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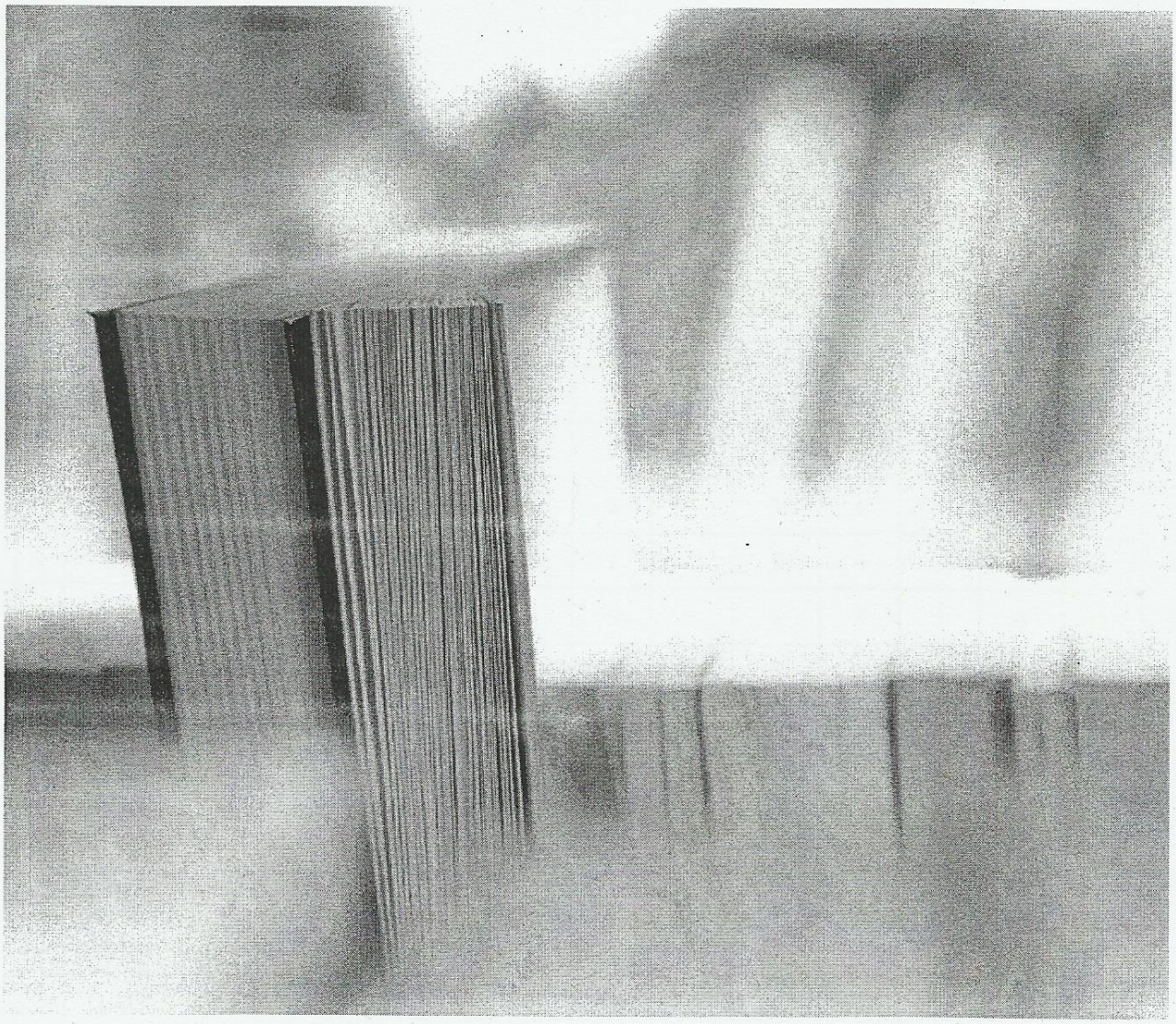

SEMINAR SPM 2014
KIMIA

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TM Education Group

#Analysis of the 2006 – 2013 SPM Paper

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 of the 2006 – 2013 SPM Paper

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 of the 2006 – 2013 SPM Paper

PAPER 3

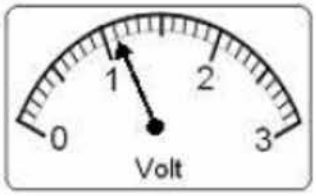
CHAPTER		YEAR							
		2006	2007	2008	2009	2010	2011	2012	2013
		Number of Questions							
Form 4									
1	Introduction to Chemistry	–	–	–	–	–	–	–	–
2	The Structure of the Atom	–	–	–	–	–	–	–	–
3	Chemical Formulae and Equations	–	–	–	–	–	–	–	–
4	Periodic Table of Elements	–	–	1	–	1	–	–	–
5	Chemical 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

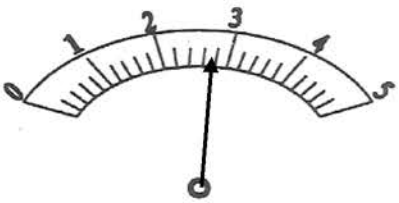
#Back to Basic

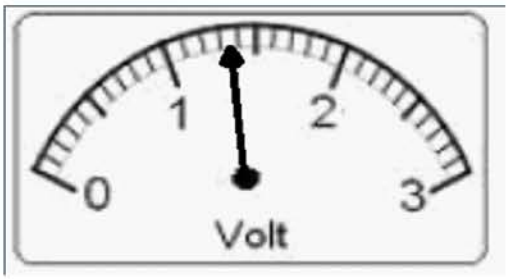
1. Apparatus Measurement

	NOTE	Decimal Place
1.	$\frac{1}{\text{Time}}$	
2.	Burette	
3.	Voltmeter * Based on the scale	
4.	Ruler	
5.	Stopwatch	
6.	Thermometer	

#Voltmeter





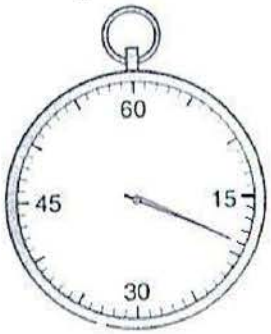


Reading: .....V Reading: .....V Reading: V

#Thermometer

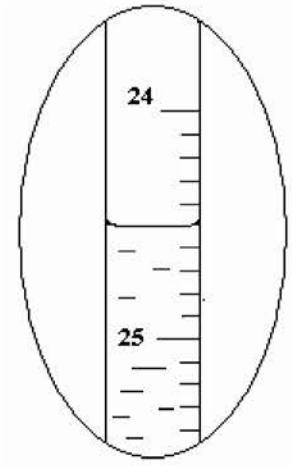
Temperature at 60 s:_____

#Stopwatch



t_3 at 40°C = _____s

#Burette



.....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 : Sodium : Argon :	Oxygen : Carbon dioxide : Ammonia :	Potassium ion : Magnesium ion : Chloride : Oxide :

Ionic Compound	**Covalent Compound**
• Metal with non-metal, • Combination of two charge (+ve and –ve) • Metal → +ve ion • Non-metal → -ve ion	• Non-Metal with non-metal • No charge • Sharing electron
Sodium chloride : Na^{+} Cl^{-} Magnesium oxide Mg^{2+} O^{2-} Aluminium oxide : Al^{3+} O^{2-} Barium hydroxide : Ba^{2+} OH^{-}	Water : **#same as molecule**

