SEMINAR KIMIA 2014

ADURA AZLIN BIN ISHAK

CHEMISTRY SPM 4541

Paper 1

50 Objective Questions **50 Marks**

Paper 2

Part A (60 Marks) 6 Structure questions

Part B (20 Marks) 2 Essay questions
Answer only 1 question

Part C (20 Marks) 2 Essay questions
Answer only 1 question

100 marks

Paper 3

Part A (33 Marks) 1 or 2 Structure questions
Part B (17 Marks) 1 Essay question

50 Marks

TOTAL = 200 Marks

ANALYSIS SPM 2006-2013 PAPER 1

PAPER 1

	CHAPTER	YEAR							
		2006	2007	2008	2009	2010	2011	2012	2013
		Number of Questions							
Form 4									
1	Introduction to Chemistry	–	–	–	–	–	–	1	–
2	The Structure of the Atom	4	5	6	5	2	4	5	2
3	Chemical Formulae and Equations	6	6	5	9	7	7	7	6
4	Periodic Table of Elements	3	2	4	3	4	5	2	2
5	Chemical Bonds	2	2	4	5	4	3	3	4
6	Electrochemistry	5	6	5	5	4	5	6	2
7	Acids and Bases	3	4	6	5	4	4	2	4
8	Salts	2	1	–	–	2	2	1	1
9	Manufactured Substances in Industry	4	4	3	2	4	3	3	5
Form 5									
1	Rate of Reaction	4	4	2	2	2	3	2	4
2	Carbon Compounds	6	5	3	4	4	5	4	6
3	Oxidation and Reduction	4	3	5	4	4	2	6	8
4	Thermochemistry	5	6	3	3	3	5	6	3
5	Chemicals for Consumers	1	2	4	3	1	2	2	3
	TOTAL	**50**	**50**	**50**	**50**	**50**	**50**	**50**	**50**

ANALYSIS SPM 2006-2013 PAPER 2

PAPER 2

	CHAPTER	YEAR																							
		2006			2007			2008			2009			2010			2011			2012			2013		
		Section			Section			Section			Section			Section			Section			Section			Section		
		A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C
Form 4																									
1	Introduction to Chemistry	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
2	The Structure of the Atom	–	–	1	–	1	–	1	–	–				1	–	–	1	–	–	$\frac{1}{2}$	–	–	1	–	–
3	Chemical Formulae and Equations	1	–	–	1	–	–				1	–	–	1	1	–	–	–	1	1	–	–			
4	Periodic Table of Elements	$\frac{1}{3}$	–	–	1	–	–	$\frac{2}{3}$	–	1	1	–	–	1	–	–	1	–	–	$\frac{1}{2}$	–	–	1	–	–
5	Chemical Bonds	$\frac{2}{3}$	–	–	1	–	–	$\frac{1}{3}$	–	–				1	–	–				$\frac{1}{3}$	–	–	1	–	–
6	Electrochemistry	–	–	1				–	1	–	–	1	–	1	–	1	1	–	–	1	–	1	1	–	–
7	Acids and Bases	1	–	–				–	–	1	1	–	–	1	–	–	1	–	–						
8	Salts				–	1	–				–	–	1							$\frac{2}{3}$	1	–	–	–	1
9	Manufactured Substances in Industry	1	–	–	1	–	–	1	–	–	1	–	–				–	1	–						
Form 5																									
1	Rate of Reaction	1	–	–	–	–	1	1	–	–	1	–	–	–	1	–	1	–	–	–	–	1	–	1	–
2	Carbon Compounds				–	–	1	1	–	–							–	–	1	1	–	–	1	–	1
3	Oxidation and Reduction	–	1	–	1	–	–										1	–	–				–	1	–
4	Thermochemistry							1	–	–				–	–	1				–	1	–	1	–	–
5	Chemicals for Consumers	1	–	–	1	–	–	–	1	–							–	1	–	1	–	–			
	TOTAL	10			10			10			10			10			10			10			10		

ANALYSIS SPM 2006-2013 PAPER 3

PAPER 3

	CHAPTER	YEAR							
		2006	2007	2008	2009	2010	2011	2012	2013
		Number of Questions							
Form 4									
1	Introduction to Chemistry	–	–	–	–	–	–	–	–
2	The Structure of the Atom	–	–	–	–	–	–	–	–
3	Chemical Formulae and Equations	–	–	–	–	–	–	–	–
4	Periodic Table of Elements	–	–	1	–	1	–	–	–
5	Chemical Bonds	–	–	–	–	–	–	–	–
6	Electrochemistry	–	1	–	1	–	–	–	1
7	Acids and Bases	–	–	–	1	1	–	1	–
8	Salts	–	–	–	–	–	1	–	1
9	Manufactured Substances in Industry	–	–	–	–	–	–	–	–
Form 5									
1	Rate of Reaction	–	–	–	1	1	1	–	–
2	Carbon Compounds	1	–	1	–	–	–	–	–
3	Oxidation and Reduction	–	–	–	–	–	–	–	–
4	Thermochemistry	1	1	–	–	–	–	1	–
5	Chemicals for Consumers	–	–	–	–	–	–	–	–
	TOTAL	2	2	2	3	3	2	2	2

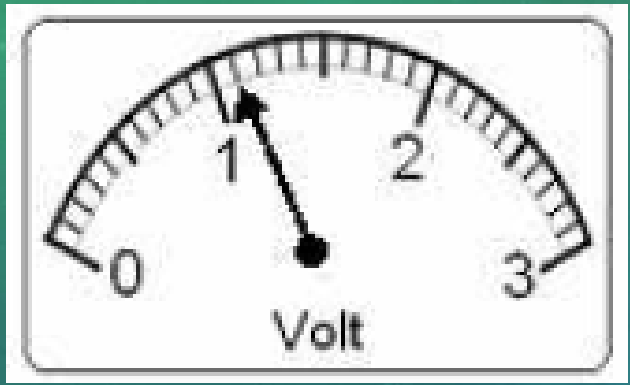
BACK TO BASIC

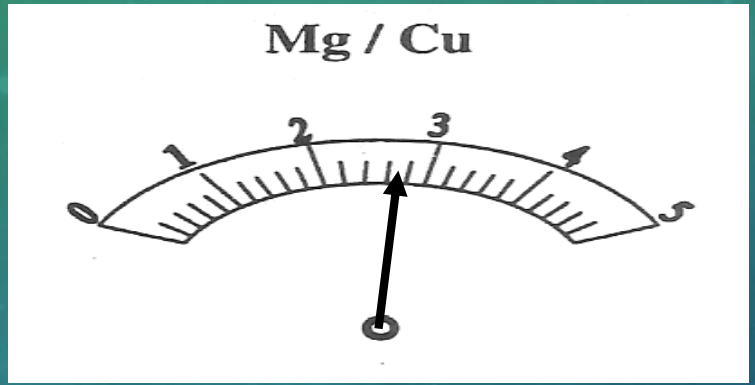
http://edu.joshuatly.com/

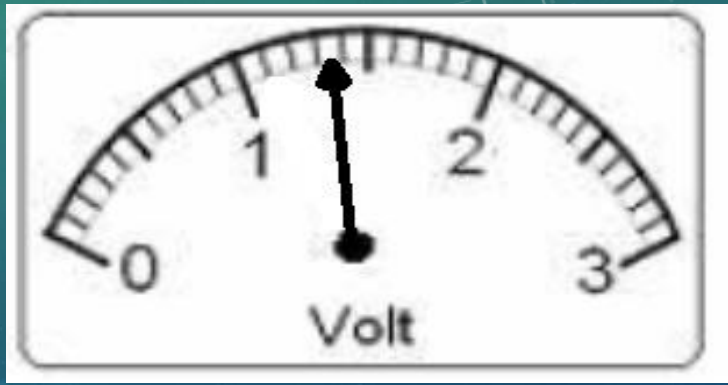
A. Apparatus Measurement

- 1/times – 3 Decimal points
- Burette – 2 Decimal points
- Voltmeter – 1 decimal point
- Ruler – 1 decimal point
- Stopwatch – 1 decimal point
- Thermometer – 1 decimal point

