Science Department – Year 10

***Year10**: "**Proficient scientist**" = Learners are now able to take their KS3 knowledge and develop it further to become proficient in the subject*
***Challenge pupils to**: Link KS3 ideas to higher level thinking.*

Shirley High Curriculum Map	**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:
	1 Cell Biology 8 Atomic structure and the PT 18 Energy	20 Particle model of matter 21 Atomic structure *2 Organisation*	9 Bonding, structure and the properties of matter 10 Quantitative chemistry *3 Infection and response*	11 Chemical changes 12 Energy changes	4 Bioenergetics 19 Electricity	13 The rate and extent of chemical change WEX Cultural Capital Week
Why Now?	Having completed the KS3 course, the pupils will begin their GCSE studies. They will learn that cells are the fundamental building blocks of life, atoms have a specific structure that gives them their properties, and they will also study energy as a resource – a key topic in this current world..	Pupils will build on last term to learn about the particle model of matter, and how nuclear reactions can occur. They will discover the transport systems that allow multicellular organisms to function..	Pupils will explore bonding in chemistry – a fundamental concept With current world issues linked to disease, the pupils will delve into the infection and response topic. They will also now study the mathematical and quantitative chemistry needed to move on to becoming 'expert scientists' next year	With knowledge of the 3 types of bonding now from last half term, pupils will look at the energy changes in reactions and how reactions occur in terms of bonds. They will also study energy as a resource – a key topic in this current world.	Pupils will learn about the key reactions of photosynthesis and respiration – the very way all organisms gain and use energy. Pupils will also build on last half terms learning on energy to see electricity as an efficient energy transfer process.	The pupils will finish the year exploring practically the way that rates of reactions can be altered
Fundamental Concepts	1 Cells are the fundamental building blocks of life 8 Atoms have a specific structure 18 Energy sources can be renewable or non-renewable and have their pros and cons	20 The arrangement and movement of particles if key to the properties 21 Atoms can change and break down in nuclear reactions 2 Transport systems are used by multicellular organisms	9 Chemistry is the study of how atoms bond through the loss and sharing of electrons 3 Diseases can be communicable or non-communicable and spread by different vectors. 10 Numerical formulas	11 Chemical reactions involve the making and breaking of bonds. 12 Energy changes in reactions can be measured quantitatively	4 Photosynthesis is the reaction that light energy is converted to a chemical energy store 19 Electricity is an efficient way to transfer energy and is linked to power.	13 Chemical reactions are caused by successful collisions causing bonds to break and new ones to be formed

Students will learn about…	Cells
	• cells as the basic structural unit of all organisms; adaptations of cells related to their functions; the main sub-cellular structures of eukaryotic and prokaryotic cells
	• stem cells in animals and meristems in plants
	• enzymes
	• factors affecting the rate of enzymatic reactions
	• the importance of cellular respiration; the processes of aerobic and anaerobic respiration
	• carbohydrates, proteins, nucleic acids and lipids as key biological molecules
	
	Atomic structure and the PT
	• a simple model of the atom consisting of the nucleus and electrons, relative atomic mass, electronic charge and isotopes
	• the number of particles in a given mass of a substance
	• the modern Periodic Table, showing elements arranged in order of atomic number
	• position of elements in the Periodic Table in relation to their atomic structure and arrangement of outer electrons
	• properties and trends in properties of elements in the same group
	• characteristic properties of metals and non-metals
	• chemical reactivity of elements in relation to their position in the Periodic Table
	
	Energy
	• energy changes in a system involving heating, doing work using forces, or doing work using an electric current: calculating the stored energies and energy changes involved
	  ◦ power as the rate of transfer of energy
	  ◦ conservation of energy in a closed system, dissipation
	  ◦ calculating energy efficiency for any energy transfers
	  ◦ renewable and non-renewable energy sources used on Earth, changes in how these are used
		Particle model of matter
		• relating models of arrangements and motions of the molecules in solid, liquid and gas phases to their densities
		• melting, evaporation, and sublimation as reversible changes
		• calculating energy changes involved on heating, using specific heat capacity; and those involved in changes of state, using specific latent heat
		• links between pressure and temperature of a gas at constant volume, related to the motion of its particles (qualitative)
		
		Atomic structure
		• the nuclear model and its development in the light of changing evidence
		• masses and sizes of nuclei, atoms and small molecules
		• differences in numbers of protons, and neutrons related to masses and identities of nuclei, isotope characteristics and equations to represent changes
		• ionisation; absorption or emission of radiation related to changes in electron orbits
		• radioactive nuclei: emission of alpha or beta particles, neutrons, or gamma-rays, related to changes in the nuclear mass and/or charge
		• radioactive materials, half-life, irradiation, contamination and their associated hazardous effects, waste disposal
		• nuclear fission, nuclear fusion and our sun's energy
		
