

Curriculum Area: Science

Long-Term Plan

Academic Year 2022 - 2023

	Autumn Term	Spring Term	Summer Term
	<u>Autumn 1</u>	<u>Spring 1</u>	<u>Summer 1</u>
Years 7/8	<p>Introduction to Science/key skills</p> <ul style="list-style-type: none"> ❖ use appropriate apparatus, during laboratory work, paying attention to health and safety ❖ ask questions and develop a line of enquiry based on observations ❖ make predictions using scientific knowledge and understanding ❖ select, plan and carry out the most appropriate types of scientific enquiries to test predictions, including identifying independent, dependent and control variables, where appropriate ❖ make and record observations and measurements ❖ present observations and data ❖ interpret observations and data, ❖ present reasoned explanations ❖ evaluate data ❖ understand and use SI units 	<p>Forces</p> <ul style="list-style-type: none"> ❖ forces as pushes or pulls, arising from the interaction between two objects ❖ using force arrows in diagrams, ❖ stretching and squashing – springs; ❖ friction between surfaces ❖ measuring of forces ❖ measurements of stretch or compression as force is changed ❖ contact and non-contact forces <p>Reactions</p> <ul style="list-style-type: none"> ❖ chemical reactions as the rearrangement of atoms ❖ representing chemical reactions using formulae and using equations ❖ combustion, thermal decomposition, oxidation and displacement reactions ❖ defining acids and alkalis in terms of neutralisation reactions ❖ the pH scale for measuring acidity/alkalinity; and indicators 	<p>Light</p> <ul style="list-style-type: none"> ❖ the similarities and differences between light waves and waves in matter ❖ light waves travelling through a vacuum ❖ speed of light ❖ the transmission of light through materials ❖ use of ray model to explain imaging in mirrors ❖ the pinhole camera ❖ the refraction of light ❖ the human eye ❖ colours and the different frequencies of light. <p>Separation techniques</p> <ul style="list-style-type: none"> ❖ the concept of a pure substance ❖ mixtures, including dissolving ❖ simple techniques for separating mixtures ❖ the identification of pure substances. <p>Sound</p> <ul style="list-style-type: none"> ❖ frequencies of sound wave ❖ measurement of sound waves ❖ echoes ❖ properties of sound ❖ how sound waves are produced ❖ the structure of the human ear ❖ auditory range of humans and animals

	<u>Autumn 2</u>	<u>Spring 2</u>	<u>Summer 2</u>
	<p>Basic Chemistry</p> <ul style="list-style-type: none"> ❖ atoms and molecules as particles ❖ The particulate nature of matter ❖ the properties of the different states of matter (solid, liquid and gas) ❖ Atoms, elements and compounds ❖ chemical symbols and formulae for elements and compounds ❖ the Periodic Table: periods and groups; ❖ metals and non-metals and their properties. <p>Cells & organisation</p> <ul style="list-style-type: none"> ❖ cells as the unit of living organisms ❖ how to observe, interpret and record cell structure using a light microscope ❖ the functions of the cell wall, cell membrane, cytoplasm, nucleus, vacuole, mitochondria and chloroplasts ❖ the similarities and differences between plant and animal cells ❖ the hierarchical organisation of multicellular organisms ❖ the role of diffusion in the movement of materials in and between cells ❖ the structural adaptations of some unicellular organisms 	<p>The skeletal and muscular systems</p> <ul style="list-style-type: none"> ❖ the structure and functions of the human skeleton ❖ biomechanics – the interaction between skeleton and muscles, ❖ measurement of force exerted by different muscles ❖ the function of muscles and examples of antagonistic muscles. <p>Gas exchange systems</p> <ul style="list-style-type: none"> ❖ the structure and functions of the gas exchange system in humans, including adaptations to function ❖ the mechanism of breathing to move air in and out of the lungs, using a pressure model to explain the movement of gases, including simple measurements of lung volume 	<p>Reproduction</p> <ul style="list-style-type: none"> ❖ reproduction in humans ❖ the structure and function of the male and female reproductive systems, ❖ menstrual cycle ❖ gametes, fertilisation, gestation and birth ❖ effect of maternal lifestyle on the foetus through the placenta ❖ reproduction in plants ❖ flower structure ❖ pollination, ❖ fertilisation ❖ seed and fruit formation ❖ seed dispersal