#VOLTMETER

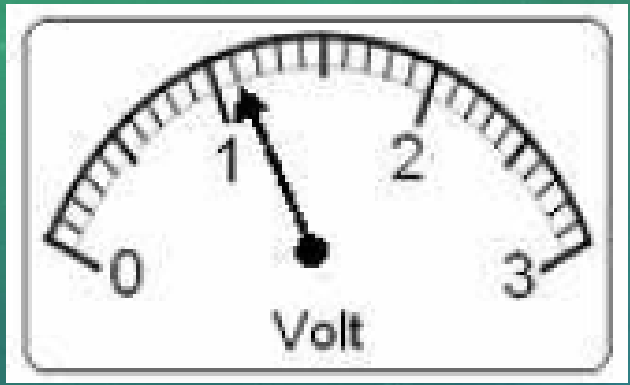


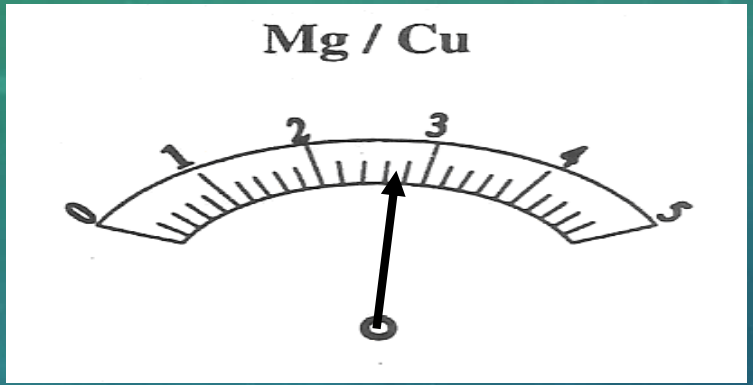


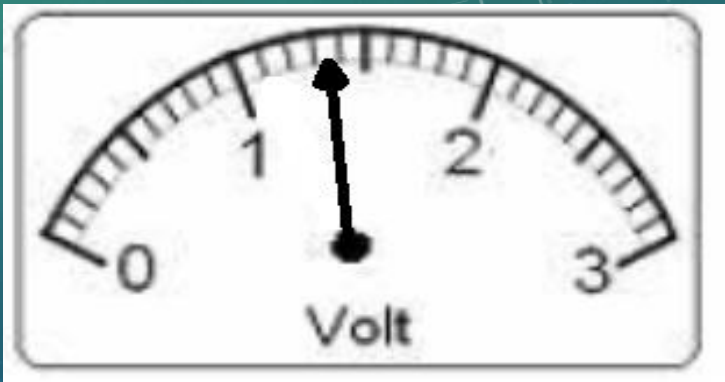


..... V	 V	 V

#VOLTMETER

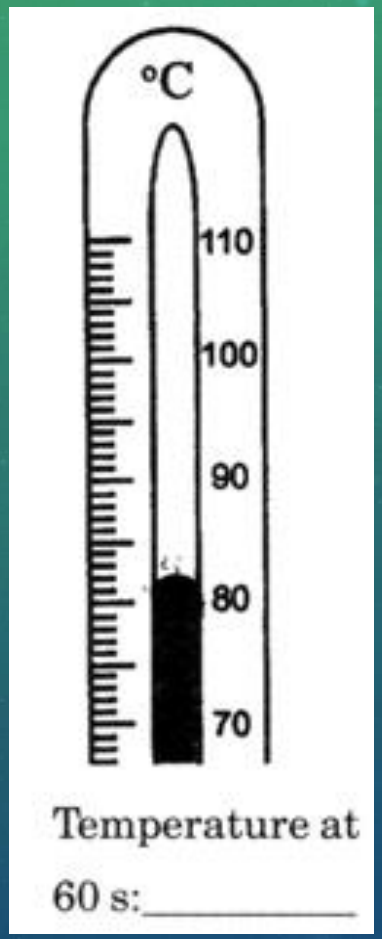






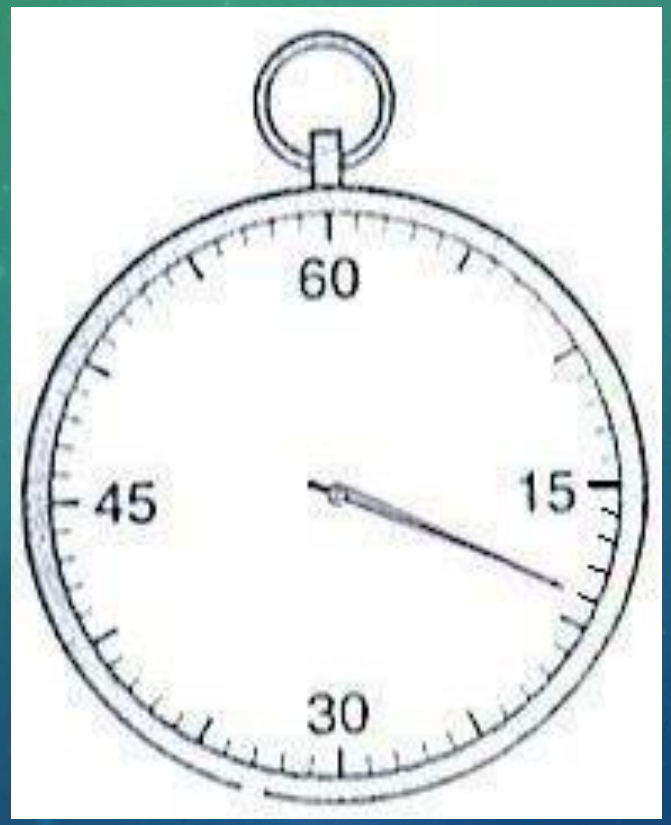
1.1 V	**2.7 V**	**1.35 V**

#THEMOMETER



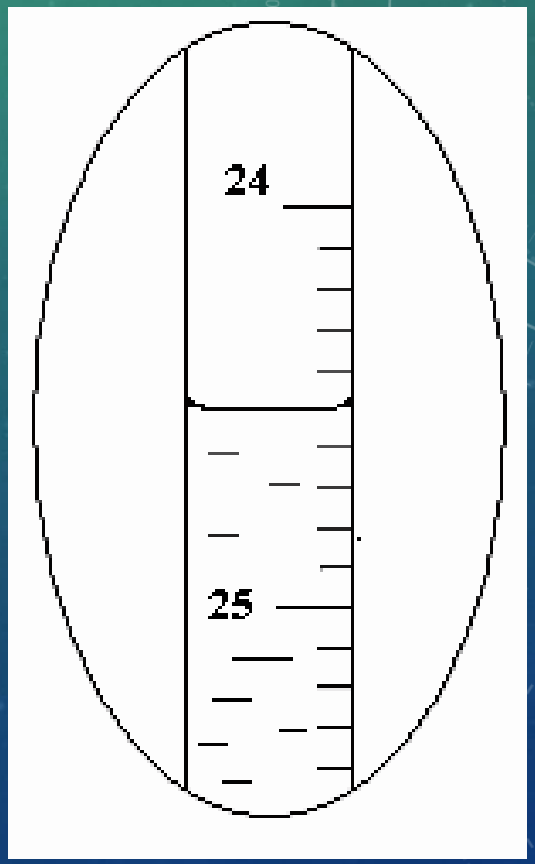
Temperature at 60 s:_____

#STOPWATCH



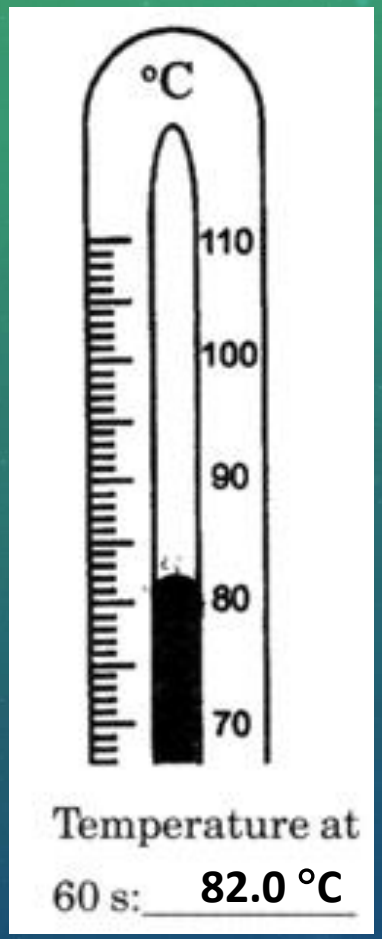
t_3 at 40°C = _____s

#BURETTE



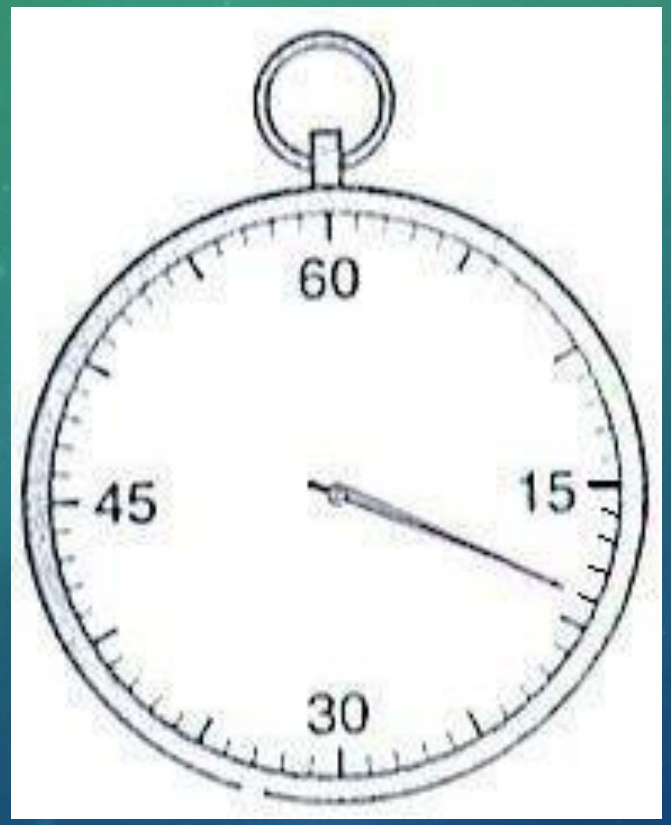
……cm^3

#THEMOMETER



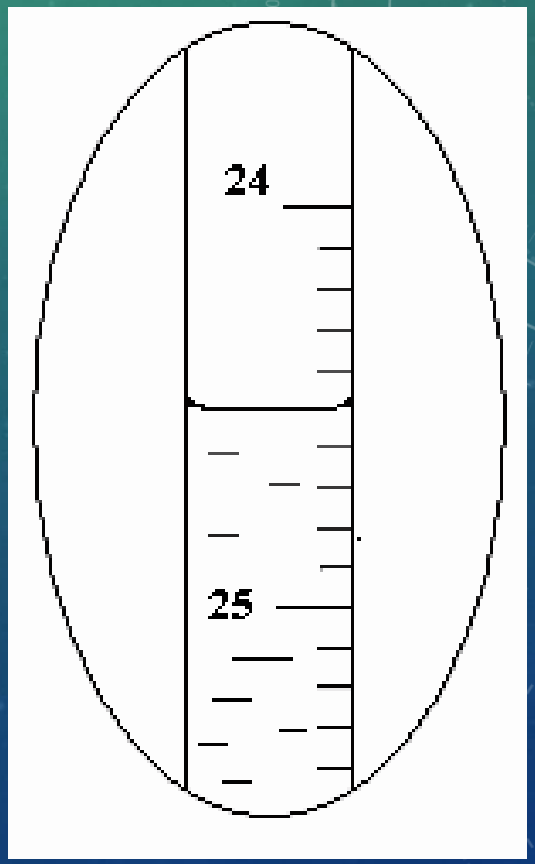
Temperature at 60 s: **82.0 °C**

#STOPWATCH



t_3 at 40°C = **19.0** s

#BURETTE



24.50 cm^3

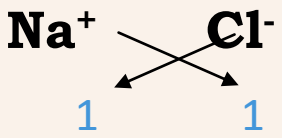
2. Formula and equation

A. #Formula

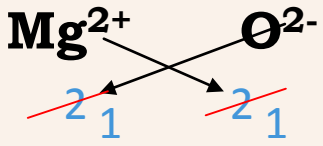
Atom	Molecule	Ion
• Single • No charge (neutral)	• Two or more atom • Round number as subscript	• Single • Has a charge (+ve or –ve)
Potassium : **K**	Oxygen : **O_2**	Potassium ion : **K^+**
Sodium : **Na**	Carbon dioxide : **CO_2**	Magnesium ion : **Mg^{2+}**
Argon : **Ar**	Ammonia : **NH_3**	Chloride : **Cl^-**
		Oxide : **O^{2-}**

