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 Prepare slides of plant and animal cells and describe the procedure. Correctly use a microscope to observe cells under different magnifications. Describe the order of size of: cell, nucleus, chromosome and gene. Explain the need for differentiation in a multicellular organism. Describe the differences between differentiation in plants and in animals. Explain how specialised cells are adapted for their function. Define the term 'stem cell'. Describe how stem cells could be used to treat disease. Describe where stem cells can be	Active transport Archaea (three-domain system) Bacteria Bacterium Binary fission Cell cycle Cell membrane Cell wall Cellulose Chloroplast Cytoplasm Differentiation Diffusion Electron microscope Eukaryotic Eukaryotic cell Exchange surface Extremophile Mitochondria Mitosis Multicellular organism Mutation Nucleus Osmosis Partially permeable	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.	Working Scientifically: WS 1.1 Understand how scientific methods and theories develop over time. WS 1.2 Use a variety of models such as representational, spatial, descriptive, computational and mathematical to solve problems, make predictions and to develop scientific explanations and understanding of familiar and unfamiliar facts. WS 1.3 Appreciate the power and limitations of science and consider any ethical issues which may arise. WS 1.5 Evaluate risks both in practical science and the wider societal context, including perception of risk in relation to data and consequences. WS 2.2 Plan experiments or devise procedures to make observations, produce or characterise a substance, test hypotheses, check data or explore phenomena. Apply understanding of apparatus and techniques to suggest a procedure for a specified purpose. WS 2.4 Carry out experiments appropriately hav-	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
Cells	Describe the differences between eukaryotic and prokaryotic cells in terms of structure and size. Describe the differences in magnification and resolution of light and electron microscopes. Explain how electron microscopy has increased understanding of organelles. Calculate the magnification of a light microscope. Carry out calculations using the formula: $real\ size = \frac{image\ size}{magnification}$ Rearrange the equation to calculate image size or magnification. Convert values for the units: cm, mm, µm and nm. Know that bacteria multiply by simple cell division. Know how bacteria can be grown.	Prokaryotic cell Resolution Ribosome Root hair cell Selective breeding Specialised cell Stem cell		Maths Skills: 1.a. Recognise and use expressions in decimal form 1.b. Recognise and use expressions in standard form 1.c. Use ratios, fractions and percentages 1.d. Make estimates of the results of simple calculations 2.a. Use an appropriate number of significant figures 2.h. Make order of magnitude calculations 3.a. Understand and use the symbols: =, <, <<, >>, >, $\propto$, ~ 3.b. Change the subject of an equation 4.a. Translate information between graphical and numeric form 4.b. Understand that $y = mx + c$ represents a linear relationship 4.c. Plot two variables from experimental or other data 4.d. Determine the slope and intercept of a linear graph 5.c. Calculate areas of triangles and rec-	

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Cells	Describe what a chromosome is and where chromosomes are found in the cell. Describe simply how and why body cells divide by. Draw simple diagrams to describe mitosis. Draw a simple diagram to describe the cell cycle Define the term 'diffusion'. Explain how temperature, concentration gradient and surface area affect the rate of diffusion. Give examples of substances that diffuse into and out of cells. Calculate and compare surface area: volume ratios. Explain how the small intestine and lungs in mammals, and roots and leaves in plants, are adapted for exchange of substances. Describe and explain how an exchange surface is made more effective.			Practical Skills: AT 7 Use of appropriate apparatus, techniques and magnification, including microscopes, to make observations of biological specimens and produce labelled scientific drawings (links to A-level AT d and e).	

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Atomic structure and the Periodic Table	Define an atom, element and compound. Use the names and symbols of the first 20 elements in the periodic table. Write word equations and formulae and balanced chemical equations. Write balanced half equations and ionic equations (HT only) Know a mixture contains two or more chemical elements not chemically combined. Describe and give examples of separation methods and suggest suitable techniques. Know how the model of the atom was developed and how it has changed over time and through new experimental evidence Know the radius of a nucleus is less than 1/10 000 of that of the atom (about 1 x 10-14 m). Know almost all of the mass of an atom is in the nucleus. Know the relative masses of protons, neutrons and electrons are: The sum of the protons and neutrons in an atom is its mass number.	Atoms Elements Compounds Symbols Balanced Unbalanced Half equations Ionic equations Groups/Periods Filtration Crystallisation Distillation Fractional Chromatography Evidence Timeline Electrons Protons Neutrons Plum pudding Charge Electrons Protons Neutrons Particle	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.	Working Scientifically: WS 1.1 Understand how scientific methods and theories develop over time. WS 1.2 Use a variety of models such as representational, spatial, descriptive, computational and mathematical to solve problems, make predictions and to develop scientific explanations and understanding of familiar and unfamiliar facts. WS 1.6 Recognise the importance of peer review of results and of communicating results to a range of audiences. WS 2.2 Plan experiments or devise procedures to make observations, produce or characterise a substance, test hypotheses, check data or explore phenomena. Apply understanding of apparatus and techniques to suggest a procedure for a specified purpose. WS 2.3 Apply a knowledge of a range of techniques, instruments, apparatus, and materials to select those appropriate to the experiment. WS 4.3	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
Atomic structure and the Periodic Table	Know atoms of the same element can have different numbers of neutrons; these atoms are called isotopes of that element. Know relative atomic mass of an element is an average value that takes account of the abundance of isotopes. Know the relative electrical charges of the particles in atoms. Know atoms are very small, having a radius of about 0.1 nm (1 x 10-10 m). Know the electrons in an atom occupy the lowest available energy levels (innermost available shells). Know elements in the same group in the periodic table have the same number of electrons in their outer shell (outer electrons) and this gives them similar chemical properties. explain how the position of an element in the periodic table is related to the arrangement of electrons in its atoms and hence to its atomic number	Mass number Atomic number Ion Size Scale Physical world Calculate Abundance Shells Energy levels Electronic structure First/second/third energy levels 2 8 8 filling order of electrons Reactivity Positive ion Negative ion Characteristics Physical Chemical Alkali Halogen Inert Transition		Maths Skills: 1.b. Recognise and use expressions in standard form 1.d. Make estimates of the results of simple calculations 5.b. Visualise and represent 2D and 3D forms including two dimensional representations of 3D objects Practical Skills: AT 4 Safe use of a range of equipment to purify and/or separate chemical mixtures including evaporation, filtration, crystallisation, chromatography and distillation (links to A-level AT d and g). AT 6 Safe use and careful handling of gases, liquids and solids, including careful mixing of reagents under controlled conditions, using appropriate apparatus to explore chemical changes and/or products (links to A-level AT a and k).	

