws to solve multi-step problems under timed constraints?
	Threshold Concepts / Key Knowledge	• Scalar quantities have magnitude only; vectors have magnitude and direction; forces act to change shape, speed, or direction. • Weight is the force acting on an object due to gravity (W = mg); work is done when a force moves an object through a distance (W = Fs). • Newton's three laws describe how forces alter velocity, acceleration, and momentum in dynamic systems.	• Waves transfer energy without transferring matter; they can be longitudinal or transverse. • Reflection, refraction, and absorption occur when light interacts with boundaries between materials. • The Big Bang theory is supported by red-shift observations showing galaxies are moving away from us.	• Physics uses a unified framework of force, energy, and particle properties to model reality. • Every physical equation represents an underlying causal mechanism that can be measured. • Experimental precision depends on minimizing random parallax and systematic apparatus errors.
	Assessment	Extended writing GCSE style 6 mark questions: *State Newton's three laws of motion, explaining how they apply to a parachutist falling through the air from the moment they jump until terminal velocity is reached.* 50 multiple choice recall questions marked with ZipGrade.	Extended writing GCSE style 6 mark questions: *Explain the concept of red-shift, describing how Edwin Hubble's observations of distant galaxies provide evidence for the expansion of the universe and the Big Bang theory.* 50 multiple choice recall questions marked with ZipGrade.	Extended writing GCSE style 6 mark questions: *[Synoptic Physics Mastery Challenge] Analyse a mechanical system, determining its energy transformations, force vectors, and overall mechanical efficiency.* 50 multiple choice recall questions marked with ZipGrade.

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	Experiences/ Purposeful Fun	• Investigating the relationship between force and extension for a spring (Hooke's Law practical). • Investigating terminal velocity by dropping paper cones through the air and tracking with light gates. • Measuring the acceleration of a trolley on a ramp using varying masses and pulling forces (F = ma).	• Measuring the wave speed in a stretched string or ripple tank apparatus. • Using a glass prism and a ray box to map the refraction index of light at boundary surfaces. • Analysing cosmological spectrum shifts using simulated star spectrum alignment sets.	• Recalibrating analog instruments to eliminate systematic zero errors across core equipment setups. • Completing timed calculation marathons featuring complex multi-equation conversions. • Peer-marking calibration exercises analysing past exam boards' exemplars.
	Skills	• Resolving non-perpendicular vector forces using scale diagrams and trigonometric layouts. • Calculating values using Hooke's Law (F = ke) and calculating elastic potential energy (E=0.5ke^2). • Interpreting distance-time and velocity-time graphs to deduce speed, acceleration, and distance travelled (area under the curve).	• Using the wave speed equation and rearranging for frequency or wavelength. • Drawing accurate normal lines and ray vectors showing reflection and refraction boundaries. • Calculating distances from astronomical redshift parameters.	• Selecting and linking multiple separate physics equations together to solve synoptic challenges. • Managing spatial units (cm to m, g to kg) flawlessly inside multi-step workflows. • Plotting and line fitting complex datasets.
	Has links to... (prior and future)	• Prior: Year 9 Physics P1 energy transformations, work done, and basic force limits. • Future: A-Level Physics vector mechanics, structural loading analysis, and linear momentum tracking.	• Prior: Year 9 Physics P7 basic wave limits, sound ranges, and light pathways. • Future: A-Level Physics wave optics, Doppler tracking, astrophysics, and quantum wave mechanics.	• Prior: Year 9/10 core concept sequences (P1 through P8). • Future: University level mechanical engineering, applied physics, and computer modelling tracks.
	Cultural/contextual knowledge	• Exploring the engineering safety history behind crumple zones, seatbelts, and air bags in reducing modern impact forces via momentum changes.	• Investigating how Hubble's space observations fundamentally altered humanity's understanding of our place in an expanding cosmos.	• Developing systemic problem-solving frameworks, building emotional resilience under time pressure, and preparing for professional engineering pathways.
	Careers links	• Structural Engineer, Automotive Crash Safety Analyst, Aerospace Designer, Ergonomics Engineer.	• Telecommunications Specialist, Satellite Optical Engineer, Astrophysicist, Audio Technician.	• Aerospace Mechanical Specialist, Medical Imaging Physicist, Systems Modeller, Research Physicist.
	Literacy elements	• Key vocabulary: Scalar, Vector, Magnitude, Displacement, Terminal Velocity, Inertia, Momentum. • Writing highly precise technical descriptions explaining vector interactions in complex mechanical frames.	• Key vocabulary: Transverse, Longitudinal, Amplitude, Refraction, Electromagnetic, Cosmological, Red-shift. • Formulating comprehensive explanatory texts linking star speed to light spectrum changes.	• Key vocabulary: Synoptic, Proportionality, Precision, Parallax, Mathematical Modelling, Conversion. • Structuring high-mark logical answers that progress systematically from data extraction to variable proof.