Ionic Compound

- **Metal with non-metal,**
- **Combination of two charge (+ve and –ve)**
- **Metal → +ve ion**
- **Non-metal → -ve ion**



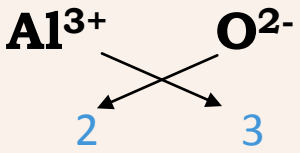
Sodium chloride : **NaCl**



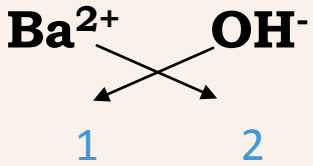
Magnesium oxide **MgO**

Ionic Compound

- **Metal with non-metal,**
- **Combination of two charge (+ve and –ve)**
- **Metal → +ve ion**
- **Non-metal → -ve ion**



Aluminium oxide : Al_2O_3



Barium hydroxide : $Ba(OH)_2$

Covalent Compound

- **Non-Metal with non-metal**
- **No charge**
- **Sharing electron**

Water : H_2O

#same as molecule

B. #Equation	#Type of full equation:
Gabung	**Element + Element** **Magnesium + Oxygen** $2Mg + O_2 \rightarrow 2MgO$
Singkir	**Element + Compound** **Magnesium + Copper(II) sulphate** $Mg + CuSO_4 \rightarrow MgSO_4 + Cu$
Ganti	**Compound + Compound** **Argentum nitrate + Sodium chloride** $AgNO_3 + NaCl \rightarrow NaNO_3 + AgCl$
Urai	**Compound** **Copper(II) carbonate** $CuCO_3 \rightarrow CuO + CO_2$

#Steps to balance the Full Equation

1. Write the correct formula of substance of reactant and product
2. Determine the **compound** that has odd number at the end
3. Round it by time with 2

1. $2Na + 2H_2O \rightarrow 2NaOH + H_2$

2. $2CO + O_2 \rightarrow 2CO_2$

3. $2Fe + 3Cl_2 \rightarrow 2FeCl_3$

4. $2Fe_2O_3 + 3C \rightarrow 4Fe + 3CO_2$

5. $C_2H_4 + 3O_2 \rightarrow 2CO_2 + 2H_2O$

6. $Cu(OH)_2 + 2HCl \rightarrow CuCl_2 + 2H_2O$

##Half equation

Metal → Metal ion [+ve ion]	Metal ion → Metal [+ve ion]
$X \rightarrow X^{n+} + ne$	$X^{n+} + ne \rightarrow X$
Example	
Potassium $K \rightarrow K^{+} + e$	Potassium ion $K^{+} + e \rightarrow K$
Magnesium $Mg \rightarrow Mg^{2+} + 2e$	Magnesium ion $Mg^{2+} + 2e \rightarrow Mg$
Copper $Cu \rightarrow Cu^{2+} + 2e$	Copper ion $Cu^{2+} + 2e \rightarrow Cu$

(molecule) Non-Metal → non-Metal ion [-ve ion]	Non-Metal ion → non-Metal (molecule) [-ve ion]
$Y_2 + 2ne \rightarrow 2Y^{n-}$	$2Y^{n-} \rightarrow Y_2 + 2ne$
Example	
Chlorine $Cl_2 + 2e \rightarrow 2Cl^-$	Chloride $2Cl^- \rightarrow Cl_2 + 2e$
Bromine $Br_2 + 2e \rightarrow 2Br^-$	Bromide $2Br^- \rightarrow Br_2 + 2e$
Oxygen $O_2 + 4e \rightarrow 2O^{2-}$	Oxide $2O^{2-} \rightarrow O_2 + 4e$

###Ionic equation *Commonly used in chapter 6 form 4 and Redoks

(a) Combine 2 half equation	
#Involving metal and metal ion Magnesium $Mg \rightarrow Mg^{2+} + 2e$ Copper(II) ion $Cu^{2+} + 2e \rightarrow Cu$ $Mg + Cu^{2+} \rightarrow Mg^{2+} + Cu$	#Involving non-metal Chlorine $Cl_2 + 2e \rightarrow 2Cl^-$ Iodide $2I^- \rightarrow I_2 + 2e$ $Cl_2 + 2I^- \rightarrow 2Cl^- + I_2$

(b)Cross the ion that not change in equation

#Displacement of metal

$$Mg + CuSO_4 \rightarrow MgSO_4 + Cu$$

$$Mg + Cu^{2+} \rightarrow Mg^{2+} + Cu$$

DIY : $Zn + CuCl_2 \rightarrow ZnCl_2 + Cu$

$$Zn + Cu^{2+} \rightarrow Zn^{2+} + Cu$$

(b)Cross the ion that not change in equation

#Displacement of halide

$2\cancel{KI} + Cl_2 \rightarrow 2\cancel{K}Cl + I_2$

$2I^- + Cl_2 \rightarrow 2Cl^- + I_2$

DIY : $2\cancel{K}Br + Cl_2 \rightarrow 2\cancel{K}Cl + Br_2$

$2Br^- + Cl_2 \rightarrow 2Cl^- + Br_2$

(b)Cross the ion that not change in equation

#Double Decomposition Reaction| Precipitation

$AgNO_3 + NaCl \rightarrow AgCl + NaNO_3$

$Ag^+ + Cl^- \rightarrow AgCl$

DIY: $Pb(NO_3)_2 + K_2SO_4 \rightarrow PbSO_4 + 2KNO_3$

$Pb^{2+} + SO_4^{2-} \rightarrow PbSO_4$

3. #Formula for Calculation

#Chapter 3 – formula and equation

Mol		
$\text{mol} = \frac{\text{mass}}{\text{molar mass}}$	$\text{mol} = \frac{\text{volume}}{\text{molar volume}}$	$\text{mol} = \frac{\text{no of particles}}{\text{Avogadro number}}$
Molar mass = RAM | RMM | RFM	Molar volume @ room condition= 24 dm^3 mol^{-1} @ STP = 22.4 dm^3 mol^{-1}	Particles = atom | ion | molecules

Chapter 7 – Acid and bases

Mol	Dilution	Neutralisation
$\text{Mol} = \frac{MV}{1000}$	$M_1V_1 = M_2V_2$	$\frac{M_aV_a}{a} = \frac{M_bV_b}{b}$
M = molarity V = volume in cm^3	M = molarity V = volume	M_a = molarity acid V_a = Volume acid a = mol acid M_b = molarity alkali V_b = Volume alkali b = mol alkali

Convert the concentration in mol dm^{-3} to concentration in g dm^{-3}

Mol dm^{-3} = $\frac{\text{g } dm^{-3}}{\text{Molar Mass}}$

NOTE: 1 dm^3 = 1000 cm^3

#Chapter 04 – Thermochemistry

1. Heat released or absorb by experiment or heat change can be calculate by using the formula,

$Q = mc\theta$
Q = heat released or absorbed by experiment
m = mass of solution
c = specific heat capacity of water
θ = change of temperature

2. The mole of the substance, n

Mole, n = $\frac{MV}{1000}$	@ Mole, n = $\frac{mass}{molar\ mass}$
M = molarity V = volume of solution in cm^3	

Heat of
a. PRECIPITATION
b. DISPLACEMENT
c. NEUTRALISATION

Heat of COMBUSTION

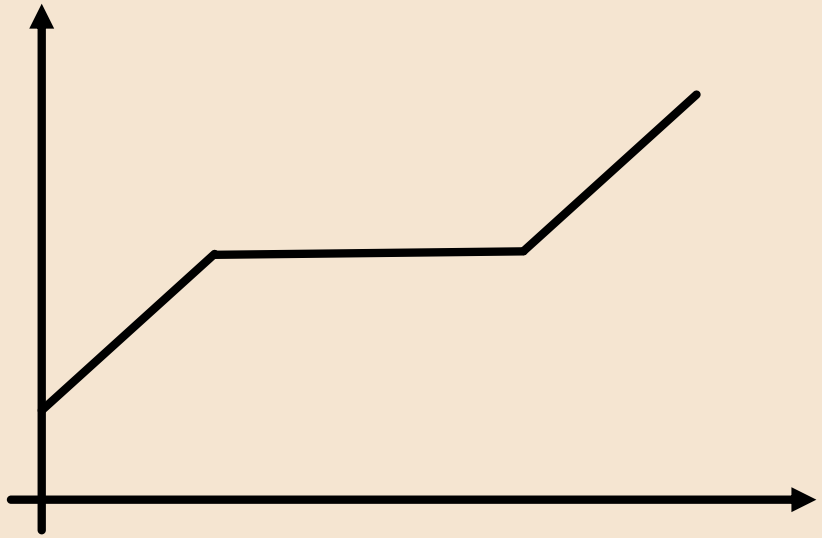
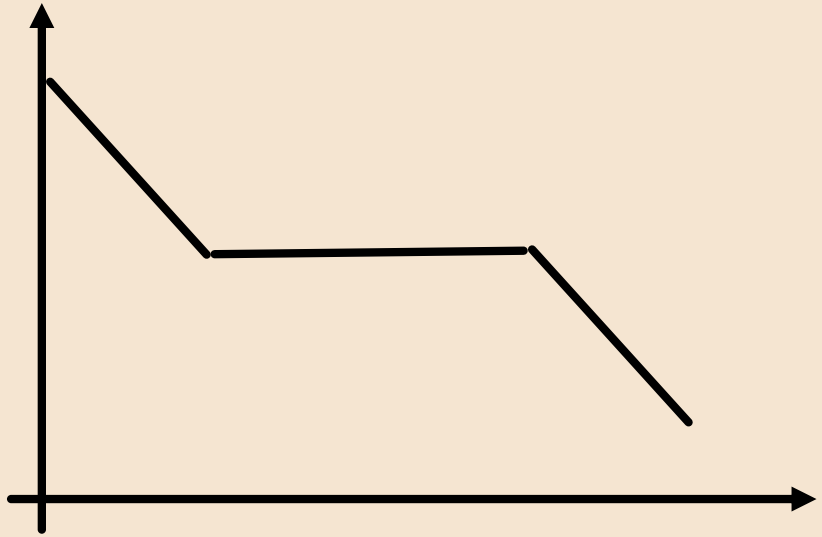
3. Heat of reaction, ΔH can be calculated by using the formula,

ΔH = Q/n
Q = heat released or absorb by experiment
n = number of mole

4. "Heat of …" heat for 1 mole of reactants used or product produce.

