Science Department - Year 9

Shirley High Curriculum Map

***Year 9**: "**Competent**" = Learners are now able to apply their classroom science to the wider world and how their learning links with possible career options.*
***Challenge pupils to**: Communicate with the correct scientific keywords*

	Autumn 1	Autumn 2	Spring 1	Spring 2	Summer 1	Summer 2
	Theme/Topic/Skill:	Theme/Topic/Skill:	Theme/Topic/Skill:	Theme/Topic/Skill:	Theme/Topic/Skill:	Theme/Topic/Skill:
	B: Cell Structure and Cell Transport C: Atomic Structure	P: Conservation and Dissipation of Energy C: The Periodic Table B: Cell Division	P: Energy Transfer by Heating C: Bonding and Structure B: Organisation and the Digestive System	P: Energy resources B: Organising animals and plants	C: Chemical Changes P: Electrical Circuits	Revision / EOY exam
Why Now?	Students build on KS3 biology and chemistry foundations to transition smoothly into GCSE Science. Cell Structure and Cell Transport establishes understanding of cells and transport mechanisms, foundational to later Biology. Atomic Structure introduces key atomic concepts necessary for all future chemistry topics.	These units provide foundational understanding of energy, reactivity, and cell reproduction which are key for linking to later units in Physics, Chemistry, and Biology. Students will build fluency in quantitative reasoning and start to explore ethical dilemmas in science.	Students now have a strong grasp of basic biology, chemistry, and physics principles, so they are ready to apply that knowledge to more complex, abstract, and interconnected systems. In Physics, understanding how heat moves leads directly into future energy systems and sustainability. In Chemistry, students move from particle theory to bonding which is essential for later understanding of chemical reactions and material properties. In Biology, this unit bridges structure to function and students explore how body systems operate and how enzymes drive biological processes.	Students are now familiar with energy transfers and biological systems; this term builds on those ideas with a real-world focus on sustainability and human/plant physiology. Energy resources introduces students to the environmental impact of energy choices, linking to global citizenship and critical thinking. Organising animals and plants brings together structural understanding of organs and systems with practical applications in both animal and plant biology.	Having built foundational knowledge in atomic structure, bonding, and energy transfer, students are now ready to apply this to chemical reactions and electrical systems. Chemical Changes develops fluency with reactions, equations, and practical methods to make salts. These are skills that underpin much of KS4 Chemistry. Electrical Circuits builds on circuit basics with calculations and investigations that develop students' quantitative and analytical skills in Physics.	Having built foundational knowledge in energy transfer, bonding students are now ready to apply this to electrical circuits. Electrical Circuits builds on circuit basics with calculations and investigations that develop students' quantitative and analytical skills in Physics.
Fundamental Concepts	Light and electron microscopy offer different levels of detail for studying cell structure. Transport (diffusion, osmosis, active transport) takes place across cells and relates to internal and external conditions of the cell. Specialised cells perform specific roles within multicellular organisms, and their structure is directly linked to function. Atoms are the smallest units of elements, and their structure determines the properties of substances. The conservation of mass governs all chemical reactions; atoms are neither created nor destroyed but rearranged. Mixtures can be separated by physical processes	Energy cannot be created or destroyed; it is transferred between stores and can be dissipated or conserved depending on system efficiency. The periodic table is structured based on atomic number, electron configuration, and recurring patterns of reactivity. Group trends help predict element behaviour. The structure of atoms determines an element's chemical properties and reactivity. Mitosis is essential for growth and repair in organisms, producing genetically identical cells. Stem cells are undifferentiated and have the potential to become specialised cells that are used in development, repair, and medical applications.	Energy is transferred via conduction, convection, and radiation; materials can be compared based on their thermal properties. Bonding determines the properties of substances; particles form ions or molecules depending on their arrangement and interaction. Organisation in biological systems reflects increasing complexity; enzymes control chemical reactions crucial for digestion and metabolism.	Different energy resources have distinct benefits and drawbacks; students evaluate them using data and scenarios. The environmental impact of energy production is a key concern in modern science. The circulatory system and plant transport systems maintain life by moving essential materials around the organism. Specialised structures (e.g. heart valves, alveoli, xylem, guard cells) are adapted to their functions and regulated by feedback systems.	The reactivity series helps predict and explain how substances will react in displacement and extraction processes. Acids react with bases, metals, and carbonates in predictable ways to form salts; these can be used in industry and agriculture. Electricity involves the flow of electrons; potential difference and resistance affect current. Series and parallel circuits behave differently in terms of current and potential difference.	Electricity involves the flow of electrons; potential difference and resistance affect current. Series and parallel circuits behave differently in terms of current and potential difference.
