# CHEMISTRY

## Y12 Chemistry Bridging Work 2025-26

The tasks and reading below are designed to support you in your transition from GCSE Chemistry to A-Level Chemistry-

## Task 1 – GCSE Chemistry Background reading

Use the information below to guide your revision around key topics from GCSE to ensure your knowledge and skills are secure for you to be successful as you start at A Level Chemistry.

The AQA GCSE specification and A-Level specifications are a useful starting point to help your consolidation of GCSE and planning for a smooth transition onto your A-Level. The following table details areas to focus your consolidation of GCSE work. In preparation for your baseline test in the first few weeks of term the key areas are- 4.1 Atomic structure, 4.2 Bonding and 4.3 Quantitative Chemistry.

Note: Click the main topic link to go to the free science lessons playlist for that unit….

| **Revision topics AQA GCSE Chemistry** | **Topics not covered in AQA trilogy(combined) but would help transition to A-Level.** |
|---|---|
| **4.1 Atomic structure and the periodic table**<br>Elements and compounds- Elements, compounds and mixtures - BBC Bitesize<br>Structure of the atom – Structure of the atom - BBC Bitesize<br>Electronic structure - Electronic structure - AQA - BBC Bitesize | Properties of transition metals- Physical properties of transition elements AQA - BBC Bitesize |
| **4.2 Bonding, structure, and the properties of matter**<br>Ionic bonding - Ionic bonding - AQA- BBC Bitesize<br>Covalent bonding - Covalent bonds - Small molecules - AQA - BBC Bitesize<br>Giant covalent structures - Substances with many covalent bonds - Giant covalent molecules - AQA - BBC Bitesize<br>Metallic structures- Structure and bonding in metals - Metals and alloys - AQA -BBC Bitesize<br>Polymers- Polymers - AQA - BBC Bitesize | Nanoparticles- Nanoscience - AQA (bbc.co.uk) |
| **4.3 Quantitative chemistry**<br>Calculating Mr, moles and reacting masses- Calculations in chemistry - AQA (bbc.co.uk)<br>- | Percentage yield, Atom economy and gas volumes - Atom economy, percentage yield and gas calculations - AQA (bbc.co.uk)<br>Using concentrations of solutions - Concentration of solutions - AQA - BBC Bitesize |

| | |
|---|---|
| **4.4 Chemical Changes**<br>Redox- Reactions of metals and REDOX - AQA - BBC Bitesize<br>Reactions of acids and acid strength - Acidic and alkaline solutions - AQA - BBC Bitesize<br>Electrolysis- Electrolysis - AQA (bbc.co.uk) | Titrations- Titrations - AQA (bbc.co.uk) |
| **4.5 Energy Changes**<br>Exo and endothermic reactions- Exothermic and endothermic reactions - AQA (bbc.co.uk)<br>Energy profiles- Reaction profiles - AQA - BBC Bitesize | Chemical cells and fuel cells- Chemical cells - AQA (bbc.co.uk) |
| **4.6 Rate and extent of Chemical Change**<br>Calculating rates- Rates of reaction - AQA (bbc.co.uk)<br>Collision theory- Collision theory - BBC Bitesize<br>Reversible reactions- Reversible reactions - AQA (bbc.co.uk) | |
| **4.7 Organic Chemistry**<br>Alkanes- Alkanes - AQA - BBC Bitesize<br>Alkenes- Alkenes - AQA - BBC Bitesize | Reactions of alcohols and alkenes- Alcohols - AQA - BBC Bitesize<br>Polymerisation- Addition polymerisation - AQA - BBC Bitesize<br>Biochemistry- Biological polymers - AQA - BBC Bitesize |
| **4.8 Chemical Analysis**<br>Chromatography- Chromatography - BBC Bitesize | Ion tests- Testing for ions and gases - BBC Bitesize |
| **Essential skills for successful start to A-Level Chemistry-**<br>Working out formulae- Ionic formulae - BBC Bitesize<br>Calculating Mr- Relative formula mass - - BBC Bitesize<br>Balancing equations- Balancing equations - - BBC Bitesize<br>Rearranging equations- Changing the subject of a formula - - BBC Bitesize | |