	Autumn Term	Spring Term	Summer Term
	<u>Autumn 1</u>	<u>Spring 1</u>	<u>Summer 1</u>
Year 9	<p><u>Adaptation & Inheritance</u></p> <ul style="list-style-type: none"> ♣ heredity as the process by which genetic information is transmitted from one generation to the next ♣ a simple model of chromosomes, genes and DNA in heredity, including the part played by Watson, Crick, Wilkins and Franklin in the development of the DNA model ♣ differences between species ♣ the variation between individuals within a species being continuous or discontinuous, to include measurement and graphical representation of variation ♣ the variation between species and between individuals of the same species means some organisms compete more successfully, which can drive natural selection ♣ changes in the environment may leave individuals within a species, and some entire species, less well adapted to compete successfully and reproduce, which in turn may lead to extinction ♣ the importance of maintaining biodiversity and the use of gene banks to preserve hereditary material. <p><u>Periodic Table</u></p> <ul style="list-style-type: none"> ♣ the varying physical and chemical properties of different elements ♣ the principles underpinning the Mendeleev Periodic Table 	<p><u>Health & Lifestyle</u></p> <ul style="list-style-type: none"> ♣ the effects of recreational drugs (including substance misuse) on behaviour, health and life processes. <p><u>Energy</u></p> <ul style="list-style-type: none"> ♣ comparing energy values of different foods (from labels) (kJ) ♣ comparing power ratings of appliances in watts (W, kW) ♣ comparing amounts of energy transferred (J, kJ, kW hour) ♣ domestic fuel bills, fuel use and costs ♣ fuels and energy resources. <p>simple machines give bigger force but at the expense of smaller movement (and vice versa): product of force and displacement unchanged</p> <ul style="list-style-type: none"> ♣ heating and thermal equilibrium: temperature difference between two objects leading to energy transfer from the hotter to the cooler one, through contact (conduction) or radiation; such transfers tending to reduce the temperature difference: use of insulators ♣ other processes that involve energy transfer: changing motion, dropping an object, completing an electrical circuit, stretching a spring, metabolism of food, burning fuels ♣ energy as a quantity that can be quantified and calculated; the total energy has the same value before and after a change ♣ comparing the starting with the final conditions of a system and describing increases and decreases in the amounts of energy associated with 	<p><u>Ecosystem Processes</u></p> <ul style="list-style-type: none"> ♣ importance and process of photosynthesis ♣ the structure and function of a leaf including the distribution of chloroplasts in a leaf ♣ how plants use minerals for healthy growth ♣ the role of nitrates in plant growth ♣ the process of chemosynthesis and where it takes place ♣ importance and process of aerobic respiration ♣ the process and importance of anaerobic respiration ♣ the interdependence of organisms in an ecosystem, including food chains and webs ♣ how organisms affect, and are affected by, their environment, including the accumulation of toxic materials. ♣ resources that plants and animals compete for ♣ how organisms are adapted to their environments <p>Motion & pressure</p> <ul style="list-style-type: none"> ♣ speed and the quantitative relationship between average speed, distance and time (speed = distance ÷ time) ♣ the representation of a journey on a distance-time graph ♣ relative motion: trains and cars passing one another ♣ moment as the turning effect of a force

	<ul style="list-style-type: none"> ♣ the Periodic Table: periods and groups; metals and non-metals ♣ how patterns in reactions can be predicted with reference to the Periodic Table ♣ the properties of metals and non-metals ♣ the chemical properties of metal and non-metal oxides with respect to acidity. 	<p>movements, temperatures, changes in positions in a field, in elastic distortions and in chemical compositions</p> <ul style="list-style-type: none"> ♣ using physical processes and mechanisms, rather than energy, to explain the intermediate steps that bring about such changes 	<ul style="list-style-type: none"> ♣ pressure in gases, atmospheric pressure, decreases with increase of height as weight of air above decreases with height ♣ pressure liquids, increasing with depth; upthrust effects, floating and sinking ♣ pressure measured by ratio of force over area – acting normal to any surface.
	<u>Autumn 2</u>	<u>Spring 2</u>	<u>Summer 2</u>
	<p><u>Separation Techniques</u></p> <ul style="list-style-type: none"> ♣ the concept of a pure substance ♣ mixtures, including dissolving ♣ diffusion in terms of the particle model ♣ simple techniques for separating mixtures: filtration, evaporation, distillation and chromatography ♣ the identification of pure substances. <p><u>Metals and acids</u></p> <ul style="list-style-type: none"> ♣ compare the reactions of different metals with dilute acids, oxygen and water ♣ performing the test for hydrogen gas ♣ the reactivity series & metal displacement reactions ♣ extracting metals by heating with carbon ♣ properties and uses of ceramics ♣ properties and uses of polymers ♣ properties and uses of composites 	<p><u>Electricity & Magnetism</u></p> <ul style="list-style-type: none"> ♣ magnetic poles, attraction and repulsion ♣ magnetic fields by plotting with compass, representation by field lines ♣ Earth's magnetism, compass and navigation ♣ the magnetic effect of a current, electromagnets, D.C. motors (principles only). <p><u>The Earth</u></p> <ul style="list-style-type: none"> ♣ the composition of the Earth ♣ the structure of the Earth ♣ the rock cycle and the formation of igneous, sedimentary and metamorphic rocks ♣ Earth as a source of limited resources and the efficacy of recycling ♣ the carbon cycle ♣ the composition of the atmosphere ♣ the production of carbon dioxide by human activity and the impact on climate. 	<p>Revision</p> <p>End of year Examination</p> <p>Preparation for GCSE</p>

	Autumn Term	Spring Term	Summer Term
	<u>Autumn 1</u>	<u>Spring 1</u>	<u>Summer 1</u>
Year 10	<p>B1: Cell Biology</p> <ul style="list-style-type: none"> Plant and animal cells (eukaryotic cells) Bacterial cells (prokaryotic cells) are much smaller in comparison. Students should be able to demonstrate an understanding of the scale and size of cells and be able to make order of magnitude calculations, including the use of standard form. Students should be able to explain how the main sub-cellular structures are related to their functions. use a light microscope to observe, draw and label a selection of plant and animal cells. how the structure of different types of cell relate to their function in a tissue, an organ or organ system, or the whole organism. Cells may be specialised to carry out a particular function: sperm cells, nerve cells and muscle cells in animals; root hair cells, xylem and phloem cells in plants. Students should be able to explain the importance of cell differentiation. understand how microscopy techniques have developed over time explain how electron microscopy has increased understanding of sub-cellular structures. The nucleus of a cell contains chromosomes made of DNA molecules. Students should be able to describe the stages of the cell cycle, including mitosis. 	<p>C2: Bonding, Structure and the properties of matter</p> <p>Ionic bonding:</p> <ul style="list-style-type: none"> State that metal atoms lose electrons and form positive ions. State that non-metal atoms gain electrons and form negative ions. Represent the electron transfer by use of a dot cross diagram. Deduce charge on ions of Groups 1, 2, 6 and 7 <p>Ionic compounds:</p> <ul style="list-style-type: none"> Describe how ionic compounds are held together in lattice structures. Represent the structure of sodium chloride. Evaluate the different methods of representing giant ionic structures. Deduce the formula of an ionic compound from a diagram. <p>Properties of ionic compounds:</p> <ul style="list-style-type: none"> Explain the high melting and boiling points of ionic compounds. Describe that once molten or dissolved, ionic compounds will conduct electricity. Draw dot and cross representations of ionic compounds. <p>Properties of small molecules:</p> <ul style="list-style-type: none"> Define intermolecular forces as the attraction between molecules. 	<p>P3: Particle model of matter</p> <ul style="list-style-type: none"> explain how the motion of the molecules in a gas is related to both its temperature and its pressure explain qualitatively the relation between the temperature of a gas and its pressure at constant volume. <p>P4: Atomic structure (Radioactivity)</p> <ul style="list-style-type: none"> to relate differences between isotopes to differences in conventional representations of their identities, charges and masses. to show an understanding of why and describe how scientific methods and theories develop over time. to describe why the new evidence from the scattering experiment led to a change in the atomic model and the difference between the plum pudding model of the atom and the nuclear model of the atom Students should be able to apply their knowledge to the uses of radiation and evaluate the best sources of radiation to use in a given situation. use the names and symbols of common nuclei and particles to write balanced equations that show single alpha (α) and beta (β) decay. This is limited to balancing the atomic numbers and mass numbers

- Students should be able to describe the function of stem cells in embryos, in adult animals and in the meristems in plants.
- Students should be able to explain how different factors affect the rate of diffusion.
- Students should be able to calculate and compare surface area to volume ratios.
- Students should be able to explain the need for exchange surfaces and a transport system in multicellular organisms in terms of surface area to volume ratio.
- Students should be able to explain how the small intestine and lungs in mammals, gills in fish, and the roots and leaves in plants, are adapted for exchanging materials.
- Students should be able to:
 - use simple compound measures of rate of water uptake
 - use percentages
 - calculate percentage gain and loss of mass of plant tissue.
- Students should be able to plot, draw and interpret appropriate graphs.
- investigate the effect of a range of concentrations of salt or sugar solutions on the mass of plant tissue.
- describe how substances are transported into and out of cells by diffusion, osmosis and active transport
- explain the differences between the three processes.

C1: Atomic structure and the periodic table

Subatomic particles:

- Describe small molecules as having relatively low melting and boiling points and often gases or liquids at room temperature.
- Explain why weak intermolecular forces lead to low melting and boiling points.
- Describe the trend that when increasing the molecular mass, the intermolecular forces increase.

Covalent bonding:

- Define covalent bond as sharing of electrons.
- Recognise small molecules, polymers and giant covalent structures as examples of covalent substances.
- Draw dot cross diagrams for hydrogen, chlorine, oxygen, nitrogen, hydrogen chloride, water, ammonia and methane.
- Evaluate the different methods of representing covalent molecules or giant structures.
- Deduce the molecular formula of a substance from a model or diagram.

Polymers:

- Describe polymers as very large molecules.
- Explain why polymers are often solids at room temperature compared to small molecules that are often gas or liquid.
- Recognise polymers from diagrams.

Giant covalent structures:

- State examples of giant covalent substances (diamond, graphite and silicon dioxide)
- Compare the melting points of giant covalent structures to simple molecules.
- Recognise giant covalent structures from diagrams.

Metallic bonding:

- Represent the bonding in metals.

