

Khalsa 6th@
ATAM



A Level Chemistry Transition work



This transition work book are designed to give you an introduction and prepare you for advanced study in your chosen subjects. The tasks are to be completed independently over the summer and handed into your subject teachers in your first lesson. You should aim to spend a **minimum** of four hours on this transition booklet.

1. Atomic structure, isotopes and relative mass

- a) Read through the specification on this topic.
- b) Watch and make notes: <https://www.youtube.com/watch?v=gqoDeTOP6JQ>
- c) Define: isotope, mass number, ion, relative atomic mass, relative isotopic mass.
- d) Complete the questions related to this topic.

2. Compounds, formulae and equations (the absolute fundamentals of chemistry!!)

- a) Read through the specification on this topic.
- b) Complete the worksheet on charges of ions and balancing equations.
- c) Watch and make notes: <https://www.youtube.com/watch?v=Djt3ktFeBys> or <https://www.youtube.com/watch?v=crk43-yJlww>
- d) Complete the questions related to this topic.

3. Amount of substance, gas volumes and titrations

- a) Read through the specification on this topic.
- b) Watch and make notes: <https://www.youtube.com/watch?v=dO0kjefmunk> and <https://www.youtube.com/watch?v=9NG6DUBC8sM> and <https://www.youtube.com/watch?v=x4QxYDyHst0> and <https://www.youtube.com/watch?v=ovx-Sro4NXM>
- c) Complete the questions related to this topic.

4. Redox and acids

- a) Watch and make notes: <https://www.youtube.com/watch?v=9v5Y3h8Jm0I>
- b) Complete the questions related to this topic.

5. Bonding, energy changes and rates

- a) Read through the specification on these topic.
- b) Go through the C2, C5 and C6 unit respectively from GCSE Chemistry.
- c) Complete the questions related to this topic.
- d) For further work on these areas, use youtube videos to see what new content is covered.

Atomic Structure

1 This question is about the structure of atoms.

a Name the three particles that are found inside atoms.

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b Which of these particles are found inside the nucleus of the atom.

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c Which of these particles is neutral?

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d Which of these particles has a negative electric charge?

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e Which of these particles has a positive electric charge?

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2 This questions is about Al atoms.

a How many protons, neutrons and electrons are in this atom?

protons = neutrons = electrons =

b What is it that makes this an atom of aluminium?

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3 Geiger and Marsden carried out an experiment where they fired alpha particles at a thin piece of gold. A small number of alpha particles were deflected or bounced back. This experiment led to Rutherford developing a new model of the atom.

a Why do most of the alpha particles pass straight through the gold atoms?

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b Why do some of the alpha particles deflect or bounce back?

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c Give two key differences between Rutherford's model of the atom and the Thomson's plum pudding model that it replaced.

1.....

2.....

4 a Define the term atomic number.

.....

b Define the term mass number.

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Formulae and Equations

1 Give the formula of the following substances.

- a** potassium carbonate (1)
- b** magnesium hydroxide (1)
- c** oxygen (1)
- d** aluminium bromide (1)
- e** sodium (1)
- f** argon (1)
- g** iron(III) sulfate (1)
- h** phosphorus (1)
- i** copper(I) oxide (1)
- j** hydrogen sulfide (1)

2 In what molar ratio do the following substances react?

- a** hydrochloric acid with barium hydroxide (1)
- b** sulfuric acid with ammonia (1)
- c** nitric acid with sodium hydrogencarbonate (1)

3 Write an ionic equation, including state symbols, for each of the following reactions.

- a** reaction of aqueous potassium carbonate with nitric acid
..... (2)
- b** precipitation of lead(II) bromide when aqueous lead(II) nitrate is mixed with aqueous sodium bromide
..... (2)
- c** reaction of aqueous ammonia with sulfuric acid
..... (2)
- d** reaction of hydrochloric acid with aqueous potassium hydroxide

Atoms and Ions

- 1) Complete the following table about some atoms and ions. The first row has been done for you.

Particle	Atom or ion	Atomic number	Mass number	Number of protons	Number of neutrons	Number of electrons	Electron structure
Na	ion	11	23	11	12	10	2,8
P							
		13	27			10	
	atom	2	4				
				12	12		2,8

- 2) a) Complete the table to show the electron structure of the following ions.

