Curriculum Information: Year 9 Science

- Year 9 marks the beginning of the GCSE programme. Students study topics from the AQA GCSE Science specifications across biology, chemistry, and physics.
- The year begins with a dedicated unit on Working Scientifically, equipping students with the investigative and analytical skills they will use throughout their GCSEs.
- Each unit is divided into key knowledge and key scientific skills. Each unit has a particular focus on one or more of the three science disciplines.
- Knowledge is assessed through end-of-topic tests, regular retrieval practice, and regularly assigned homework.

Autumn 1

Unit	**Key Knowledge**	**Key Scientific Skills**	**Assessing Understanding**
Working Scientifically	• The nature of science as a systematic study of the natural world • The purpose of hypotheses, aims, and predictions • Types of variables: independent, dependent, and control • Writing clear, replicable methods • Identifying and using scientific equipment correctly • Recording results in tables, including repeated measurements and mean values • Types of graphs: bar charts and line graphs • Drawing lines and curves of best fit • Qualitative and quantitative observations • Analysing data to identify patterns, trends, and anomalies • Evaluating reliability, validity, and sources of error	• Formulating testable hypotheses using 'If... then...' statements • Identifying variables in unfamiliar investigations • Designing fair tests with appropriate control variables • Selecting suitable equipment for accurate measurement • Constructing results tables with correct headings and units • Plotting graphs with appropriate scales, labelled axes, and lines of best fit • Interpreting graphs to describe trends and make predictions • Calculating mean values and identifying anomalous results • Writing evidence-based conclusions linked to hypotheses • Evaluating experimental methods and suggesting improvements	• Working Scientifically booklet • End-of-topic test • Regular retrieval practice in lessons • Homework tasks set regularly

Unit	Key Knowledge	Key Scientific Skills	Assessing Understanding
Atoms and Elements	• Elements are substances made of one type of atom • Atoms of an element have the same number of protons; different elements have different numbers of protons • Structure of the atom: protons, neutrons, and electrons; their charges and relative masses • The current atomic model and how it has developed over time (Dalton, Thomson, Rutherford, Bohr, Chadwick) • The plum-pudding model vs the nuclear model • How scattering experiment evidence led to changes in the atomic model • Atomic number, mass number, and how to calculate the numbers of subatomic particles • Electronic structure of the first 20 elements • Isotopes: atoms with the same number of protons but different numbers of neutrons • Compounds: substances made of atoms of different elements chemically bonded together • Writing word equations and balanced symbol equations • Conservation of mass in chemical reactions	• Using the periodic table to identify elements and their properties • Calculating the number of protons, neutrons, and electrons from the atomic number and mass number • Drawing and interpreting electronic structure diagrams • Writing and interpreting chemical formulae • Balancing symbol equations • Naming compounds from given formulae	• End-of-topic test • Regular retrieval practice in lessons • Homework tasks set regularly

Autumn 2

Unit	Key Knowledge	Key Scientific Skills	Assessing Understanding
Cells	• Structure of eukaryotic cells (plant and animal) and prokaryotic cells (bacteria)	• Calculating magnification, real size, and image size	• End-of-topic test · • Regular retrieval practice in

Unit	Key Knowledge	Key Scientific Skills	Assessing Understanding
	• Functions of organelles: nucleus, cell membrane, cytoplasm, mitochondria, ribosomes, cell wall, chloroplasts, vacuole, plasmid • Differences between eukaryotic and prokaryotic cells • Cell differentiation and specialised cells (sperm, nerve, muscle, root hair, xylem, phloem) • Light and electron microscopes: differences in magnification and resolution • The magnification equation • Diffusion: the movement of particles from high to low concentration • Factors affecting the rate of diffusion • Surface area to volume ratio and exchange surfaces • Adaptations of exchange surfaces in the lungs, small intestine, gills, roots, and leaves	• Preparing microscope slides (onion cell practical) • Using a light microscope and measuring cell length • Calculating orders of magnitude • Explaining how cell structure relates to function • Applying knowledge of diffusion to biological contexts • Evaluating how organisms are adapted for efficient exchange	lessons · • Homework tasks set regularly
Matter	• The three states of matter: solid, liquid, and gas • Particle arrangement, spacing, energy, and forces in each state • How particle arrangement affects density and compressibility • Calculating density using density = mass ÷ volume · • Changes of state: melting, freezing, boiling, evaporating, condensing, and sublimating • Changes of state as physical (not chemical) changes that conserve mass • Reversing a change of state recovers the original substance and its properties	• Calculating density from mass and volume measurements • Measuring the density of regular solids, irregular solids, and liquids • Drawing particle diagrams for solids, liquids, and gases • Explaining changes of state in terms of particle energy and arrangement • Applying conservation of mass to changes of state	• End-of-topic test • Regular retrieval practice in lessons • Homework tasks set regularly

