



The Hart School - Faculty of Science

A Level Chemistry (Year 12 and 13) Curriculum Overview

Curriculum Intent: Science encompasses everything that we are and allows us to make sense of the world around us. Science at The Hart School is more than just a core subject. We believe an outstanding science education should develop students' curiosity and scientific knowledge to question the world in which we live, enable critical-thinking and encourage students to become socially aware global citizens.

Our Science faculty has planned an inspiring, inclusive, and diverse curriculum that is designed to engage and enthuse students with the real-life applications of the subject whilst promoting ambition and aspirations for their future.

In an ever-changing world, in which STEAM subjects are at the forefront of advancements for the future, we want to prepare our students for this by not only looking at the knowledge of the subject, but also the methods, processing skills and applications associated with it. This ensures that our students are scientifically literate, able to evaluate what they see in the news and the world around them and make informed decisions that will affect their future lives and the planet.

Useful Links:

Specification: AQA A Level Chemistry	Past Exam Papers & Mark Schemes
Practise Exam Questions	Revision Notes

Yr12	Topic	Knowledge Overview	Topic	Knowledge Overview
Autumn	3.1.1 Atomic Structure	The chemical properties of elements depend on their atomic structure and in particular on the arrangement of electrons around the nucleus. The arrangement of electrons in orbitals is linked to the way in which elements are organised in the Periodic Table. Chemists can measure the mass of atoms and molecules to a high degree of accuracy in a mass spectrometer. The principles of operation of a modern mass spectrometer are studied.	3.1.2 Amount of Substance	When chemists measure out an amount of a substance, they use an amount in moles. The mole is a useful quantity because one mole of a substance always contains the same number of entities of the substance. An amount in moles can be measured out by mass in grams, by volume in dm ³ of a solution of known concentration and by volume in dm ³ of a gas.
	3.1.3 Bonding	The physical and chemical properties of compounds depend on the ways in which the compounds are held together by chemical bonds and by intermolecular forces. Theories of bonding explain how atoms or ions are held together in these structures. Materials scientists use knowledge of structure and bonding to engineer new materials with desirable properties. These new materials may offer new applications in a range of different modern technologies.	3.3.1 Introduction to Organic Chemistry	Organic chemistry is the study of the millions of covalent compounds of the element carbon. These structurally diverse compounds vary from naturally occurring petroleum fuels to DNA and the molecules in living systems. Organic compounds also demonstrate human ingenuity in the vast range of synthetic materials created by chemists. Many of these compounds are used as drugs, medicines and plastics. Organic compounds are named using the International Union of Pure and Applied Chemistry (IUPAC) system and the structure or formula of molecules can be represented in various different ways. Organic mechanisms are studied, which enable reactions to be explained. In the search for sustainable chemistry, for safer agrochemicals and for new materials to match the desire for new technology, Chemistry plays the dominant role.
	3.1.4 Energetics	The enthalpy change in a chemical reaction can be measured accurately. It is important to know this value for chemical reactions that are used as a source of heat energy in applications such as domestic boilers and internal combustion engines.	3.3.2 Alkanes	Alkanes are the main constituent of crude oil, which is an important raw material for the chemical industry. Alkanes are also used as fuels and the environmental consequences of this use are considered in this section.
	3.1.5 Kinetics	The study of kinetics enables chemists to determine how a change in conditions affects the speed of a chemical reaction. Whilst the reactivity of chemicals is a significant factor in how fast chemical reactions proceed, there are variables that can be manipulated in order to speed them up or slow them down.	3.3.3 Halogenoalkanes	Halogenoalkanes are much more reactive than alkanes. They have many uses, including as refrigerants, as solvents and in pharmaceuticals. The use of some halogenoalkanes has been restricted due to the effect of chlorofluorocarbons (CFCs) on the atmosphere.
	3.1.6 Chemical Equilibria, Le Chatelier's Principle and Kc	In contrast with kinetics, which is a study of how quickly reactions occur, a study of equilibria indicates how far reactions will go. Le Chatelier's principle can be used to predict the effects of changes in temperature, pressure and concentration on the yield of a reversible reaction. This has important consequences for many industrial processes. The further study of the equilibrium constant, Kc, considers how the mathematical expression for the equilibrium constant enables us to calculate how an equilibrium yield will be influenced by the concentration of reactants and products.	3.3.4 Alkenes	In alkenes, the high electron density of the carbon-carbon double bond leads to attack on these molecules by electrophiles. This section also covers the mechanism of addition to the double bond and introduces addition polymers, which are commercially important and have many uses in modern society.
Spring	3.1.7 Oxidation, Reduction and REDOX Equations	Redox reactions involve a transfer of electrons from the reducing agent to the oxidising agent. The change in the oxidation state of an element in a compound or ion is used to identify the element that has been oxidised or reduced in a given reaction. Separate half-equations are written for the oxidation or reduction processes. These half-equations can then be combined to give an overall equation for any redox reaction.	3.3.5 Alcohols	Alcohols have many scientific, medicinal and industrial uses. Ethanol is one such alcohol and it is produced using different methods, which are considered in this section. Ethanol can be used as a biofuel.