- explain the concept of half-life and how it is related to the random nature of radioactive decay.
- determine the half-life of a radioactive isotope from given information.
- calculate the net decline, expressed as a ratio, in a radioactive emission after a given number of half-lives.
- compare the hazards associated with contamination and irradiation.
- understand that it is important for the findings of studies into the effects of radiation on humans to be published and shared with other scientists so that the findings can be checked by peer review.

B4: Bioenergetics

- recognise the chemical symbols: CO₂, H₂O, O₂ and C₆H₁₂O₆.
- describe photosynthesis as an endothermic reaction in which energy is transferred from the environment to the chloroplasts by light.
- explain the effects of temperature, light intensity, carbon dioxide concentration, and the amount of chlorophyll on the rate of photosynthesis.
- explain graphs of photosynthesis rate involving two or three factors and decide which is the limiting factor.
- understand and use inverse proportion – the inverse square law and light intensity in the context of photosynthesis.

- Relate size and scale of atoms to other objects.
- Draw the general structure of an atom.
- Define the relative charge and mass of subatomic particles.
- Calculate numbers of protons, neutrons and electrons when given the atomic number and mass number.

Atoms and elements:

- Define atoms as the smallest part of an element.
- Describe the format of the periodic table and find given elements in terms of group and period.
- Define names/symbols of first 20 elements, Group 1 and Group 7.

Compounds:

- State that compounds are formed from elements by chemical reactions.
- Name compounds from given formula or symbol equations.
- State the proportions of each atom in a chemical formula

Relative atomic mass and electron configuration:

- Define the term isotope.
- Define and calculate relative atomic mass.
- Represent electron configuration by diagram or by numbers.
- Define the term ion and deduce charge when electrons are gained or lost.

A model of the atom:

- Explain why metallic substances conduct heat and electricity.

Properties of metals and alloys:

- Define the term alloy.
- Explain properties of metallic substances including high melting points and the ability to be bent and shaped.
- Explain why alloys are harder than pure metals.

Explaining states of matter:

- Use particle theory to explain melting, boiling, freezing and condensing. (HT)
- Predict states of different substances. (HT)
- Use state symbols to indicate solid (s), liquid (l), gas (g) or aqueous solution (aq). (HT)
- Evaluate the use of particle theory to model states of matter. (HT)

Review of giant covalent structures:

- State examples of giant covalent substances (diamond, graphite and silicon dioxide)
- Compare the melting points of giant covalent structures to simple molecules.
- Recognise giant covalent structures from diagrams.
- Explain properties of diamond including hardness, high melting point and non-conduction of electricity.

Different forms of carbon:

- Describe bonding and structure of graphite.
- Compare properties of graphite to diamond and to metals.
- Describe bonding and structure of graphene and fullerenes.
- Describe application of carbon structures in field of nanotechnology.

- investigate the effect of light intensity on the rate of photosynthesis using an aquatic organism such as pondweed.
- describe cellular respiration as an exothermic reaction which is continuously occurring in living cells
- compare the processes of aerobic and anaerobic respiration with regard to the need for oxygen, the differing products and the relative amounts of energy transferred.
- Investigations into the effect of exercise on the body.
- explain the importance of sugars, amino acids, fatty acids and glycerol in the synthesis and breakdown of carbohydrates, proteins and lipids.

- Describe the plum-pudding model.
- Describe how alpha particle scattering experiments led to development of nuclear model.
- Describe how Niels Bohr adapted the model to include the idea of protons.
- Describe how James Chadwick provided evidence for existence of neutrons.
- Evaluate how new experimental evidence may lead to a scientific model being changed.

The periodic table:

- Identify metals and non-metals on the periodic table. 2 Explain the difference between metals and non-metals.
- Compare outer-shell electron arrangements to group numbers and chemical properties.
- Explain how atomic structure relates to position in the periodic table.

Group 0 and Group 1 Elements:

- Explain in terms of outer-shell electrons why Group 0 are unreactive.
- Describe the trend in boiling points down Group 0.
- State that Group 1 are called the alkali metals and have a single electron in their outer shell.
- Describe the softness and density of Group 1 metals compared to other metals.
- Describe the trend in melting point of Group 1 metals.

Reactions of Group 1 Elements:

- Describe reactions of Group 1 metals (Li, Na and K) with oxygen, chlorine and water.
- Describe the trend in reactivity down Group 1.

P2: 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.

- Predict the reactivity of Group 1 metals further down the group.

Introducing Group 7 Elements:

- State that Group 7 are called the halogens and have 7 electrons in their outer shell.
- Define the halogens as non-metals that consist of molecules made up of pairs of atoms (diatomic).
- Describe the trends in melting and boiling point.
- Describe the appearance of the halogens at room temperature.

