Dallam School

Curriculum overview

Department: Chemistry
Year Group: 10

Autumn		Spring		Summer	
Bonding (7 lessons)	**Organic chemistry 1 (10 lessons)**	**Mass and moles 1 (4 lessons)**	**Energy changes (7 lessons)**	**Sustainable development (14 lessons)**	**Rates of reaction (13 lessons)**
Explore how atoms share and transfer electrons to form compounds	**Examine the use of crude oil and its derivatives**	**Make a quantitative interpretation of chemical equations**	**Develop a quantitative understanding of the energy shifts in a reaction**	**Assess the sustainability of humanities use of the world's resources**	**Investigate factors which affect the rate of a chemical reaction**
By the end of this topic pupils will know *(key knowledge, including tier 3 vocabulary)*					
➢ Ionic bonding occurs when atoms transfer electrons to form ions. ➢ Covalent bonding occurs when atoms of non-metals share pairs of electrons with each other. ➢ Metals are held together by metallic bonds. ***Keywords*** ➢ ionic ➢ ion ➢ covalent ➢ bond ➢ delocalised electrons ➢ molecule ➢ diatomic	➢ Crude oil is made up of a mixture of hydrocarbons called alkenes. ➢ Large hydrocarbons can be broken into smaller molecules in a process called cracking. ➢ The names, formula, properties, reactions, and uses of the homologous series known as alkanes / alkenes / alcohols / carboxylic acids. ***Keywords*** ➢ (un)saturated ➢ functional group ➢ homologous series ➢ colourless	➢ The masses of atoms are compared by measuring them relative to the mass of atoms of carbon-12. ➢ The relative formula mass of a compound by is calculated from the sum of the relative atomic masses of the elements in it, in the ratio shown by its formula. ➢ Balanced symbol equations give the number of particles of substances involved in a chemical reaction. ***Keywords*** ➢ relative atomic mass, A_r ➢ relative formula mass, M_r	➢ Energy is conserved in chemical reactions. ➢ A reaction where energy is shifted to the surroundings is called an exothermic reaction. ➢ A reaction where energy is shifted to the reacting substances is called an endothermic reaction. ➢ Breaking chemical bonds releases energy; forming them requires energy. ➢ The definition of activation energy. ***Keywords*** ➢ exothermic ➢ endothermic ➢ activation energy ➢ bond energy	➢ Natural resources are finite. ➢ Methods of producing clean water and treating wastewater. ➢ Methods of extracting copper, such as electrolysis and smelting. ➢ Recycling metals saves energy and limited, finite metal ores, and reduces pollution. ***Keywords*** ➢ finite ➢ (non-)renewable ➢ thermal decomposition ➢ bioleaching ➢ life cycle assessment ➢ blast furnace	➢ The rate of a chemical reaction is a measure of how reactants are used up over time. ➢ Particles must collide successfully to react. ➢ Increasing temperature, surface area, and concentration increases the rate of reaction. ➢ Some reactions are reversible, and the products react to re-form the original reactants. ***Keywords*** ➢ collision theory ➢ anhydrous ➢ closed system ➢ equilibrium

