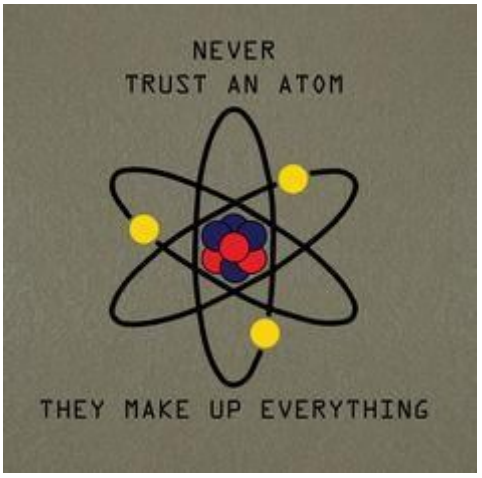
BRISTOL CATHEDRAL
CHOIR SCHOOL

BCCS

Chemistry

AS Level



Welcome to AS Level Chemistry

The AQA Chemistry GCE course has been designed to ensure that the subject content is relevant to real world experiences and is interesting to teach and learn. The Chemistry specifications are a stepping stone to future study, and have been developed through consultation with top universities, ensuring that students develop the skills that they want to see. We hope that this course will inspire students, nurture a passion for Chemistry and lay the groundwork for further study in Sciences.

Like you, we believe that Chemistry is fundamentally an experimental subject. This course will provide numerous opportunities to use practical experiences to link theory to reality, and equip students with the essential practical skills they need.

The government recently changed the format of A-levels so that AS-levels are a stand-alone qualification that does not contribute to the full A-level qualification. The specification we follow allows for co-teaching of AS and A-level. This means you do not have to decide which qualification you want to complete right away.

Content

The course is divided up into 3 areas of study:

- ☆ Physical Chemistry
  - the study of macroscopic, atomic, subatomic, and particulate phenomena in chemical systems in terms of laws and concepts of physics
  - topics include bonding, kinetics, equilibria, energetics, redox, acids and bases and amount of substance
- ☆ Inorganic Chemistry
  - the study of the synthesis and behavior of inorganic and organometallic compounds
  - topics include periodicity, group 2, group 7 and transition metal chemistry
- ☆ Organic Chemistry
  - study of the structure, properties, and reactions of organic compounds and organic materials, i.e., matter in its various forms that contain carbon atoms
  - topics include alkanes, alkenes, isomerism, carbonyl groups, amines, amino acids and organic synthesis and analysis

For more information on the content of the Chemistry AQA course, download the specification from:

http://www.aqa.org.uk/subjects/science/as-and-a-level/chemistry-7404-7405

AS Level Assessments

To complete the AS-level students must complete two assessments at the end of Y12.

Paper 1	Paper 2
What's assessed • Relevant Physical chemistry topics (sections 3.1.1 to 3.1.4, 3.1.6 and 3.1.7) • Inorganic chemistry (Section 3.2.1 to 3.2.3) • Relevant practical skills	**What's assessed** • Relevant Physical chemistry topics (sections 3.1.2 to 3.1.6) • Organic chemistry (Section 3.3.1 to 3.3.6) • Relevant practical skills
How it's assessed • written exam: 1 hour 30 minutes • 80 marks • 50% of the AS	**How it's assessed** • written exam: 1 hour 30 minutes • 80 marks • 50% of the AS
Questions 65 marks of short and long answer questions 15 marks of multiple choice questions	**Questions** 65 marks of short and long answer questions 15 marks of multiple choice questions

A Level Assessments

To complete the full A-level students must complete three assessments at the end of Y13 which test students on the content covered in both Y12 and Y13.

Paper 1	Paper 2	Paper 3
What's assessed • Relevant Physical chemistry topics (sections 3.1.1 to 3.1.4, 3.1.6 to 3.1.8 and 3.1.10 to 3.1.12) • Inorganic chemistry (Section 3.2) • Relevant practical skills	**What's assessed** • Relevant Physical chemistry topics (sections 3.1.2 to 3.1.6 and 3.1.9) • Organic chemistry (Section 3.3) • Relevant practical skills	**What's assessed** • Any content • Any practical skills
How it's assessed • written exam: 2 hours • 105 marks • 35% of A-level	**How it's assessed** • written exam: 2 hours • 105 marks • 35% of A-level	**How it's assessed** • written exam: 2 hours • 90 marks • 30% of A-level
Questions 105 marks of short and long answer questions	**Questions** 105 marks of short and long answer questions	**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

Required Practicals

Coursework/ISAs are no more, but this doesn't mean that Chemistry will no longer be a practical subject. AQA has issued a list of 12 Required Practicals that you must complete throughout your course, 6 for Y12 and 6 for Y13. These develop skills in the use of many of the following apparatus and techniques.

