Morecambe Bay Academy

Chemistry

Why study A Level Chemistry

Have you ever wondered....

- Why does ice float?
- Why do people put salt on icy roads?
- Why do onions make you cry?
- How does aspirin stop pain in your body?
- Can you turn lead into gold?

Study A Level Chemistry to find out the answers.

Chemistry is everywhere and our modern lifestyles would be completely different without the knowledge and application of this fascinating subject. From a bottle of bleach in the bathroom, food colourings in the kitchen, fuels in our cars and even the paper and inks which make up this booklet, Chemistry has enabled them all to come into existence!

A Level Chemistry will give you an exciting insight into the contemporary world of chemistry. It covers the key concepts of chemistry and practical skills are integrated throughout the course. This combination of academic challenge and practical focus makes the prospect of studying A Level Chemistry highly appealing.

You will learn about chemistry in a range of different contexts and the impact it has on industry and many aspects of everyday life. You will learn to investigate and solve problems in a range of contexts.

Key features

- Simple straightforward assessment through examinations.
- Based on key concepts in chemistry
- Opportunities to build practical skills through a range of experiments and investigations.

A level chemistry is a good subject to study with any other science subject and/ or maths. Many students have also combined chemistry with geography or a language.

Where can A Level Chemistry take me?

A Level Chemistry is an excellent base for a university degree in healthcare such as medicine, pharmacy and dentistry as well as the biological sciences, physics, mathematics, pharmacology and analytical chemistry. Chemistry is also taken by many law applicants as it shows you can cope with difficult concepts. Chemistry can also complement a number of arts subjects.

A range of career opportunities including chemical, manufacturing and pharmaceutical industries and in areas such as forensics, environmental protection and healthcare. The problem solving skills are useful for many other areas, too, such as law and finance.

Chemistry A: Course Content

Module 1 – Development of practical skills

Skills of planning, implementing, analysis and evaluation

Module 2 – Foundations in chemistry

Includes:

- Atoms, compounds, molecules and equations
- Amount of substance
- Acid–base and redox reactions
- Electrons, bonding and structure.

Module 3 – Periodic table and energy

Includes:

- The periodic table and periodicity
- Group 2 and the halogens
- Qualitative analysis
- Enthalpy changes
- Reaction rates and equilibrium (qualitative).

Module 4 – Core organic chemistry

Includes:

- Basic concepts
- Hydrocarbons
- Alcohols and haloalkanes
- Organic synthesis
- Analytical techniques (IR, MS).

Module 5 – Physical chemistry and transition elements

Includes:

- Reaction rates and equilibrium (quantitative)
- pH and buffers
- Enthalpy, entropy and free energy
- Redox and electrode potentials
- Transition elements.

Module 6 – Organic chemistry and analysis

Includes:

- Aromatic compounds
- Carbonyl compounds
- Carboxylic acids and esters
- Nitrogen compounds
- Polymers
- Organic synthesis
- Chromatography and spectroscopy (NMR).

Emphasis throughout the course is on developing knowledge, competence and confidence in practical skills and problem solving. You will learn how society makes decisions about scientific issues and how sciences contribute to the success of the economy and society.

Chemistry: Year 12

Scheme of Learning	Assessments
Half Term One: Module 2 – Foundations in chemistry Teacher 1 Atomic structure and isotopes 2.1 Relative mass 2.2 The mole 3.1 Determination of formulae 3.2 Moles and Volumes 3.3 Reacting quantities 3.4 Teacher 2 Formulae and equations 2.3 Electron structure 5.1 Acids and redox 4.3 Ionic bonding and structure 5.2 Covalent bonding 5.3 Shapes of molecules and ions 6.1 Electronegativity and polarity 6.2 Intermolecular forces 6.3 Hydrogen bonding 6.4 Outcomes: Teacher 1 This section builds directly from GCSE Science, starting with basic atomic structure and isotopes. Important basic chemical skills are developed: calculating chemical quantities using the concept of amount of substance. Teacher 2 Important basic chemical skills are developed: writing chemical formulae, constructing equations. Redox reactions are studied within the context of oxidation number and electron transfer. This section then introduces the concept of atomic orbitals and develops a deeper understanding of electron configurations linked to the periodic table. The central role of electrons in ionic and covalent bonding is then studied. The important role of molecules is studied, including an explanation of polarity and intermolecular forces. Finally, this section looks at how bonding and structure contribute to properties of substances.	Teacher 1: Assessed homework 1 (End of chapter exam questions) PAG 1.3 PAG 1.1 PAG 1.2 Past exam questions Teacher 2: Assessed homework 2 (End of chapter exam questions) Past exam questions October Exam Teachers will liaise on/coordinate delivery of the PAGS

Half Term Two: Module 2 continued Begin Module 3 -Periodic Table and Energy Begin Module 4 – Core Organic Chemistry Teacher 1 Acids, bases and neutralisation 4.1 Acid-base titrations 4.2 BEGIN MODULE 3 The Periodic Table 7.1 Ionisation energies 7.2 Periodic trends in bonding and structure 7.3 Group 2 8.1 Teacher 2 BEGIN MODULE 4 Organic chemistry 11.1 Nomenclature of organic compounds 11.2 Representing formulae of organic compounds Isomerism 11.4 Alkanes 12.1 Chemical reactions of alkanes 12.2 Outcomes: Teacher 1 The role of acids, bases and salts in chemistry is developed in the context of neutralisation reactions. Module 3: Periodic trends are first studied to extend the understanding of structure and bonding. Group properties are then studied using Group 2 as a typical metal group, allowing an understanding of redox reactions to be developed further. Teacher 2 Module 4: This section is fundamental to the study of organic chemistry. This section introduces the various types of structures used routinely in organic chemistry, nomenclature, and the important concepts of homologous series, functional groups, isomerism and reaction mechanisms using curly arrows. The initial ideas are then developed within the context of the hydrocarbons: alkanes.	Teacher 1 Assessed homework 3 (End of chapter exam questions) PAG 2.1 PAG 2.2 PAG 2.3 Teacher 2 Assessed homework 4 (End of chapter exam questions) Past exam questions Teachers will liaise on/coordinate delivery of the PAGS

Half Term Three: Module 3 – Periodic Table and Energy and module 4 – Core organic chemistry Teacher 1 – module 3 The Halogens 8.2 Qualitative analysis 8.3 Teacher 2 – module 4 Properties of the alkenes 13.1 Stereoisomerism 13.2 Reactions of alkenes 13.3 Electrophilic addition in alkenes 13.4 Polymerisation in alkenes 13.5 Outcomes: Teacher 1 Group properties are studied using the halogens as typical non-metal group, allowing an understanding of redox reactions to be developed further. Finally, this section looks at how unknown ionic compounds can be analysed and identified using simple test-tube tests. Teacher 2 This section introduces the various types of structures used routinely in organic chemistry, nomenclature, and the important concepts of homologous series, functional groups, isomerism and reaction mechanisms using curly arrows. The initial ideas are then developed within the context of the hydrocarbons: alkenes.	Teacher 1 Assessed homework 5 (End of chapter exam questions) Past exam questions. PAG 4.1 PAG 4.2 PAG 4.3 Teacher 2 Assessed homework 6 Past exam questions. End of chapter questions January Exam
Half Term Four: Module 3 and module 4 continued Teacher 1 - module 3 continued Enthalpy changes 9.1 Measuring enthalpy changes 9.2 On enthalpies 9.3 Hess' Law and enthalpy cycles 9.4 Teacher 2 – module 4 continued Reactions of alcohols 14.2 Haloalkanes 15.1 Organohalogen compounds in the environment 15.2 Organic synthesis16.1 Synthetic routes 16.2 Outcomes:	Teacher 1 Assessed homework 7 (End of chapter exam questions) Past exam questions. PAG 3.1, 3.2, 33 Teacher 2 Assessed homework 8 (End of chapter exam questions) PAG 5.1, 5.2, 5.3 Past exam questions

Teacher 1 This section introduces physical chemistry within the general theme of energy. Learners first learn about the importance of enthalpy changes, their uses and determination from experimental results including enthalpy cycles. Teacher 2 This section introduces two further functional groups: alcohols and haloalkanes, and considers the importance of polarity and bond enthalpy to organic reactions. Throughout this section, there are many opportunities for developing organic practical skills, including preparation and purification of organic liquids.	
Half Term Five: Module 3 and Module 4 continued Teacher 1 Reaction rates 10.1 Catalysts 10.2 The Boltzmann distribution 10.3 Dynamic equilibrium and Le Chatalier's Principle 10.4 The equilibrium constant, Kc part 1 10.5 Revision of AS content Teacher 2 Synthetic routes 16.2 Mass spectrometry 17.1 Infrared spectroscopy 17.2 Outcomes: Teacher 1 This section then investigates the ways in which a change in conditions can affect the rate of a chemical reaction, in terms of activation energy, the Boltzmann distribution and catalysis. Reversible reactions are then studied, including the dynamic nature of chemical equilibrium and the influence of conditions upon the position of equilibrium. Finally, the integrated roles of enthalpy changes, rates, catalysts and equilibria are considered as a way of increasing yield and reducing energy demand, improving the sustainability of industrial processes. Teacher 2 The important techniques of infrared spectroscopy and mass spectrometry are used to illustrate instrumental analysis as a valuable tool for identifying organic compounds.	Teacher 1 Assessed homework 9 (End of chapter exam questions) Past exam questions. Teacher 2 Assessed homework 10 (End of chapter exam questions) Past exam questions