## Some things to learn –

| **Positive ions** | | **Negative ions** | |
|---|---|---|---|
| Name | Formula | Name | Formula |
| Hydrogen | $H^+$ | Chloride | $Cl^-$ |
| Sodium | $Na^+$ | Bromide | $Br^-$ |
| Silver | $Ag^+$ | Fluoride | $F^-$ |
| Potassium | $K^+$ | Iodide | $I^-$ |
| Lithium | $Li^+$ | Hydroxide | $OH^-$ |
| Ammonium | $NH_4^+$ | Nitrate | $NO_3^-$ |
| Barium | $Ba^{2+}$ | Oxide | $O^{2-}$ |
| Calcium | $Ca^{2+}$ | Sulfide | $S^{2-}$ |
| Copper(II) | $Cu^{2+}$ | Sulfate | $SO_4^{2-}$ |
| Magnesium | $Mg^{2+}$ | Carbonate | $CO_3^{2-}$ |
| Zinc | $Zn^{2+}$ | | |
| Lead | $Pb^{2+}$ | | |
| Iron(II) | $Fe^{2+}$ | | |
| Iron(III) | $Fe^{3+}$ | | |
| Aluminium | $Al^{3+}$ | | |

**Extensionandfurtherinterest…..**
ThefollowingsitesaregreatforA-LevelChemistryreference:Chemguide,Physicsand maths tutor,s-coolandsavemyexams.

Thesearejustsomereallygreatchemistrysites:CompoundChemistry,CrashCourse Chemistry,Chem Talk,Chemix, and Chem Elementsperiodic table.

**Extension and further interest**
The following sites are great for A-Level Chemistry reference: Chemguide, Physics and maths tutor, s-cool and savemyexams.

These are just some great chemistry sites: Compound Chemistry, Crash Course Chemistry, Chem Talk, Chemix, and Chem Elements periodic table.

## Task 2 – Folder preparation

Being well organised is vital for success at A-Level. So you are ready for September please get yourself two folders. One a smaller ring binder, this will be your day-to-day folder that you must bring to each and every lesson, and a larger A4 lever arch file, this will be for the long term storage of your notes.

**Day to Day folder-**
Should contain the following-

- Your student record sheet – this should be filled out as you go through the year
- Assessments - stepping stones and milestone assessments for the current academic year
- Your **current** work books and associated notes – with a divider between the two sections for your two teachers.

**Y12 'Storage' Folder Organisation**
Please order your folder in the following way with dividers between each section:

**Physical chemistry(**blue covers**)** study and question booklets in the following order:

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 $K_c$
3.1.7 Oxidation, reduction and redox equations
3.1.10 Equilibrium constant $K_p$ for homogeneous systems (A-level only)

**Inorganic chemistry**(grey covers)study and question booklets in the following order

3.2.1 Periodicity
3.2.2 Group 2, the alkaline earth metals
3.2.3 Group 7(17), the halogens

**Organic chemistry**(green covers) study and question booklets in the following order

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)

**Task 3 – Written Work**

Please complete the tasks and bring them into your chemistry lessons in the first week of the coursework. The sections at the end of the work are designed to help fill gaps in knowledge for students who studied a combined science course e.g. AQA Trilogy and did not do a separate science Chemistry qualification.

# MOLECULAR SUBSTANCES

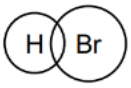
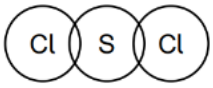
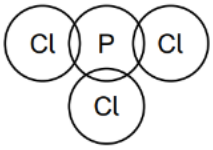
1) Fill in the spaces in the passage with suitable words.

Simple molecular substances are substances made of …… . A molecule is a particle made from atoms joined together by …… bonds. A covalent bond is …… shared electrons between two atoms. Simple molecular substances have …… melting and boiling points. This is because there are weak forces between the …… . They do not conduct electricity because molecules are not electrically charged, they are …… .