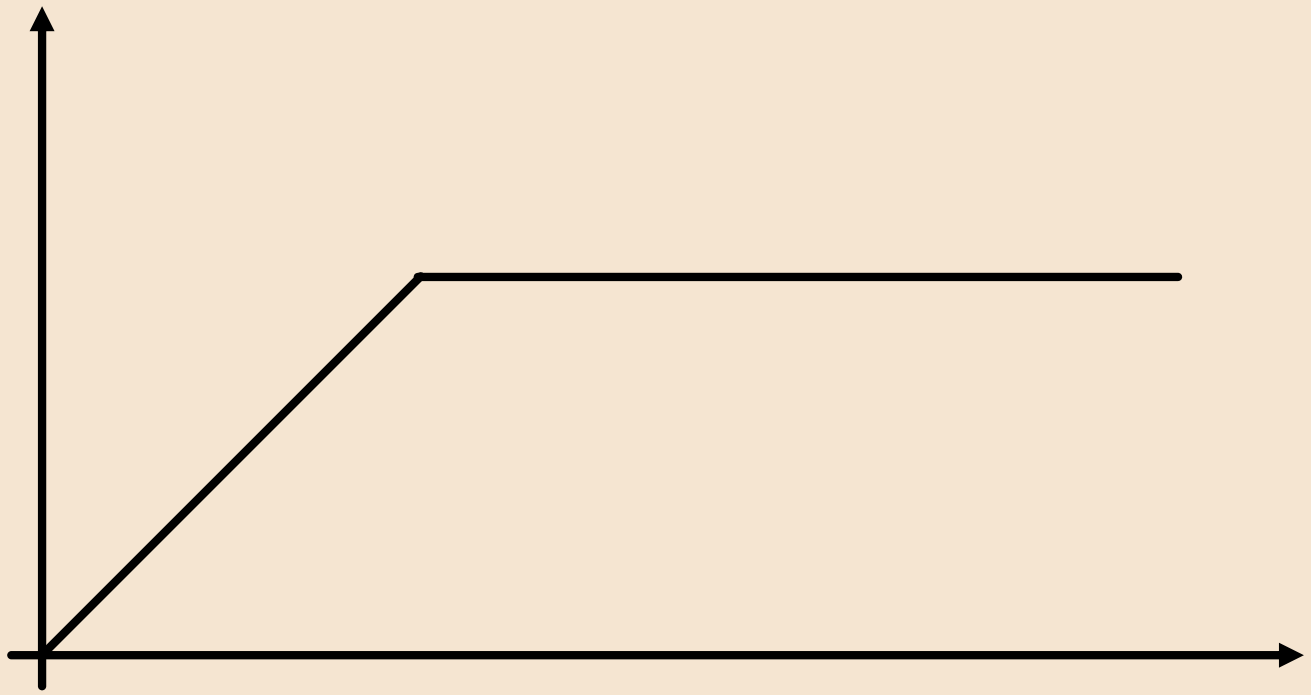
4. #Graph

##Chapter 2 – heating and cooling acetamide/ naphthalene

Heating	Cooling
	

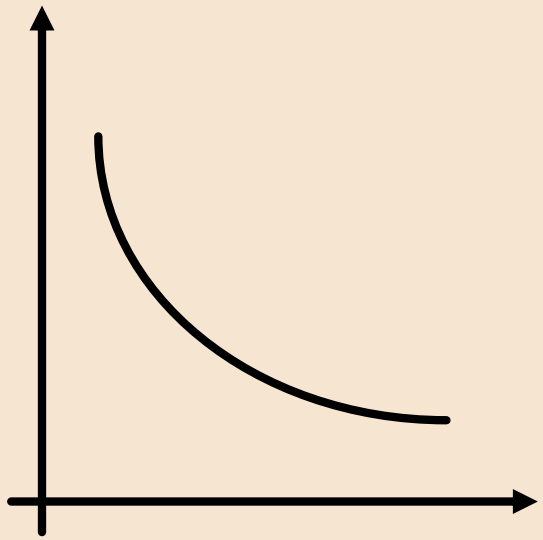
##Chapter 8 – salts

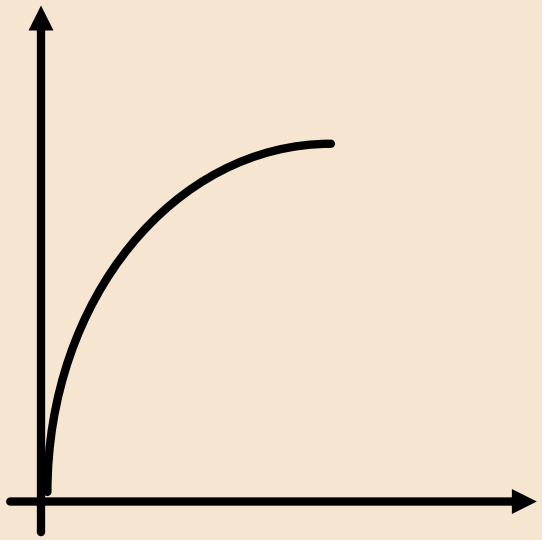
Construct ionic equation

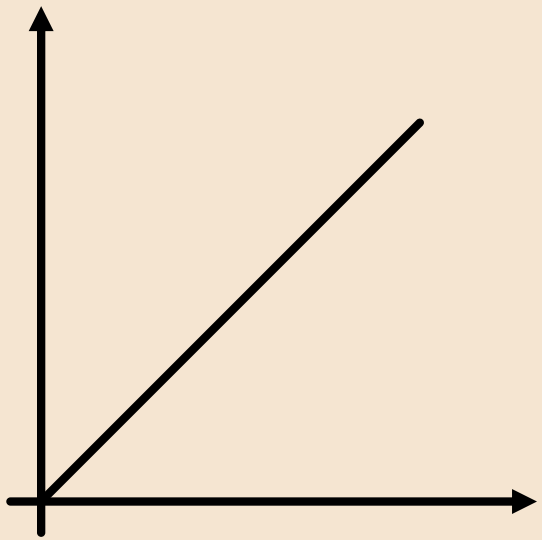


Chapter 10 – Rate of reaction

#Reactant	#Product	$\frac{1}{\text{time}}$
#Temperature	#Size	#Temperature
#Concentration	#Catalyst	#concentration







List of important command words, with examples

The words used in examination questions often indicate what sort of answers are expected.

1. Define (Takrifkan)

This means you are only required to write a concise statement to say what something is or means

Example: Define relative atomic mass

Suggested Answer:

It is the average mass of an atom of an element compared with $1/12^{th}$ of the mass of a carbon-12 atom

2. State (Nyatakan)

This means a short, concise answer is expected, without explanation

Example: State one commercial use of aluminium

Suggested Answer:
It is used to manufacture soft drink cans

3. List (Senaraikan)

This means you are to give a number of points in a list. Each point might only be a single word or a short phrase or sentence

Example: List three pollutants that are produced by car engines.

Suggested Answer: Carbon dioxide, Nitrogen dioxide, Unburnt fuel /soot

4. Explain (Jelaskan/huraikan)

This usually means some reference to chemical theory

Example:

Explain why 2.0 mol dm^{-3} hydrochloric acid reacts more quickly with solid calcium carbonate than 1.0 mol/dm^3 acid

Suggested Answer:

For the 2.0 mol dm^{-3} acid, there are more hydrogen ions per unit volume of acid and so collide more frequently with calcium carbonate

(*your mention of 'more frequent collisions' is the theory*)

5. Describe (Huraikan)

Writing in full and systemically, what has been carried out, observed or deduced and with diagram of apparatus used.

Example: Describe how ethanol can be produced by fermentation in the laboratory.

Suggested Answer: Your answer should contain the following:

- Simple diagram of the apparatus
- One or two sentences saying what you should do, including:
- Materials used (ie sugar, yeast, water)
- Conditions (ie leave in a warm place for a few days; plug the flask so that air cannot get in)
- Equation (if you know it) or at least mention that glucose decomposes into ethanol and carbon dioxide.

(*How much you write would depend on the marks allocated for the question*)

6. Predict or deduce (Ramalkan)

This means you are to deduce an answer from information in the question or from an earlier answer. You are not expected to produce an answer from memory.

Example: Predict the physical state of octane, which has 8 carbon atoms
(You are given the boiling points of all the alkanes with 1-7 carbons atoms)

Suggested Answer: A liquid at room temperature

(*From the given boiling points of the other alkanes, you can predict that octane will have a higher boiling point and will thus be a liquid at room temperature*)

7. Suggest (Cadangkan)

This means that you are not expected to know the correct answer but you are supposed to make a logical deduction from the information given in the question or from your chemical knowledge. Your answer may not be true, but it is correct if what you say is sensible from what you might reasonably be expected to know

Example: From your knowledge of Group VII, suggest two physical properties of astatine at the bottom of the Group

Suggested Answer:
Astatine would be a black solid which does not conduct electricity, because all the Group VII elements are non-metals and the elements become darker down the Group, with increasing density. (This would be the logical answer even though no one has ever been able to obtain a lump of astatine to see what it looks like or to find out if it really does not conduct electricity!

8. Calculate (Hitungkan)

This means a numerical answer is expected and the working given in full/all the steps shown

Example:
In an experiment, 1.30 g of zinc powder and 200 cm^3 of 0.2 mol/dm^3 sulphuric acid were reacted together.

(a) Calculate the number of moles of zinc in 1.30 g [1]
(b) Calculate the number of moles of sulphuric acid in the solution [2]

Suggested Answer: (a) moles of zinc = 1.3/65 = 0.02 mole
(b) 200/1000 x 0.2 = 0.04 mol

9. Determine (Tentukan)

This usually means the answer cannot be measured directly but is obtained by calculation or perhaps, by taking a reading from graph. Normally a numerical answer is expected

10. Sketch (Lakarkan)

This is often applied to graphs. It means that only the correct shape and approximate position of the graph is expected. It might mean you need to add one or two numbers to make the position clear. (**Plotting** a graph requires actual/experimental readings)

If you are asked to sketch a diagram then only a freehand drawing is expected. It can be quite rough but it must be clear what is shown and any important details must be clear. For example, if a rubber bung is supposed to seal a flask, this should be obvious in your sketch; it would be wrong to leave a gap between the flask and the bung.

In a sketch of apparatus, the proportions must be roughly correct. Eg a test tube should not be drawn larger than a conical flask.

Some command words in Paper 3

(1) To differentiate between **'products'** and **'observation'**
Observation: describe what is actually seen/observed/smelled
Products: names in full, not formula

- Examples of observation

  (i) Solid or precipitate formed. Colour must be mentioned
  (ii)Whether solid in (i) is soluble or insoluble in excess of named reagent
  (iii) If gas, colour must be stated (if relevant) or chemical test described followed by the result
  (iv) change in colour : must state initial and the final colours

- Common mistakes in describing observations

Inaccurate/Incorrect	Correct
Clear (solution)	Colourless (solution)
No reaction seen	No change seen
Hydrogen gas released	Colourless gas given out
Movement shown by ammeter	Deflection of ammeter needle
Purple colour disappears or purple solution bleached	Purple solution decolourised
Product of electrolysis at the cathode: Brown precipitate seen	Brown deposit/solid seen
Red litmus paper becomes blue litmus paper	Moist red litmus paper turns blue

- Examples of ‘Action Words’ in Chemical Tests

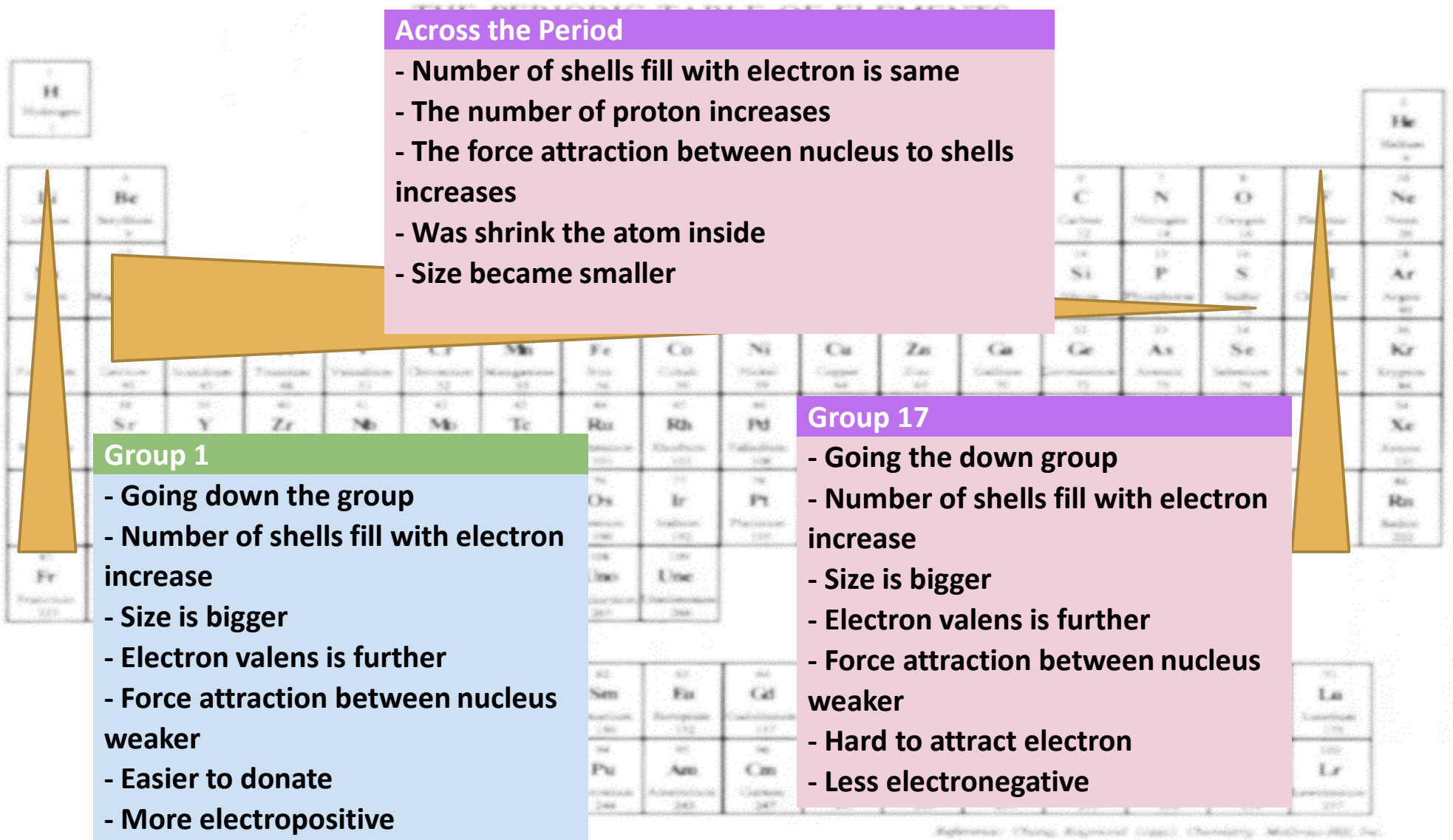
  (i) **Add** one reagent to another in a named container
  (ii) **Mix** together 2 reagents /chemicals in named container

  (iii) For gases:
  Channel/pass a gas through eg a combustion tube (excess will escape)
  Bubble the gas into eg lime water (no excess coming out)

  (iv) **Insert** glowing splint into a test tube containing ----------
  (v)**Place**/**Put** lighted splint near the mouth of a test tube containing --------
  (vi) Titiskan / add, drop by drop or a little at a time.

NOTE

Periodic Table



Across the Period

- Number of shells fill with electron is same
- The number of proton increases
- The force attraction between nucleus to shells increases
- Was shrink the atom inside
- Size became smaller

Group 1

- Going down the group
- Number of shells fill with electron increase
- Size is bigger
- Electron valens is further
- Force attraction between nucleus weaker
- Easier to donate
- More electropositive

Group 17

- Going the down group
- Number of shells fill with electron increase
- Size is bigger
- Electron valens is further
- Force attraction between nucleus weaker
- Hard to attract electron
- Less electronegative

NOTE

Molten (solute only)			Aqueous		
Solute	1 +ve ion	1 -ve ion	Solute	1 +ve ion	1 -ve ion
			Solvent (Water)	1 +ve ion, H^+	1 -ve ion, OH^-

Factor:

1. The position of ions in Electrochemical Series. CHOOSE THE LOWER

Cation	Anion
K^+	**F^-**
Na^+	**SO_4^{2-}**
Ca^{2+}	**NO_3^-**
Mg^{2+}	Cl^-
Al^{3+}	Br^-
Zn^{2+}	I^-
Fe^{2+}	OH^-
Sn^{2+}	
Pb^{2+}	
H^+	
Cu^{2+}	
Ag^+	

2. The concentration of Solution

3. The Type of electrode

Anode
• The electrode will dissolve into the solution • The electrode produce ions • The electrode become **thinner**
Cathode
• The electrode act as "middle person" • Choose the concentrated ions or the lower position of ions in the solution • The electrode will be **coated** or **thicker**

----------oooOO aĎaŽ OOooo----------

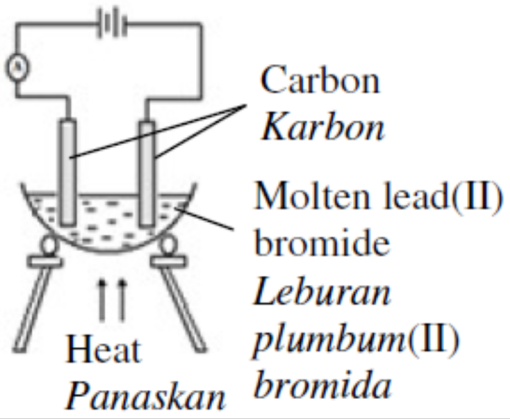
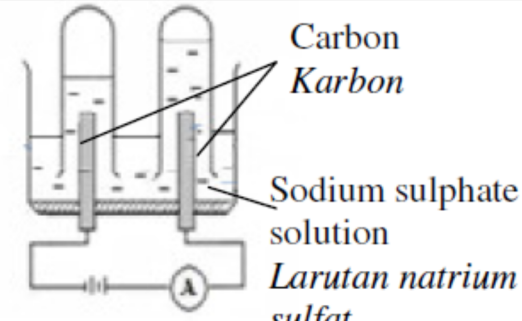
Voltaic Cell

Negative Terminal/Anode	Positive Terminal/Cathode
• The metal which top in ECS (more electropositive) • The metal will dissolve into the solution • The metal produce ions • The metal become **thinner**	• The metal which lower in ECS (less electropositive) • The metal receive electron • Choose the lower position of positive ion in the solution • The electrode will be **coated** or **thicker**

Function of Salt Bridge// Porous Pot

Allow ions through it
To complete the circuit

[MRSM11-03] Table 3 shows the apparatus set-up, description and observation for experiment I and II.

Experiment	I	II
Apparatus set-up		
Description	Electrolysis of molten lead(II) bromide using carbon electrodes	Electrolysis of 1 mol dm^{-3} sodium sulphate solution using carbon electrodes
Observation	Grey solid is formed at the cathode	Gas bubbles are released at the anode and cathode

Carta Alir ion

Exp 1 – Molten

Ions Present	Pb^{2+}, Br^-	
	Anode (+ve terminal)	*Cathode (-ve terminal)*
Ion attract	Br^-	Pb^{2+}
Ion choose	Br^-	Pb^{2+}
Half equation	$2Br^- \rightarrow Br_2 + 2e$	$Pb^{2+} + 2e \rightarrow Pb$
Observation	*Brown gas released*	*Grey solid deposited*
Product	*Bromine gas*	*Lead metal*

Exp 2

Ions Present	Na^+, SO_4^{2-}, H^+ , OH^-	
	Anode (+ve terminal)	*Cathode (-ve terminal)*
Ion attract	SO_4^{2-}, OH^-	Na^+, H^+
Ion choose	OH^-	H^+
Reason	*Less electronegative*	*Less electropositive*
Half equation	$4OH^- \rightarrow 2H_2O + O_2 + 4e$	$2H^+ + 2e \rightarrow H_2$
Observation	*Bubbles gas released*	*Bubbles gas released*
Confirmatory test	*1. Put the glowing splinter into test tube contain the gas* *2. glowing → ignite*	*1. Place the burning splinter near the mouth of the test tube that contain the gas* *2. Pop sound produce*
Products	*Oxygen*	*Hydrogen*

(a) State all the ions present in [2M]

(i) molten lead(II) bromide : **lead(II) ions and bromide ion**

(ii) sodium sulphate solution : **sodium, sulphate, hydrogen and hydroxide**

(*b*) Based on experiment I:
(i) Name the grey solid produced. [1M]

lead

(ii) Write the half equation for the formation of grey solid. [1M]

Pb^{2+} +2e → Pb

Untuk menulis half equation – ion +ve ke metal
Tambahkan nombor cas sekali dengan nombor elektron