B. #Equation

#Type of full equation:

Gabung	***Element*** **+** ***Element*** Magnesium + Oxygen
Singkir	***Element*** **+** ***Compound*** Magnesium + Copper(II) sulphate
Ganti	***Compound*** **+** ***Compound*** Argentum nitrate + Sodium chloride
Urai	***Compound*** Copper(II) carbonate

#MUST Balance

#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. $Na + H_2O \rightarrow NaOH + H_2$

2. $CO + O_2 \rightarrow CO_2$

3. $Fe + Cl_2 \rightarrow FeCl_3$

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

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

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

##Half equation

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

(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	Chloride
Bromine	Bromide
Oxygen	Oxide

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

(a) Combine 2 half equation	(b)Cross the ion that not change in equation
#Involving metal and metal ion Magnesium Copper(II) ion _____	#Displacement of metal $Mg + CuSO_4 \rightarrow MgSO_4 + Cu$ ..... DIY : $Zn + CuCl_2 \rightarrow ZnCl_2 + Cu$ .....

#Involving non-metal Chlorine Iodide	#Displacement of halide $2KI + Cl_2 \rightarrow 2KCl + I_2$ ..... DIY : $2KBr + Cl_2 \rightarrow 2KCl + Br_2$ .....
	#Double Decomposition Reaction | Precipitation $AgNO_3 + NaCl \rightarrow AgCl + NaNO_3$ ..... DIY: $Pb(NO_3) + K_2SO_4 \rightarrow PbSO_4 + 2KNO_3$ .....

3. #Formula for Calculation

#Chapter 3 – formula and equation

Mol		
$mol = \frac{mass}{molar\ mass}$	$mol = \frac{volume}{molar\ volume}$	$mol = \frac{no\ of\ particles}{Avogadro\ number}$
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
$Mol = \frac{MV}{1000}$	$M_1V_1 = M_2V_2$	$\frac{M_aV_a}{a} = \frac{M_bV_b}{b}$
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}

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

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= 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, $n = \frac{MV}{1000}$ @ Mole, $n = \frac{\text{mass}}{\text{molar mass}}$

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

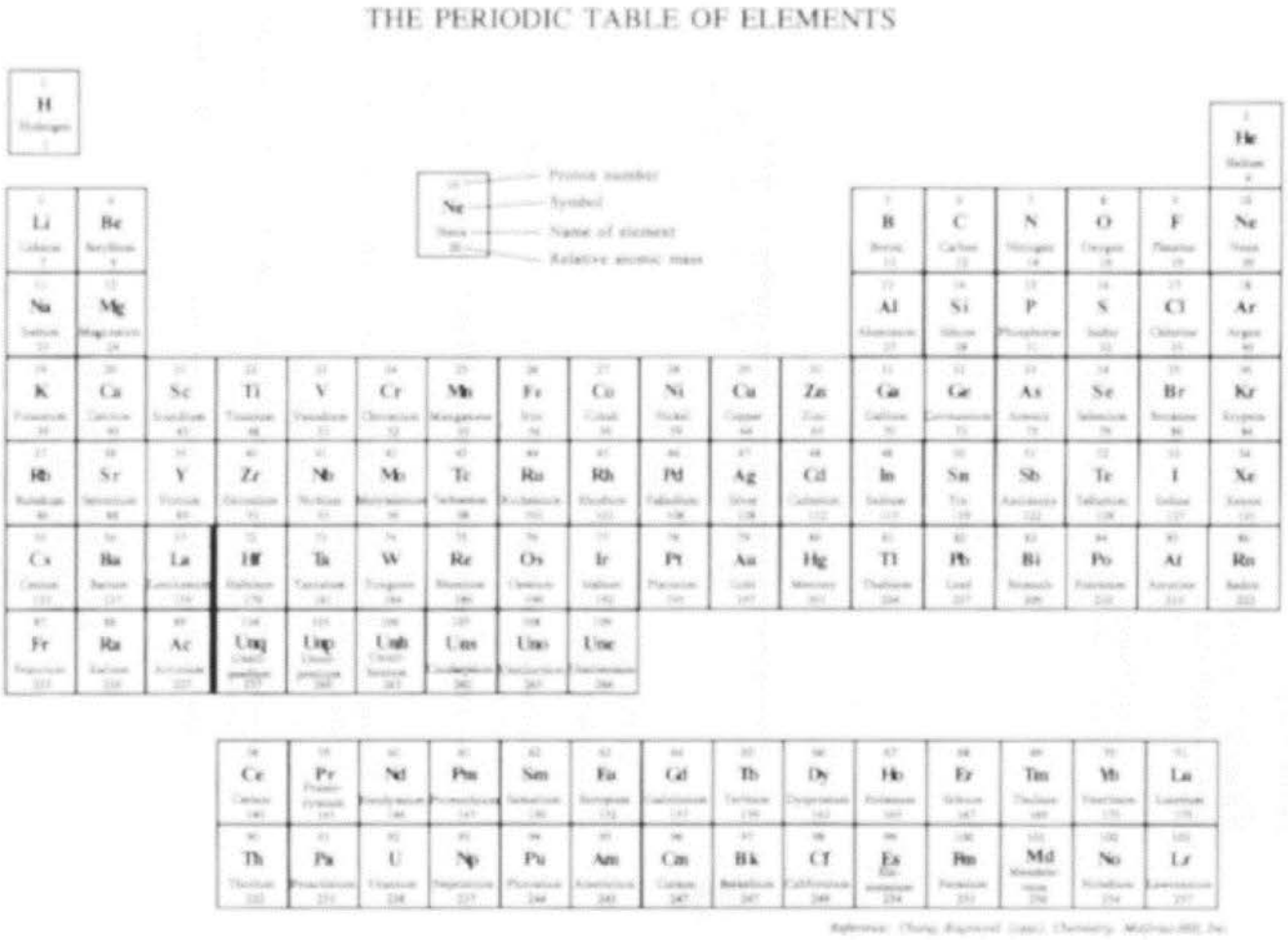
- Common mistakes in describing observations

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



Group 1	Period	Group 17

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

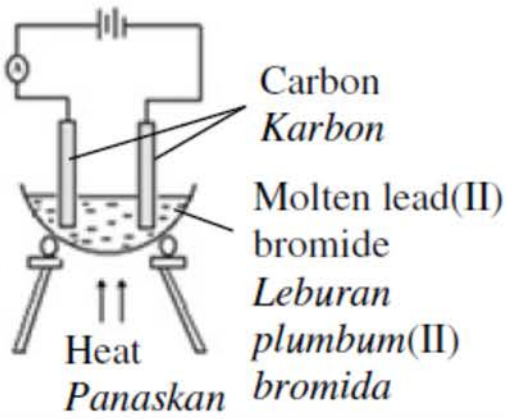
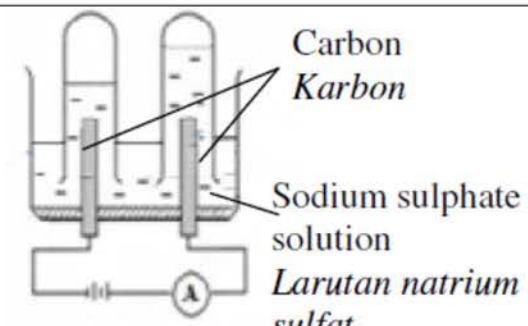
Negative Terminal/Anode	Positive Terminal/Cathode
• The metal which top in ECS (more electropositive) • The metal will dissolve into the solution • The metal produce ions • The metal become **thinner**	• The metal which lower in ECS (less electropositive) • The metal receive electron • Choose the lower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

Function of Salt Bridge// Porous Pot

.....

.....

[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

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

(i) molten lead(II) bromide : .....

(ii) sodium sulphate solution : .....

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

.....

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

.....

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

.....

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

.....

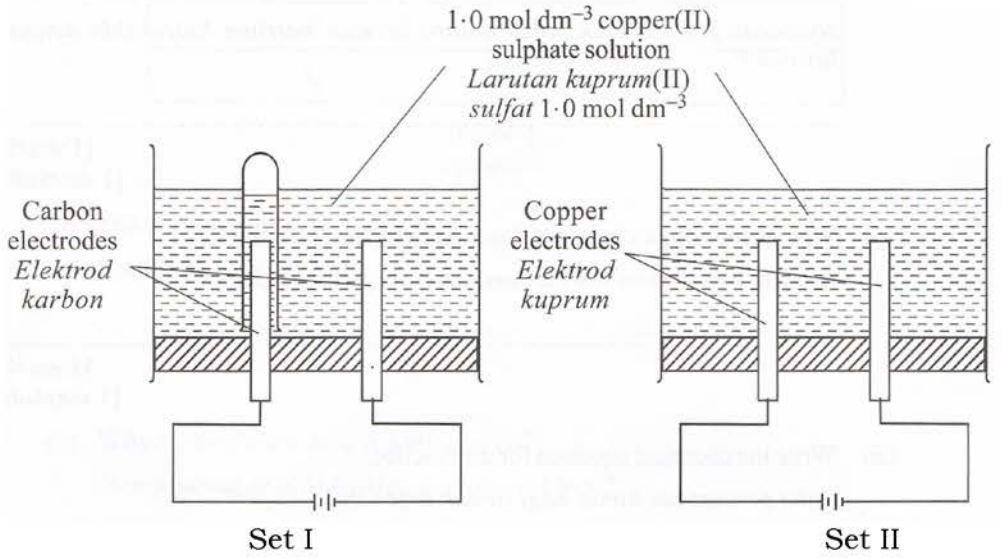
(ii) State the product of electrolysis at [2M]

Anode : ..... Cathode :.....

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

.....

[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.



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

.....

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

Anions : ..... Cations : .....

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

.....

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

.....

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

.....

.....

(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]

Comparison : .....

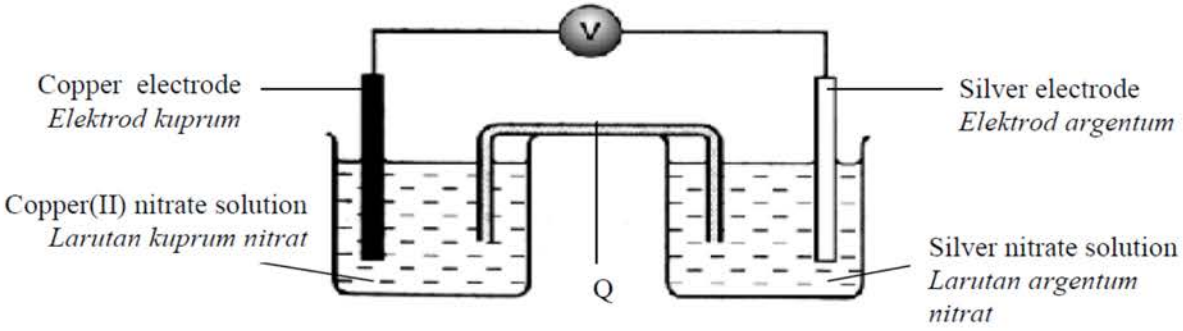
.....

Reason : .....

.....

.....

[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]

.....

(b) (i) State the function of Q. [1M]

.....

(ii) Name a chemical substance that can be used as Q. [1M]

.....

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

(d) State the colour change of copper(II) nitrate solution . Give a reason for your answer. [2M]

.....

.....

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

.....

(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]

.....

(ii) give a reason for your answer. [1M]

.....

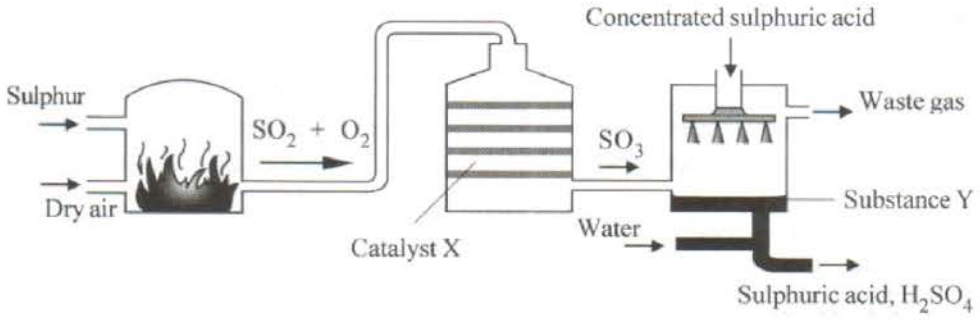
NOTE

A. Contact Process

B. Haber Process

	Contact Process	Haber Process
Catalyst		
Temperature		
Pressure		

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



(a) What is the name of this process? [1 M] .....

(b) State the name of catalyst X. [1 M] .....

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

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

.....

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

.....

.....

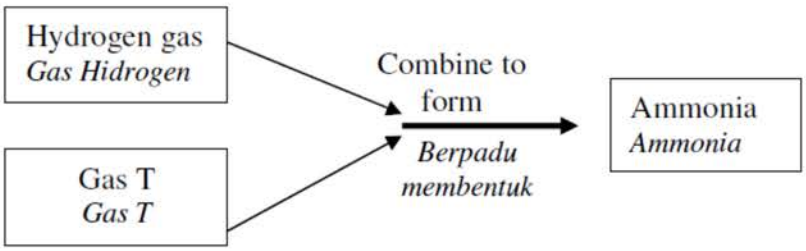
(e) The sulphuric acid produced can be used to manufacture fertilizers.
(i) Name one fertilizer manufacture from sulphuric acid. [1 M]

.....

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

.....

[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. .....

(ii) Name gas T. .....

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

.....

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.