Autumn		Spring		Summer	
Bonding (7 lessons)	**Organic chemistry 1 (10 lessons)**	**Mass and moles 1 (4 lessons)**	**Energy changes (7 lessons)**	**Sustainable development (14 lessons)**	**Rates of reaction (13 lessons)**
Explore how atoms share and transfer electrons to form compounds	**Examine the use of crude oil and its derivatives**	**Make a quantitative interpretation of chemical equations**	**Develop a quantitative understanding of the energy shifts in a reaction**	**Assess the sustainability of humanities use of the world's resources**	**Investigate factors which affect the rate of a chemical reaction**
They will understand *(key concepts)*					
➢ How elements form compounds. ➢ How an atom's placement in the periodic table relates to whether it forms a negative or positive ion. ➢ Why atoms share electrons. ➢ How double and triple covalent bonds arise.	➢ How fractional distillation can be used to separate crude oil into fractions. ➢ The economic reasons for cracking long-chain hydrocarbons. ➢ The differences between complete and incomplete combustion of hydrocarbons. ➢ How to name esters formed by reacting carboxylic acids and alcohols.	➢ Why chemical equations must be balanced. ➢ Why relative atomic masses may not be whole numbers. ➢ How to apply the principle of conservation of mass to chemical reactions, including those with an apparent mass change.	➢ How a reaction profile can be used to show the relative difference in the energy of reactants and products. ➢ How to use reaction profiles to identify reactions as exothermic or endothermic.	➢ Different methods of producing safe drinking water and treating wastewater. ➢ How to evaluate alternative biological methods of metal extraction. ➢ How to carry out simple comparative Life Cycle Assessments. ➢ How to evaluate ways of reducing the use of limited supplies of metal ores.	➢ How to use collision theory to explain how temperature, pressure, surface area, and concentration affect the rate of reaction. ➢ How altering reaction conditions can maximise yield (Le Chatelier's principle). ➢ Why compromise conditions are used in industrial processes.
They will know how to *(key skills)*					
➢ Use 'dot and cross' diagrams to represent transfer and sharing of electrons in ionic and covalent bonding.	➢ Draw the chemical structure of alkanes, alkenes, alcohols, carboxylic acids, and esters. ➢ Write balanced symbol equations for the reactions of alkanes, alkenes, alcohols, and carboxylic acids. ➢ Test for the presence of unsaturated hydrocarbons.	➢ Calculate the relative atomic mass of an element from information about the relative abundance of its isotopes. ➢ Calculate the relative formula mass of simple molecules and complex ionic compounds.	➢ Calculate the energy shifted in chemical reactions when supplied with bond energies. ➢ Investigate the energy changes in reacting solutions.	➢ Analyse and purify water samples. ➢ Evaluate the impact of the use of natural resources on the environment.	➢ Collect data on the rate of different chemical reactions. ➢ Interpret graphs to determine the rate at a specific time in a reaction.

Dallam School

Curriculum overview

Department: Chemistry
Year Group: 11

Autumn		Spring		Summer	
Properties and structure (7 lessons)	**Mass and moles 2 (6 lessons)**	**Organic chemistry 2 (4 lessons)**	**Chemical analysis 2 (4 lessons)**	**Chemical calculations (7 lessons)**	**Redox (11 lessons)**
Link the structure / properties of a substance to its bonding	**Use the concept of moles to calculate reacting masses**	**Explore the synthesis of man-made and natural polymers**	**Analyse the results of chemical tests to identify the presence of specific ions**	**Explore how chemical companies use calculations to ensure sustainable production**	**Use half equations to describe a range of chemical processes**
By the end of this topic pupils will know *(key knowledge, including tier 3 vocabulary)*					
➢ Ionic bonding leads to formation of giant ionic lattice structures. ➢ Carbon can form many allotropes with properties related how each atom is bonded. ➢ Materials behave differently on very tiny scales, and this gives rise to many novel applications in material science. ***Keywords*** ➢ intermolecular forces ➢ polymers ➢ fullerenes ➢ alloys ➢ nanoparticles	➢ Chemical amounts are measured in moles. ➢ The mass of one mole of a substance in grams is numerically equal to its relative formula mass. ➢ Balanced symbol equations tell you the number of moles of substances involved in a chemical reaction. ➢ A limiting reactant is used up first in a reaction. ***Keywords*** ➢ mole ➢ Avogadro constant	➢ Polymers are made from long chains of covalently bonded molecules. ➢ The basic principles of addition and condensation polymerisation. ➢ Proteins are polymers made from different amino acid monomers. ➢ DNA is made up from monomers called nucleotides. ***Keywords*** ➢ monomer ➢ polymer ➢ addition / condensation polymerisation ➢ amino acids ➢ nucleotides	➢ The flame colours produced by ions of Li, Na, K, Ca, and Cu. ➢ The precipitates formed in the reactions of positive ions which form insoluble hydroxides. ➢ The test for carbonate ions. ➢ The test for halide ions. ➢ The test for sulfate ions. ➢ Methods of modern instrumental analysis. ***Keywords*** ➢ flame test ➢ precipitate	➢ In the chemical industry, atom economy is maximised to conserve resources and minimise pollution. ➢ A titration is used to measure what volumes of acid and alkali react together completely. ➢ A more concentrated solution has more solute in the same volume of solution than a less concentrated solution. ***Keywords*** ➢ atom economy ➢ concentration ➢ titration ➢ end point	➢ Oxidation is the loss of electrons. ➢ Reduction is the gain of electrons. ➢ Simple electrical cells use the difference in reactivity of metals to produce a voltage. ➢ Electrolysis breaks down a substance using electricity; positive ions move to the cathode and negative ions move to the anode. ***Keywords*** ➢ electrolyte ➢ anode ➢ cathode ➢ metal ore ➢ reduction ➢ oxidation