(iii) State the observation at anode. [1M]

Brown gas released

(*c*) Based on experiment II:
(i) Name the ion that is discharged at anode. [1M]

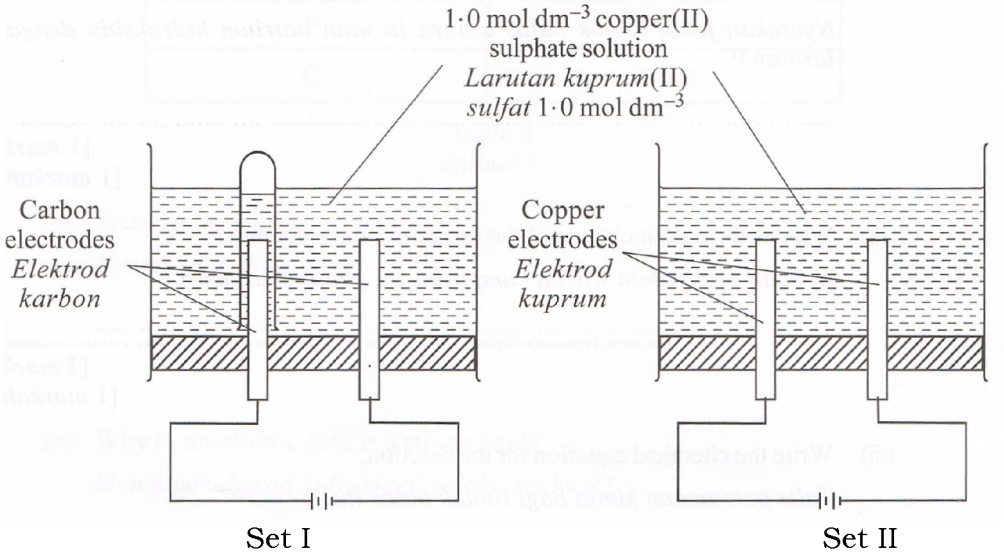
hydroxide

(ii) State the product of electrolysis at [2M]

Anode : **oxygen gas** Cathode : **hydrogen gas**

(iii) Name another solution that will give the same products of electrolysis as in experiment II. [1M]
Sodium nitrate
.....

[SPM11-05] Diagram 5 shows the apparatus set-up to study the electrolysis of 1.0 moldm^{-3} copper(II) sulphate solution. In Set I, carbon electrodes are used. In Set II, copper electrodes are used.



Carta Alir Ion

Exp 1

Ions Present	Cu^{2+}, SO_4^{2-}, H^+, OH^-	
	Anode (+ve terminal)	*Cathode (-ve terminal)*
Ion attract	SO_4^{2-}, OH^-	Cu^{2+}, H^+
Ion choose	OH^-	Cu^{2+}
Reason	*Less electronegative*	*concentrated*
Half equation	$4OH^- \rightarrow 2H_2O + O_2 + 4e$	$Cu^{2+} + 2e \rightarrow Cu$
Observation	*Bubbles gas released*	*Brown solid deposited*
Confirmatory test	*1. Put the glowing splinter into test tube contain the gas* *2. glowing → ignite*	*none*
Products	*Oxygen*	*Copper metal*

Exp 2 – Electrode type

Ions Present	Cu^{2+}, SO_4^{2-}, H^+, OH^-	
	Anode (+ve terminal)	*Cathode (-ve terminal)*
Ion attract	SO_4^{2-}, OH^-	Cu^{2+}, H^+
Ion choose	*NO ion, but electrode produce ion*	Cu^{2+}
Reason	*Active electrode*	*Less electropositve*
Half equation	$Cu \rightarrow Cu^{2+} + 2e$	$Cu^{2+} + 2e \rightarrow Cu$
Observation	*Electrode became thinner*	*Brown solid deposited*
Products	*Copper(II) ions*	*Copper metal*

(a) What is the meaning of an anion? [1M]

Negatively charged ion

(b) State all the anions and cations in copper(II) sulphate solution. [2M]

Anions : **Sulphate and hydroxide** Cations : **copper(II) and hydrogen**

(c) Based on Set I in Diagram 5:
(i). Write the formula of the ion that is selectively discharged at the anode. [1M]

OH-

(ii). Write the half-equation for the reaction that takes place at the anode. [2M]

$4OH^- \rightarrow 2H_2O + O_2 + 4e$

Bila half equation –ve; sebelah cas –ve terus letakkan tanda →

.....

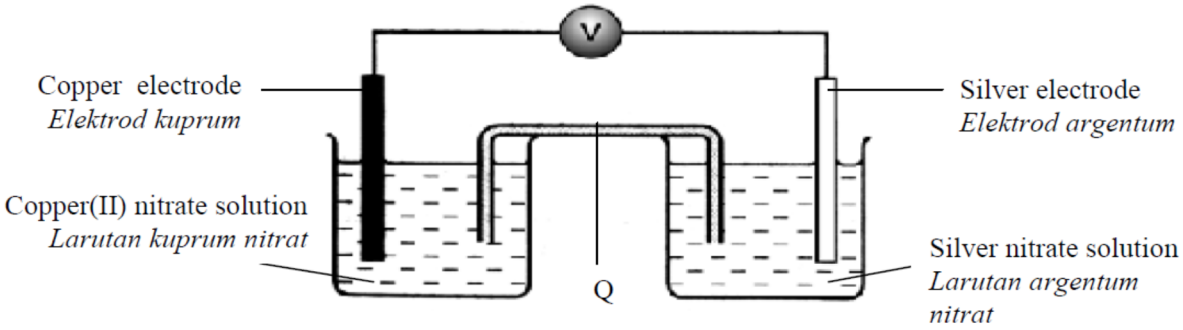
(iii). Describe briefly the **chemical test** to confirm the product at the anode. [2M]

Procedure 1. Put the glowing splinter into the test tube contains the gas
Result : 2. Glowing splinter will ignite/ burn

(d). Compare the colour of the copper(II) sulphate solutions in Set I and Set II after one hour of electrolysis. Give one reason for the answer. [2M]

	Exp I	Exp II
Comparison :	blue copper(II) sulphate in exp I change to colourless	blue remain unchanged in exp II
Reason	Copper (II) in solution was selected and discharge to formed Copper metal The number of Copper ions in solution decreases	The rate of produce Cu^{2+} ions at anode equal to rate of discharge Cu^{2+} ions at cathode The number of Copper ions in solution remain same

[SBPtrial11-03] Diagram 3 shows the apparatus set-up of a chemical cell



(a) What is the process that takes place at copper electrode? [1M]
Oxidation

[sebab Copper more electropositive than Silver]

(b) (i) State the function of Q. [1M]
Allow ion through it to complete the circuit

(ii) Name a chemical substance that can be used as Q. [1M]
Sulphuric acid // [name - any soluble salt]

(c) In Diagram 3, mark the direction of the electron flow. [1M]
[Dari Copper ke Silver]

(d) State the colour change of copper(II) nitrate solution . Give a reason for your answer. [2M]
Blue intensity increases
Copper electrode dissolve and ionise to copper(II) ion,
The number of copper(II) ion increases

(e) Write the half equation for the reaction at the negative terminal. [2M]

$Cu \rightarrow Cu^{2+} + 2e$

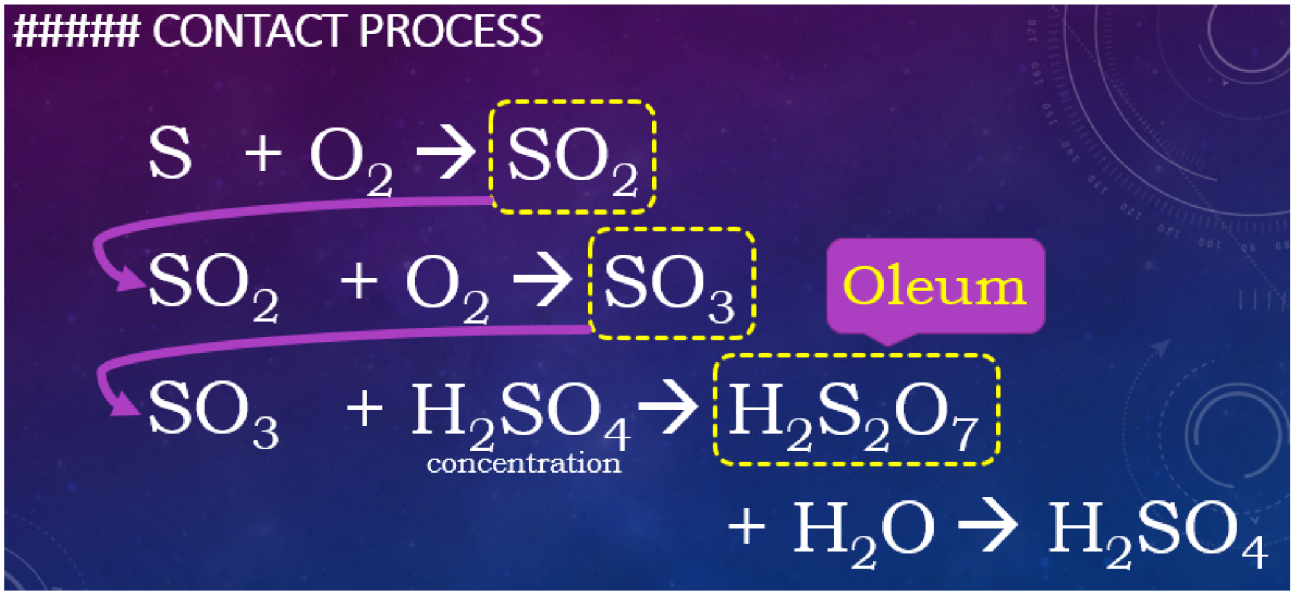
(f) If copper electrode and copper(II) nitrate solution are replaced with zinc electrode and zinc nitrate solution,