Reactions of the halogens:

- Describe the compounds formed when Group 7 elements react with metals.
- Describe the compounds formed when Group 7 elements react with non-metals.
- Describe the outcomes of displacement reactions between solutions of the halogens with aqueous halide salts.
- Describe the trend in reactivity of Group 7

The history of the periodic table:

- Describe Newlands' octaves.
- Explain why Newlands' idea was incomplete.
- Describe key aspects of Mendeleev's approach.
- Evaluate how new experimental evidence may lead to a scientific model being changed.

Mixtures and compounds

- Compare compounds and mixtures.
- Define key terms: solvents, solute, solution, soluble, insoluble, miscible, immiscible.
- Recognise mixtures from particle diagrams.

	<ul style="list-style-type: none"> Describe how a mixture of sand, salt and water could be separated using filtration, evaporation and crystallisation. Describe how a mixture of immiscible liquids could be separated using a separating funnel. <p>.</p> <p>Separating mixtures:</p> <ul style="list-style-type: none"> Describe how a solvent could be separated from a solution by the process of simple distillation. Describe how a mixture of miscible liquids could be separated by the process of fractional distillation. Describe the process of chromatography 		
	<u>Autumn 2</u>	<u>Spring 2</u>	<u>Summer 2</u>
	<p><u>P1: Energy</u> Energy stores and systems:</p> <ul style="list-style-type: none"> To understand the energy store/fuel analogy. List eight stores. Counting energy, energy conservation: Define the joule. Practise/recall prefixes (kilo, etc.). Recall the principle of conservation of energy 	<p><u>B3: Infection and response</u></p> <ul style="list-style-type: none"> explain how diseases caused by viruses, bacteria, protists and fungi are spread in animals and plants. explain how the spread of diseases can be reduced or prevented. describe the non-specific defence systems of the human body against pathogens explain the role of the immune system in the defence against disease. 	<p><u>C5: Energy changes</u></p> <ul style="list-style-type: none"> State the law of conservation of energy. State that some chemical reactions involve energy changes. Describe how we can monitor energy changes by measuring the temperature of the surroundings. Describe an exothermic reaction as one which transfers energy to the surroundings so increasing the temperature. Describe an endothermic reaction as one which takes in energy from the

	<p>Transferring energy (circuits):</p> <ul style="list-style-type: none"> To list examples of energy transfers. Give examples of common energy pathways/processes <p>Calculating energy:</p> <ul style="list-style-type: none"> Recall/choose correct equation to solve exam-style problems. Use work done equation. Tell the difference between 'energy' and 'power'. Define rate of energy transfer. Calculate 'personal power'. <p>Energy changes in systems:</p> <ul style="list-style-type: none"> Tell the difference between temperature and heat Introduce quantity of specific heat capacity and the equation. <p>Calculating specific heat capacity:</p> <ul style="list-style-type: none"> Collect data for temperature change for materials/insulation. <p>Reducing energy dissipation:</p> <ul style="list-style-type: none"> Why hot objects cool down. Define dissipated versus lost energy. List cases of useful/wasted energy <p>Keeping warm at home:</p> <ul style="list-style-type: none"> Compare house insulation methods. Describe in terms of reduced CCR. Uses of insulators. <p>Efficiency:</p> <ul style="list-style-type: none"> Define efficiency Perform calculations involving the efficiency equation <p>Increasing efficiency:</p> <ul style="list-style-type: none"> Explain energy dissipated in work against friction and air resistance. 	<ul style="list-style-type: none"> explain how vaccination will prevent illness in an individual, and how the spread of pathogens can be reduced by immunising a large proportion of the population. explain the use of antibiotics and other medicines in treating disease. describe the process of discovery and development of potential new medicines, including preclinical and clinical testing. <p>C3: Quantitative chemistry</p> <p>Relative mass and moles:</p> <ul style="list-style-type: none"> Review the relative atomic mass (A_r). Review proportions of each atom in a chemical formulae. Calculate the relative formula mass (M_r). Define mole as an amount of substance represented by the M_r. (HT) <p>Using the mole: (Higher tier)</p> <ul style="list-style-type: none"> Define Avogadro's constant as the number of atoms, molecules or ions in one mole of a given substance. (HT) Calculate the number of moles in a given mass of a substance. (HT) Calculate the mass of a substance given the number of moles. (HT) <p>Conservation of mass:</p> <ul style="list-style-type: none"> Define the law of conservation of mass. Review proportions of each atom in a chemical formulae. Use normal script numbers in front of a chemical symbol to indicate multiples of that substance. 	<p>surroundings so decreasing the temperature.</p> <ul style="list-style-type: none"> Give examples of everyday uses of reactions involving energy changes. Evaluate uses and applications of exothermic and endothermic reactions. <p>Investigating energy changes:</p> <ul style="list-style-type: none"> Investigate variables that affect temperature changes in reacting solutions. <p>Energy profiles:</p> <ul style="list-style-type: none"> Define activation energy. Draw simple reaction profiles for exothermic and endothermic reactions. Recognise whether a reaction is exothermic or endothermic based on its reaction profile <p>Bond energies: (Higher tier)</p> <ul style="list-style-type: none"> Describe how energy must be supplied to break bonds in reactants. (HT) Describe how energy is released when bonds in the products are formed. (HT) Describe how each type of bond has a specific bond energy. (HT) Be able to identify the type and number of bonds in a given symbol equation. (HT) <p>Calculating energy changes: (Higher tier)</p> <ul style="list-style-type: none"> State that the difference between the sum of energy needed to break bonds
--	----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------	---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------	--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------