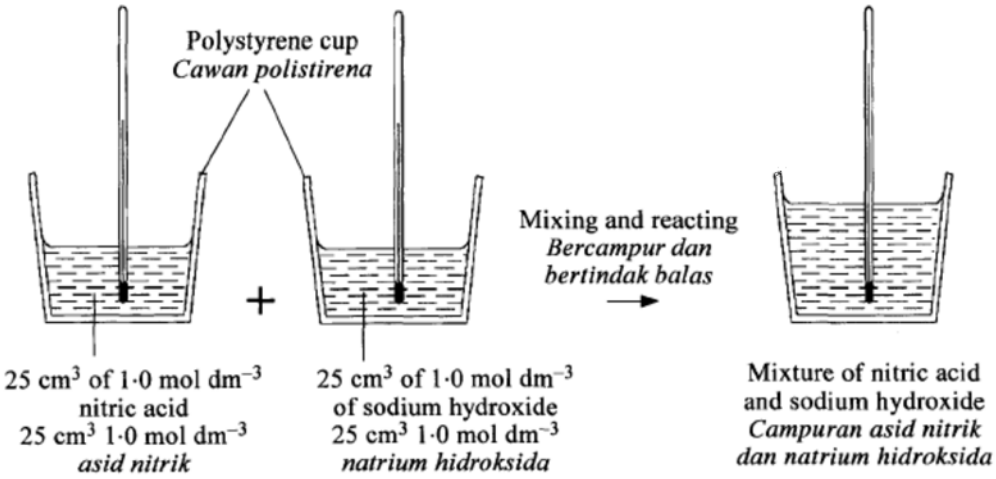


Diagram 6

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]

.....

(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}]

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

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

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

(d) The experiment is repeated using 25 cm^3 of 1.0 $moldm^{-3}$ 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]

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

.....

.....

.....

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.

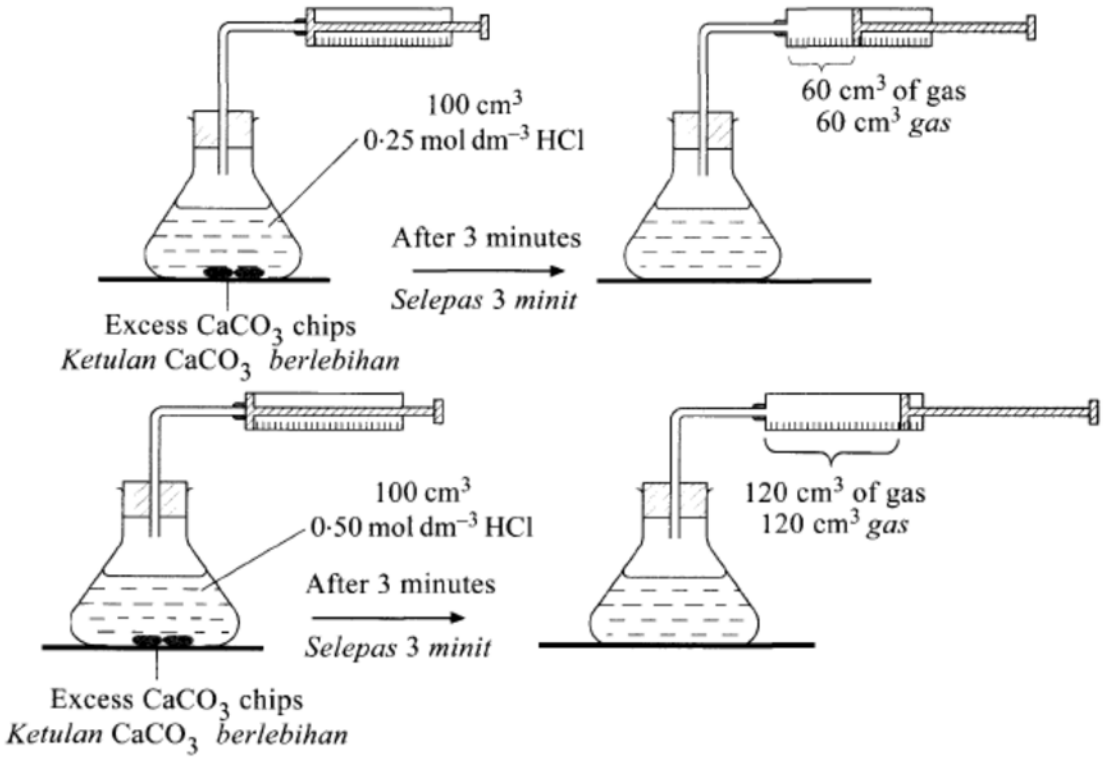
[must give what particles react with what particles.
Example H+ ion react with $S_2O_3^{2-}$ ions]

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]

.....

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

.....

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

(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]

.....

.....

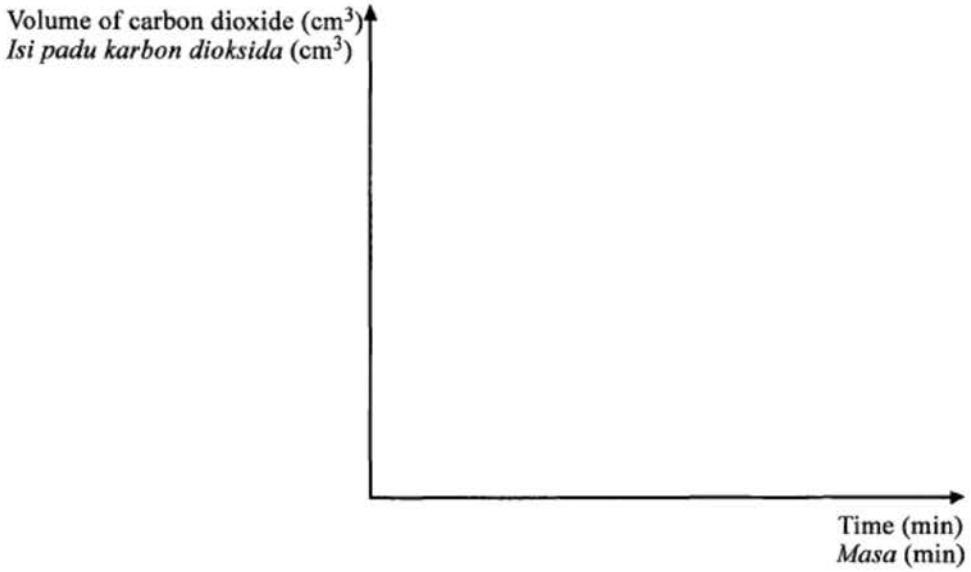
(ii)Explain the answer in 5(d)(i) with reference to the collision theory.[3M]

.....

.....

.....

(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]



Note - REDOX

HALF EQUATION FOR:

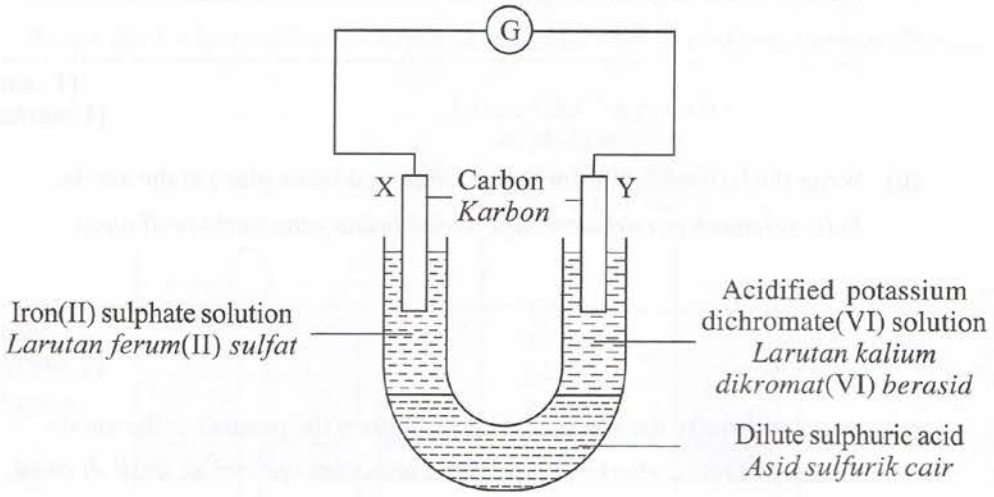
(i) ACIDIFIED POTASSIUM MANGANATE (VII) solution

Colour :

(i) ACIDIFIED POTASSIUM DICHROMATE (VI) solution

Colour :

[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]

.....