Ion	F^-	Na^+	Al^{3+}	K^+	S^{2-}	H^+
Electron structure						

Ion	O^{2-}	Ca^{2+}	Li^+	Mg^{2+}	Cl^-	Be^{2+}
Electron structure						

- b) i) Complete the table below to show the electronic structure of some Group 0 elements (noble gases).

- ii) Place the ions from part (a) into the correct row of the table.

Element	Electron structure	Ions from part (a) with the same electronic structure
He		
Ne		
Ar		

c) What is the link between the electronic structure of ions and Group 0 elements (noble gases)?

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d) i) Complete the table with the ions from part 2a (except H⁺). Ions for Group 1 have been done for you.

Group	1	2	3	4	5	6	7	0
Ions	Li ⁺ Na ⁺ K ⁺							
Charge	+1							

ii) Predict the charge that the following ions would have using the Periodic Table and your table.

strontium ions iodide ions rubidium ions

Moles

1 What is the mass of one mole of CO₂?

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2 How many moles are there in 99 g of H₂O?

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3 What is the mass of 0.250 moles of N₂?

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4 How many moles are there in 1.2 kg of Mg?

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5 Calculate the relative formula mass (M_r) of each of the following substances.

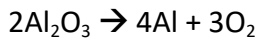
- a Mg(NO₃)₂.....
- b oxygen.....
- c potassium sulfate

6 Calculate the mass in grams of one atom of ³¹P. Give your answer in standard form to 3 significant figures. (the Avogadro constant = 6.022 x 10²³ mol⁻¹)

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Reacting Masses

- 1) Calculate the mass of aluminium that can be formed from 1020 g of aluminium oxide.



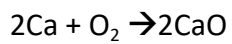
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- 2) Calculate the mass of oxygen needed to react 10.0 g of calcium to form calcium oxide.



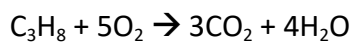
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- 3) What mass of propane could burn in 48.0 g of oxygen?



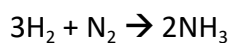
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- 4) What mass of ammonia can be made from 20.0 g of hydrogen?



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Gas Volumes

- 1 Find the volume of the following gases (measured at room temperature and pressure).
- a 4.00 moles of oxygen (O₂)
- b 0.250 moles of methane (CH₄)
- c 15.0 g of argon (Ar)
- d 0.220 g of carbon dioxide (CO₂).....
- 2 Find the number of moles of the following gases (measured at room temperature and pressure).
- a 48.0 dm³ of carbon monoxide (CO)
- b 1.20 dm³ of hydrogen (H₂)
- c 360 cm³ of oxygen (O₂).....
- 3 Find the mass of the following gases (measured at room temperature and pressure).
- a 7.20 dm³ of ammonia (NH₃)
- b 480 cm³ of nitrogen (N₂)
- c 100 cm³ of oxygen (O₂)
- 4 Find the volume of hydrogen gas (measured at room temperature and pressure) formed when 0.540 g of calcium reacts with hydrochloric acid.



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- 5 Find the volume of carbon dioxide gas (measured at room temperature and pressure) formed when 1.50 g of calcium carbonate reacts with hydrochloric acid.



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- 6 Find the volume of carbon dioxide gas (measured at room temperature and pressure) formed when 6.00 kg of ethane (C₂H₆) burns in oxygen.



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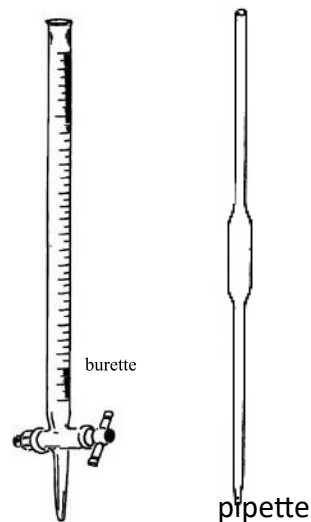
Titration

Titration is a very accurate way of measuring the concentration of acids and alkalis.

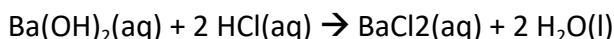
In a titration, we measure the volume of an acid (or alkali), measured in a burette, needed to exactly neutralise an alkali (or acid) which has been carefully measured into a conical flask with a pipette.

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.



