

Subject: Chemistry

Year 12	Year 13
<p>Atomic Structure: Revises the idea of the atom, looking at some of the evidence for sub-atomic particles. Here we introduce the mass spectrometer which is used to measure the masses of atoms. The evidence for the arrangement of electrons is studied and students will see how a more sophisticated model using atomic orbitals rather than circular orbits was developed.</p>	<p>Halogenoalkanes: This topic looks at how these compounds are formed, how they react and their role in the problem of depletion of the ozone layer.</p>
<p>Amount of Substance: This unit focuses on quantitative chemistry, that is, how much product you get from a given amount of reactants. The idea of the mole is used as the unit of quantity to compare equal numbers of atoms and molecules of different substances, including gases and solutions. Balanced equations are used to describe and measure the efficiency of chemical processes.</p>	<p>Alkenes: Here students will describe the reactions of these compounds which have one or more double bonds. Knowledge of addition polymerisations is also built upon and developed.</p>
<p>Bonding: This unit revisits the three types of strong bonds that hold atoms together: ionic, covalent, and metallic. It introduces three weaker types of forces that act between molecules, the most significant of these being hydrogen bonding. Students will examine how the various types of forces are responsible for the solid, liquids, and gaseous states, and explore how the electrons contribute to the shapes of molecules.</p>	<p>Alcohols: This unit shows the importance of ethanol and describes the primary, secondary, and tertiary structures of alcohols and their reactions.</p>
<p>Oxidation, Reduction and Redox Reactions: Students will expand the definition of oxidation as addition of oxygen to include reactions that involve electron transfers. It explains the idea of oxidation state for elements and ions and uses this to help balance complex redox (reduction-oxidation) equations.</p>	<p>Organic Analysis: Students will revisit the mass spectrometer and describe its use in determining the relative molecular masses of compounds and their molecular formulae. Infra-red spectroscopy is introduced as a vital tool for identifying functional groups in organic compounds. Some test tube reactions that may be useful to help identify organic compounds are described.</p>
<p>Electrode Potentials and Electrochemical Cells: Here we explore the idea of half cells which can be joined to generate an electrical potential difference is introduced. This leads on to a method of predicting the course of redox reactions and also to a description of how a number of types of batteries work.</p>	<p>Nomenclature and Isomerism: This topic revisits the IUPAC naming system introduced earlier and applies it to further families of organic compounds. A further type of isomerism, optical isomerism based on mirror image molecules, is introduced.</p>
<p>Thermodynamics: This unit revisits bond energies, exothermic and endothermic reactions and introduces the concept of enthalpy. It looks at different ways of measuring enthalpy changes and then uses Hess' law to predict energy changes of reactions and the enthalpy changes involved in forming ionic compounds. The ideas of entropy, a measure of disorder, that drives chemical reactions and free energy, a way of predicting whether a reaction will take place at a particular temperature, are also introduced.</p>	<p>Compounds Containing the Carbonyl Group: This unit introduces the chemistry of aldehydes, ketones, carboxylic acids and esters, all of which contain the carbonyl group, C=O.</p>
<p>Equilibria: This unit is about reactions that do not go to completion so that the end results are a mixture of reactants and products. It examines how to get the greatest proportion of desired products in the mixture by changing the conditions, and how to calculate the equilibrium composition. Some industrially important reversible reactions are then discussed.</p>	<p>Aromatic Chemistry: This topic looks at the chemistry of compounds based on the benzene ring, which have unexpected properties due to their system of electrons delocalised over a hexagonal ring of carbon atoms.</p>
<p>Kinetics: In this unit, students explore rates of reactions, reinforcing the idea that reactions only happen when molecules of the reactants collide with enough energy to break bonds. The Maxwell-Boltzmann distribution shows us mathematically what fraction of the reactant molecules have enough collision energy at a given temperature. The role of catalysts is explored. The rate equation is an expression that links the rate of a reaction to the concentrations of different species in the reaction mixture. The idea of a reaction mechanism as a series of simple steps is introduced along with the concept of the rate determining step.</p>	<p>Polymerisation: Students will investigate two types of long chain molecules based on smaller repeating units – condensation and addition polymers. It describes their synthesis and uses and their biodegradability (or lack of it).</p>
<p>Acids, Bases and Buffers: Here, students extend their understanding of the definition of acids and bases and identify an expression to find the pH of a solution. The idea of strong and weak acid and bases is introduced and applied quantitatively. Titrations between strong and weak acids and bases are discussed and the operation of buffer solutions, which resist changes of pH, is explained.</p>	
<p>Periodicity and the Oxides of Period 3: This topic gives an overview of the Periodic Table and classifies blocks of elements in terms of s-, p-, d- and f-orbitals. It then concentrates on the properties of elements in period 3 and their oxides.</p>	<p>Amino Acids, Proteins, and DNA: The unit looks at how proteins are built up from amino acids and explains how DNA molecules hold the 'blueprint' for living things.</p>
<p>Group 7, The Halogens: This unit focuses on the reactive non-metal elements, explaining the trends in their reactivity in terms of electronic structure. It includes the reactions of the elements and their compounds using the idea of redox reactions and oxidation states, and the uses of chlorine and some of its compounds.</p>	<p>Organic Synthesis and Analysis: This topic shows how a series of organic reactions can be linked together to make a target molecule from a given starting material.</p>
<p>Group 2, The Alkaline Earth Metals: Students will use the ideas of electron arrangements to understand the bonding in compounds of these elements and the reactions and trends in reactivity in the group.</p>	<p>Structure Determination: This topic explains the techniques of proton nuclear magnetic resonance (NMR) and carbon-13 NMR and shows how these techniques can be used to help deduce the structures of organic compounds.</p>
<p>The Transition Metals and Reactions of Ions in Aqueous Solutions: Here students explore the unique chemical structures of transition metals that give their compounds characteristic (and useful) properties. Reactions of</p>	<p>Chromatography: This topic describes a group of techniques used for separating mixtures of organic compounds and shows how they can be linked with mass spectrometry to help identify the components.</p>

ions in aqueous solutions looks at some reactions of some metal ions in solution – including acid-base reactions and ligand substitution reactions – forming metal-aqua ions.

Introduction to Organic Chemistry: This topic explores the nature of carbon compounds and explains the different types of formulae that can be used to represent a compound as well as the IUPAC naming system. It looks at the different sorts of isomers that are possible in some organic compounds.

Alkanes: This topic is about crude oil and its fractional distillation. It also looks at the different ways that large alkane molecules can be cracked into smaller, more useful molecules. It deals with the combustion of carbon compounds.