2) Give the letters of the substances in the table which have a simple molecular structure. ……..

| Substance | Melting point (°C) | Boiling point (°C) | Electrical conductivity as | |
|---|---|---|---|---|
| | | | solid | liquid |
| A | 125 | 192 | does not conduct | does not conduct |
| B | 212 | 352 | does not conduct | does not conduct |
| C | -39 | 357 | conducts | conducts |
| D | 732 | 1037 | does not conduct | conducts |
| E | 1984 | 2510 | does not conduct | does not conduct |
| F | -196 | -152 | does not conduct | does not conduct |

3) Some stick diagrams are shown below. Complete the dot-cross diagram for each molecule.

| Substance | hydrogen bromide HBr | sulfur dichloride $SCl_2$ | phosphorus chloride $PCl_3$ |
|---|---|---|---|
| Stick diagram | H—Br | Cl—S—Cl | Cl—P(—Cl)—Cl |
| Dot-cross diagram |   |   |   |

4) Complete the stick diagram and draw a dot-cross diagram for each molecule shown below.

| Substance | bromine $Br_2$ | hydrazine $N_2H_4$ | oxygen fluoride $OF_2$ |
|---|---|---|---|
| Stick diagram | Br Br | H N N H<br>H H | F O F |
| Dot-cross diagram | | | |

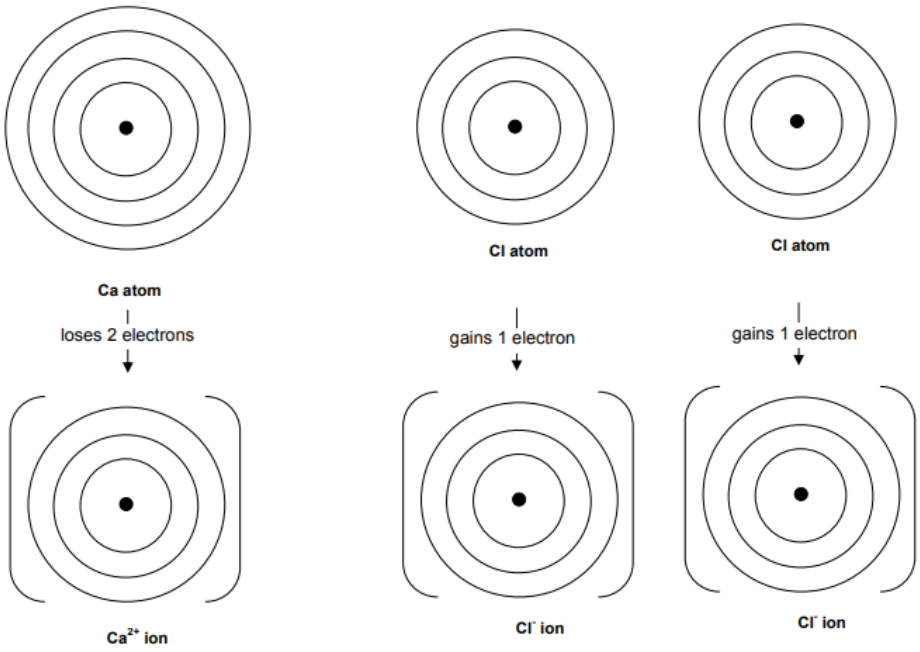
# DRAWING MOLECULES 2

| Stick diagram | Molecule | Dot-cross diagram |
|---|---|---|
| | $H_2$ | |
| | HBr | |
| | $I_2$ | |
| | $H_2S$ | |
| | $NF_3$ | |
| | $N_2H_4$ | |

# IONIC COMPOUNDS 1

1) Calcium atoms reacts with chlorine atoms to form the ionic compound calcium chloride. Calcium atoms each lose two electrons to form calcium ions. Chlorine atoms each gain one electron to form chloride ions. This means that calcium atoms react with chlorine atoms in the ratio of one calcium atom for every two chlorine atoms.

Complete the following diagram to show the electronic structure of the calcium and chlorine atoms and the calcium and chloride ions.




2) Complete this passage:

The elements in Group 1 of the Periodic Table are called the ..... . They are all metals. When any Group 1 element reacts with a non-metal, an ionic compound is formed in which the metal ion has a ..... charge (e.g. $Li^+$, $Na^+$, $K^+$, $Rb^+$, $Cs^+$) as the metal atom ..... one electron.

The elements in Group 7 of the Periodic Table are called the ..... . They are all non-metals. When any Group 7 element reacts with a metal, an ionic compound is formed in which the ion has a ..... charge (e.g. $F^-$, $Cl^-$, $Br^-$, $I^-$, called halide ions) as the non-metal ..... one electron.

3) When metals react with non-metals:

a) What happens to the metal atoms? .....

b) What happens to the non-metal atoms? .....

c) What type of substance is made? .....

