

Name :



Preparing for OCR (A) A-Level Chemistry

Task 1

Buy a small folder and file the **Data book** and the **Essential Chemistry** facts sheet.

Learn the facts on the essentials sheet. You will be tested on this in the first week.

Bring your folder to your first chemistry lesson.

Task 2

Complete this booklet over the summer and hand it in when you **enrol in August** – hand it to the chemistry teacher at their desk. It will form part of your initial assessment when you start college.

Read the points on how to use the booklet before starting:

- Work on this booklet **in order** during regular sessions.
- Each activity is organised into sections which ask you to:
LEARN something
UNDERSTAND something
TRY some examples to check you really have learnt and understood,
SUGGEST your own examples, this is a higher level check of your understanding.
- The answers to **TRY** will always be found in **LEARN** and **UNDERSTAND**, so if you get stuck it's because you haven't learnt or understood **and you need to go back through those sections to try and answer the question.**

The reasons for giving you this booklet

The points cover the essential knowledge that you will need to make use of throughout your A level course. The long gap between finishing your GCSEs and starting A Level chemistry means there is a danger of forgetting much of what you worked so hard to learn. This bridging booklet covers the essential groundwork for you to start the course fully prepared.

Learn

- Metal elements form positive ions by losing electrons.
- Non-metal elements form negative ions by gaining electrons.
- Ionic compounds are mostly between metal and non-metal elements.

Look at your Periodic Table and **learn** these two simple rules:

1. For Group 1, 2 and 3 metals: group number = size of positive charge

ie Group 1 form 1+ ions eg Na⁺ Group 3 form 3+ ions eg Al³⁺

2. For Group 5, 6 and 7 non-metals: (8 - group number) = size of negative charge

ie Group 7 form 1- ions eg Cl⁻ Group 6 form 2- ions eg O²⁻

Note that metal ions have the name of the metal eg Na⁺ is called a sodium ion, but non-metal ions' names end in **ide** eg Br⁻ is a bromide ion, S²⁻ a sulfide ion.

Cover the last column, then fill column A to test yourself to the complete table **A**

| name of ion | formula | formula | formula | formula | formula |
|-------------|---------|---------|---------|---------|-------------------------------|
| hydroxide | | | | | OH ⁻ |
| carbonate | | | | | CO ₃ ²⁻ |
| sulfate | | | | | SO ₄ ²⁻ |
| nitrate | | | | | NO ₃ ⁻ |
| ammonium | | | | | NH ₄ ⁺ |

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Understand

The formulae of ionic compounds arise from the charges of their ions: ionic bonds are the attractions between positive ions and negative ions so that the total number of positives equals the total number of negatives.

Examples:

potassium chloride contains K⁺ and Cl⁻ so formula is KCl

magnesium hydroxide contains Mg²⁺ and OH⁻ here two 1- hydroxide ions are needed to make the negative charge equal the positive charge so the formula is Mg(OH)₂

ammonium carbonate contains NH₄⁺ and CO₃²⁻ giving (NH₄)₂CO₃

Note how brackets are used when a formula contains two or more of an ion that has more than one element symbol, such as SO₄²⁻ or NO₃.

Try

Referring to the information above, write formula for the following names:

Example: sodium carbonate contains Na⁺ ions and CO₃²⁻ ions so **two** Na⁺ are needed since 2 x 1+ equals the 2- ion charge to give a formula of Na₂CO₃

a) potassium bromide

b) magnesium chloride

c) sodium sulfide

d) sodium oxide

e) calcium nitrate

f) aluminium sulfate

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Suggest

From the ions in the table above and the positive ions of Groups 1, 2 and 3 metals and the negative ions of Groups 5, 6 and 7 non-metal elements, suggest the formulae and names for **four different** ionic compounds.

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Atoms in molecules and metals / reaction equations

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Learn

Molecules contain atoms joined by **covalent** bonds.

Use this Cover & Write grid to **learn** the formulae for these simple molecules:

| name of molecule | formula | formula | formula | formula | Formula |
|------------------|---------|---------|---------|---------|-----------------|
| hydrogen | | | | | H ₂ |
| oxygen | | | | | O ₂ |
| nitrogen | | | | | N ₂ |
| chlorine | | | | | Cl ₂ |
| bromine | | | | | Br ₂ |
| carbon dioxide | | | | | CO ₂ |
| ammonia | | | | | NH ₃ |

- **Metals** contain atoms joined by **metallic** bonds.
- The formula of any metal is its symbol eg sodium is Na, copper is Cu

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Understand

In equations the total number of reactant symbols for each element must equal the total number of product symbols for each element. This is called "balancing the equation".

Burning ethane in oxygen: $C_2H_6 + 3.5 O_2 \rightarrow 2 CO_2 + 3 H_2O$
 Check: there are 2C, 6H and 7O on each side of the arrow

Electrolysing aluminium oxide: $2 Al_2O_3 \rightarrow 4 Al + 3 O_2$
 Check: there are 4Al and 6O on each side of the arrow

- Note that since the formulae of substances cannot change, numbers are put in front of them to make the equation "balance".
- Always check the total number of symbols.