	Apparatus and techniques
AT a	Use appropriate apparatus to record a range of measurements (to include mass, time, volume of liquids and gases, temperature)
AT b	Use water bath or electric heater or sand bath for heating
AT c	Measure pH using pH charts, or pH meter, or pH probe on a data logger
AT d	Use laboratory apparatus for a variety of experimental techniques including: • titration, using burette and pipette • distillation and heating under reflux, including setting up glassware using retort stand and clamps • qualitative tests for ions and organic functional groups • filtration, including use of fluted filter paper, or filtration under reduced pressure
AT e	Use volumetric flask, including accurate technique for making up a standard solution
AT f	Use acid–base indicators in titrations of weak/strong acids with weak/strong alkalis
AT g	Purify: • a solid product by recrystallisation • a liquid product, including use of separating funnel
AT h	Use melting point apparatus
AT i	Use thin-layer or paper chromatography
AT j	Set up electrochemical cells and measuring voltages
AT k	Safely and carefully handle solids and liquids, including corrosive, irritant, flammable and toxic substances
AT l	Measure rates of reaction by at least two different methods, for example: • an initial rate method such as a clock reaction • a continuous monitoring method

In the AS course, the Required Practicals are:

Required activity	Apparatus and technique reference
1 Make up a volumetric solution and carry out a simple acid–base titration	a, d, e, k
2 Measurement of an enthalpy change	a, d, k
3 Investigation of how the rate of a reaction changes with temperature	a, b, k
4 Carry out simple test-tube reactions to identify: • cations – Group 2, NH_4^+ • anions – Group 7 (halide ions), OH^-, CO_3^{2-}, SO_4^{2-}	b, d, k
5 Distillation of a product from a reaction	b, d, k
6 Tests for alcohol, aldehyde, alkene and carboxylic acid	b, c, d, k

Required Practical Lab Book

You will be expected to keep a lab book, recording any and all experiments you undertake in class:

1. You will need a hard back A4 book with bound pages.
2. Notes are to be made during the sessions and need to be legible and well-ordered but they DO NOT need to be "neat" and NOT written up after the date they were done.
3. Mistakes should be crossed out and re-written, not overwritten, erased, nor should Tippex be used.
4. Pencil should only be used for graphs and tables.
5. All work should lie flat and NOT be folded or covering other work.

For every practical your book will include:
Title and date of experiment.
Notes on what the objectives of the experiment.
Notes on the method, including all details (eg temperatures, volumes, settings of pieces of equipment) with justification where necessary.
Sketches of how equipment has been set up can be helpful. Photographs pasted in are also acceptable.
Data and observations input to tables (or similar) while carrying out the experiment.
Calculations – annotated to show thinking.
Graphs and charts.
Summary, discussions and conclusions.
Cross-references to earlier data and references to external information.

Chemistry stinks – olfactory indicators experiment

Chemicals that change colour with pH are frequently used as indictors for acid base titrations; however it is also possible to use chemicals that change odour with pH – termed 'olfactory indicators'. The aim of this experiment is to determine the concentration of an unknown base using garlic powder as an olfactory indicator, and to analyse the accuracy and precision of the results.

Apparatus	Chemicals
Eye protection **Beaker (500cm^3), 2** **Parafilm or watch glass** **Burette (25 cm^3)** **Pipette (10cm^3)** **Small funnel** **Conical flasks (50cm^3 or 100cm^3), 3**	Hydrochloric acid solution, HCl(aq) (0.1 M) (IRRITANT) 250cm^3 Sodium hydroxide solution, NaOH(aq) (Unknown Concentration, approx. 0.1M) (IRRITANT) 100cm^3 Garlic powder (May cause allergic response and skin/eye irritation), approx. 0.4g

What safety precautions do you need to take based on the above chemical information? Do you feel safe and confident conducting the titration experiment?

Procedure

1. Using a small funnel, pour a few cubic centimetres hydrochloric acid, HCl (aq) (0.1 mol dm^{-3}) into the burette, with the tap open and a beaker under the open tap. Once the tip of the burette is full of solution, close the tap and add more solution up to the zero mark. (Do not re-use the acid in the beaker – this should be rinsed down the sink with plenty of water.)

2. Use a pipette with pipette filler to transfer 10 cm^3 of the unknown concentration garlic infused sodium hydroxide solution to the conical flask.

3. Add the hydrochloric acid to the garlic infused sodium hydroxide solution in small volumes, swirling gently after each addition. A sudden change in intensity to the smell is detectable at the end-point of the titration.

4. Repeat until concordant results are obtained

NB: The smell is detectable in basic conditions but at the end point there is a sudden change of intensity whereby the smell seems to get richer and can easily be detected by wafting the odour towards oneself.

Volume of acid added:

Discussion: How would using an olfactory indicatory compare with using a colour-based indicator? How would you rate the accuracy of this method?

Preparation Tasks

The fundamentals in A-level Chemistry are so important to doing well in this subject. Basics like writing formulae, naming compounds and writing equations are essential.