4) Potassium reacts with fluorine to form potassium fluoride.

a) Potassium is in Group 1 of the Periodic Table. Name this group. ……

b) Fluorine is in Group 7 of the Periodic Table. Name this group. ……

c) Give the formula of the potassium ions in potassium fluoride. ……

d) Give the formula of the fluoride ions in potassium fluoride. ……

e) Draw the electronic structure of the potassium and fluoride ions formed in the space below.

f) Explain why potassium fluoride has a high melting point. ……

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g) Explain why potassium fluoride conducts electricity when dissolved or molten but not as a solid. ……

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……

# IONIC FORMULAE 1

**1**

a) sodium iodide .....
b) potassium oxide .....
c) aluminium chloride .....
d) magnesium bromide .....
e) aluminium oxide .....
f) iron(II) oxide .....
g) iron(III) oxide .....
h) magnesium sulfide .....
i) copper(II) fluoride .....
j) lithium iodide .....
k) barium bromide .....
l) zinc(II) sulfide .....
m) lead(II) iodide .....
n) iron(III) sulfide .....
o) magnesium oxide .....
p) rubidium bromide .....
q) strontium chloride .....
r) caesium selenide .....
s) calcium astatide .....
t) radium polonide .....
u) gallium fluoride .....
v) scandium(III) bromide .....
w) chromium(III) oxide .....
x) strontium iodide .....
y) lithium arsenide .....

**2**

a) sodium sulfate .....
b) calcium sulfate .....
c) magnesium hydroxide .....
d) zinc(II) nitrate .....
e) copper(II) carbonate .....
f) sodium hydroxide .....
g) potassium carbonate .....
h) iron(III) hydroxide .....
i) ammonium nitrate .....
j) ammonium hydroxide .....
k) iron(III) sulfate .....
l) aluminium nitrate .....
m) silver(I) nitrate .....
n) calcium carbonate .....
o) magnesium nitrate .....
p) ammonium astatide .....
q) caesium nitrate .....
r) strontium hydroxide .....
s) platinum(II) nitrate .....
t) cobalt(II) carbonate .....
u) copper(I) oxide .....
v) copper(II) oxide .....
w) francium telluride .....
x) gold(I) fluoride .....
y) rubidium sulfate .....

# REACTIONS OF ACIDS 1

metal + acid → .....

metal oxide + acid → .....

metal hydroxide + acid → .....

metal carbonate + acid → .....

ammonia + acid → .....

**PART A** Complete the table to show the name of the salt formed when the following acids react with the bases.

| | nitric acid, $HNO_3$ | hydrochloric acid, HCl | sulfuric acid, $H_2SO_4$ |
|---|---|---|---|
| sodium carbonate, $Na_2CO_3$ | | | |
| magnesium, Mg | | | |
| potassium oxide, $K_2O$ | | | |
| copper hydroxide, $Cu(OH)_2$ | | | |
| ammonia, $NH_3$ | | | |

**PART B** Now complete the following word equations for reactions between some acids and some bases.

1) iron + hydrochloric acid → .....

2) hydrochloric acid + copper carbonate → .....

3) iron(II) hydroxide + sulfuric acid → .....

4) nitric acid + calcium oxide → .....

5) sulfuric acid + ammonia → .....

6) ..... → zinc sulfate + water + carbon dioxide

7) ..... → magnesium nitrate + hydrogen

8) ..... → ammonium nitrate

9) ..... + potassium oxide → potassium chloride + .....

10) calcium hydroxide + ..... → calcium citrate + .....

**PART C** On the back of the sheet, write a balanced equation for reactions 2-9.

# BALANCING EQUATIONS 1

- An equation is balanced when there are the same number of atoms of each type on both sides of the equation.
- An equation can only be balanced by putting numbers in front of formulas – you cannot change the formula itself.
- Equations can be written with state symbols: (s) = solid, (l) = liquid, (g) = gas, (aq) = aqueous (dissolved in water).

**How to balance an equation:**

a) Calculate how many atoms of each type are on each side of the equation.
b) If the numbers are the same then the equation is balanced.
c) If the numbers are not the same, then numbers are put in front of the formulas (this adds more of that substance). You cannot change the formulas (this would make a different substance). Hint – start with unbalanced elements that only appear in one substance on each side of the equation.
d) Keep doing this until the equation is balanced.

e.g. $CH_4 + O_2 \rightarrow CO_2 + H_2O$

**Questions**

Put your final answers here although you may wish to do your working on a separate sheet of paper or on the back.