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

.....

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

.....

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

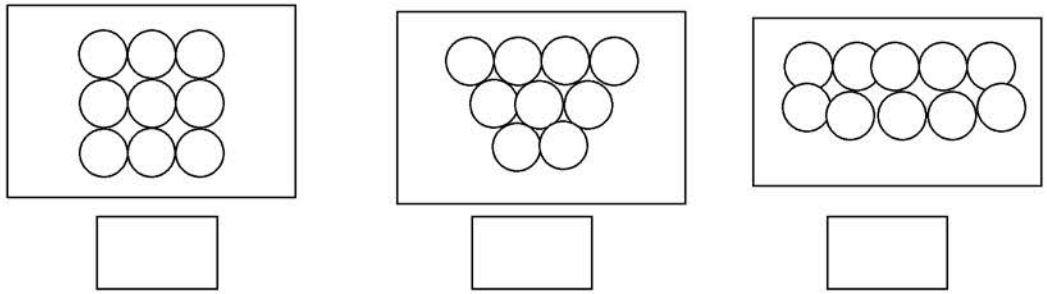
Apparatus and Materials	
• Porous pot	• Carbon electrodes
• Beaker	• Bromine water
• Connecting wires	• Potassium iodide solution
• Galvanometer	

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]

CHAPTER 2: THE STRUCTURE OF THE ATOM

<table>
<tr><th>Questions and sample answers by candidates</th><th>The correct/accurate answer</th></tr>
<tr><td>1. Drawing Diagrams
Choose the correct drawings for the arrangement of particles in the solid state
  </td><td>Minimum 3 layers of atoms
Same size of atoms
Atoms do not overlap</td></tr>
<tr><td>2. Explain why temperature does not change when ice melts.

Wrong ans:
Because heat is used to increase the distance between particles</td><td></td></tr>
<tr><td>3. An experiment is carried out to determine the melting point of a compound X. Figure 2.20 shows the set-up of apparatus. Powder of compound X is heated in a water bath. The temperature of X is recorded every minute, from 70 °C to 95 °C. The results of the experiment are shown in table below.

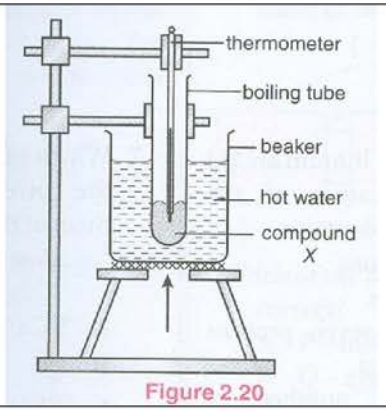
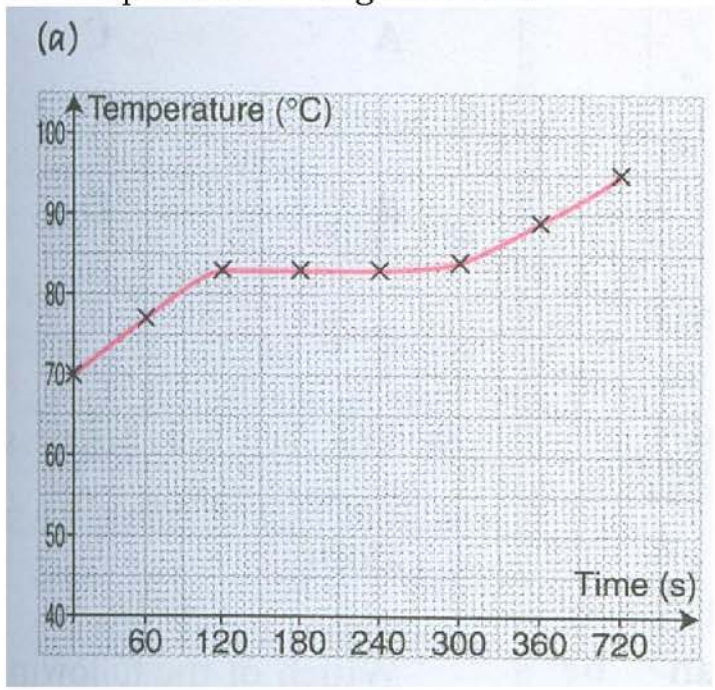
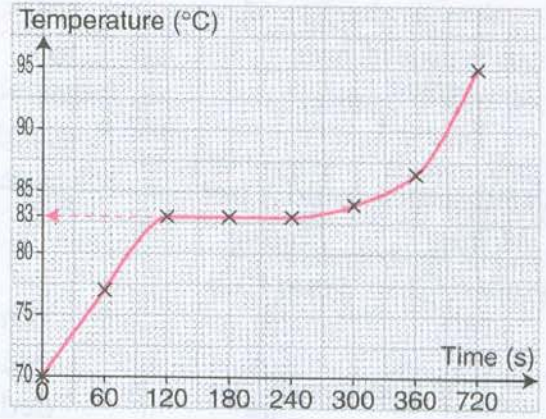
<table>
<tr><th>Time, s</th><th>Temperature, °C</th></tr>
<tr><td>0</td><td>70.0</td></tr>
<tr><td>60</td><td>77.0</td></tr>
<tr><td>120</td><td>83.0</td></tr>
<tr><td>180</td><td>83.0</td></tr>
<tr><td>240</td><td>83.0</td></tr>
<tr><td>300</td><td>84.0</td></tr>
<tr><td>360</td><td>89.0</td></tr>
<tr><td>420</td><td>95.0</td></tr>
</table>


Figure 2.20</td><td></td></tr>
</table>

(a) Plot a graph of the temperature of X against time



The y-axis scale is too small. The graph should occupy at least $\frac{1}{3}$ of the space provided in the graph paper.



(b) Based on the graph in (a), what is the melting point of X? Show how you get the answer.

83

(c) Explain why there is no change in temperature from 120s to 240s.

(d) State the movement of particles X between 60 s to 120 s.

The particles are closely packed and vibrate at their fixed position

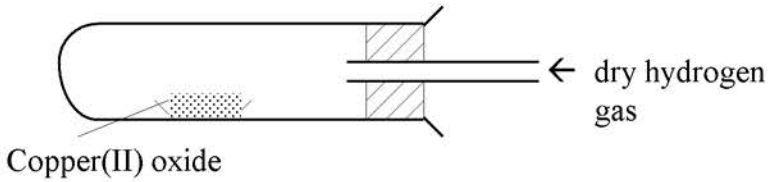
(e) What is the reason for using a water bath?