(i) what happened to the voltmeter reading? [1M]
Reading of voltmeter increases

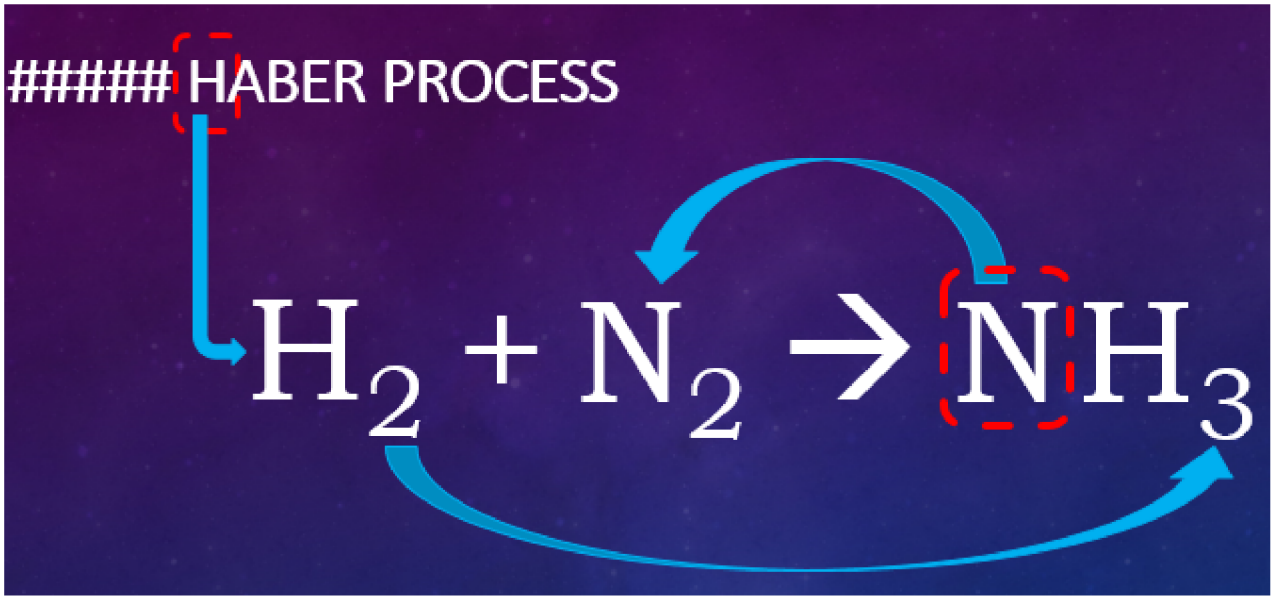
(ii) give a reason for your answer. [1M]
The distance between Zinc and Silver is bigger than the distance between Copper and silver

NOTE

A. Contact Process

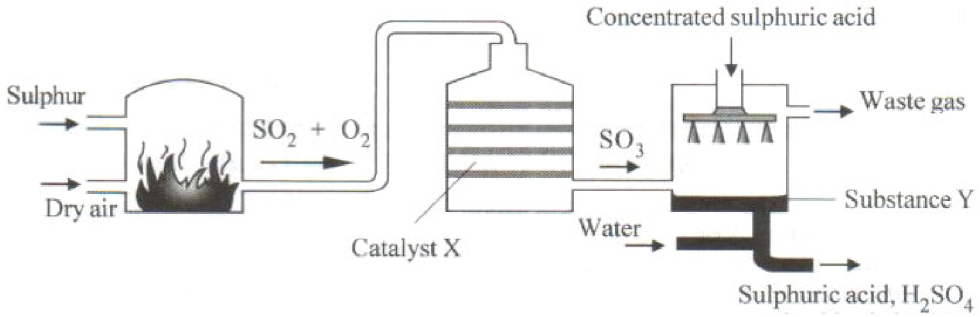


B. Haber Process



	Contact Process	Haber Process
Catalyst	**Vanadium(V) oxide**	**Iron**
Temperature	**450 °C**	**450 °C**
Pressure	**1 atm**	**200 atm**

[SPM08-01] Diagram 1 shows the manufacture of sulphuric acid.



(a) What is the name of this process? [1 M] **Contact Process**

(b) State the name of catalyst X. [1 M] **Vanadium(V) Oxide**

(c) (i) State the name of substance Y. [1 M] **Oleum**

(ii) Substance Y is formed when sulphur trioxide reacts with concentrated sulphuric acid. Write the chemical equation for this reaction. [2 M]

$SO_3 + H_2SO_4 \rightarrow H_2S_2O_7$

.....

(d) A waste gas is produced during the manufacture of sulphuric acid. Explain briefly how this gas can cause environmental pollution. [2 M]

1. SO_2 dissolve in rain water to produce acid rain.
2. Acid rains increase the acidity of lake, aquatic live will die

.....

(e) The sulphuric acid produced can be used to manufacture fertilizers.
(i) Name one fertilizer manufacture from sulphuric acid. [1 M]

Ammonium sulphate

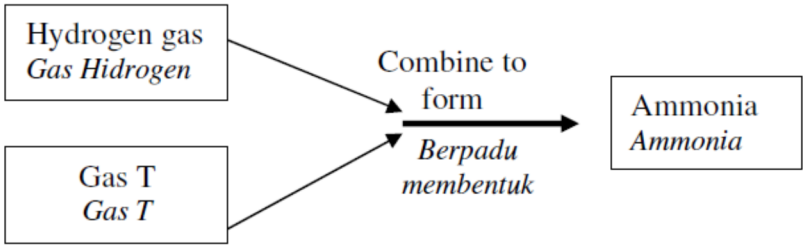
.....

(ii) State another use of sulphuric acid. [1 M]

As electrolyte in car battery

.....

[MRSM10-01a] (*a*) Diagram 1.1 shows the step involved in an industrial process to produce ammonia.



(i) Name the process in the production of ammonia. .**Haber Process**

(ii) Name gas T. **Nitrogen**

(iii) Write the chemical equation for the reaction between hydrogen and gas T to produce ammonia. [1 *mark*]

$T_2 + 3H_2 \rightarrow 2TH_3$ //
$N_2 + 3H_2 \rightarrow 2NH_3$

NOTE! Calculation involved Thermochemistry

1. Heat released or absorb by experiment or heat change can be calculate by using the formula,

Q= mcθ

Q = heat released or absorbed by experiment
m = mass of solution
c = specific heat capacity of water
θ = change of temperature

2. The mole of the substance, n

Mole, n = $\frac{MV}{1000}$

M = molarity
V = volume of solution in cm^3

@ Mole, n = $\frac{mass}{molar\ mass}$

Heat of
a. PRECIPITATION
b. DISPLACEMENT
c. NEUTRALISATION

Heat of COMBUSTION

3. Heat of reaction, ΔH can be calculated by using the formula,

ΔH = Q/n

Q = heat released or absorb by experiment
n = number of mole

4. **"Heat of** ..." heat for 1 mole of reactants used or product produce.

[SPM09-06] Diagram 6 shows the apparatus set-up to determine the heat of neutralisation between nitric acid and sodium hydroxide solution.

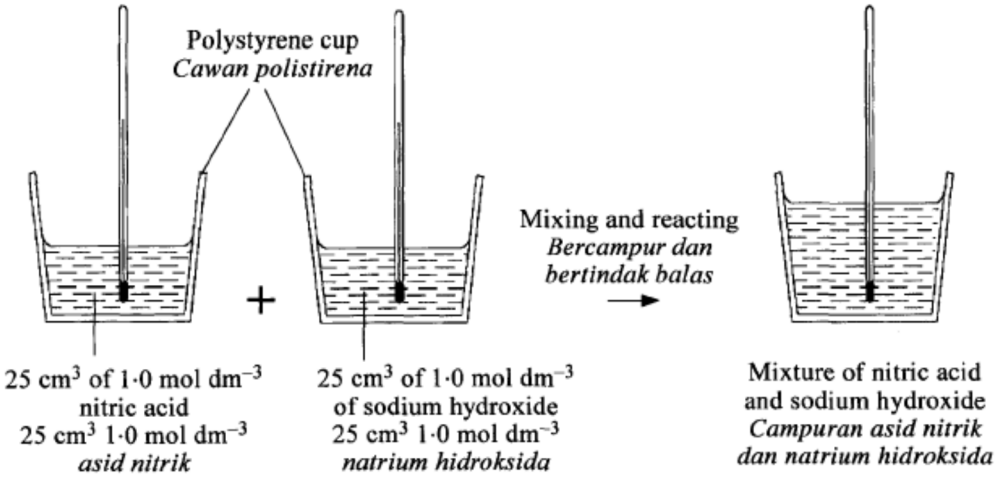


Diagram 6

Table 6 shows the result of this experiment.

Description	Temperature (°C)
Initial temperature of nitric acid	30.0
Initial temperature of sodium hydroxide	30.0
Highest temperature of the mixture	36.8

Table 6

(a) What is the meaning of heat of neutralisation? [1M]
Heat change when 1 mole of hydrogen ion react with 1 mole of hydroxide ion to formed 1 mole of water

(b) calculate
(i) The heat released during the reaction. [1M]
[Specific heat capacity of solution, c = 4.2 J g^{-1} °C, Density of solution=1 gcm^{-3}]

Q = mcO = [25+25]x4.2 x 6.8 = 1428 J = 1.428 kJ

(ii) The number of moles of nitric acid reacting. [1M]

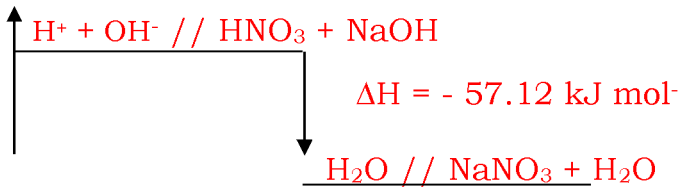
mol = MV/1000 = 1.0 X 25/1000 = 0.025 mol

(iii) The heat of neutralisation. [1M]

ΔH = Q/mol = 1.428/0.025 = 57.12 kJ mol^{-1}

(e) Draw an energy level diagram for this reaction.[3M]

(c) Energy



(d) The experiment is repeated using 25 cm^3 of 1.0 mol dm^{-3} ethanoic acid to replace the nitric acid. The heat of neutralisation using ethanoic acid is 55.0 kJ mol^{-1}.
Explain the difference of the heat of neutralisation. [3M]

1. Nitric acid is strong acid and ethanoic acid is weak acid.
2. Ethanoic acid ionise partially in water and some is not ionise
2. Heat energy is released by ethanoic acid was absorb back to completely ionise of ethanoic acid

(e) Give one reason why a copper container cannot replace the polystyrene cup in this experiment.

Copper container also absorb the heat released and the reading of thermometer will be not accurate

Note

Explanation how the collision theory affected the factor affecting rate of reaction

i. State the factor
ii. Explain how the factor that affect the rate of reaction affected.
iii. The frequency of collisions between particles increase.
iv. The frequency of affective collisions between particles increase.
v. The conclusion. Rate of reaction increase

a. Effect of the size of reactants

1. The size of ..... [exp: Calcium carbonate] is smaller.
2. The **smaller** the **size** of solid reactant, the **larger total surface area** exposed to collision. More particles collide with each other.
3. The frequency of collisions between particles increase.

