

# A Level Chemistry

Year 12

## 3.1.1 Atomic structure

Chemical properties rely on atomic structure, especially electron arrangement. Mass spectrometers accurately measure atomic and molecular masses, with their principles are studied extensively.

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## 3.1.2 Amount of substance

Chemists measure substances in moles because it provides a consistent quantity; one mole always contains a fixed number of entities. Moles facilitate precise measurements in chemistry.

## 3.1.3 Bonding

Compounds' properties stem from their chemical bonds and intermolecular forces. Material scientists use their understanding of structure and bonding to innovate materials for diverse modern applications.

## 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.

## 3.1.5 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 to speed them up or slow them down.

## 3.1.6 Chemical equilibria, Le Chatelier's principle and Kc

Equilibria assess reaction extents. Le Chatelier's principle predicts changes in reversible reactions due to temperature, pressure, or concentration alterations, crucial in industrial processes. Equilibrium constant ( $K_c$ ) calculations further inform on yield influences.

## 3.1.7 Oxidation, reduction and redox equations

Redox reactions entail electron transfer between agents. Oxidation state changes identify elements oxidized or reduced. Half-equations are written for oxidation and reduction, then combined for the overall redox equation.

## YEAR 13 PHYSICAL CHEMISTRY

## 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.

## 3.1.9 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.

## 3.1.10 Equilibrium constant $K_p$ for homogeneous systems

The further study of equilibria considers how the mathematical expression for the equilibrium constant  $K_p$  enables us to calculate how an equilibrium yield will be influenced by the partial pressures of reactants and products.

## 3.1.11 Electrode potentials and electrochemical cells

Redox reactions take place in electrochemical cells. Electrochemical cells have very important commercial applications as a portable supply of electricity to power electronic devices. On a larger scale, they can provide energy to power a vehicle.

## 3.1.12 Acids and bases

Acids and bases are important in industrial contexts. Acidity in aqueous solutions is caused by hydrogen ions and a logarithmic scale, pH, has been devised to measure acidity.

## 3.1.13 Amino acid, 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.

## 3.1.14 Organic synthesis

The formation of new organic compounds by multi-step syntheses using reactions included in the specification is covered in this section.

## 3.1.15 NMR

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.

## 3.1.16 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.

## 3.1.17 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 polymers

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## YEAR 12 INORGANIC CHEMISTRY

## 3.2.1 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.

## 3.2.2 Group 2, the alkaline earth metals

Group 2 elements, alkaline earth metals, exhibit solubility trends in hydroxides and sulfates. Barium sulfate, magnesium hydroxide, and sulfate find medicinal applications; calcium hydroxide aids agriculture, adjusting soil pH for crop production.

## 3.2.3 Group 7(17), the halogens

The halogens in Group 7 are very reactive non-metals. Trends in their physical properties are examined and explained. Fluorine is too dangerous to be used in a school laboratory but the reactions of chlorine are

## 3.2.4 Properties of Period 3 elements and their oxides

The reactions of the Period 3 elements with oxygen are considered. Explanations of these reactions offer opportunities to develop an in-depth understanding of how and why these reactions occur.

## 3.2.5 Transition metals

The 3d block contains 10 elements, all of which are metals. 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.

## 3.2.6 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

## 3.2.7 Introduction to organic chemistry

Organic chemistry studies carbon's compounds. Organic mechanisms explain reactions for sustainability and technological advancement.

## 3.2.8 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.

## 3.2.9 Carboxylic acids and their derivatives

Carboxylic acids are weak acids. Esters occur naturally in vegetable oils and animal fats. Important products obtained from esters include biodiesel, soap and glycerol.

## 3.2.10 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.

## 3.2.11 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

## 3.2.12 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.

## YEAR 12 ORGANIC CHEMISTRY

## 3.3.1 Introduction to organic chemistry

Organic chemistry studies carbon's compounds. Organic mechanisms explain reactions for sustainability and technological advancement.

## 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.

## 3.3.3 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.

## 3.3.4 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.

## 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.

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## 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.

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## YEAR 13 ORGANIC CHEMISTRY

## Intervention & Therapy

- ✓ Personalised Learning Checklists (PLC's) used to identify areas of weak, developing, and secure subject knowledge.
- ✓ Therapy lessons used to address gaps in knowledge.
- ✓ SMART intervention in place to support students' progress.

## Revision

- ✓ Papst paper exam questions booklet
- ✓ Organic revision maps
- ✓ Revision guide and Textbook

## Assessments

- ✓ Paper 1: Inorganic and Physical Chemistry
- ✓ Paper 2: Organic and Physical Chemistry
- ✓ Paper 3: All Chemistry
- ✓ Practical assessments

Exams