YEAR 9 HALF TERM 1 SCIENCE LEARNING PROGRAMME

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Topic	Learning Objectives	Key Vocabulary	Learning Sequence	Linked Learning	Home Learning
Cells	Draw, label and describe the structure and function of both Animal and Plant Cells. Describe the difference between prokaryotic and eukaryotic cells. Correctly use a slide/microscope to observe cells under different magnifications and calculate magnification. Describe the difference between light and electron microscopes. Describe the differences between differentiation in plants and in animals. Define the term 'stem cell'. Describe how stem cells could be used to treat disease. Describe where stem cells can be found in animals and plants and their uses, evaluating risks and benefits. Explain how to grow bacteria and describe the conditions needed. Describe mitosis and the cell cycle and why it is important, with reference to chromosomes and what they are. Describe and explain gas exchange in plants and animals with reference to surface area . Including calculating surface area::volume ratio.	Active transport Archaea (three-domain system) Binary fission Differentiation Eukaryotic cell Extremophile Mitosis Mutation Osmosis Prokaryotic cell Resolution Selective breeding Stem cell	Cells are the basic unit of all forms of life. In this section, we explore how structural differences between types of cells enables them to perform specific functions within the organism. These differences in cells are controlled by genes in the nucleus. For an organism to grow, cells must divide by mitosis producing two new identical cells. If cells are isolated at an early stage of growth before they have become too specialised, they can retain their ability to grow into a range of different types of cells. This phenomenon has led to the development of stem cell technology. This is a new branch of medicine that allows doctors to repair damaged organs by growing new tissue from stem cells.	This GCSE topic builds upon a foundation provided in Year 7/8 during the Cells and The body topics/	This will be set as either a Vocabulary test or as consolidation questions on a weekly basis.

YEAR 9 HALF TERM 2 SCIENCE LEARNING PROGRAMME

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Topic	Learning Objectives	Key Vocabulary	Learning Sequence	Linked Learning	Home Learning
Atomic structure and the Periodic Table	Define an atom, element , compound and mixture. Write word equations and formulae and balanced chemical equations. Describe and give examples of separation methods and suggest suitable techniques. Describe the development of the atom how it has changed over time. Identify the number of protons, neutrons and electrons in elements. Describe what an Isotope is. Describe how elements in the same group have the same number of electrons in their outer shell. Describe elements in Group 1, Group 7, Group 0 and the transition metals. Explain the differences between metals and non-metals linked to their characteristic physical and chemical properties. Explain the development of the Periodic table and the work of Dimitri Mendeleev.	Protons Neutrons Electrons Electron shells Atomic Mass Atomic Number Isotope Periodic Table Periods Groups Group 7—Halogens Group 1—Alkali Metals. Group 0—Nobel Gases Metals Non-Metals	The periodic table provides chemists with a structured organisation of the known chemical elements from which they can make sense of their physical and chemical properties. The historical development of the periodic table and models of atomic structure provide good examples of how scientific ideas and explanations develop over time as new evidence emerges. The arrangement of elements in the modern periodic table can be explained in terms of atomic structure which provides evidence for the model of a nuclear atom with electrons in energy levels.	This topic builds upon the foundation provided in the Year 7 topic of the Periodic Table. Pupils have an understanding of atoms, the periodic table and key groups in the periodic table. This is the first Chemistry topic of the GCSE syllabus and therefore covers the key principles of Chemistry, which all the other topics build upon.	This will be set as either a Vocabulary test or as consolidation questions on a weekly basis.

