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| **Year 10 and Year 11 Chemistry** | |
| **Unit C1 – Atomic Structure and the Periodic Table** | **Unit C2 – Bonding, Structure, and the properties of matter** |
| 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.  **Keywords for this Unit**  **Atom** – the smallest part of an element that can exist  **Element** – a substance made of only one type of atom  **Compound** – a substance made of 2 or more types of atoms chemically joined  **Evaporation** – the process of turning a liquid into a gas  **Distillation** – a separation process which uses both evaporation and condensation  **Isotope** – atoms of the same element with a different number of neutrons  **Neutron** – subatomic particle found in the nucleus with no charge  **Proton** - subatomic particle found in the nucleus with positive charge  **Electron** – subatomic particle which orbits the nucleus with a negative charge  **Ion** – an atom which has gained or lost electrons, causing it to become charged  **Catalyst** – a substance which speeds up the rate of a reaction by lowering the activation energy. | 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.  **Keywords for this Unit**  **Ionic bond** – electrostatic force of attraction between oppositely charged ions  **Covalent bond** – shared pair(s) of electrons between the atoms of non-metal elements  **Molecule** – 2 or more atoms bonded together  **Monomer** – a single atom or molecule  **Polymer** – a long chain molecule formed from many monomers joining together  **Alloy** – a mixture of metal atoms  **Nanoparticle** – a particle on the nanoscale (between 1 and 100 nm) |
| **Unit C3 – Quantitative Chemistry (interspersed between units C1-C5)** | **Unit C4 – Chemical change** |
| Chemists use quantitative analysis to determine the formulae of compounds and the equations for reactions. Given this information, analysts can then use quantitative methods to determine the purity of chemical samples and to monitor the yield from chemical reactions.  Chemical reactions can be classified in various ways. Identifying different types of chemical reaction allows chemists to make sense of how different chemicals react together, to establish patterns and to make predictions about the behaviour of other chemicals. Chemical equations provide a means of representing chemical reactions and are a key way for chemists to communicate chemical ideas.  **Keywords for this Unit**  **Conservation of mass** – atoms cannot be created nor destroyed during a chemical reaction  **Oxidation** - addition of oxygen / loss of electrons  **Solute** – substance which dissolves in a liquid to form a solution  **Solvent** - liquid in which a substance dissolves  **Concentration** – mass of solute dissolved in a volume of solvent  **Yield (chem)** – mass of a product obtained in a reaction  **Mole** – Unit of counting particles in chemistry  **Avogadro’s constant** – the number of particles in a mole of substance (6.02 x 1023)  **Titration** – method used to make salts from soluble reactants  **Burette** – piece of equipment used in titration experiment | 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’.  **Keywords for this Unit**  **Oxidation** - addition of oxygen / loss of electrons  **Reduction** – loss of oxygen / gain of electrons  **pH** – a measure of acidity of a solution  **Neutralisation** – chemical reaction between and acid and a base  **Salt** – formed during neutralisation reactions  **Base** – a substance which neutralises acids  **Alkali** – a soluble base  **Displacement** – chemical reaction in which a more reactive substance takes the place of a less reactive one  **Indicator** – chemicals which change colour to denote whether a substance is an acid or alkali  **Crystallisation** – slow evaporation of water from a solution to allow crystals of solid to form  **Dissociation** (of hydrogen ions) – the ability of an acidic substance to release hydrogen ions when placed in water. |
| **Unit C5 – Energy changes** | **Unit C6 – The rate and extent of chemical change** |
| 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 (Chemistry only)**  **Keywords for this Unit**  **Exothermic** – releases energy to the surroundings  **Endothermic** – absorbs energy from the surroundings  **Activation energy** – energy required by the particles in order to successfully react  **Anode** – positive electrode in an electrolytic cell  **Cathode** – negative electrode in an electrolytic cell  **Electrolysis** – to split a compound into its elements using electricity  **Electrolyte** – the solution / molten substance being electrolysed  **Ion** – charged particle | Chemical reactions can occur at vastly different rates. Whilst the reactivity of chemicals is a significant factor in how fast chemical reactions proceed, there are many variables that can be manipulated in order to speed them up or slow them down. Chemical reactions may also be reversible and therefore the effect of different variables needs to be established in order to identify how to maximise the yield of desired product. Understanding energy changes that accompany chemical reactions is important for this process. In industry, chemists and chemical engineers determine the effect of different variables on reaction rate and yield of product. Whilst there may be compromises to be made, they carry out optimisation processes to ensure that enough product is produced within a sufficient time, and in an energy-efficient way.  **Keywords for this Unit**  **Enzyme** – biological catalyst  **Rate** – speed at which a reaction happens  **Catalyst** – a substance which increases the rate of a chemical reaction without taking part in the reaction itself  **Reactant** – chemicals at the start of the reaction  **Product** – chemicals formed in the reaction  **Concentration** – mass of solute dissolved in a volume of solvent  **Equilibrium** – the rate of the forwards reaction is the same as the rate of the reverse reaction. |
| **Unit C7 – Organic Chemistry** | **Unit C8 – Chemical Analysis** |
| The chemistry of carbon compounds is so important that it forms a separate branch of chemistry. A great variety of carbon compounds is possible because carbon atoms can form chains and rings linked by C-C bonds. This branch of chemistry gets its name from the fact that the main sources of organic compounds are living, or once-living materials from plants and animals. These sources include fossil fuels which are a major source of feedstock for the petrochemical industry. **Chemists are able to take organic molecules and modify them in many ways to make new and useful materials such as polymers, pharmaceuticals, perfumes and flavourings, dyes and detergents (chemistry only)**  **Keywords for this Unit**  **Catalyst** – a substance which speeds up the rate of a reaction but remains unchanged  **Polmer** – a long chain molecule made of repeating units called monomers  **Hydrocarbon** – a chemical made of hydrogen and carbon atoms only  **Fractional Distillation** – a method of separating the different hydrocarbons in a mixture based on their boiling points  **Combustion** – oxidation reaction (burning)  **Viscosity** – a measure of the thickness of a liquid  **Volatility** – the ease with which a substance changes from a liquid to a gas | Analysts have developed a range of qualitative tests to detect specific chemicals. The tests are based on reactions that produce a gas with distinctive properties, or a colour change or an insoluble solid that appears as a precipitate.  Instrumental methods provide fast, sensitive and accurate means of analysing chemicals, and are particularly useful when the amount of chemical being analysed is small. Forensic scientists and drug control scientists rely on such instrumental methods in their work.  **Keywords for this Unit**  **Pure** – made of only one type of substance  **Impure** – made of a mixture of different substance  **Component** – a part of something  **Chromatography** – a process which uses a solvent to separate a mixture of pigments / dyes  **Precipitate** – an insoluble solid formed from the reaction between 2 solutions  **Emission** – to give out  **Spectrum** – a range of colours of light produced when a substance is heated |