Half Term Six: Start Year 2 modules Module 5 Physical chemistry and transition elements Module 6 – Organic chemistry and analysis Continued revision of AS content up to PPE date Teacher 1 – module 5 Orders, rate equations and rate constants 18.1 Concentration-time graphs 18.2 Rate, concentration graphs and initial rate 18.3 Rate determining step 18.4 Rate constants and temperature 18.5 Teacher 2 – module 6 Introducing benzene 25.1 Electrophilic substitution reactions of benzene 25.2 Chemistry of phenol 25.3 Directing groups 25.4 Carbonyl compounds 26.1 Identifying aldehydes and ketones 26.2 Outcomes: Teacher 1 The largely qualitative treatment of reaction rates and encountered in Module 3 is developed within a quantitative and graphical context. This section also allows learners to develop practical quantitative techniques involved in the determination of reaction rates. There are many opportunities for developing mathematical skills, including use of logarithms and exponents, when studying the content of this section and when carrying out quantitative practical work. Teacher 2 This section extends the range of functional groups encountered in Module 4. Aromatic compounds are first introduced, including the central role of delocalisation within the chemistry of arenes and phenols. Directing groups are also introduced, including their importance to organic synthesis. The important carbonyl compounds, aldehydes and ketones, are then studied.	Teacher 1 Assessed homework 11 (End of chapter exam questions) Past exam questions. PAG 9.1, 9.2, 9.39.3 PAG 10.1, 10.2, 10.3 Teacher 2 Assessed homework 12 (End of chapter exam questions) Past exam questions. PAG 7.1, 7.2, 7.3 Year 12 May Exam: AS papers Breadth in chemistry 1 h 30 Depth in Chemistry 1 h 30

Module 1: Development of practical skills in chemistry

Chemistry is a practical subject and the development of practical skills is fundamental to understanding the nature of chemistry. Chemistry A gives learners many opportunities to develop the fundamental skills needed to collect and analyse empirical data. Skills in planning, implementing, analysing and evaluating, will be assessed in the written papers.

	Assessment Objective
AO1	Demonstrate knowledge and understanding of scientific ideas, processes, techniques and procedures.
AO2	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	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.

AO weightings in A Level in Chemistry A

The relationship between the assessment objectives and the components are shown in the following table:

Component	% of A Level in Chemistry A (H432)		
	AO1	AO2	AO3
Periodic table, elements and physical chemistry (H432/01)	13–14	15–16	8–9
Synthesis and analytical techniques (H432/02)	13–14	15–16	8–9
Unified chemistry (H432/03)	5–6	10–12	9–10
Practical endorsement in chemistry (H432/04)*	N/A	N/A	N/A
Total	**31–34**	**40–44**	**25–28**

Chemistry: Year 13

Scheme of Learning	Assessments
Half Term One: Module 5 – Physical chemistry and transition elements continued and Module 6 – Organic chemistry and analysis Teacher 1 Equilibrium constant Kc- part 2 19.1 Equilibrium constant Kp 19.2 Controlling the position of equilibrium 19.3 Bronsted-Lowry acids and bases 20.1 pH scale and strong acids 20.2 The acid dissociation constant, Ka 20.3 The pH of weak acids 20.4 pH of strong bases 20.5 Buffers and neutralisation 21.1 Buffer solutions in the body 21.2 Neutralisation 21.3 Teacher 2 Carboxylic acids 26.3 Carboxylic acid derivatives 26.4 Further practical techniques 28.2 Outcomes: Teacher 1 The largely qualitative treatment of equilibria encountered in Module 3 is developed within a quantitative and graphical context. This section also allows learners to develop practical quantitative techniques involved in the determination of reaction rates and pH. There are many opportunities for developing mathematical skills, including use of logarithms and exponents, when studying the content of this section and when carrying out quantitative practical work. Teacher 2 Carboxylic acids and their related functional groups, acyl chlorides and esters, are studied. The importance of acyl chlorides in organic synthesis is emphasised.	Teacher 1: Assessed homework 1 (End of chapter exam questions) PAG 11.1 PAG 11.2 PAG 11.3 Past exam questions Teacher 2: Assessed homework 2 (End of chapter exam questions) Past exam questions PAG 6.1 Preparation of aspirin October Exam Teachers will liaise on/coordinate delivery of the PAG
Half Term Two: Half Term One: Module 5 – Physical chemistry and transition elements continued	Teacher 1 Assessed homework 3 (End of chapter exam questions)