Spring 1

Unit	Key Knowledge	Key Scientific Skills	Assessing Understanding
Rates of Reaction	• How to measure the rate of a chemical reaction • Calculating mean rate of reaction from quantity of reactant used or product formed • Units of rate of reaction • Factors affecting rate: temperature, concentration, surface area, catalysts • Collision theory: particles must collide with sufficient energy (activation energy) to react • How changing factors affect the frequency and energy of collisions • Surface area to volume ratio and its effect on reaction rate • Catalysts: substances that increase reaction rate without being used up • Catalysts lower the activation energy • Reaction profiles with and without a catalyst	• Drawing and interpreting graphs of product formed or reactant used against time • Describing how the rate of reaction changes over the course of a reaction • Using collision theory to explain the effects of changing conditions • Calculating mean rates of reaction • Drawing and interpreting reaction profile diagrams • Identifying catalysts from experimental data • Using ideas about proportionality to explain rate changes	• End-of-topic test • Regular retrieval practice in lessons • Homework tasks set regularly
Organisation	• Levels of organisation: cells, tissues, organs, organ systems, organisms • The human digestive system as an organ system • Functions of key digestive organs	• Describing the hierarchical organisation of multicellular organisms · • Explaining how organs and organ systems work together • Applying knowledge of organisation to unfamiliar contexts	• End-of-topic test • Regular retrieval practice in lessons • Homework tasks set regularly

Spring 2

Unit	Key Knowledge	Key Scientific Skills	Assessing Understanding
Energy	• Energy can be stored in: kinetic, gravitational potential, elastic potential, thermal, chemical, magnetic, electrostatic, and nuclear energy stores	• Describing energy transfers and changes in energy stores for different systems • Calculating kinetic energy, gravitational potential energy, and power	• End-of-topic test • Regular retrieval practice in lessons

Unit	Key Knowledge	Key Scientific Skills	Assessing Understanding
	• Energy can be transferred mechanically, electrically, by heating, or by radiation • The conservation of energy: energy can be transferred, stored, or dissipated but never created or destroyed • Calculating kinetic energy: KE = ½mv² • Calculating gravitational potential energy: GPE = mgh • How energy is transferred in falling objects (GPE to KE) • Power as the rate of energy transfer, measured in watts • Using the equation P = E ÷ t • Renewable and non-renewable energy resources • Advantages and disadvantages of different energy resources • Environmental impacts of energy resource use • How electricity demand changes during the day	• Rearranging and applying energy equations • Using conservation of energy to solve problems • Comparing and evaluating different energy resources • Interpreting data on energy resource use and trends	• Homework tasks set regularly
Forces	• Scalar quantities (magnitude only) vs vector quantities (magnitude and direction) • Forces as vectors; representing forces with arrows • Contact and non-contact forces • Weight, mass, and gravity: W = mg • Resultant forces: calculating the single force that replaces all original forces • Balanced forces produce zero resultant and no change in motion • Work done = force × distance (W = Fd); measured in joules • 1 joule = 1 newton metre • Energy is transferred when work is done • Work done against friction transfers energy to thermal stores	• Calculating weight using W = mg • Calculating resultant forces along the same line • Calculating work done using W = Fd • Describing energy transfers when work is done • Drawing and interpreting force diagrams • Distinguishing between contact and non-contact forces • Using the equation P = W ÷ t for power	• End-of-topic test • Regular retrieval practice in lessons • Homework tasks set regularly