- Give cases where these are reduced.
- Fossil fuels, (thermal) power stations:
- Define three uses of energy resources.
 - Use data to compare energy resources.
 - List advantages and disadvantages for the three uses of energy resources.
 - Define renewable/non-renewable.
- Use different criteria to rank resources including environmental impact, carbon dioxide and cost.
 - Appreciate that no solution is perfect.

B2: Organisation

- relate knowledge of enzymes to Metabolism.
- describe the nature of enzyme molecules and relate their activity to temperature and pH changes.
- carry out rate calculations for chemical reactions.
- use the 'lock and key theory' as a simplified model to explain enzyme action.
- recall the sites of production and the action of amylase, proteases and lipases.
- understand simple word equations but no chemical symbol equations are required.
- Use qualitative reagents to test for a range of carbohydrates, lipids and proteins.
- Investigate the effect of pH on the rate of reaction of amylase enzyme.
- use a continuous sampling technique to determine the time taken to completely

- Recognise that the number in front represents a multiple of the number of moles of that substance.

Balancing chemical equations:

- Balance given equations

Mass changes with gases:

- Recognise that mass may appear to increase if one of the reactants is a gas (e.g. metal + oxygen).
- Recognise that mass may appear to decrease if one of the products is a gas (e.g. thermal decomposition).
- Explain the observed change in mass.

Reacting masses: (Higher tier)

- Describe what reacting mole ratios represent in a balanced equation. (HT)
- Review the calculation of the number of moles in a given mass of a substance. (HT)
- Review the calculation of the mass of a substance given the number of moles. (HT)
- Calculate the reacting masses from given equations and the known mass of one substance. (HT).

Using moles to balance equations: (Higher tier)

- Convert mole ratio to simple whole number equivalents. (HT)
- Recognise whole number ratios as information to balance an equation given masses of reactants and products. (HT)

Limiting reactant: (Higher tier)

- State that in many reactions it is common to use an excess of one of the reactants. (HT)

in the reactants and the energy released when bonds form is the overall energy change of the reaction. (HT)

- Calculate the overall energy change in given reactions. (HT)
- Recognise an exothermic reaction as one where energy from forming new bonds is greater than energy needed to break bonds in reactants. (HT)
- Recognise an endothermic reaction as one where energy needed to break bonds in reactants is greater than energy released from forming new bonds. (HT)

	<p>digest a starch solution at a range of pH values</p> <ul style="list-style-type: none"> • know the structure and functioning of the human heart and lungs, including how lungs are adapted for gaseous exchange. • explain how the structure of blood vessels relates to their function. • use simple compound measures such as rate and carry out rate calculations for blood flow. • know the functions of each of the blood components • recognise different types of blood cells in a photograph or diagram, and explain how they are adapted to their functions. • evaluate the advantages and disadvantages of treating cardiovascular diseases by drugs, mechanical devices or transplant. • describe the relationship between health and disease and the interactions between different types of disease. • translate disease incidence information between graphical and numerical forms, construct and interpret frequency tables and diagrams, bar charts and histograms, and use a scatter diagram to identify a correlation between two variables. • understand the principles of sampling as applied to scientific data, including epidemiological data. • discuss the human and financial cost of these non-communicable diseases to an individual, a local community, a nation or globally • explain the effect of lifestyle factors including diet, alcohol and smoking on 	<ul style="list-style-type: none"> • Name the reactant that is completely used up as the limiting reactant. (HT) • Explain the effect of a limiting quantity on the amount of product that can form. (HT) <p>Concentration of solutions:</p> <ul style="list-style-type: none"> • State the unit of concentration is g/dm³. • Calculate the mass of solute in a given volume. • Explain how the mass of solute and volume of solution relates to concentration. (HT) <p><u>C4: Chemical changes</u></p> <p>The reactivity series of metals:</p> <ul style="list-style-type: none"> • Define reactivity of metals as the tendency to form an ion. • Describe the reactions of metals with oxygen, water and dilute acids. • Describe reactions with oxygen as oxidation. • Explain how the reactions with water or dilute acids can be used to place metals in order of reactivity. • Deduce an order of reactivity based on experimental results. <p>Displacement reactions:</p> <ul style="list-style-type: none"> • Describe what happened when a more reactive metal is combined with a compound containing a less reactive metal. • Write balanced symbol equations, including state symbols, for reactions of metals. <p>Oxidation and reduction: (Higher tier)</p> <ul style="list-style-type: none"> • Define oxidation as the loss of electrons and reduction as the gain of electrons. (HT) 	
--	---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------	---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------	--

the incidence of non-communicable diseases at local, national and global levels.