1) $Ca + O_2 \rightarrow CaO$

2) $Na_2O + H_2O \rightarrow NaOH$

3) $Al + O_2 \rightarrow Al_2O_3$

4) $Na + Cl_2 \rightarrow NaCl$

5) $Na_2CO_3 \rightarrow Na_2O + CO_2$

6) $K + O_2 \rightarrow K_2O$

7) $C_4H_8 + O_2 \rightarrow CO_2 + H_2O$

8) $Fe_2O_3 + HCl \rightarrow FeCl_3 + H_2O$

9) $F_2 + KBr \rightarrow KF + Br_2$

10) $C_5H_{12} + O_2 \rightarrow CO_2 + H_2O$

11) $NH_3 + O_2 \rightarrow NO + H_2O$

12) $HNO_3 \rightarrow NO_2 + H_2O + O_2$

# RELATIVE FORMULA MASS

Calculate the relative formula mass of the following substances.

**1** $F_2$ .....

**2** Fe .....

**3** $H_2SO_4$ .....

**4** $Al_2O_3$ .....

**5** $Mg(OH)_2$ .....

**6** $Al(NO_3)_3$ .....

**7** $(NH_4)_2SO_4$ .....

**8** $CuCO_3$ .....

**9** $AgNO_3$ .....

**10** $NH_4NO_3$ .....

**11** $CuSO_4.5H_2O$ .....

**12** magnesium .....

**13** oxygen .....

**14** sodium bromide .....

**15** calcium fluoride .....

**16** potassium sulfate .....

**17** chlorine .....

**18** chromium(III) oxide .....

**19** sodium .....

**20** iron(III) sulfate .....

# MOLES

1) Calculate the number of moles of each of the following substances. Give your answers to 3 sig figs.

a) 90.0 g of $H_2O$ .....

.....

b) 20.0 g of $C_4H_{10}$ .....

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c) 685 g of $NH_3$ .....

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d) 102 tons of $O_2$ .....

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e) 2.00 kg of $Al_2O_3$ .....

.....

f) 20.6 mg of Au .....

.....

2) Calculate the mass of each of the following substances. Give your answers to 3 sig figs.

a) 4.00 moles of $N_2$ .....

.....

b) 0.100 moles of $HNO_3$ .....

.....

c) 0.0200 moles of $K_2O$ .....

.....

d) 2.50 moles of $PH_3$ .....

.....

e) 0.400 moles of $C_2H_5OH$ .....

.....

f) 10.0 moles of $Ca(OH)_2$ .....

.....

3) 0.0200 moles of a compound is found to have a mass of 1.64 g. Find the formula mass of the compound. Give your answers to 3 sig figs. .....

.....

# REACTING MASS CALCULATIONS - INTRODUCTION

**Step 1** Write ✓ for the substance whose mass is given and ? for the substance whose mass is to calculated on the balanced equation

**Step 2** Find the moles of the ✓ substance ( using $\boldsymbol{moles} = \frac{\boldsymbol{mass}}{\boldsymbol{M_r}}$ )

**Step 3** Use the balanced equation and your answer from step 2 to find the moles of the ? substance

**Step 4** Find the mass of the ? substance ( using $\boldsymbol{mass} = \boldsymbol{M_r\ x\ moles}$ )

1) What mass of oxygen reacts with 12 g of magnesium? $2Mg + O_2 \rightarrow 2MgO$

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2) What mass of calcium hydroxide is made from 14 kg of calcium oxide? $CaO + H_2O \rightarrow Ca(OH)_2$

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3) What mass of aluminium is needed to react with 640 g of iron oxide? $Fe_2O_3 + 2Al \rightarrow 2Fe + Al_2O_3$

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4) What mass of titanium chloride reacts with 460 g of sodium? $TiCl_4 + 4Na \rightarrow Ti + 4NaCl$

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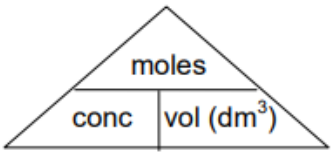
**Key Topics for students who have not studied separate sciences-**

# CONCENTRATION OF SOLUTIONS

The concentration of a solution is usually measured in moles per cubic decimetre ($mol/dm^3$). This is a measure of the number of moles in one cubic decimetre.

