Tarporley Sixth Form College

Chemistry A Level

Programme of Study

Exam Board: AQA
100% Examination
Plus the practical endorsement
(Centre assessed)

NAME:	
TARGET GRADE	
ASPIRATIONAL GRADE	

Assessment:

Paper 1	**Paper 2**	**Paper 3**
Relevant Physical chemistry topics (sections 1.1 to 1.4, 1.6 to 1.8 and 1.10 to 1.12) Inorganic chemistry (Section 2.1 to 2.6) Relevant practical skills	Relevant Physical chemistry topics (sections 1.2 to 1.6 and 1.9) Organic chemistry (Section 3.1 to 3.16) Relevant practical skills	Any content Any practical skills
Written exam: 2 hours 105 marks	Written exam: 2 hours 105 marks	Written exam: 2 hours 90 marks
35% of A-level Questions 105 marks of short and long answer questions	35% of A-level Questions 105 marks of short and long answer questions	30% of A-level Questions 40 marks of questions on practical techniques and data analysis 20 marks of questions testing across the specification 30 marks of multiple choice questions

Your Assessment Objectives:

AO1 Knowledge	Demonstrate knowledge and understanding of scientific ideas, processes, techniques and procedures
AO2 Application	Apply knowledge and understanding of scientific ideas, processes, techniques and procedures: • in a theoretical context • in a practical context • when handling qualitative data • when handling quantitative data
AO3 Analysis	Analyse, interpret and evaluate scientific information, ideas and evidence, including in relation to issues, to: • make judgements and reach conclusions • develop and refine practical design and procedures.

Weighting of Assessment Objectives:

Assessment Objectives (AOs)	Paper 1 (approx. %)	Paper 2 (approx. %)	Paper 3 (approx. %)	Overall (approx. %)
AO1	30	30	32	30
AO2	48	48	34	45
AO3	22	22	34	25
Overall	35	35	30	100

20% of the overall assessment of A-level Chemistry will contain mathematical skills equivalent to Level 2 or above. At least 15% of the overall assessment of A-level Chemistry will assess knowledge, skills and understanding in relation to practical work.

Your Key Topics over the Course:

Topic	Key Content
1.1 Atomic Structure	The chemical properties of elements depend on their atomic structure and 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.
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 dm3 of a gas.
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.
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.
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.
1.6 Equilibria	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. The study of the equilibrium constant, K_c , 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.
1.7 Redox Reactions	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.
1.8 Thermo-dynamics	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.
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.
1.10 Equilibrium Constant	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.
1.11 Electrode Potentials and Electro-chemical 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.
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.
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. The historical development of the Periodic Table and models of atomic structure provide good examples of how scientific ideas and explanations develop over time.
2.2 Group 2	The elements in Group 2 are called the alkaline earth metals. The trends in the solubilities of the hydroxides and the sulfates of these elements are linked to their use. Barium sulfate, magnesium hydroxide and magnesium sulfate have applications in medicines whilst calcium hydroxide is used in agriculture to change soil pH, which is essential for good crop production and maintaining the food supply.
2.3 Group 7	The halogens in Group 7 are very reactive non-metals. Trends in their physical properties are examined and explained. Challenges in studying the properties of elements in this group include explaining the trends in ability of the halogens to behave as oxidising agents and the halide ions to behave as reducing agents.
2.4 Period 3	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.
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.
2.6 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.
3.1 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 different ways. Organic mechanisms are studied, which enable reactions to be explained.
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 Halogenalkanes	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.
3.4 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.

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.
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.
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.
3.8 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.
3.9 Carboxylic Acids and Esters	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.
3.10 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.
3.11 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.
3.12 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.
3.13 Biochemical Molecules	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.
3.14 Organic Synthesis	The formation of new organic compounds by multi-step syntheses using reactions included in the specification is covered in this section.
3.15 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.
3.16 Chroma-tography	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.

Text Books

There are a variety of different books that you can use to study A level Chemistry. We recommend the Oxford Chemistry A Level text book as your main course companion. Other useful books include the CGP AQA Year 1 & 2 Complete revision and CGP Essential Maths Skills for A Level Chemistry.

You will find other text books in the school library, it is useful to look topics up in more than one book when you find something difficult.

How your course is structured:

Year 12		
Physical Chemistry • Atomic Structure • Amount of Substance	Inorganic Chemistry • Periodicity	Organic Chemistry • Introduction to Organic Chemistry • Alkanes
Christmas Holidays		
Physical Chemistry • Bonding • Energetics • Kinetics	Inorganic Chemistry • Group 2 Elements	Organic Chemistry • Halogenalkanes • Alkenes
Easter Holidays		
Physical Chemistry • Equilibria • Redox Reactions	Inorganic Chemistry • Group 7 Elements	Organic Chemistry • Alcohols • Organic Analysis
Summer Holidays		
Year 13		
Physical Chemistry • Rate Equations • Thermodynamics • Equilibrium Constants	Inorganic Chemistry • Transition Metals	Organic Chemistry • Optical Isomerism • Aldehydes and Ketones • Carboxylic Acids
Christmas Holidays		
Physical Chemistry • Acids and Bases	Inorganic Chemistry • Ions in Aqueous Solution	Organic Chemistry • Aromatic Chemistry • Amines • Polymers • Biochemical Molecules
Easter Holidays		
Physical Chemistry • Electrode Potentials and Electrochemical Cells	Inorganic Chemistry • Period 3 Oxides	Organic Chemistry • Organic Synthesis • nmr Spectroscopy • Chromatography