Students will…	Use a microscope to observe and measure cells accurately. Calculate magnification and analyse microscopic images using standard form. Compare prokaryotic and eukaryotic cells, and describe how cell structures relate to function. Apply their understanding of diffusion, osmosis, and active transport to explain biological processes. Describe the structure of atoms and identify elements, compounds, and mixtures. Balance symbol equations and explain the conservation of mass in chemical reactions. Use separation techniques to purify substances and interpret chromatography results.	Calculate and compare energy stores and transfers in everyday contexts. Define and apply equations for gravitational potential energy, kinetic energy, and efficiency. Use the periodic table to predict reactivity and properties of elements based on their position. Describe and explain trends in Groups 1 and 7, including how and why displacement occurs. Describe the stages of the cell cycle, particularly mitosis, and explain its importance. Evaluate the use of stem cells in medicine and debate associated ethical concerns. Carry out and evaluate a plant cloning practical.	Explain and calculate how thermal energy is transferred through conduction, convection, and radiation Compare how different materials retain or transfer heat, and justify which are best insulators Use the particle model to describe states of matter and transitions Draw and interpret dot-and-cross diagrams for ionic and covalent compounds Relate bonding types to the properties and uses of different substances Identify organs and enzymes involved in digestion and describe how they work Design and carry out practical investigations on enzymes and food testing Analyse how surface area to volume ratio affects properties of nanoparticles	Distinguish between renewable and non-renewable energy sources and evaluate their use Analyse energy data to recommend suitable energy resources in context Describe and explain how the heart, blood, and blood vessels maintain circulation Explain how alveoli and capillaries are adapted for gas exchange Identify and describe transport tissues in plants and their roles in water and sugar movement Investigate how environmental conditions affect the rate of transpiration	Describe how acids react with metals, bases, and carbonates to form salts Carry out practicals to make and purify a sample of a salt Use the reactivity series to predict and explain displacement and extraction reactions Use and rearrange equations to calculate current, charge, and resistance Interpret I-V graphs for components and identify when Ohm's law applies Construct and analyse series and parallel circuits, measuring current and potential difference	Use and rearrange equations to calculate current, charge, and resistance Interpret I-V graphs for components and identify when Ohm's law applies Construct and analyse series and parallel circuits, measuring current and potential difference
Language for Life (Key terms / Vocabulary)	cell membrane, nucleus, cytoplasm, mitochondria, prokaryotic, eukaryotic, osmosis, diffusion, active transport, vacuole, turgor, plasmolysis, atom, element, compound, mixture, proton, neutron, electron, nucleus, isotopes, electron configuration, conservation of mass	energy transfer, energy dissipation, efficiency, work, power, elastic potential energy, gravitational potential energy, periodic table, alkali metals, halogens, transition metals, reactivity, displacement, mitosis, stem cells, differentiation, therapeutic cloning, cell cycle, chromosome, zygote	infrared radiation, thermal conductivity, insulation, specific heat capacity, radiation, ionic bond, covalent bond, lattice, polymer, nanoparticle, intermolecular forces, delocalised electrons, enzyme, catalyst, bile, active site, denatured, protease, lipase, amylase, metabolism, organ system	renewable, non-renewable, biofuel, geothermal, base load, start-up time, efficiency, National Grid, aorta, pulmonary artery/vein, atria, ventricles, valves, alveoli, transpiration, xylem, phloem, guard cells, stents, statins	acid, alkali, base, salt, neutralisation, pH, reactivity series, oxidation, reduction, displacement, ion, electrolysis, potential difference, current, resistance, series circuit, parallel circuit, diode, thermistor, Ohm's Law, LED, LDR, static electricity	potential difference, current, resistance, series circuit, parallel circuit, diode, thermistor, Ohm's Law, LED, LDR, static electricity

Extended writing Opportunities	• Compare and contrast prokaryotic and eukaryotic cells. • Explain the process and importance of osmosis in plant and animal cells. • Justify the use of electron microscopes over light microscopes. • Describe the history of atomic models and how they've changed over time. • Explain how mixtures are separated using chromatography.	• Debate writing on ethical implications of stem cell research. • Describe the stages of mitosis and its importance in growth and repair.	• Evaluate how the structure of bonding types affects material properties. • Explain the lock-and-key theory and how enzymes are affected by pH and temperature. • Compare the effectiveness of different home insulation materials. • Describe the role of nanoparticles in modern materials and medicine.	• Evaluate the pros and cons of different energy resources for a community. • Describe how the heart and circulatory system maintain blood flow and support respiration. • Explain how leaf structure supports transpiration and photosynthesis. • Compare transport in animals and plants.	• Evaluate the use of different methods to extract metals based on reactivity. • Explain how to safely make a pure, dry sample of a salt from an acid and an insoluble base. • Compare series and parallel circuits • Analyse the relationship between resistance and wire length or temperature.	• Compare series and parallel circuits • Analyse the relationship between resistance and wire length or temperature.