- 1 25.0 cm³ of 0.200 mol/dm³ barium hydroxide solution reacted with 22.8 cm³ of hydrochloric acid. Calculate the concentration of the hydrochloric acid in mol/dm³. Give your answer to 3 significant figures.



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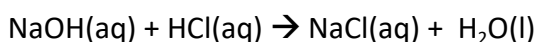
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- 2 22.5 cm³ of sodium hydroxide solution reacted with 25.0 cm³ of 0.100 mol/dm³ hydrochloric acid.



- a) Calculate the concentration of the sodium hydroxide solution in mol/dm³. Give your answer to 3 significant figures.

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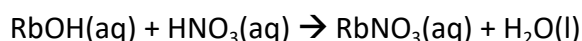
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b) Calculate the concentration of the sodium hydroxide solution in g/dm³. Give your answer to 3 significant figures.

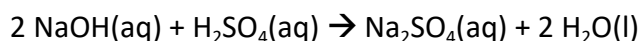
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3 What volume of 0.150 mol/dm³ rubidium hydroxide reacts with 25.0 cm³ of 0.240 mol/dm³ nitric acid? Give your answer to 3 significant figures.



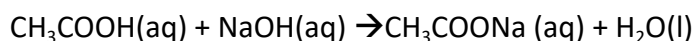
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4 25.0 cm³ of 0.200 mol/dm³ sodium hydroxide solution reacted with 28.7 cm³ sulfuric acid. Calculate the concentration of the sulfuric acid in mol/dm³. Give your answer to 3 significant figures.



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5 25.0 cm³ of 0.150 mol/dm³ sodium hydroxide reacted with 30.3 cm³ of a solution of ethanoic acid.



c) Calculate the concentration of the ethanoic acid in mol/dm³. Give your answer to 3 significant figures.

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d) Calculate the concentration of the ethanoic acid in g/dm³. Give your answer to 3 significant figures.

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Bonding

- 1) Which of the following substances could be simple molecular, giant covalent, ionic or are do they have another type of structure?

	C	C ₆₀	SiO ₂	N ₂ H ₄	KNO ₃	S ₈	He	Mg	Fe ₂ S ₃
ionic									
simple molecular									
giant covalent									
neither									

- 2) Look at the properties of the following substances.

Substance	Melting point (°C)	Boiling point (°C)	Electrical conductivity as	
			solid	liquid
M	673	926	does not conduct	conducts
N	3520	4658	does not conduct	does not conduct
O	-87	25	does not conduct	does not conduct
P	98	345	conducts	conducts
Q	1537	2318	does not conduct	conducts
R	835	1280	conducts	conducts

- a) Which of these compounds could have an ionic structure?

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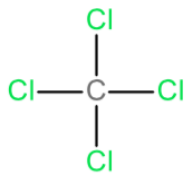
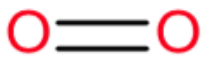
- b) Which of these compounds could have a simple molecular structure?

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- c) Which of these compounds could have a giant covalent structure?

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3) Complete the table to show stick and/or dot-cross diagrams for these molecules.

Molecule	Stick diagram	Dot-cross diagram
CCl ₄		
O ₂		
NF ₃		

4) Write the formula of the following **ionic** compounds.

- | | |
|-----------------------------|-------------------------------|
| a) potassium oxide | d) iron (III) hydroxide |
| b) aluminium chloride | e) magnesium nitrate |
| c) sodium carbonate | f) ammonium iodide |

5) Diamond and graphite both have giant covalent structures. Explain each of the following.

a) Diamond and graphite both have very high melting points.

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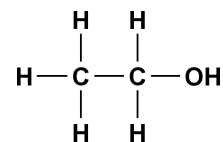
b) Graphite conducts electricity but diamond does not.

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c) Graphite is soft but diamond is hard.

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6) Ethanol (alcohol) is made of molecules with the formula C_2H_5OH . A diagram of an ethanol molecule is shown.



Explain why ethanol has a low boiling point.

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7) Magnesium sulfate is an ionic compound with the formula $MgSO_4$.

a) Explain why magnesium sulfate has a high melting point.

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b) Explain why magnesium sulfate conducts electricity as a liquid but not as solid.