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Topic	Learning Objectives	Key Vocabulary	Learning Sequence	Linked Learning	Home Learning
Atomic structure and the Periodic Table	Know Mendeleev overcame some of the problems by leaving gaps for elements that he thought had not been discovered and in some places changed the order based on atomic weights. Know elements with properties predicted by Mendeleev were discovered and filled the gaps. Know elements that react to form positive ions are metals. Students should be able to: explain the differences between metals and non-metals on the basis of their characteristic physical and chemical properties. explain how the atomic structure of metals and non-metals relates to their position in the periodic table explain how the reactions of elements are related to the arrangement of electrons in their atoms and hence to their atomic number. Students should be able to describe elements in Group 1, Group 7, Group 0 and the transition metals.				

YEAR 9 HALF TERM 2 SCIENCE LEARNING PROGRAMME

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Topic	Learning Objectives	Key Vocabulary	Learning Sequence	Linked Learning	Home Learning
Chemical Changes	Students should be able to explain reduction and oxidation in terms of loss or gain of oxygen. Know metals can be arranged in order of their reactivity in a reactivity series and recall and describe the reactions with water or dilute acids. Know unreactive metals such as gold are found in the Earth as the metal itself but most metals are found as compounds that require chemical reactions to extract the metal. Metals less reactive than carbon can be extracted from their oxides by reduction with carbon. Know acids are neutralised by alkalis (eg soluble metal hydroxides) and bases (eg insoluble metal hydroxides and metal oxides) to produce salts and water, and by metal carbonates to produce salts, water and carbon dioxide. Know a solution with pH 7 is neutral. Aqueous solutions of acids have pH values of less than 7 and aqueous solutions of alkalis have pH values greater than 7.	Metals Oxides Oxidation Reduction Ions Positive Reactivity series Order Neutral Acidity Alkalinity Hydrogen ion Hydroxide ion Melt Dissolve conduct Electricity Electrolytes Negative cathode Positive anode Discharged Electrolysis Half equations Balance Reduction reactions Oxidation reactions	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. The 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'.	Working Scientifically: WS 1.2 Use a variety of models such as representational, spatial, descriptive, computational and mathematical to solve problems, make predictions and to develop scientific explanations and understanding of familiar and unfamiliar facts. Maths Skills: 2.h. Make order of magnitude calculations Practical Skills: AT 3 Use of appropriate apparatus and techniques for conducting and monitoring chemical reactions, including appropriate reagents and/or techniques for the measurement of pH in different situations (links to A-level AT a and d). AT 6 Safe use and careful handling of gases, liquids and solids, including careful mixing of reagents under controlled conditions, using appropriate apparatus to explore chemical changes and/or products (links to A-level AT a and k).	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
Chemical Changes	Describe neutralisation reactions between an acid and an alkali, hydrogen ions react with hydroxide ions to produce water. Describe the use of universal indicator or a wide range indicator to measure the approximate pH of a solution Use the pH scale to identify acidic or alkaline solutions. use and 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 about within the liquid or solution. These liquids and solutions are able to conduct electricity and are called electrolytes. Know passing an electric current through electrolytes causes ions to move to the electrodes. Positively charged ions move to the negative electrode (the cathode), and negatively charged ions move to the positive electrode (the anode).				

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Chemical Changes	Know metals can be extracted from molten compounds using electrolysis. Know aluminium is manufactured by the electrolysis of a molten mixture of aluminium oxide and cryolite using carbon as the positive electrode. Know during electrolysis, at the cathode (negative electrode), positively charged ions gain electrons and so the reactions are reductions. At the anode (positive electrode), negatively charged ions lose electrons and so the reactions are oxidations. (HT ONLY) Reactions at electrodes can be represented by half equations, for example: $2H^+ + 2e^- \rightarrow H_2$ and $4OH^- \rightarrow O_2 + 2H_2O + 4e$ or $4OH^- - 4e^- \rightarrow O_2 + 2H_2O$				

YEAR 9 **HALF TERM 3** **SCIENCE** **LEARNING PROGRAMME**

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YEAR 9 **HALF TERM 4** **SCIENCE** **LEARNING PROGRAMME**

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YEAR 9 **HALF TERM 5** **SCIENCE** **LEARNING PROGRAMME**

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YEAR 9 **HALF TERM 6** **SCIENCE** **LEARNING PROGRAMME**

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