Maths Across the Curriculum	Calculate total magnification and real cell size Use and rearrange the magnification formula Interpret measurements in standard form Balance symbol equations Calculate subatomic particles using atomic and mass numbers	Energy equations (e.g. work done, GPE, KE, efficiency) Balancing equations Interpreting data on Group 1 and Group 7 reactivity trends	Calculating specific heat capacity Rearranging and using the equations for: • Energy = mass × SHC × temperature change • Power = energy / time • Efficiency = (useful energy / total energy) × 100 Analysing enzyme graphs (rate vs temperature/pH) Interpreting particle size using standard form (nanoparticles)	Use and rearrangement of energy-related formulae (e.g. energy = power × time) Calculate start-up times, base load comparisons, and energy usage Estimate rate of water loss using a potometer Use ratio, averages, and scale to analyse blood cell sizes or stomatal density	Use and rearrange equations: (e.g. Q = It, V = IR) Interpret and analyse I-V graphs for components (e.g. resistors and diodes) Write and balance symbol equations, ionic equations and half-equations	Use and rearrange equations: (e.g. Q = It, V = IR) Interpret and analyse I-V graphs for components (e.g. resistors and diodes) Write and balance symbol equations, ionic equations and half-equations
Links to careers / aspirations	Healthcare professionals (e.g., pathology, microbiology): working with cells and disease Materials scientists: understanding atoms, mixtures, and elements Forensics and pharmaceutical research: applying separation techniques and atomic understanding	Energy engineers: understanding power, energy loss, and sustainability Medical researchers: stem cell applications in disease treatment Chemical scientists: element discovery, reactivity series, and periodic trends Geneticists: working with mitosis and cloning in biotechnology	Biomedical scientists: studying enzymes and digestion Materials scientist: understanding chemical bonding and nanoparticles Home energy adviser/architect: applying physics to home design and insulation Pharmacologist: investigating enzymes, drug delivery, and nanotech applications	Environmental engineer: choosing sustainable energy options Cardiologist: understanding blood flow and heart disease Plant scientist: developing crops and improving water use efficiency Public health scientist: evaluating interventions like stents and statins	Chemical engineers: designing industrial reactions and electrolysis systems Electricians and engineers: designing safe and efficient electrical systems Pharmacists and lab technicians: preparing and analysing compounds and solutions Environmental scientists: understanding acid-base interactions and pollution effects	Electricians and engineers: designing safe and efficient electrical systems
Cultural Capital	An understanding and appreciation of the scientific method and contributions of historical scientists (e.g., Rutherford, Dalton, Fleming Considering the impact of drug discovery and microscopy in modern medicine Understanding how cells and their transport mechanisms relate to diseases and treatments	Ethical debates on stem cell use and therapeutic cloning Historical significance of the development of the periodic table (e.g., Mendeleev) Exploration of energy use in society: conserving resources and designing efficient systems Comparing technological advancement in medicine, energy, and chemical classification	Role of enzymes in food production, biotechnology, and washing powders Impact of thermal insulation on energy bills and sustainability Discussion of nanotechnology in consumer goods (e.g., sun creams, electronics) Awareness of chemical properties in everyday materials (e.g., why graphite is used in pencils or diamonds in tools)	Current debates around climate change, fossil fuel use, and energy policy Health awareness: heart disease, cholesterol, and preventive treatments Understanding how water is transported in plants links to agriculture and food security Connections to engineering, medicine, and global sustainability issues	Discuss how acid rain forms and how neutralisation is used in treating it Explore the global importance of accessible electricity and sustainable extraction of metals Recognise the impact of battery and circuit design on modern technology Understand utilisation of enzymes/salts in everyday products (e.g., fertilisers, cleaning agents)	Explore the global importance of accessible electricity and sustainable extraction of metals Recognise the impact of battery and circuit design on modern technology
Practical Application of Skills	Using microscopes to observe cells and calculate their magnification Investigating osmosis in plant cells Separation techniques (e.g., chromatography, filtration)	Investigating friction and energy dissipation Displacement reactions with halogens and reactivity of Group 1 metals Cloning plants via tissue culture	Measure and compare specific heat capacity of different materials Investigate the effect of surface colour on radiation Carry out food tests and enzyme investigations	Investigate energy output from different fuels or solar cells Debate scenarios for selecting appropriate energy resources Dissect and identify structures in a mammalian heart Observe leaf cross-sections under a microscope and identify transport tissues Use a potometer to measure the rate of transpiration under different conditions	Prepare salts from acids and metals, bases, or carbonates Use indicators to determine pH and track neutralisation Investigate resistance in wires, components, and changing conditions (e.g., thermistor, LDR) Construct series and parallel circuits and measure current and voltage	Investigate resistance in wires, components, and changing conditions (e.g., thermistor, LDR) Construct series and parallel circuits and measure current and voltage