- describe cancer as the result of changes in cells that lead to uncontrolled growth and division.
- explain how the structures of plant tissues are related to their functions.
- explain how the structure of root hair cells, xylem and phloem are adapted to their functions.
- to explain the effect of changing temperature, humidity, air movement and light intensity on the rate of transpiration.
- to understand and use simple compound measures such as the rate of transpiration.
- describe the process of transpiration and translocation, including the structure and function of the stomata.

- Write ionic equations for displacement reactions. (HT)
- Identify in a given equation which species are oxidised and which are reduced. (HT)

Extraction of metals by reduction:

- Explain why metals must be extracted from their ores.
- Describe metals that are found in the Earth as the metal itself and those which need extraction.
- Describe that metals less reactive than carbon can be extracted from their oxides using carbon.
- Define reduction as loss of oxygen.
- Recognise which species are oxidised or reduced in terms of gain or loss of oxygen.

pH scale:

- Define pH scale as a measure of acidity or alkalinity.
- Describe the measurement of pH with a wide range indicators or pH probes.
- Describe neutral solutions as having a pH equal to 7.
- Describe acidic solutions as having a pH less than 7 and alkaline solutions as having a pH greater than 7.
- Use the pH scale to identify acidic or alkaline solutions.

Neutralisation:

- Identify the ions produced by acidic and alkaline solutions.
- Represent neutralisation with an ionic equation to produce water.

- State that the other product of neutralisation is a salt.

Strong and weak acids: (Higher tier)

- Describe the degree of ionisation in solution as a measure of acidic strength. (HT) 2 Give examples of strong and weak acids. (HT)
- Explain the terms dilute and concentrated (in terms of amount of substance), and weak and strong (in terms of the degree of ionisation) in relation to acids. (HT)
- Describe relative acidity in terms of hydrogen ion concentration and the numerical value of pH (whole numbers only). (HT)

Reactions of acids and metals:

- Describe production of hydrogen when acids react with metals.
- Write balanced symbol equations including state symbols for reactions of Mg, Zn, Fe with HCl or H₂SO₄.
- Explain why these are redox reactions. (HT)
- Identify which species are oxidised or reduced. (HT)

Neutralisation reactions:

- State the salts produced from common acids.
- Summarise the reaction of acids with alkalis, bases and metal carbonates.
- Name the salt produced from a given reaction.
- Write word and symbol equations for given neutralisation reactions.

Salt production:

- Describe practical steps in salt production.

- Use context of equipment for salt production (measuring cylinders, burettes, balance) to review uncertainty in measuring equipment.

Making soluble salts part 1:

- Order steps in salt production
- Explain the purpose of each step.
- Complete preparation of a pure dry sample of a soluble salt from insoluble oxide or carbonate.

Introduction to electrolysis:

- Describe molten liquids or solutions as electrolytes.
- Describe that when an electric current is passed ions will move to oppositely charged electrodes.
- Describe the negative electrode as the cathode and the positive electrode as the anode.
- Describe that ions are discharged at the electrodes producing elements.
- Write half-equations to show what happens at each electrode. (HT)

Electrolysis of molten ionic compounds:

- Label a diagram of equipment used for electrolysis of molten ionic compounds.
- Describe that the metal is produced at the cathode and the non-metal at the anode.
- Predict the products of the electrolysis of substances containing two different elements.
- Write half-equations for the reactions at the cathode and anode. (HT)

Using electrolysis to extract metals:

- Review metals that are found in the Earth as the metal itself and those which need extraction.
- Describe that electrolysis can be used to extract metals too reactive to be extracted by reduction with carbon.
- State that large amounts of energy are used to melt the ore and produce the electrical current.
- Explain why the positive electrode (which is made of carbon) must be continually replaced during the electrolysis of aluminium oxide and cryolite.
- Explain why a mixture is used as the electrolyte in the manufacture of aluminium.

Electrolysis of aqueous solutions part 1:

- Describe that in aqueous solutions the water molecule can be ionised into H^+ and OH^- ions.
- Describe that at the cathode, hydrogen is produced if the metal is more reactive than hydrogen.
- Describe that at the anode, oxygen is produced unless the solution contains halide ions.
- Develop a hypothesis for the observations and reactions expected in the electrolysis of a given solution.