CHAPTER 3: CHEMICAL FORMULAE AND EQUATIONS

1. Drawing Diagrams

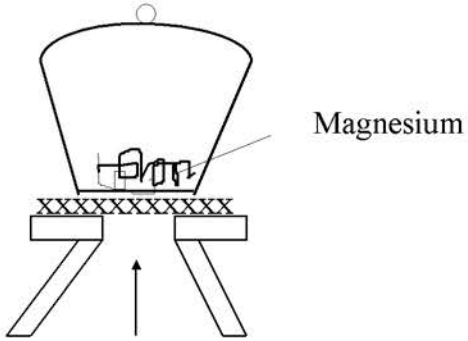
Correct the mistakes found in the drawings below:

(a) Experiment to determine the empirical formula of copper oxide:



- Position of cork//stopper
- No gas outlet
- No heating
- No support

2. Experiment to determine the empirical formula of magnesium oxide.



- Direct heating//without wire gauze
- Heat

3. An experiment is carried out to determine the empirical formula of magnesium oxide. The results of the experiment are recorded.

Mass of crucible + lid = 26.8 g
Mass of crucible + lid + magnesium ribbon = 29.2 g
Mass of crucible + lid + magnesium oxide = 30.8 g

a) What is meant by empirical formula?
The empirical formula is the chemical formula that shows the smallest/simplest ratio of the elements

b) Based on the results,
i) calculate the mass of magnesium that has reacted
ii) calculate the mass of oxygen that has reacted
iii) calculate the number of moles of magnesium and oxygen that have reacted

i) mass of magnesium = 29.2 – 26.8
= 2.4

ii) 1.6 g

iii) Number of moles of magnesium
=2.4/24
= 0.1 mol

Number of moles of oxygen
= 1.6/16
= 0.1 mol

c) Determine the empirical formula of magnesium oxide.
The simplest whole number mole ratio of magnesium atom: oxygen atom
= 0.1 : 0.1
= 1 : 1

d) Write a balanced equation for the reaction

e) Why is the crucible lid lifted once in a while in the experiment?
Wrong ans: To allow the white fumes to escape.

CHAPTER 4: PERIODIC TABLE OF ELEMENTS

1. Neon is not reactive chemically. Explain based on the electron arrangement

Incomplete Answer :
Neon atom has an electron arrangement of 2.8.8. All the shells are fully filled with electrons

Neon atom has an electron arrangement of 2.8/ Neon atom has 8 electron in the outermost shell/Stable electron arrangements/Octet electron arrangement
So neon atom does not receive, release or share electron with itself or other atom

2.

Element	Nucleon number	Proton number
Lithium	7	3
Sodium	23	11
Potassium	39	19

a) (i) Write the electron arrangement of lithium
2 : 1 *(wrong)*

(ii) Write the chemical formula of lithium ions

b) (i) State one similar physical property of group 1 elements
They are a metals *(wrong)*

(ii) Explain why group 1 elements show similar properties
They have the same number of electrons *(wrong)*

c) (i) Group 1 elements react with cold water vigorously. Write a balanced chemical equation for the reaction of potassium with cold water.
$2K + H_2O \rightarrow K_2O + H_2$ *(wrong)*

(ii) Which of the elements in Group 1 react most vigorously with cold water? Explain
Potassium because it is reactive *(wrong)*

d) How are these metals kept in the laboratory? Give a reason for your answer.
They are kept in paraffin
because they are reactive. *(not specific)*

e) Rubidium, Rb is a group 1 element, which is located below potassium in the Periodic Table.
Rubidium reacts with oxygen and chlorine to form ionic compounds.
(i) Write the chemical formula of rubidium oxide
(ii) Write a balanced chemical equation for the reaction of rubidium with chlorine

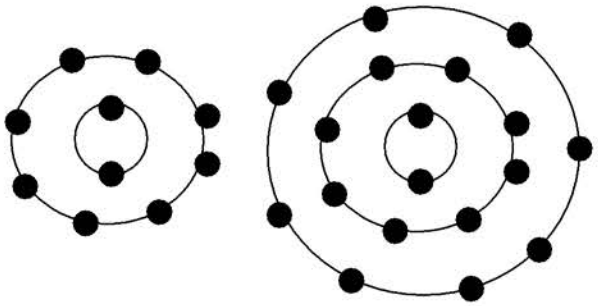
(i) RbO
(ii) Rb + Cl $\rightarrow$ RbCl

CHAPTER 5: CHEMICAL BONDS

1. Drawing Diagrams

Correct the mistakes found in the drawings below:

Element J (proton number 11) and element M (proton number 17) react to form a compound. Draw the electron arrangement for the compound formed.



- Nucleus
- Charge of ions
- Label

2.

Particles	Electron arrangement
X	2.6
Y	2.8.1

(a)What is the formula of the compound formed between X and Y

Wrong answer:

XY_2

(b) Give one chemical property of the compound formed

Wrong answer:

It dissolve in water but cannot dissolve in organic solvent

3. Table below shows the subatomic composition of a few particles.

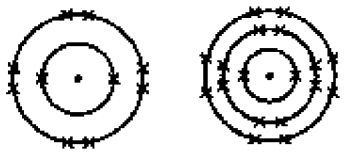
Particles	Number of protons	Number of neutrons	Number of electrons
U^+	3	4	
V	6	6	6
W^{2-}	8	8	
Y	9	10	9
Z	11	12	11

a) What is the number of electrons in U^+?
3

b) What is the electron arrangement of ion W^{2-}?
2.6

c) Y and Z atoms combine to form a compound.
(i) What is the chemical formula of the compound?
YZ

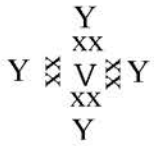
(ii) Draw the electron arrangement for the particles found in the compound.



Ion Z^+ Ion Y^-

d) V and Y atoms combine to form a compound.
(i) What is the type of bond found in the compound?
Covalent bond

(ii) Draw Lewis structure for the compound formed.
Incomplete



e) Compare two physical properties of the compound in (c) and (d)
Wrong/inaccurate answer

- The compound in (c) is soluble in water and the compound in (d) is soluble in organic solvents

- The compound in (c) conducts electricity but the compound in (d) does not conduct electricity

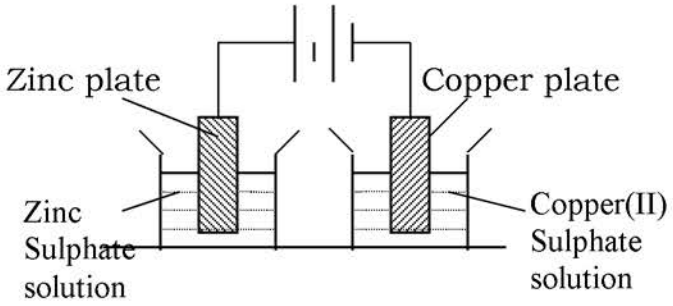
f) Draw a diagram for the apparatus set-up to compare one of the physical properties of the compounds (c) and (d) that is mentioned in (e)

CHAPTER 6: ELECTROCHEMISTRY

1. Drawing Diagrams

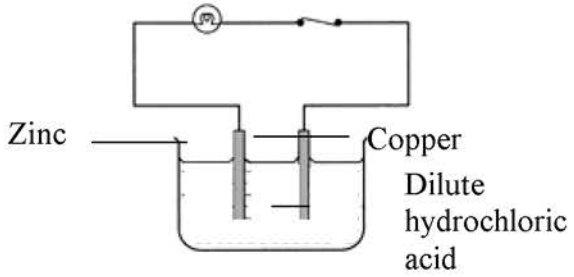
Correct the mistakes found in the drawings below:

Diagram of a **chemical** cell



- Voltmeter/ galvanometer
- Salt bridge

Diagram of a chemical cell



3. Explain why lead(II) bromide can conduct electricity in molten state but not in the solid state **Incomplete Answer:** Because **Pb^{2+}** and **Br^{-}** ions can move freely in the molten state **Wrong answer:** Because lead(II) bromide can move freely in molten state	
4. Explain why molten lead(II) bromide can conduct electricity but molten naphthalene does not conduct electricity **Inaccurate Answer:** Because molten lead(II) bromide is an ionic compound whereas molten naphthalene is an covalent compound	
5. The electrolysis of copper(II) sulphate solution is carried out using copper electrodes (a) What is observed at the anode? **Inaccurate answer:** The copper electrode corrodes (b) Explain why the intensity of the blue colour does not change **Inaccurate answer:** Because the concentration of Cu^{2+} ions does not change. Rate of change of Cu^{2+} to Cu metal is the same as the rate of change of Cu to Cu^{2+}	

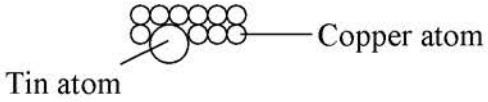
CHAPTER 7: ACIDS AND BASES

1. $Zn + 2HCl \rightarrow ZnCl_2 + H_2$ (a) What can you observed from the reaction above? **Wrong answer :** Gas is given out (b) Suggest a method to collect the gas given out at 30 second interval **Inaccurate Answer:** Let the gas flowed into a burette filled with water	
2. Explain why hydrogen chloride shows acidic properties in aqueous solution **Inaccurate answer:** Hydrogen chloride decomposes to produce H^+ ions when it dissolves in water	

CHAPTER 8: SALTS

1. $AgNO_3 + NaCl \rightarrow AgCl + NaNO_3$ How can you obtain a dry silver chloride salt from the above reaction? **Inaccurate Answer:** Filter the products	
2. What is observed when lead(II) carbonate is heated? **Wrong Answer:** Carbon dioxide is released/Lead(II) carbonate is brown when hot and yellow when cold	
3. $PbCO_3 \rightarrow PbO + CO_2$ Give a test for the gas produced in the reaction? **Inaccurate Answer:** Test the gas with lime water, lime water turns chalky.	

CHAPTER 9: MANUFACTURED SUBSTANCES IN INDUSTRY

1. Drawing Diagrams Correct the mistakes found in the drawings below: Arrangement of particles in bronze alloy.  	More than two layers of atom
2. Why does duralumin which contains 95 % aluminium and 4 % copper is harder than aluminium? **Inaccurate Answer**: Aluminium atoms cannot slide over each other due to the presence of added metallic atoms of different size. Draw the arrangement of particles in duralumin. 	

CHAPTER 10: RATE OF REACTION

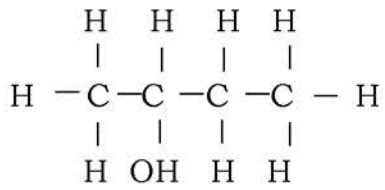
1. A bit of manganese(IV) oxide powder is added to hydrogen peroxide solution in a test tube. Give a test to identify the gas given out **Inaccurate answer:** Used a glowing wooden splinter. The glowing wooden splinter rekindles	
2. Applications of Rate of Reaction - Flour suspended in the air in flour mills can burn very rapidly in an explosion - Mixture of methane and air in mines can burn rapidly in an explosion. - Acid rain corrodes buildings and metal structures slowly - Catalysts are used in many industrial reactions	

CHAPTER 11: CARBON COMPOUND

1. Drawing Diagrams

Correct the mistakes found in the drawings below:

Structure formula of alcohol.



- Bond between C-O

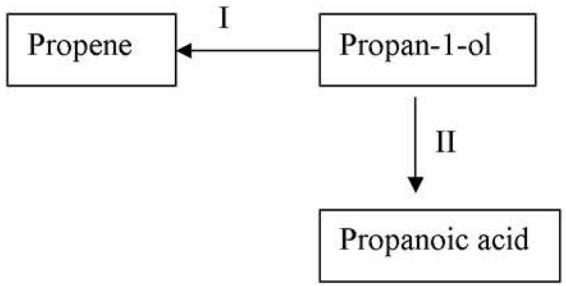
2. Give one chemical test how to distinguish between butene and butane.

Inaccurate answer:

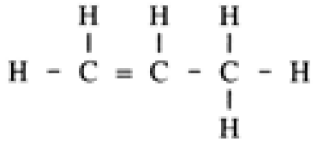
Add bromine water to butane and butene in two separate test tubes.

Butene decolourized the bromine water

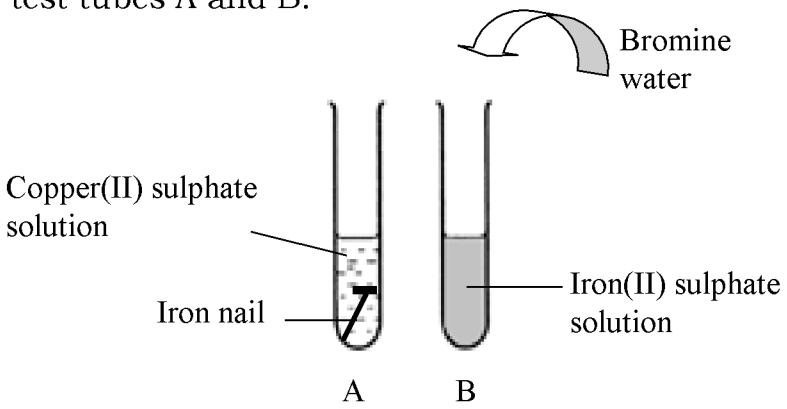
3.



The flow chart above shows the conversion of propan-1-ol to another organic compounds.

a) Propan-1-ol is converted to propene in reaction I. i) Write the structural formula for propene ii) Describe briefly how to convert propan-1-ol to propene in the laboratory **Inaccurate answer:** Propan-1-ol is heated with aluminium oxide b) i) Name process II Oxidation ii) State the reagent used in process II Potassium manganate(VII)	

CHAPTER 12: OXIDATION AND REDUCTION

1. Why must powdered carbon be mixed evenly with zinc oxide powder before being heated? **Inaccurate answer:** So that reaction takes placed evenly/reaction takes place easily/reactants react completely	
2. Figure below shows the apparatus set-up to investigate the redox reactions in test tubes A and B.  a) State two observations obtained from test tube A Copper is formed *(wrong)* The solution turned pale green *(incomplete)* b) Write two half equations to show the electron transfer in test tube A Cu^{2+} → Cu + 2e *(wrong)* Fe + 2e → Fe^{2+} *(wrong)* c) What is meant by oxidizing agent in terms of electron transfer? Oxidising agent is the substance that is reduced in the reaction d) State two observations obtained from test tube B Bromine water decolourized The solution turned brown	

e) What is the change in oxidation number of iron in the test tube B 2 → 0 f) Name another substance can replaced bromine water in test tube B $KMnO_4$ *(Wrong)* Potassium manganate(VII) *(Incomplete)*	