Try

Balance the following reactant and product formulae: **READ THIS**

Burning propane: $C_3H_8 + O_2 \rightarrow CO_2 + H_2O$

check:

Oxidising sodium: $Na + O_2 \rightarrow Na_2O$

check:

Making ammonia: $N_2 + H_2 \rightarrow NH_3$

check:

Making hydrogen: $CH_4 + H_2O \rightarrow CO + H_2$

check:

Write the reactant and product formulae and then balance the equation:

ethene (C₂H₄) and oxygen → carbon dioxide and water

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Aqueous Solutions: ionic solutions / acids

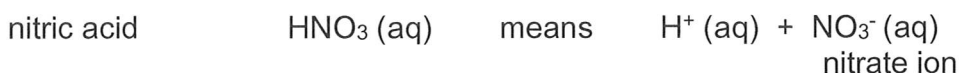
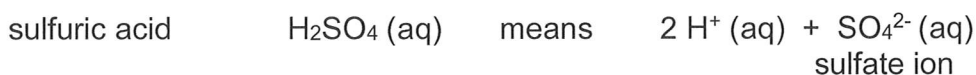
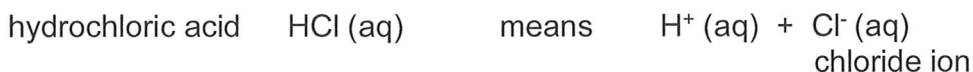
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Learn

If an **ionic** compound dissolves in water its ions are completely separated from each other eg the formula for sodium chloride's aqueous ionic solution is NaCl (aq) which means separate $\text{Na}^+ \text{(aq)}$ and $\text{Cl}^- \text{(aq)}$ ions;



Acids dissolve in water to produce separate $\text{H}^+ \text{(aq)}$ and a dissolved negative ion



Understand

Solutes eg NaCl **dissolve** in **solvents** eg water to form **solutions**.

A substance which dissolves is **soluble**; one that does not is **insoluble**.

- When ionic compounds dissolve in water, the ions form new attractions with the water molecules and so the water molecules keep the ions apart.
- Ionic compounds are **insoluble** in water if their ionic bonding is stronger than the new attractions which would form between the separate ions and H_2O .

Try

Write what each of these formulae for compounds in **aqueous** solution means:

a) $\text{Ca(OH)}_2 \text{(aq)}$ means

b) $\text{NH}_4\text{Cl (aq)}$ means

c) HBr (aq) means

d) $\text{Al(NO}_3)_3 \text{(aq)}$ means

check you have added state symbols

Write the formulae and what it means for aqueous solutions of:

e) ammonium sulfate solution

f) barium nitrate solution

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Suggest

CaCO_3 and BaSO_4 are ionic compounds which are both insoluble in water. Explain their insolubility in terms of the strength of attractions between the particles involved.

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Learn

Use this Cover & test grid to **learn** the formulae for these **acids**:

| name of acid | formula | formula | formula | formula | formula | formula |
|--------------|---------|---------|---------|---------|---------|-------------------------------------|
| hydrochloric | | | | | | HCl (aq) |
| sulfuric | | | | | | H ₂ SO ₄ (aq) |
| nitric | | | | | | HNO ₃ (aq) |

There are three reactions of acids that you must **learn**:

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1. acid + metal → salt + hydrogen eg $2\text{HCl} + \text{Mg} \rightarrow \text{MgCl}_2 + \text{H}_2$

check: 2H, 2Cl and 1Mg on eac side of the arrow

Bases are metal hydroxides (contain OH⁻ ions) or metal oxides (contain O²⁻ ions)

2. acid + base → salt + water eg $\text{HNO}_3 + \text{NaOH} \rightarrow \text{NaNO}_3 + \text{H}_2\text{O}$

check: 2H, 1NO₃, 1Na and 1O on each side of the arrow

eg $2\text{HNO}_3 + \text{Na}_2\text{O} \rightarrow 2\text{NaNO}_3 + \text{H}_2\text{O}$

check: 2H, 2NO₃, 2Na and 1O on each side

3. acid + carbonate → salt + water + carbon dioxide

eg $2\text{HCl} + \text{K}_2\text{CO}_3 \rightarrow 2\text{KCl} + \text{H}_2\text{O} + \text{CO}_2$

check: 2H, 1Cl, 2K, 1C and 3O on each side

Note: in each reaction an H⁺ in the acid is replaced by a metal ion in the salt.

Try

Write balanced equations for the following acid reactions:

hydrochloric acid and aluminium:

sulfuric acid and potassium hydroxide:

sulfuric acid and potassium oxide:

nitric acid and sodium carbonate:

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Suggest

Write a different balanced reaction equation for each one of the three types of acid reaction, **include the name of the salt** produced.

1. acid + metal → salt + hydrogen

2. acid + base → salt + water

3. acid + carbonate → salt + water + carbon dioxide

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Learn

Physical quantities such as mass, volume, temperature and amounts of particles all have units.

| | |
|----------------------------|--|
| mass | grams (g) |
| volume | cubic centimetres (cm³) or cubic decimeters (dm³) 1 dm ³ = 1000 cm ³ so to convert cm ³ to dm ³ → $\times 10^{-3}$ 25cm ³ into dm ³ then $25 \times 10^{-3} = 0.025\text{dm}^3$ 0.5dm ³ into cm ³ then $0.5 \times 10^3 = 500 \text{cm}^3$ |
| temperature | degrees centigrade (°C) or Kelvin (K) To convert: °C → K then +273 |
| number of particles | moles (mol) where 1 mol of any substance is its formula mass in grams eg 18 g of H ₂ O contains 1 mol of water molecules |

Try

Answer the following:

Convert the following volumes to dm³ (value decreases):

- a) 25.3 cm³ b) 217 cm³ c) 2620 cm³

Convert the following volumes to cm³ (value increases):

- a) 1.43 dm³ b) 0.528 dm³ c) 0.018 dm³

Convert the following temperatures:

- a) 15.5 °C to K b) 392 K to °C c) 25 °C to K

Use the **atomic masses** given in the Periodic Table to calculate the mass of 1 mole of the following formulae:

- a) CO₂ b) NaCl
c) Ba(OH)₂ d) SiO₂

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**After
this is
marked**

Teacher feedback:

Actions: