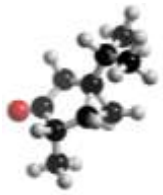
A LEVEL ESSENTIALS

Name ..... Form .....



Chemistry at LRGS – What to Expect

At LRGS we sit the AQA A level Chemistry specification (GCE Chemistry 7405)

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

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

Topics

3.1 Physical chemistry

3.1.1 Atomic structure
3.1.2 Amount of substance
3.1.3 Bonding
3.1.4 Energetics
3.1.5 Kinetics
3.1.6 Chemical equilibria, Le Chatelier's principle and Kc
3.1.7 Oxidation, reduction and redox equations
3.1.8 Thermodynamics (A-level only)
3.1.9 Rate equations (A-level only)
3.1.10 Equilibrium constant Kp for homogeneous systems (A-level only)
3.1.11 Electrode potentials and electrochemical cells (A-level only)
3.1.12 Acids and bases (A-level only)

3.2 Inorganic chemistry

3.2.1 Periodicity
3.2.2 Group 2, the alkaline earth metals
3.2.3 Group 7(17), the halogens
3.2.4 Properties of Period 3 elements and their oxides (A-level only)
3.2.5 Transition metals (A-level only)
3.2.6 Reactions of ions in aqueous solution (A-level only)

3.3 Organic chemistry

3.3.1 Introduction to organic chemistry
3.3.2 Alkanes
3.3.3 Halogenoalkanes
3.3.4 Alkenes
3.3.5 Alcohols
3.3.6 Organic analysis
3.3.7 Optical isomerism (A-level only)
3.3.8 Aldehydes and ketones (A-level only)
3.3.9 Carboxylic acids and derivatives (A-level only)
3.3.10 Aromatic chemistry (A-level only)
3.3.11 Amines (A-level only)
3.3.12 Polymers (A-level only)
3.3.13 Amino acids, proteins and DNA (A-level only)
3.3.14 Organic synthesis (A-level only)
3.3.15 Nuclear magnetic resonance spectroscopy (A-level only)
3.3.16 Chromatography (A-level only)

What is expected from you?

Equipment: You will need a well organised file (there will be checks) and must bring a calculator and Periodic Table to every Chemistry lesson.

Hard work: You need to work extremely hard to be successful at A-level Chemistry. It is expected that you will **review your work** as a matter of course after every lesson, in addition to **reading the relevant section** in a textbook. There will be written work set in addition to this.

Independent study: The resources library is available for quiet study and the Chemistry teachers are always willing to answer queries at any time. There is a wealth of resources available on the VLE: http://vle.lrgs.lancs.sch.uk/, along with many other web based resources.

Basic units to know:

Physical Quantity	Name of unit	Symbol
Mass	kilogram	kg
Thermodynamic temperature	kelvin	K (not ˚K)
Amount of substance	mole	mol
Pressure	Newton per metre squared (pascal)	Nm^{-2} (Pa)
Specific heat capacity	joule per kilogram kelvin	$Jkg^{-1}K^{-1}$
Concentration (molarity)	mol per decimetre cubed	$moldm^{-3}$ (M)

Some Important Physical Constants

Gas constant (R)	8.314 $Jkg^{-1}K^{-1}$
Specific heat capacity of water	4.2 $Jg^{-1}K^{-1}$

Useful Conversions

1 atmosphere = 101325 Nm^{-2} (Pa)
1 litre (l) is equivalent to $1dm^3$
$1dm^3 = 10^{-3}m^3$
$1cm^3 = 10^{-3}dm^3 = 10^{-6}m^3$
0˚C = 273K

Some important chemicals to know

Hydrochloric acid	HCl
Sulphuric acid	H_2SO_4
Nitric acid	HNO_3
Sodium hydroxide	NaOH
Ammonia	NH_3

Formulae of Ionic Compounds

Ions are charged particles. Ions with a positive charge are known as **cations** and ions with a negative charge are known as **anions**. The formula of an ionic compound is the formula which shows the simplest whole number ratio in which the ions in the compound exist. This depends on the charges of the ions involved.