YEAR 9 HALF TERM 3 SCIENCE LEARNING PROGRAMME

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Topic	Learning Objectives	Key Vocabulary	Learning Sequence	Linked Learning	Home Learning
Chemical Changes	Explain reduction and oxidation in terms of loss or gain of oxygen and (H) in terms of electrons. Recall and use the reactivity series and describe reactions with water or dilute acids. Know most metals are found as compounds that require chemical reactions to extract the metal. Know acids are neutralised by bases to produce salts and water, and by carbonates to produce salts, water and CO_2. Describe neutralisation reactions as $H^+ + OH^-$ à H_2O (H) Explain the terms dilute and concentrated and weak and strong in relation to acids Know when an ionic compound is melted or dissolved in water, the ions are free to move and these can conduct electricity. Know aluminium is manufactured by the electrolysis of a molten mixture of aluminium oxide and cryolite. (H) Describe reactions at electrodes with half equations.	Oxide Oxidation Reduction Reactivity series Hydrogen ion Hydroxide ion Electrolytes Negative cathode Positive anode Electrolysis Half equations	Understanding of chemical changes began when people began experimenting with chemical reactions in a systematic way and organising their results logically. Knowing about these different chemical changes meant that scientists could begin to predict exactly what new substances would be formed and use this knowledge to develop a wide range of different materials and processes. It also helped biochemists to understand the complex reactions that take place in living organisms. T he extraction of important resources from the Earth makes use of the way that some elements and compounds react with each other and how easily they can be 'pulled apart'.	Links to year 7 topic on Chemical Reactions and year 8 topic 'Fast and Furious.' Links to the KS4 year 9 topic on Bonding.	This will be set as either a Vocabulary test or as consolidation questions on a weekly basis.

YEAR 9 HALF TERM 4 SCIENCE LEARNING PROGRAMME

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Topic	Learning Objectives	Key Vocabulary	Learning Sequence	Linked Learning	Home Learning
Particle model of matter	Recall and apply the density equation (required practical) To recognise/draw simple diagrams to model the difference between solids, liquids and gases Explain the differences in density between the different states of matter Describe the features of a physical change/change of state Explain the concept of internal energy Explain the concept of specific heat capacity (and apply the associated equation) To explain the concept of specific latent heat (and apply the associated equation) To interpret heating and cooling graphs that include changes of state To describe and explain the motion of molecules in a gas **(Physics only)** Explain (and calculate) the relationship between pressure and volume for a gas at constant temperature Explain how doing work on an enclosed gas increases the temperature of the gas	Density Mass Volume Solid Liquid Gas Melting Freezing Boiling Evaporating Condensing Internal Energy Temperature Specific Latent Heat Specific Heat Capacity Pressure	The particle model is widely used to predict the behaviour of solids, liquids and gases and this has many applications in everyday life. It helps us to explain a wide range of observations and engineers use these principles when designing vessels to withstand high pressures and temperatures, such as submarines and spacecraft. It also explains why it is difficult to make a good cup of tea high up a mountain!	This topic builds on the KS3 topics of: Energy (kinetic energy, temperature and internal energy) and Particles (states and state changes, density, heating and cooling graphs, specific heat capacity and specific latent heat, internal energy) This topic links with other KS4 topics including: Forces (density, weight, pressure in fluids and upthrust) Bonding, structure and the properties of matter (states, state changes, gas particle motion and specific latent heat) Energy (doing work on an enclosed gas, temperature, heating/cooling, specific heat capacity and internal/thermal energy)	This will be set as either a Vocabulary test or as consolidation questions on a weekly basis.