Keep your skills sharp over the holidays by completing the exercises on the following pages. If you need some help with how to complete these exercises you can refer to these websites:

http://www.bbc.co.uk/education/guides/zysk7ty/revision/1

http://www.bbc.co.uk/schools/gcsebitesize/science/add_aqa_pre_2011/chemcalc/chemcalc_higherrev2.shtml

http://www.bbc.co.uk/schools/gcsebitesize/science/add_aqa_pre_2011/chemcalc/chemcalc_higherrev4.shtml

There will be a quiz on this content in the first week back, as you will need to be secure in this knowledge to develop further as the course progresses.

Good luck with the exam results - we look forward to seeing you in our labs in September.

Mr Lloyd

Dr Harris

Mr Worthington

Mrs Jackson

Preparation Task

Activity 1

1. Al loses 3 electrons to become Al^{3+}
2. Mg loses 2 electrons to become _____
3. Cl gains 1 electron to become _____
4. F gains 1 electron to become _____
5. Na loses 1 …… to become _____
6. Li loses 1 …… to become _____
7. Group 1 metals have ___ electron in outer shell
8. Group 2 metals have ____ electrons in outer shell.
9. Group 6 non metals have ____ electrons in outer shell and need to _____ ___ electrons to get full outer shell.
10. Group 7 non metals have ___ electrons and need to ____ __ electron to get a full outer shell.

11. Here are the charges on some of the more common ions.

Ion	Charge	Ion	Charge
lithium	Li^{+}	fluoride	F^{-}
aluminium	Al^{3+}	sulfate	SO_4^{2-}
copper(II)	Cu^{2+}	nitrate	NO_3^{-}
potassium	K^{+}	carbonate	CO_3^{2-}

Use the charges on these ions to work out the correct formulae for these compounds.

a lithium fluoride:

b copper(II) sulfate:

c potassium carbonate:

d aluminium nitrate:

12. Balance the following symbol equations.

a. $H_2 + Br_2 \rightarrow HBr$

b. $Na + Cl_2 \rightarrow NaCl$

c. $CH_4 + O_2 \rightarrow CO_2 + H_2O$

d. $P + Cl_2 \rightarrow PCl_3$

e. $CaCO_3 \rightarrow CO_2 + CaO$

f. $Fe + H_2O \rightarrow H_2 + Fe_3O_4$

ACTIVITY TWO

Relative atomic mass - atomic mass of the element (see periodic table).

Element	Relative atomic mass
Sodium	
Oxygen	
Magnesium	
Sulphur	
Calcium	
Chlorine	
Aluminium	
Hydrogen	
Potassium	
Nitrogen	

Relative formula mass

Mass of compound (Mr) - add up the atomic mass of each element in the compound.

Compound	Relative formula mass
NaOH	
KNO_3	
SO_2	
$CaSO_4$	
$MgCO_3$	
$CuCO_3$	
HNO_3	
$Ca(OH)_2$	
Na_2CO_3	
H_2SO_4	

Moles

A mole of any substance always contains same number of particles. One mole of any substance is the relative atomic (or formula) mass of that substance in grams.

Mass = moles x relative atomic (or formula) mass

Substance	Mass of substance	Number of moles
Sodium		1
Magnesium		1
Lead		1
Barium		0.1
Chromium		0.1
Tin		0.1
HNO3		1
CuO		2
O2		1
H2O		0.5

Percentage mass (%) = $\frac{\text{Relative atomic mass of substance A x number of atoms of A}}{\text{Relative molecular mass of compound}} \times 100$

Find the percentage by mass of:

a) Lithium and oxygen in lithium oxide, Li_2O.

b) Carbon and hydrogen in ethane, C_2H_6.

c) Sodium, hydrogen and oxygen in sodium hydroxide, NaOH.

d) Sodium and chlorine in sodium chloride, NaCl.

Percentage yield

This is the amount of product produced (in grams) divided by the maximum amount possible multiplied by 100 to produce a percentage.

a) A reaction produces a theoretical yield of 200g but only makes 150g. What is the percentage yield?

b) A reaction produces 60g of product but in theory makes 80g. What is the percentage yield?

c) How much of reactant A is needed to make 80g of product D if the percentage yield is 75%?

Empirical formulae

From the mass of each element present in a sample we can find the formula of the compound.

1. Sodium (2.3g) combine with oxygen (0.8g). How many moles of sodium and oxygen are there? How many moles of sodium combine with 1 mole of oxygen? What is the formula of sodium oxide?

2. Magnesium (0.27g) combine with nitrogen (0.28g). How many moles of magnesium and nitrogen are there? How many moles of magnesium combine with 1 mole of nitrogen? What is the formula of Magnesium nitride?

3. Iron (1.68g) combine with oxygen (0.64g). How many moles of each element are there? How many moles of Iron combine with 1 mole of oxygen? What is the formula for this Iron oxide?

4. A compound contains 55.5% mercury; 44.5% bromine. How many grams of mercury and bromine are there in 100g of the compound? How many moles of mercury and bromine are there in 100g of the compound? What is the ratio of moles of bromine to moles of mercury. What is the formula?