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Acids, Bases and Salts

1 Complete the table with ticks to show whether each of the following is an acid, base, salt and/or alkali.

formula	name	acid	base	alkali	salt
CaO					
K_2SO_4					

KOH					
HNO ₃					
NH ₃					
AlCl ₃					

2 A sample of hydrochloric acid with pH 2.3 has a concentration of H⁺ ions of 0.0050 mol/dm³. Water was added to dilute the acid which reduced the concentration of H⁺ ions to 0.00050 mol/dm³. What is the pH of the diluted acid?

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3 Ethanoic acid is a weak acid. Explain the terms *acid* and *weak*.

Acid =

.....

Weak =

.....

4 a Complete the word equation for each of the following reactions.

i sodium hydroxide + sulfuric acid →

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ii copper carbonate + hydrochloric acid →

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iii ammonia + nitric acid →

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iv zinc + sulfuric acid →

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b Write an ionic equation for reaction (i)

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c Which of the reactions in (a) are redox reactions?

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d Which of the reactions in (a) are acid-base reactions?

.....

e Write balanced equations for the reactions in (a)

i

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ii

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iii

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iv

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Energy Changes

1 Tick to show if the following are exothermic or endothermic reactions.

	exothermic	endothermic
energy change is positive		
products have more chemical energy than reactants		
$\text{CuCO}_3 \rightarrow \text{CuO} + \text{CO}_2$		
$\text{H}_2\text{SO}_4 + 2\text{NaOH} \rightarrow \text{Na}_2\text{SO}_4 + 2\text{H}_2\text{O}$		
$\text{CH}_4 + 2\text{O}_2 \rightarrow \text{CO}_2 + 2\text{H}_2\text{O}$		
$\text{HNO}_3 + \text{NaHCO}_3 \rightarrow \text{NaNO}_3 + \text{H}_2\text{O} + \text{CO}_2$		

2 a Sketch an energy level diagram for this exothermic reaction: $\text{CuSO}_4 + \text{Zn} \rightarrow \text{ZnSO}_4 + \text{Cu}$

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Energy

b Draw a labelled arrow on your energy diagram to show the overall energy change.

c Draw a labelled arrow on your energy diagram to show the activation change.

d Write an ionic equation for this reaction.....

e Write two half equations for this reaction.

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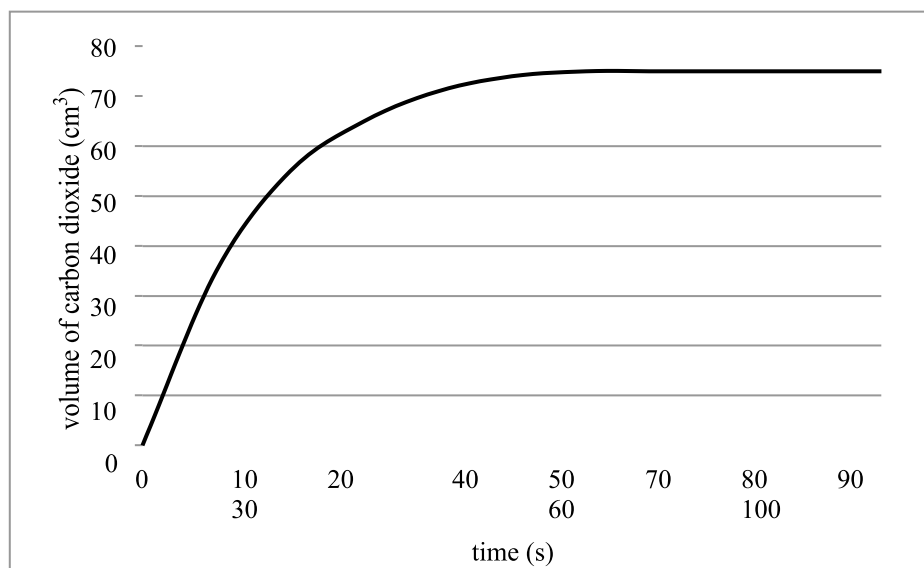
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Rates

A student carried out an experiment where she recorded the volume of carbon dioxide gas formed as calcium carbonate reacts with hydrochloric acid.



The graph shows how the volume of carbon dioxide varied with time.



- 1 Calculate the mean rate of reaction in the first 20 seconds in cm^3/s

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- 2 Draw a tangent to the graph to find the rate at 0 seconds in cm^3/s

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- 3 Draw a tangent to the graph to find the rate at 20 seconds in cm^3/s

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- 4 Explain why the rate is fastest at the beginning and then slows down and stops.

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