[must give what particles react with what particles.
Example H+ ion react with CO_3^{2-} ions]

4. The frequency of affective collisions between particles also increases.
5. Rate of reaction increase / higher.

b. Effect of concentration

1. The concentration of ..... [exp: sodium thiosulphate] is higher
2. The **higher the concentration** of solution reactant, the **greater number of particles** per unit volume. More particles collide with each other.
3. The frequency of collisions between particles increase.

[must give what particles react with what particles.
Example H+ ion react with $S_2O_3^{2-}$ ions]

4. The frequency of affective collisions between particles also increases.
5. Rate of reaction increase / higher.

c. Effect of temperature

1. The temperature of ..... [exp: sodium thiosulphate] is higher
2. The **higher the temperature** of solution reaction, the **kinetic energy** of particles **increases**. The particles **move faster**. More particles collide with each other.
3. The frequency of collisions between particles increase.

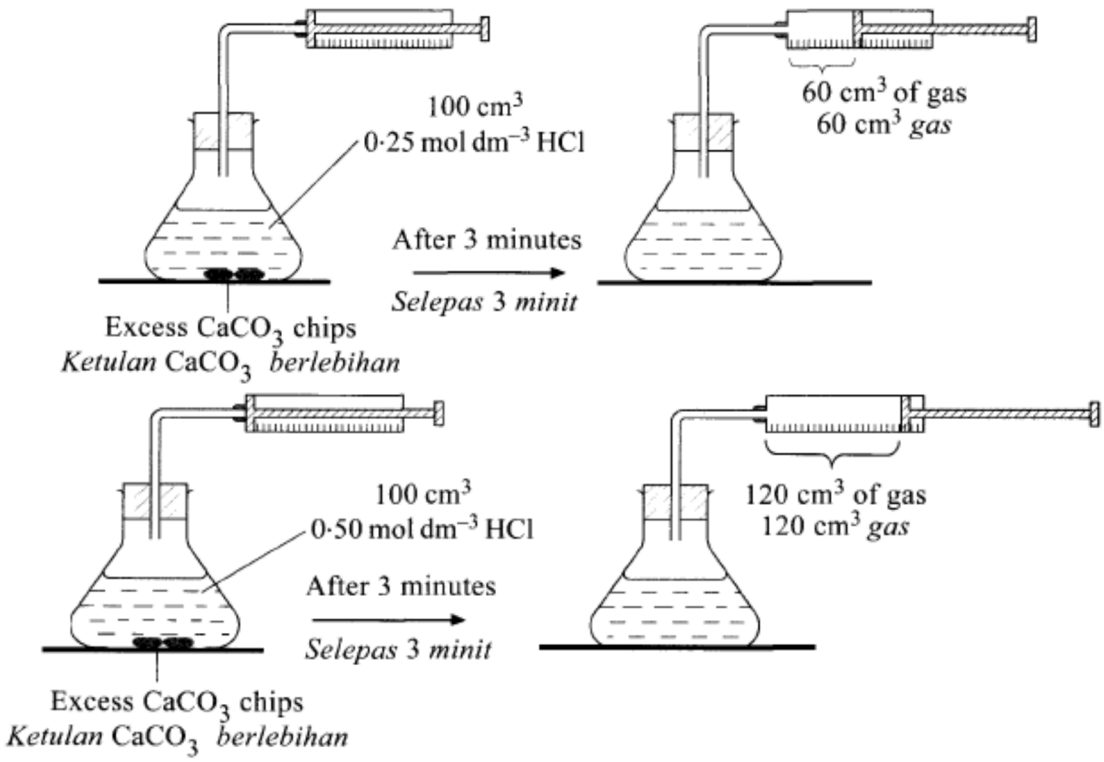
[must give what particles react with what particles.
Example H+ ion react with $S_2O_3^{2-}$ ions]

4. The frequency of affective collisions between particles also increases.
5. Rate of reaction increase / higher.

d. Effect of catalyst

1. The ..... [exp: Copper(II) sulphate] present
2. The **presence of catalyst**, **alternate the rate of reaction** by **providing an alternative pathway** of reaction **which has lower activation energy**. More particles collide with each other.
3. The frequency of collisions between particles increase.
4. The frequency of affective collisions between particles also increases.
5. Rate of reaction increase / higher.

[SPM09-05] Diagram 5 shows two sets of experiment to study the factor affecting the rate of reaction between hydrochloric acid, HCl and calcium carbonate, $CaCO_3$.



(a) Write a balanced chemical equation for the reaction in these experiments.[2M]

$CaCO_3$ + 2 HCl → $CaCl_2$ + CO_2 + H_2O

.....

(b) What is the reading needed to be recorded in both experiments to determine the rate of reaction in 3 minute? [1M]

Volume of carbon dioxide gas

.....

(c) Calculate the average rate of reaction in set I. [1M]

= volume / time taken = 60/ 3 = 20 cm^3 min^{-1}

(d)(i) Compare the rate of reaction in set I and set II. Explain your answer based on the factor affecting the rate of reaction. [2M]

Set II has higher Rate of reaction than set I
Because set II has/used higher the concentration of HCl acid

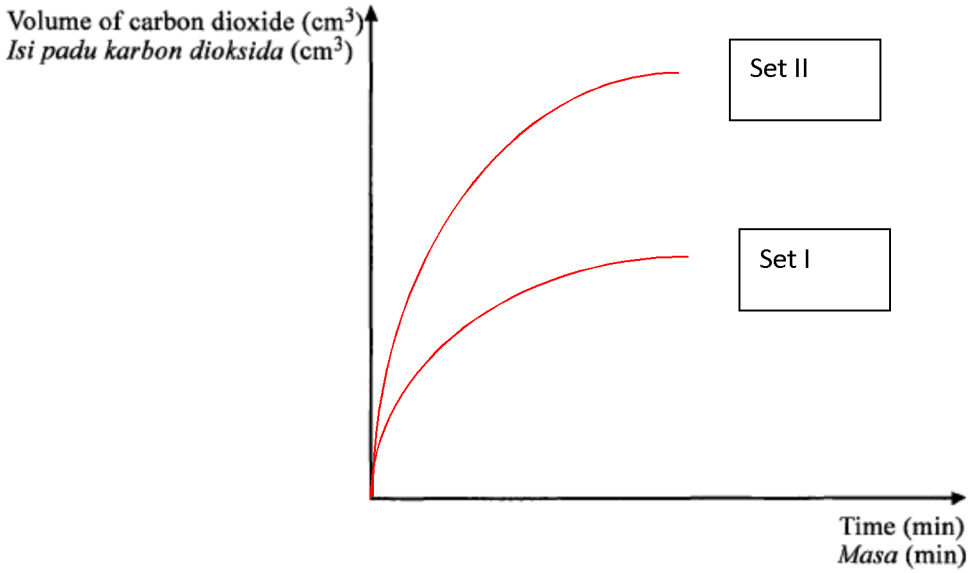
.....

(ii)Explain the answer in 5(d)(i) with reference to the collision theory.[3M]

Set II has higher the concentration of HCl, Set II has higher number of particles, The frequency of collision is increases between H^+ ion and carbonate, CO_3^{2-} ion increases
The frequency of affective collision also increases
.....

(e) Sketch the graph of the volume of carbon dioxide gas produced against time for both sets of experiment in the first 3 minute. [2M]

(e)



Note - REDOX

HALF EQUATION FOR:

(i) ACIDIFIED POTASSIUM MANGANATE (VII) solution

$$\underset{+7}{MnO_4^-} + 5e \rightarrow \underset{+2}{Mn^{2+}} + 4H_2O$$

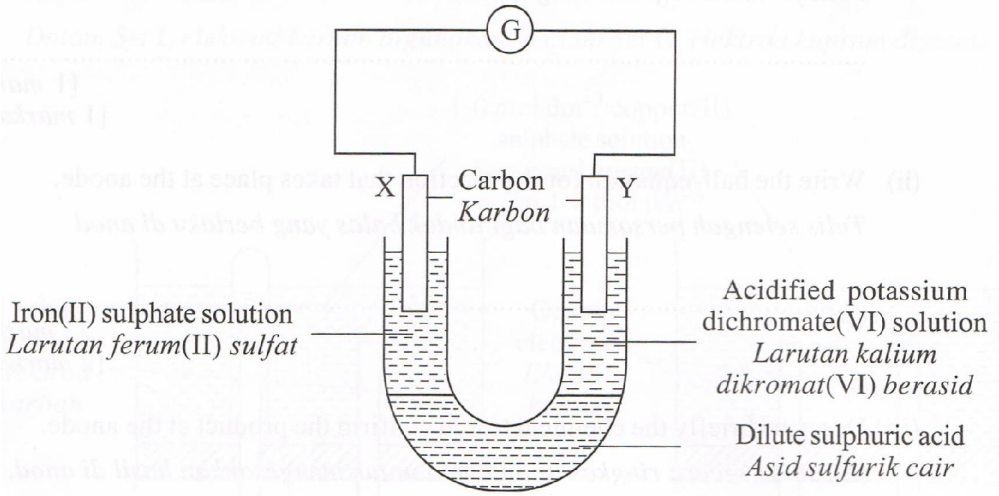
Colour : Purple to colourless

(i) ACIDIFIED POTASSIUM DICHROMATE (VI) solution

$$\underset{+6}{Cr_2O_7^{2-}} + 6e \rightarrow \underset{+3}{2Cr^{3+}} + 7H_2O$$

Colour : Orange to green

[SPM11-06] Diagram 6 shows the apparatus set-up for an experiment to investigate electron transfer at a distance in redox reactions.



(a). State the colour of iron(II) sulphate solution. [1M]

Green

.....

(b) When the circuit is completed, the galvanometer shows a deflection.
(i). Write the half-equation for the reaction at X. [1M]

$Fe^{2+} \rightarrow Fe^{3+} + e$

……

(ii). State the type of reaction in 6(b)(1). [1M]
Oxidation

……

(d) Table 6 shows a list of apparatus and materials.

Apparatus and Materials	
• Porous pot	• Carbon electrodes
• Beaker	• Bromine water
• Connecting wires	• Potassium iodide solution
• Galvanometer	

Table 6

Draw one labelled diagram to show the apparatus set-up to investigate electron transfer at a distance. The diagram must include the apparatus and materials given in Table 6.

Mark in the diagram the positive and negative terminals of the cell. [3M]