		Organisation
		• the need for transport systems in multicellular organisms, including plants
		• the relationship between the structure and functions of the human circulatory system
			Bonding, structure and the properties of matter
			• changes of state of matter in terms of particle kinetics, energy transfers and the relative strength of chemical bonds and intermolecular forces
			• types of chemical bonding: ionic, covalent, and metallic
			• bulk properties of materials related to bonding and intermolecular forces
			• bonding of carbon leading to the vast array of natural and synthetic organic compounds that occur due to the ability of carbon to form families of similar compounds, chains and rings
			• structures, bonding and properties of diamond, graphite, fullerenes and graphene
			
			Infection and response
			• the relationship between health and disease
			• communicable diseases including sexually transmitted infections in humans (including HIV/AIDs)
			• non-communicable diseases
			• bacteria, viruses and fungi as pathogens in animals and plants
			• body defences against pathogens and the role of the immune system against disease
			• reducing and preventing the spread of infectious diseases in animals and plants
			• the process of discovery and development of new medicines
			• the impact of lifestyle factors on the incidence of non-communicable diseases
			
			Quantitative chemistry
			• Measurement of energy changes in chemical reactions (quantitative)
			• Bond breaking, bond making, activation energy and reaction profiles (quantitative)
				Chemical changes
				• determination of empirical formulae from the ratio of atoms of different kinds
				• balanced chemical equations, ionic equations and state symbols
				• identification of common gases
				• the chemistry of acids; reactions with some metals and carbonates
				• pH as a measure of hydrogen ion concentration and its numerical scale
				• electrolysis of molten ionic liquids and aqueous ionic solutions
				• reduction and oxidation in terms of loss or gain of oxygen.
				
				Energy changes
				• Measurement of energy changes in chemical reactions (quantitative)
				• Bond breaking, bond making, activation energy and reaction profiles (quantitative)
					Bioenergetics
					• photosynthesis as the key process for food production and therefore biomass for life
					• the process of photosynthesis
					• factors affecting the rate of photosynthesis
					
					Electricity
					• measuring resistance using p.d. and current measurements
					• exploring current, resistance and voltage relationships for different circuit elements; including their graphical representations
					• quantity of charge flowing as the product of current and time
					• drawing circuit diagrams; exploring equivalent resistance for resistors in series
					• the domestic a.c. supply; live, neutral and earth mains wires, safety measures
					• power transfer related to p.d. and current, or current and resistance
						The rate and extent of chemical change
						• factors that influence the rate of reaction: varying temperature or concentration, changing the surface area of a solid reactant or by adding a catalyst
						• factors affecting reversible reactions

Language for Life (Key terms/Vocabulary)	Cells, sub-cellular, organelle, eukaryotic, prokaryotic, enzymes, respiration, proton, electron, neutron, isotope, mass, work, conservation of energy, dissipation, efficiency, renewable, reactivity,	Density, pressure, temperature, latent, sublimation Nuclei, radioactive, alpha, beta, gamma, ionisation, fission, fusion, transport, circulatory,	Chemical, bond, intermolecular, synthetic, diamond, graphite, fullerenes, graphene, health, disease, transmitted, communicable, lifestyle, medicine, quantitative,	Empirical, formulae, ionic, carbonates, reduction, oxidation, electrolysis, reaction profiles,	Photosynthesis, resistance, potential difference, voltage, current, circuit, series, parallel, power	Temperature, rate of reaction, pressure, concentration, catalyst reversible

Extended writing Opportunities	Cells Extended Writing, Atomic structure Extended Writing	Particle model Extended Writing, Bonding Extended Writing, Organisation Extended Writing	Infection Extended Writing, Quantitative Extended Writing,	Chemical changes Extended Writing, Energy Extended Writing,	Photosynthesis Extended Writing, Electricity Extended Writing,	Rates of reaction Extended Writing,
Maths Across the Curriculum	Calculating magnification, Boyles law, Rearrangement of formula	Boyles Law, Bond energy calculations, negative numbers,	Quantitative energy calculations – moles, concentrations	Ratios, powers of 10, rearrangement of subject in formulas, percentages	Rearrangement of formulas	Calculating rates of reaction, tangents
Links to careers/ aspirations	Researcher, sports scientist, nutritionist, engineer,	Material scientist, nuclear physicist, engineer, product designer	Healthcare professional, pharmacist, drugs researcher, chemical analyst, forensic chemist	Metallurgist, material scientist	Electrician, electrical engineer, botanist	Chemical analyst
Cultural Capital	How techniques learnt in school are applied in medical practices?	How non-metals and knowledge of bonding developed computer chips?	What does an epidemiologist do?	How do our energy demands affect the planet?	Could algae be the solution to climate change?	Why is Mr McCarthy's catalytic converter gone?
Practical Application of Skills	Using a microscope, investigating osmosis, Investigating enzymes Investigating density	Investigating respiration	Investigating bacterial growth Measuring reactions quantitatively	Investigating electrolysis	Investigating resistance Series and parallel circuits	Investigating rates of reaction