Using half-equations:

- Represent reduction reactions that occur at the cathode using half-equations. (HT)
- Represent oxidation reactions that occur at the anode using half-equations. (HT)

Year 11	Autumn Term	Spring Term	Summer Term
	<u>Autumn 1</u>	<u>Spring 1</u>	<u>Summer 1</u>
	<p>Homeostasis and response</p> <ul style="list-style-type: none"> ❖ principles of nervous coordination and control in humans ❖ the relationship between the structure and function of the human nervous system ❖ the relationship between structure and function in a reflex arc ❖ principles of hormonal coordination and control in humans ❖ hormones in human reproduction, ❖ hormonal and non-hormonal methods of contraception <p>Inheritance, variation and evolution</p> <ul style="list-style-type: none"> ❖ the genome as the entire genetic material of an organism ❖ how the genome, and its interaction with the environment, influence the development of the phenotype of an organism ❖ the potential impact of genomics on medicine ❖ most phenotypic features being the result of multiple, rather than single, genes ❖ single gene inheritance and single gene crosses with dominant and recessive phenotypes ❖ sex determination in humans ❖ genetic variation in populations of a species ❖ the process of natural selection leading to evolution ❖ the evidence for evolution ❖ developments in biology affecting classification 	<p>Ecology</p> <ul style="list-style-type: none"> ❖ levels of organisation within an ecosystem ❖ abiotic and biotic factors which affect communities; the importance of interactions between organisms in a community • how materials cycle through abiotic and biotic components of ecosystems • the role of microorganisms (decomposers) in the cycling of materials through an ecosystem • organisms are interdependent and are adapted to their environment • the importance of biodiversity • methods of identifying species and measuring distribution, frequency and abundance of species within a habitat • positive and negative human interactions with ecosystems. <p>Chemistry of the atmosphere</p> <ul style="list-style-type: none"> ❖ evidence for composition and evolution of the Earth's atmosphere since its formation ❖ evidence, and uncertainties in evidence, for additional anthropogenic causes of climate change ❖ potential effects of, and mitigation of, increased levels of carbon dioxide and methane on the Earth's climate ❖ common atmospheric pollutants: sulphur dioxide, oxides of nitrogen, particulates and their sources <p>Organic chemistry</p> <ul style="list-style-type: none"> ❖ fractional distillation of crude oil and cracking to make more useful materials 	<ul style="list-style-type: none"> ❖ Review of Topics ❖ Preparation for final exam

	<ul style="list-style-type: none"> ❖ the importance of selective breeding of plants and animals in agriculture ❖ the uses of modern biotechnology including gene technology <p>Chemistry of the atmosphere</p> <ul style="list-style-type: none"> ❖ evidence for composition and evolution of the Earth's atmosphere since its formation ❖ evidence, and uncertainties in evidence, for additional anthropogenic causes of climate change ❖ potential effects of, and mitigation of, increased levels of carbon dioxide and methane on the Earth's climate ❖ common atmospheric pollutants: sulphur dioxide, oxides of nitrogen, particulates and their sources 		
	<u>Autumn 2</u>	<u>Spring 2</u>	<u>Summer 2</u>
	<p>Using resources</p> <ul style="list-style-type: none"> ❖ extraction and purification of metals related to the position of carbon in a reactivity series ❖ life cycle assessment and recycling to assess environmental impacts associated with all the stages of a product's life ❖ the viability of recycling of certain materials ❖ carbon compounds, both as fuels and feedstock, and the competing demands for limited resources ❖ the Earth's water resources and obtaining potable water <p>Waves</p> <ul style="list-style-type: none"> ❖ amplitude, wavelength, frequency, relating velocity to frequency and wavelength ❖ transverse and longitudinal waves ❖ electromagnetic waves, velocity in vacuum ❖ waves transferring energy 	<p>Chemical analysis</p> <ul style="list-style-type: none"> ❖ distinguishing between pure and impure substances ❖ separation techniques for mixtures of substances ❖ quantitative interpretation of balanced equations • concentrations of solutions in relation to mass of solute and volume of solvent. <p>Rate of reaction</p> <ul style="list-style-type: none"> ❖ factors that influence the rate of reaction ❖ factors affecting reversible reactions. <p>Forces</p> <ul style="list-style-type: none"> ❖ forces and fields: electrostatic, magnetic, gravity ❖ forces as vectors 	

	<ul style="list-style-type: none"> ❖ wavelengths and frequencies from radio to gamma-rays ❖ velocities differing between media: absorption, reflection, refraction effects ❖ production and detection, by electrical circuits, or by changes in atoms and nuclei ❖ uses in the radio, microwave, infra-red, visible, ultra-violet, X-ray and gamma ray regions, hazardous effects on bodily tissues <p>Magnetism and electromagnetism</p> <ul style="list-style-type: none"> ❖ exploring the magnetic fields of permanent and induced magnets, and the Earth's magnetic field, using a compass ❖ magnetic effects of currents, how solenoids enhance the effect ❖ how transformers are used in the national grid and the reasons for their use 	<ul style="list-style-type: none"> ❖ calculating work done as force x distance; elastic and inelastic stretching ❖ pressure in fluids acts in all directions: variation in Earth's atmosphere with height, with depth for liquids, up-thrust force (qualitative) ❖ speed of sound, estimating speeds and accelerations in everyday contexts • ❖ interpreting quantitatively graphs of distance, time, and speed ❖ acceleration caused by forces; Newton's First Law ❖ weight and gravitational field strength ❖ decelerations and braking distances involved on roads, safety 	
--	----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------	----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------	--