Summer	3.2.1-3 Periodicity	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.	3.3.6 Organic Analysis	Our understanding of organic molecules, their structure and the way they react, has been enhanced by organic analysis. This section considers some of the analytical techniques used by chemists, including test-tube reactions and spectroscopic techniques.
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Yr13	Topic	Knowledge Overview	Topic	Knowledge Overview
Autumn	3.2.5 Transition metals	The 3d block contains 10 elements, all of which are metals. Unlike the metals in Groups 1 and 2, the transition metals Ti to Cu form coloured compounds and compounds where the transition metal exists in different oxidation states. Some of these metals are familiar as catalysts. The properties of these elements are studied in this section with opportunities for a wide range of practical investigations.	3.3.7 Optical Isomerism	Compounds that contain an asymmetric carbon atom form stereoisomers that differ in their effect on plane polarised light. This type of isomerism is called optical isomerism.
	3.2.6 Reactions of ions in aqueous solution	The reactions of transition metal ions in aqueous solution provide a practical opportunity for students to show and to understand how transition metal ions can be identified by test-tube reactions in the laboratory.	3.3.8 Aldehydes and Ketones	Aldehydes, ketones, carboxylic acids and their derivatives all contain the carbonyl group which is attacked by nucleophiles. This section includes the addition reactions of aldehydes and ketones.
	3.1.8 Thermodynamics	The further study of thermodynamics builds on the Energetics section and is important in understanding the stability of compounds and why chemical reactions occur. Enthalpy change is linked with entropy change enabling the free-energy change to be calculated.	3.3.9 Carboxylic Acid Derivatives	Carboxylic acids are weak acids but strong enough to liberate carbon dioxide from carbonates. Esters occur naturally in vegetable oils and animal fats. Important products obtained from esters include biodiesel, soap and glycerol.
	3.1.9 Rate equations	In rate equations, the mathematical relationship between rate of reaction and concentration gives information about the mechanism of a reaction that may occur in several steps.	3.1.11 Electrode Potentials and Electrochemical Cells	Redox reactions take place in electrochemical cells where electrons are transferred from the reducing agent to the oxidising agent indirectly via an external circuit. A potential difference is created that can drive an electric current to do work. Electrochemical cells have very important commercial applications as a portable supply of electricity to power electronic devices such as mobile phones, tablets and laptops. On a larger scale, they can provide energy to power a vehicle.
Spring	3.1.10 Equilibrium constant Kp for homogeneous systems	The further study of equilibria considers how the mathematical expression for the equilibrium constant Kp enables us to calculate how an equilibrium yield will be influenced by the partial pressures of reactants and products. This has important consequences for many industrial processes.	3.3.10 Aromatic Chemistry	Aromatic chemistry takes benzene as an example of this type of molecule and looks at the structure of the benzene ring and its substitution reactions.
			3.3.11 Amines	Amines are compounds based on ammonia where hydrogen atoms have been replaced by alkyl or aryl groups. This section includes their reactions as nucleophiles.
	3.1.12 Acids and bases	Acids and bases are important in domestic, environmental and industrial contexts. Acidity in aqueous solutions is caused by hydrogen ions and a logarithmic scale, pH, has been devised to measure acidity. Buffer solutions, which can be made from partially neutralised weak acids, resist changes in pH and find many important industrial and biological applications.	3.3.12 Polymers	The study of polymers is extended to include condensation polymers. The ways in which condensation polymers are formed are studied, together with their properties and typical uses. Problems associated with the reuse or disposal of both addition and condensation polymers are considered.
			3.3.13 Amino Acids, Proteins and DNA	Amino acids, proteins and DNA are the molecules of life. In this section, the structure and bonding in these molecules and the way they interact is studied. Drug action is also considered.
	3.2.4 Properties of Period 3 elements and their oxides	The reactions of the Period 3 elements with oxygen are considered. The pH of the solutions formed when the oxides react with water illustrates further trends in properties across this period. Explanations of these reactions offer opportunities to develop an in-depth understanding of how and why these reactions occur.	3.3.14 Organic Synthesis	The formation of new organic compounds by multi-step syntheses using reactions included in the specification is covered in this section.
			3.3.15 Nuclear Magnetic Resonance Spectroscopy	Chemists use a variety of techniques to deduce the structure of compounds. In this section, nuclear magnetic resonance spectroscopy is added to mass spectrometry and infrared spectroscopy as an analytical technique. The emphasis is on the use of analytical data to solve problems rather than on spectroscopic theory.
			3.3.16 Chromatography	Chromatography provides an important method of separating and identifying components in a mixture. Different types of chromatography are used depending on the composition of mixture to be separated.