YEAR 9 HALF TERM 4 SCIENCE LEARNING PROGRAMME

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Topic	Learning Objectives	Key Vocabulary	Learning Sequence	Linked Learning	Home Learning
Energy changes.	To understand that energy is conserved in chemical reactions. To distinguish between endothermic and exothermic reactions, giving examples of each. **RP:** To investigate the variables that affect temperature changes in reacting solutions. To understand and interpret simple reaction profiles. To calculate overall energy changes and bond energies given appropriate information. (HT) **Chemical cells and fuel cells.** **(Chemistry only)** To understand the principles behind cells, batteries, both rechargeable and non-rechargeable. To understand and explain how hydrogen fuel cells work. Write half equations at electrodes. (HT)	Endothermic exothermic Reaction Conservation Reaction profile Activation energy Bond energy Cell Battery Rechargeable Non-rechargeable Electrolyte Electrode Fuel cell, Oxidation Reduction	Energy changes are an important part of chemical reactions. The interaction of particles often involves transfers of energy due to the breaking and formation of bonds. Reactions in which energy is released to the surroundings are exothermic reactions, while those that take in thermal energy are endothermic. These interactions between particles can produce heating or cooling effects that are used in a range of everyday applications. Some interactions between ions in an electrolyte result in the production of electricity. Cells and batteries use these chemical reactions to provide electricity. Electricity can also be used to decompose ionic substances and is a useful means of producing elements that are too expensive to extract any other way.	This topic builds upon principles introduced in the Year 7 topic, Chemical reactions and the Year 8 topic, Fast and furious. It also builds upon knowledge pupils have developed during the GCSE curriculum on the topic Chemical changes covered during Term one in year 9.	This will be set as either a Vocabulary test or as consolidation questions on a weekly basis.

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Topic	Learning Objectives	Key Vocabulary	Learning Sequence	Linked Learning	Home Learning
Bonding	Know and describe the three types of strong chemical bonds: ionic, covalent and metallic. Explain the properties of Ionic compounds, Small covalent molecules and giant covalent structures. Students should be able to explain chemical bonding in terms of electrostatic forces and the transfer or sharing of electrons. To know and describe the three states of matter. To describe change of state in terms of particles and forces of attraction. To recognise polymers from their structures To describe and explain the properties of the different allotropes of carbon, including Diamonds, Graphite, Graphene and Fullerenes. **(Chemistry Only)** To define the term Nanoscience and explain the properties and uses of Nanoparticles.	Chemical bonds Ionic Covalent Metallic Opposite Charge Ions Electrons Delocalised Alloys Electrostatic forces Electron transfer Electron sharing Chemistry Only Nanoparticles	Chemists use theories of structure and bonding to explain the physical and chemical properties of materials. Analysis of structures shows that atoms can be arranged in a variety of ways, some of which are molecular while others are giant structures. Theories of bonding explain how atoms are held together in these structures. Scientists use this knowledge of structure and bonding to engineer new materials with desirable properties. The properties of these materials may offer new applications in a range of different technologies.	This topic builds upon principles introduced during the Year 8 Bonding and Separating topic. It continues to build upon the fundamental principles of Chemistry covered in Year 9 Term 1 topic Atoms and the Periodic Table.	This will be set as either a Vocabulary test or as consolidation questions on a weekly basis.

YEAR 9 HALF TERM 6 SCIENCE LEARNING PROGRAMME

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Topic	Learning Objectives	Key Vocabulary	Learning Sequence	Linked Learning	Home Learning
Bioenergetics	To describe photosynthesis . To explain the effects of limiting factors on the rate of photosynthesis. To describe how a plant uses the glucose. To describe aerobic respiration To describe anaerobic respiration To compare anaerobic respiration to aerobic respiration To recall the equation for fermentation and its uses. To describe and explain how the body responds to exercise. To explain metabolism.	Aerobic respiration Alveolus Amino acid Anaerobic respiration Fermentation Lactic acid Limiting factor Metabolism Oxygen debt Oxyhaemoglobin Photosynthesis Potometer Starch Stomata Transpiration stream	In this section we will explore how plants harness the Sun's energy in photosynthesis in order to make food. This process liberates oxygen which has built up over millions of years in the Earth's atmosphere. Both animals and plants use this oxygen to oxidise food in a process called aerobic respiration which transfers the energy that the organism needs to perform its functions. Conversely, anaerobic respiration does not require oxygen to transfer energy. During vigorous exercise the human body is unable to supply the cells with sufficient oxygen and it switches to anaerobic respiration. This process will supply energy but also causes the build-up of lactic acid in muscles which causes fatigue.	This GCSE topic builds upon a foundation provided in KS3 Year 7 and 8 on Cells and Plants. It also builds upon knowledge pupils have developed during the GCSE curriculum, in the topic of Cells in Year 9.	This will be set as either a Vocabulary test or as consolidation questions on a weekly basis.