The volume must be in $dm^3$ (there are 1000 $cm^3$ in 1 $dm^3$). vol in $dm^3$ = $\frac{\text{vol in } cm^3}{1000}$

**concentration ($mol/dm^3$) = $\frac{\text{moles}}{\text{volume } (dm^3)}$**




1) Calculate the concentration of the following solutions in $mol/dm^3$.

a) 0.10 moles of NaCl in 200 $cm^3$ .....

.....

b) 0.20 moles of $H_2SO_4$ in 100 $cm^3$ .....

.....

c) 0.020 moles of NaOH in 25 $cm^3$ .....

.....

2) Calculate the number of moles in the following solutions.

a) 100 $cm^3$ of 0.20 $mol/dm^3$ $HNO_3$ .....

.....

b) 25 $cm^3$ of 1.50 $mol/dm^3$ KOH .....

.....

c) 50 $cm^3$ of 0.10 $mol/dm^3$ $H_2SO_4$ .....

.....

Concentration can also be measured in grams per cubic decimetre (g/dm$^3$). This is a measure of the number of grams in one cubic decimetre. [remember that *mass* = $M_r$ *x moles*]

**1 dm$^3$**

**2 moles of $H_2SO_4$**
**196 g of $H_2SO_4$**

Concentration = 2 mol/dm$^3$

$M_r$ of $H_2SO_4$ = 98

Concentration = 2 x 98 =196 g/dm$^3$

A simple conversion is: **conc (g/dm$^3$) = conc (mol/dm$^3$) x $M_r$**

3) Calculate the concentration of the following solutions in g/dm$^3$.

a) 0.100 mol/dm$^3$ NaOH .....

.....

b) 0.250 mol/dm$^3$ $CH_3COOH$ .....

.....

c) 1.50 mol/dm$^3$ $HNO_3$ .....

.....

4) 0.20 moles of NaOH is dissolved in 250 cm$^3$ of water.

a) Calculate the concentration in mol/dm$^3$. .....

b) Calculate the concentration in g/dm$^3$. .....

.....

5) 5.0 g of $KNO_3$ is dissolved in 100 cm$^3$ of water.

a) Calculate the concentration in g/dm$^3$. .....

b) Calculate the concentration in mol/dm$^3$. .....

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# TITRATIONS 1

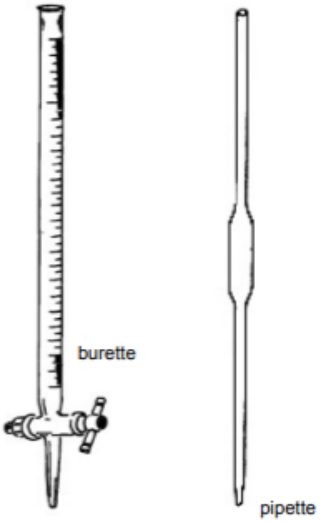
## Carrying out a titration

Titrations are a very accurate way of measuring the concentration of acids and alkalis.

In a titration, we measure the volume of an acid (or alkali), measured in a burette, needed to exactly neutralise an alkali (or acid) which has been carefully measured into a conical flask with a pipette.

We use an indicator to judge the exact volume required to do this.

1) Place some alkali (or acid) into a conical flask using a pipette.
2) Place the acid (or alkali) into a burette.
3) Add a suitable indicator (e.g. phenol red which works for most titrations)
4) Add the acid (or alkali) from the burette to the conical flask until the colour changes. Do this drop by drop near the end point.
5) Note the final reading.
6) Repeat.



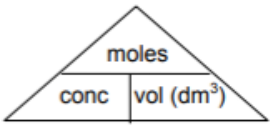

## Titration calculations

a) Use the volume and concentration of one reactant to calculate the moles.

b) Use the chemical equation to find the moles of the other reactant.

c) Calculate the volume or concentration as required of that reactant.

$$\text{concentration (mol/dm}^3\text{)} = \frac{\text{moles}}{\text{volume (dm}^3\text{)}}$$




e.g. 25.0 $cm^3$ of sulfuric acid reacts with 30.0 $cm^3$ of 0.150 $mol/dm^3$ sodium hydroxide. Find the concentration of the acid in both $mol/dm^3$ and $g/dm^3$.

$$2\,NaOH(aq) + H_2SO_4(aq) \rightarrow Na_2SO_4(aq) + 2\,H_2O(l)$$

**moles NaOH = conc x vol ($dm^3$) = 0.150 x $\frac{30.0}{1000}$ = 0.00450 mol**

**moles $H_2SO_4$ = $\frac{1}{2}$ x moles of NaOH = $\frac{1}{2}$ x 0.00450 = 0.00225 mol**

**conc $H_2SO_4$ = $\frac{\text{moles}}{\text{volume (dm}^3\text{)}}$ = $\frac{0.00225}{\frac{25.0}{1000}}$ = 0.0900 $mol/dm^3$**

**conc $H_2SO_4$ = 98 x 0.0900 = 8.82 $g/dm^3$**

**1** 25.0 $cm^3$ of 0.200 $mol/dm^3$ barium hydroxide solution reacted with 22.8 $cm^3$ of hydrochloric acid. Calculate the concentration of the hydrochloric acid in $mol/dm^3$. Give your answer to 3 significant figures.

$$Ba(OH)_2(aq) + 2\,HCl(aq) \rightarrow BaCl_2(aq) + 2\,H_2O(l)$$

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**2** 22.5 $cm^3$ of sodium hydroxide solution reacted with 25.0 $cm^3$ of 0.100 $mol/dm^3$ hydrochloric acid.

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

a) Calculate the concentration of the sodium hydroxide solution in $mol/dm^3$. Give your answer to 3 significant figures.

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.....

b) Calculate the concentration of the sodium hydroxide solution in $g/dm^3$. Give your answer to 3 significant figures.

.....

.....

**3** What volume of 0.150 $mol/dm^3$ rubidium hydroxide reacts with 25.0 $cm^3$ of 0.240 $mol/dm^3$ nitric acid? Give your answer to 3 significant figures.

$$RbOH(aq) + HNO_3(aq) \rightarrow RbNO_3(aq) + H_2O(l)$$

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**4** 25.0 $cm^3$ of 0.200 $mol/dm^3$ sodium hydroxide solution reacted with 28.7 $cm^3$ sulfuric acid. Calculate the concentration of the sulfuric acid in $mol/dm^3$. Give your answer to 3 significant figures.

$$2\ NaOH(aq) + H_2SO_4(aq) \rightarrow Na_2SO_4(aq) + 2\ H_2O(l)$$

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**5** 25.0 $cm^3$ of 0.150 $mol/dm^3$ sodium hydroxide reacted with 30.3 $cm^3$ of a solution of ethanoic acid.

$$CH_3COOH(aq) + NaOH(aq) \rightarrow CH_3COONa\ (aq) + H_2O(l)$$

a) Calculate the concentration of the ethanoic acid in $mol/dm^3$. Give your answer to 3 significant figures.

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b) Calculate the concentration of the ethanoic acid in $g/dm^3$. Give your answer to 3 significant figures.

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# EQUILIBRIA 1

**1** A mixture of chemicals **A**, **B** and **C** are present in a closed system at dynamic equilibrium. **A + B ⇌ C**

**a** Describe what is happening when the mixture is at dynamic equilibrium.

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**b** What is a closed system? .....

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**c** Under certain conditions, the position of this equilibrium lies to the right. Explain what this means.

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**2** Complete the table to show what would happen to the position of the following gaseous equilibria if the following changes were made. Tick (✓) the correct column in each case.

| Equilibrium | Energy change (forward reaction) | Increase temperature | | | Increase pressure | | |
|---|---|---|---|---|---|---|---|
| | | moves left | no move | move right | moves left | no move | move right |
| $A(g) + 2\,B(g) \rightleftharpoons X(g) + Z(g)$ | exothermic | | | | | | |
| $P(g) + Q(g) \rightleftharpoons 2\,X(g)$ | endothermic | | | | | | |
| $A_2(g) \rightleftharpoons X(g) + Z(g)$ | exothermic | | | | | | |
| $2\,P(g) \rightleftharpoons 2\,C(g) + D(g)$ | endothermic | | | | | | |

**3** Methanol ($CH_3OH$) can be made by reaction of hydrogen with carbon dioxide in a dynamic equilibrium.

$$CO_2(g) + 3H_2(g) \rightleftharpoons CH_3OH(g) + H_2O(g)$$

**a** If the steam is removed from the equilibrium mixture, what happens to the equilibrium yield of methanol?

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**b** Explain your reasoning. .....

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