Teacher 1 Redox reactions 23.1 Manganate(VII) redox titrations 23.2 Iodine/thiosulfate titrations 23.3 Electrode potentials 23.4 Predictions from electrode potentials 23.5 Storage and fuel cells 23.6 d-block elements 24.1 Formation and shape of complex ions 24.2 Stereoisomerism in complex ions 24.3 Ligand substitution and precipitation 24.4 Redox and qualitative analysis 24.5 Teacher 2 Lattice enthalpy 22.1 Enthalpy changes in solution 22.2 Factors affecting lattice enthalpy and hydration 22.3 Entropy 22.4 Outcomes: Teacher 1 Redox chemistry permeates chemistry and the introductory work in Module 2 is developed further within this section, including use of volumetric analysis for redox titrations and an introduction of electrochemistry in the context of electrode potentials. This section provides learners with a deeper knowledge and understanding of the periodic table within the context of the transition elements. This section includes the role of ligands in complex ions, stereochemistry, precipitation, ligand substitution and redox reactions. The colour changes and observations in these reactions increase the toolkit of qualitative inorganic tests for identifying unknown ionic compounds. Teacher 2 Born–Haber cycles are used as a theoretical model to illustrate the energy changes associated with ionic bonding. Entropy and free energy are then introduced as concepts used to predict quantitatively the feasibility of chemical change.	PAG 8.1 PAG 8.2 PAG 8.3 PAG 4.3 Teacher 2 Assessed homework 4 (End of chapter exam questions) Past exam questions Teachers will liaise on/coordinate delivery of the PAGS

Half Term Three:

Module 6:
Core organic chemistry continued

Teacher 1
Chromatography and functional group analysis 29.1
NMR 29.2
Carbon-13 NMR spectroscopy 29.3
Proton NMR spectroscopy 29.4
Interpreting NMR spectra 29.5
Combined techniques 29.6

Teacher 2
Amines 27.1
Amino acids, amides and chirality 27.2
Condensation polymers 27.3
Carbon carbon bond formation 28.1
Further synthetic routes 28.3

Outcomes:

Teacher 1
This section demonstrates how analytical techniques introduced in Module 4 (infrared spectroscopy, mass spectrometry and elemental analysis) may be used in combination with NMR spectroscopy to provide evidence of structural features in molecules. The instrumentation methods of analysis studied during the A level course provide learners with an important base of knowledge, understanding and awareness for further study in Higher Education and in many areas of employment in the broad scientific field.

Teacher 2
This section focuses on organic nitrogen compounds, including amines, amides and amino acids. Chirality and optical isomerism is also introduced. Condensation polymerisation is also introduced and compared with addition polymerisation. The importance of carbon–carbon bond formation in organic synthesis is stressed. Learners are also able to consider multi-stage synthetic routes towards an organic product. This module allows learners many opportunities to further develop their organic practical skills, especially in preparing and purifying organic solids, including recrystallisation and determination of melting points.

Teacher 1
Assessed homework 5
(End of chapter exam questions)
Past exam questions.

Teacher 2
Assessed homework 6
(End of chapter exam questions)
Past exam questions.

Year 13 Exam in January:
Periodic table, elements and physical chemistry (01) 100 marks
2 hours 15 minutes written paper

Half Term Four: Remaining PAGS AND REVISION Teacher 1 & Teacher 2 Teachers will liaise on/coordinate delivery of the PAGS PAG 12.1 analysis of iron tablets – revises redox titration PAG 7.1, 7.2, 7.3 – revises organic qualitative analysis PAG 6.3, 6.4 – revises organic synthesis, separation and purification	Teacher 1 Assessed homework 7 Past exam questions. Teacher 2 Assessed homework 8 Past exam questions. March Exam: Synthesis and analytical techniques (02) 100 marks 2 hours 15 minutes written paper
Half Term Five: Revision See separate revision schedule To include past exam paper practice Sample papers, practice paper set 1, practice paper set 2, June 2017 and June 2018 papers available	Teacher 1 Assessed homework 9 Past exam questions. Teacher 2 Assessed homework Past exam questions.
Half Term Six : Revision up to exams	Year 13 exams Periodic table, elements and physical chemistry (01) 100 marks 2 hours 15 minutes written paper (37%) Synthesis and analytical techniques (02) 100 mark 2 hours 15 minutes written paper (37%) Unified Chemistry (03) 70 marks 1 hour 30 minutes written paper (26%)

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Expectations

In order to achieve your potential in biology, there are a number of key areas which you must put in place. These include:-

- Personal organisation. You will need to bring a pen, pencil, ruler and calculator to each lesson. Your teacher will also use the textbook in lessons so you will need to bring this as well. You will also be using a file to store all your work in and this must be kept well organised.

- Time management. You need to organise your time so that reading, revision and homework tasks are completed by the required time.

- The types of homework tasks which are set include reading, revision, questions from textbooks, past exam papers etc. Year 12 will have approximately 3 to 4 hours of homework per week. Year 13 will have 5 to 6 hours of independent learning / homework a week.

- Safe and responsible conduct during practical lessons and full cooperation with safety procedures.

- You will need to be determined, focused and willing to put in the time and effort to learn and understand the different topics.

- You will also be expected to undertake independent learning which will be based around the PAGs, exam questions for each module and wider reading

Help and Support from Teachers

Year 12 - Mrs Cooper and Miss Smith
Year 13 – Mrs Cooper and Miss Smith.

This can start now if you wish. It is no secret that there is a big jump in the demand and level of work from GCSE. If you wish to do some preparation for the AS course, you can purchase a booklet entitled,
'Head Start to AS level Chemistry', which will make the jump easier to manage.

The chemistry department has a tradition of being available to help sixth formers when they are either stuck with homework, or just want some extra support.

You will be provided with textbooks at the beginning of the course.

CHEMISTRY A: ASSESSMENT OVERVIEW

AS Chemistry A (H032)					
ASSESSMENT OVERVIEW					
Paper			Marks	Duration	Weighting
Paper 1	Breadth in chemistry		70	1 hr 30 mins	50%
	Section A	Multiple choice	20		
	Section B	Structured questions and extended response questions covering theory and practical skills	50		
Paper 2	Depth in chemistry		70	1 hr 30 mins	50%
	Structured questions and extended response questions, covering theory and practical skills		70		

A Level Chemistry A (H432)					
ASSESSMENT OVERVIEW					
Paper			Marks	Duration	Weighting
Paper 1	Periodic table, elements and physical chemistry		100	2 hr 15 mins	37%
	Section A	Multiple choice	15		
	Section B	Structured questions and extended response questions covering theory and practical skills	85		
Paper 2	Synthesis and analytical		100	2 hr 15 mins	37%
	Section A	Multiple choice	15		
	Section B	Structured questions and extended response questions covering theory and practical skills	85		
Paper 3	Unified chemistry		70	1 hr 30 mins	26%
	Structured questions and extended response questions covering theory and practical skills		70		
Non-exam assessment	Practical Endorsement for		Pass/Fail	Non-exam assessment	Reported separately
	See pages 27 and 28. Teacher-assessed component common to Chemistry A and Chemistry B (Salters). Candidates complete a minimum of 12 practical activities to demonstrate practical competence. Performance reported separately to the A Level grade. Moderation details still to be confirmed by Ofqual at the time of going		0		

Specification

http://www.ocr.org.uk/Images/171720-specification-accredited-a-level-gce-chemistry-a-h432.pdf

Useful Websites

There are hundreds out there! Here are a few.

www.ocr.org.uk
www.rsc.org.uk
www.alevelchemistry.co.uk
www.knockhardy.org.uk
www.creative-chemistry.org.uk

Past Paper Exam Question Examples

1. Antimony, Sb, has atomic number 51.

Antimony exists as a mixture of isotopes.

i. What is meant by the term isotopes?

[1]

ii. Different isotopes of antimony have the same chemical properties.

Explain why.

[1]

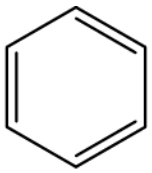
iii. Complete the table below to show the atomic structure of ^{121}Sb.

Protons	Neutrons	Electrons

[1]

2. This question is about the chemistry of benzene and substituted benzene compounds.

In 1865, the Kekulé model was suggested for the structure of benzene. Experimental evidence has led to the development of an updated model. Both models are shown below.



Kekulé model

Updated model

- Explain the experimental evidence that led to the development of the updated model from the Kekulé model of benzene.
- Describe the bonding in the updated model of benzene.

[4]

Literacy

See glossary at the back of the AS and the A2 text book for all keywords and definitions.