Some important ions and their charges are shown below. The ions in bold are compound ions.

1	hydrogen sodium potassium lithium rubidium caesium copper(I) silver(I) **ammonium**	H^+ Na^+ K^+ Li^+ Rb^+ Cs^+ Cu^+ Ag^+ $\mathbf{NH_4^+}$	chloride bromide iodide **hydroxide** **nitrate** **nitrite** **hydrogencarbonate** **hydrogensulfate**	Cl^- Br^- I^- $\mathbf{OH^-}$ $\mathbf{NO_3^-}$ $\mathbf{NO_2^-}$ $\mathbf{HCO_3^-}$ $\mathbf{HSO_4^-}$
2	calcium barium magnesium zinc iron(II) cobalt manganese(II) copper(II)	Ca^{2+} Ba^{2+} Mg^{2+} Zn^{2+} Fe^{2+} Co^{2+} Mn^{2+} Cu^{2+}	**sulfate** **sulfite** sulphide oxide **carbonate**	$\mathbf{SO_4^{2-}}$ $\mathbf{SO_3^{2-}}$ S^{2-} O^{2-} $\mathbf{CO_3^{2-}}$
3	aluminium iron(III)	Al^{3+} Fe^{3+}	**phosphate**	$\mathbf{PO_4^{3-}}$

Work out the formula for each of these compounds:

1) potassium iodide
2) potassium sulphate
3) sodium oxide
4) magnesium sulphate
5) aluminium bromide
6) magnesium hydroxide
7) magnesium chloride
8) copper(II) nitrate
9) zinc carbonate
10) iron(II) oxide
11) potassium hydroxide
12) iron(III) oxide
13) sodium carbonate
14) calcium sulphide
15) aluminium hydroxide
16) copper(II) chloride
17) aluminium iodide
18) lithium fluoride
19) ammonium chloride
20) barium chloride
21) ammonium hydroxide
22) lead(II) sulphide
23) iron(III) nitrate
24) zinc iodide
25) zinc chloride
26) aluminium sulphide
27) potassium oxide
28) barium oxide
29) potassium nitrate
30) silver bromide
31) lithium sulphide
32) iron(III) fluoride
33) potassium carbonate
34) calcium nitrate
35) ammonium sulphate
36) ammonium hydroxide

A LEVEL ESSENTIALS – ionic equations

Name ..... Form .....

Many reactions that take place in aqueous solution do not involve all of the ions that are written in the equation. Some species remain in aqueous solution before and after the reaction. They therefore play no part in the reaction and are known as **spectator ions**.

In **ionic equations**, spectator ions are left out.

eg $BaCl_2(aq) + Na_2SO_4(aq) \rightarrow BaSO_4(s) + 2NaCl(aq)$

This reaction involves the precipitation of barium sulphate.

Notice that the Cl^- ions and the Na^+ ions remain in the aqueous state before and after the reaction. They are therefore spectator ions.

The above reaction can then be rewritten as follows:

$Ba^{2+}(aq) + SO_4^{2-}(aq) \rightarrow BaSO_4(s)$

Ionic equations are very useful for simplifying **precipitation** reactions (when a solid is formed from two solutions).