Autumn		Spring		Summer	
Properties and structure (7 lessons)	**Mass and moles 2 (6 lessons)**	**Organic chemistry 2 (4 lessons)**	**Chemical analysis 2 (4 lessons)**	**Chemical calculations (7 lessons)**	**Redox (11 lessons)**
Link the structure / properties of a substance to its bonding	**Use the concept of moles to calculate reacting masses**	**Explore the synthesis of man-made and natural polymers**	**Analyse the results of chemical tests to identify the presence of specific ions**	**Explore how chemical companies use calculations to ensure sustainable production**	**Use half equations to describe a range of chemical processes**
They will understand *(key concepts)*					
➢ How the state of an ionic compound determines whether it can conduct electricity. ➢ Why substances made of simple molecules have low melting and boiling points. ➢ How the structure of metals leads to their properties of good thermal and electrical conductivity, malleability, and ductility.	➢ How to use balanced symbol equations to calculate the masses of reactants and products. ➢ Why limiting a quantity of reactant affects the amount of product it is possible to obtain.	➢ How addition polymerisation can form polymers from alkene monomers. ➢ The key differences between addition / condensation polymerisation. ➢ How polyesters are formed. ➢ The role of polymerisation in synthesis of starch, cellulose, polypeptides, proteins, and DNA.	➢ How to identify positive ions through flame tests, and precipitations formed in reactions with sodium hydroxide. ➢ How to identify negative ions including carbonates, halides, and sulfates. ➢ The advantages of instrumental analysis, such as fame emission spectroscopy, compared to traditional chemical tests.	➢ How different factors affect the percentage yield. ➢ Why it is important to maximise atom economy. ➢ How to use a titration to determine the unknown concentration of a solution. ➢ How to express concentration in a variety of units and convert between volumes in cm^3 and dm^3.	➢ How a fuel cell works. ➢ Why the chemical addition of oxygen results in the loss of electrons. ➢ How electrolysis is used in the extraction of aluminium. ➢ How the electrolysis of brine is used in the production of bleach and for killing bacteria in swimming pools and drinking water.
They will know how to *(key skills)*					
➢ Evaluate the suitability of models used to represent the structure of molecules. ➢ Calculate a surface area to volume ratio. ➢ Assess the benefits and possible risks of the use of nanoparticle materials.	➢ Calculate the number of moles or mass of a substance from data supplied. ➢ Interpret balanced symbol equations in terms of mole ratios. ➢ Use balanced symbol equations to calculate reacting masses.	➢ Use diagrams to represent the repeating units of polymers. ➢ Name polymers from the monomers that are used in their synthesis.	➢ Carry out flame tests to identify ions of Li, Na, K, Ca, and Cu. ➢ Produce a flowchart to identify positive ions of Al, Mg, Ca, Cu(II), Fe(II), and Fe(III) in from the reaction with (excess) sodium hydroxide. ➢ Test for the presence of carbonates, halides, and sulfates.	➢ Calculate the percentage yield of a chemical reaction. ➢ Calculate the atom economy of a reaction from a balanced equation. ➢ Accurately measure the amount of acid and alkali that react together completely using a titration.	➢ Write half equations for displacement reactions. ➢ Write half equations to represent the reactions occurring at the anode and cathode during electrolysis.