Summer 1

Unit	Key Knowledge	Key Scientific Skills	Assessing Understanding
Periodic Table	• Early periodic tables arranged elements by relative atomic mass • Problems with early tables: some elements placed in wrong groups • Mendeleev's periodic table: gaps left for undiscovered elements; elements reordered to fit group properties • Discovery of predicted elements as evidence for Mendeleev's approach • The modern periodic table: elements arranged by atomic (proton) number • Position in the periodic table relates to electronic structure • Metals and non-metals: positions in the table and differences in physical properties • Metals form positive ions; electronic structure determines reactivity • Group 1 (Alkali Metals): low densities, reactivity increases down the group, melting and boiling points decrease • Reactions of Group 1 with water (forming hydroxides and hydrogen) and with chlorine (forming chlorides) • Group 7 (Halogens): exist as diatomic molecules, reactivity decreases down the group, displacement reactions • Group 0 (Noble Gases): full outer shell, unreactive, boiling points increase down the group • Predicting properties from trends within groups	• Using the periodic table to predict element properties from position • Explaining trends in reactivity using electronic structure • Writing word and symbol equations for Group 1 and Group 7 reactions • Predicting displacement reactions for halogens • Interpreting data on group trends (melting points, boiling points, reactivity) • Predicting properties of unfamiliar elements from trends	• End-of-topic test • Regular retrieval practice in lessons • Homework tasks set regularly
Infection and Response	• Pathogens: microorganisms that cause disease (viruses, bacteria, protists, fungi)	• Explaining how different types of pathogens cause disease	• End-of-topic test

Unit	Key Knowledge	Key Scientific Skills	Assessing Understanding
	• How pathogens are spread and how spread can be reduced • How bacteria and viruses reproduce in the body and cause illness • Specific diseases: measles (viral), HIV (viral), TMV (viral), salmonella (bacterial), gonorrhoea (bacterial), rose black spot (fungal), malaria (protist) • Symptoms, transmission, and treatment of each disease • The body's natural defences against infection • The role of white blood cells: phagocytosis, antibody production, antitoxin production • Vaccination and herd immunity • Antibiotics and the problem of antibiotic-resistant bacteria • Why viral diseases are difficult to treat with drugs	• Comparing the transmission and prevention of different diseases • Explaining the mechanism of vaccination • Evaluating the role of vaccination in preventing disease spread • Explaining why antibiotics cannot treat viral infections • Applying knowledge of disease to unfamiliar contexts	• Regular retrieval practice in lessons • Homework tasks set regularly

Summer 2

Unit	Key Knowledge	Key Scientific Skills	Assessing Understanding
Electricity	• Circuit symbols: cell, battery, switch, filament lamp, ammeter, voltmeter, resistor, variable resistor, fuse, thermistor, diode, LED, LDR • How to construct basic circuits • Ammeters connected in series; voltmeters connected in parallel • Current as the flow of electric charge: Q = It • In a series circuit, current is the same at all points • Potential difference as the driving force that pushes current around a circuit: V = E ÷ Q • Resistance reduces the flow of current	• Constructing and interpreting circuit diagrams using standard symbols • Connecting ammeters and voltmeters correctly • Using the equations Q = It, V = IR, and V = E ÷ Q • Investigating the effect of wire length on resistance • Drawing and interpreting graphs of resistance data	• End-of-topic test • Regular retrieval practice in lessons • Homework tasks set regularly

Unit	Key Knowledge	Key Scientific Skills	Assessing Understanding
	• Resistance increases with temperature • The relationship V = IR • How wire length affects resistance (directly proportional)	• Rearranging and applying electrical equations • Describing the relationship between current, potential difference, and resistance	

End-of-year assessment: Students sit an end-of-year examination covering all topics studied.

Resources: A revision guide is available for purchase on ParentPay.