They can also simplify **acid-base** reactions:

eg $NaOH(aq) + HCl(aq) \rightarrow NaCl(aq) + H_2O(l)$

The Na^+ and Cl^- ions are spectator ions, so the ionic equation for the reaction is:

$$\mathbf{H^+(aq) + OH^-(aq) \rightarrow H_2O(l)}$$

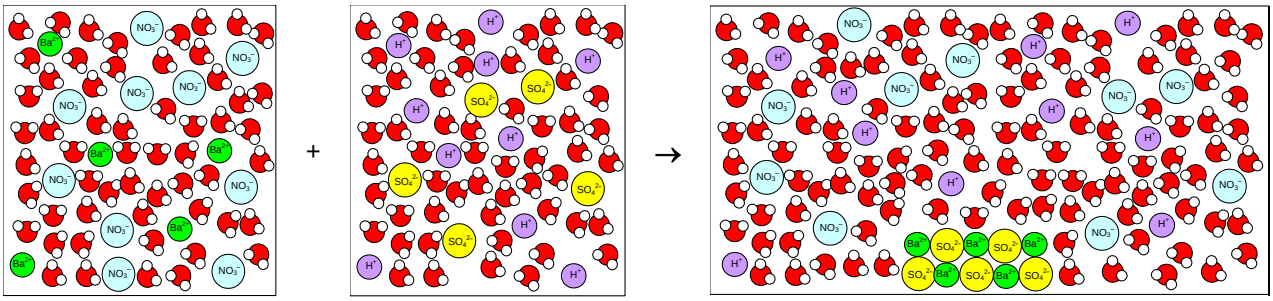
All reactions between strong acids and strong alkalis have the same ionic equation.

Visual Example

eg $Ba(NO_3)_2(aq) + H_2SO_4(aq) \rightarrow BaSO_4(s) + 2HNO_3(aq)$

Ionic Equation:

$Ba^{2+}(aq) + SO_4^{2-}(aq) \rightarrow BaSO_4(s)$



$Ba(NO_3)_2(aq)$ + $H_2SO_4(aq)$ → Reaction takes place: $Ba^{2+}(aq) + SO_4^{2-}(aq) \rightarrow BaSO_4(s)$

Some general reactions you should know:

General Reaction	Examples
substance + oxygen → oxides	$2\ Mg + O_2 \rightarrow 2\ MgO$ $2\ H_2S + 3\ O_2 \rightarrow 2\ H_2O + 2\ SO_2$ $C_3H_8 + 5\ O_2 \rightarrow 3\ CO_2 + 4\ H_2O$
metal + water → metal hydroxide + hydrogen	$2\ Na + 2\ H_2O \rightarrow 2\ NaOH + H_2$
metal + acid → salt + hydrogen	$Mg + 2\ HCl \rightarrow MgCl_2 + H_2$
oxide + acid → salt + water	$MgO + 2\ HNO_3 \rightarrow Mg(NO_3)_2 + H_2O$
hydroxide + acid → salt + water	$2\ NaOH + H_2SO_4 \rightarrow Na_2SO_4 + H_2O$
carbonate + acid → salt + water + carbon dioxide	$CuCO_3 + 2\ HCl \rightarrow CuCl_2 + H_2O + CO_2$
hydrogencarbonate + acid → salt + water + carbon dioxide	$KHCO_3 + HCl \rightarrow KCl + H_2O + CO_2$
ammonia + acid → ammonium salt	$NH_3 + HCl \rightarrow NH_4Cl$
metal carbonate → metal oxide + carbon dioxide (on heating)	$CaCO_3 \rightarrow CaO + CO_2$

1) Balance the following equations.

a) $Mg + HNO_3 \rightarrow Mg(NO_3)_2 + H_2$

b) $CuCl_2 + NaOH \rightarrow Cu(OH)_2 + NaCl$

c) $SO_2 + O_2 \rightarrow SO_3$

d) $C_4H_{10} + O_2 \rightarrow CO_2 + H_2O$

2) Give balanced equations for the following reactions.

a) sodium + oxygen → sodium oxide

b) aluminium + chlorine → aluminium chloride

c) calcium + hydrochloric acid → calcium chloride + hydrogen

d) ammonia + sulphuric acid → ammonium sulphate

State Symbols

(s) - solid
(l) - liquid
(g) - gas
(aq) – aqueous (dissolved in water)
(alc) – alcoholic solution (dissolved in alcohol)