CHAPTER 13: THERMOCHEMISTRY

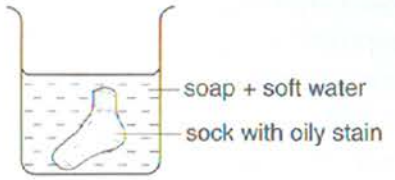
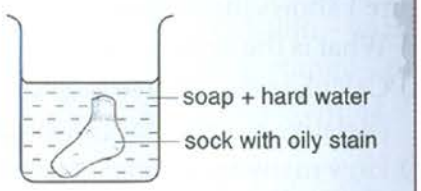
1. $HCl + KOH \rightarrow KCl + H_2O$ $\quad \Delta H = -57$ kJ mol^{-1} (a) What does ΔH represent in the equation above **Inaccurate Answer:** 57 kJ heat energy given out when 1 mole of water is formed (b) What causes the energy change in the reaction **Wrong answer:** When bond is formed when potassium chloride is produce	
2. In an experiment to determine the Heat of Neutralisation, 40 cm^3 of 2.0 mol dm^{-3} sodium hydroxide is added to 80 cm^3 of 0.5 mol dm^{-3} nitric acid. An increase in temperature of 4.0 °C is recorded. (Specific heat capacity = 4.2 J g^{-1} $°C^{-1}$) (a) Calculate the heat released **Wrong Answer :** Heat released = $\frac{120 \times 4.2 \times 4}{0.02}$ = 100,800 J (100.8 kJ)	

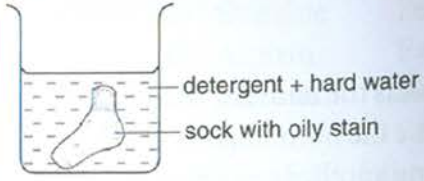
(b) Calculate the heat of neutralization **Wrong Answer :** Heat of neutralization = 100.8 kJ mol^{-1} (c) How much would the energy change be if the nitric acid is replaced with sulphuric acid of the same volume and concentration ? Explain your answer **Inaccurate Answer:** Heat released is double. Sulphuric acid is diprotic/dibasic whereas hydrochloric acid is monoproptic (d) What is the increase in temperature if 80 cm^3 of 2 mol dm^{-3} sodium hydroxide is added to 160 cm of 0.5 mol dm^{-3} nitric acid? Explain your answer **Wrong Answer:** Increase/rise in temp is 8.0 °C because heat released is doubled	

CHAPTER 14: CHEMICAL FOR CONSUMER

1. (a) A student washed his socks which had oily stains. Explain the cleansing action of soap on the oily stains.	

(b) Another student carried out four experiments to investigate the cleansing effect of soap and detergent on oily stains in soft water and hard water respectively.

Experiment	Experiment I	Experiment II
		
Observation	Oily stain disappears	Oily stain remains

Experiment	Experiment III	Experiment IV
		
Observation	Oily stain disappears	Oily stain disappears

Compare the cleansing effect between

(i) experiments I and II

(ii) experiment II and IV

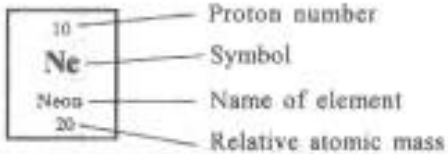
Explain the differences in the observation.

Lampiran 1

The cations and anions

Cations		**Anions**	
Ion Name	**Ions Formula**	**Ion Name**	**Ions Formula**
Potassium ion	K^+	Fluoride ion	F^-
Sodium ion	Na^+	Chloride ion	Cl^-
Hydrogen ion	H^+	Bromide ion	Br^-
Silver ion	Ag^+	Iodide ion	I^-
Ammonium ion	$(NH_4)^+$	Hydroxide ion	$(OH)^-$
Lithium ion	Li^+	Nitrate ion	$(NO_3)^-$
Rubidium ion	Rb^+	Manganese (VII) ion	$(MnO_4)^-$
Barium ion	Ba^{2+}	Carbonate ion	$(CO_3)^{2-}$
Calcium ion	Ca^{2+}	Oxide ion	O^{2-}
Nickel (II) ion	Ni^{2+}	Sulphide ion	$(SO_3)^{2-}$
Copper (II) ion	Cu^{2+}	Sulphate ion	$(SO_4)^{2-}$
Iron (II) ion	Fe^{2+}	Dichromate (VI) ion	$(Cr_2O_7)^{2-}$
Lead (II) ion	Pb^{2+}	Chromate (VI) ion	$(CrO_4)^{2-}$
Zinc ion	Zn^{2+}	Phosphate ion	$(PO_4)^{3-}$
Magnesium ion	Mg^{2+}		
Aluminium ion	Al^{3+}		
Iron (III) ion	Fe^{3+}		

THE PERIODIC TABLE OF ELEMENTS

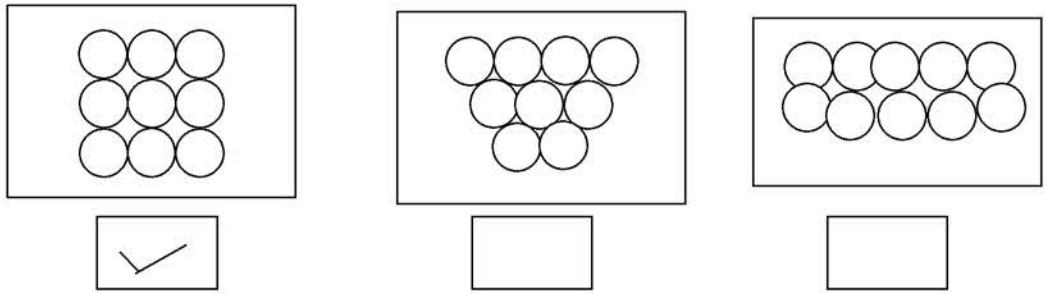


1 H Hydrogen 1																	2 He Helium 4
3 Li Lithium 7	4 Be Beryllium 9											5 B Boron 11	6 C Carbon 12	7 N Nitrogen 14	8 O Oxygen 16	9 F Fluorine 19	10 Ne Neon 20
11 Na Sodium 23	12 Mg Magnesium 24											13 Al Aluminum 27	14 Si Silicon 28	15 P Phosphorus 31	16 S Sulfur 32	17 Cl Chlorine 35	18 Ar Argon 40
19 K Potassium 39	20 Ca Calcium 40	21 Sc Scandium 45	22 Ti Titanium 48	23 V Vanadium 51	24 Cr Chromium 52	25 Mn Manganese 55	26 Fe Iron 56	27 Co Cobalt 59	28 Ni Nickel 59	29 Cu Copper 64	30 Zn Zinc 65	31 Ga Gallium 70	32 Ge Germanium 73	33 As Arsenic 75	34 Se Selenium 79	35 Br Bromine 80	36 Kr Krypton 84
37 Rb Rubidium 86	38 Sr Strontium 88	39 Y Yttrium 89	40 Zr Zirconium 91	41 Nb Niobium 93	42 Mo Molybdenum 96	43 Tc Technetium 98	44 Ru Ruthenium 101	45 Rh Rhodium 103	46 Pd Palladium 106	47 Ag Silver 108	48 Cd Cadmium 112	49 In Indium 115	50 Sn Tin 119	51 Sb Antimony 122	52 Te Tellurium 128	53 I Iodine 127	54 Xe Xenon 131
55 Cs Cesium 133	56 Ba Barium 137	57 La Lanthanum 139	72 Hf Hafnium 179	73 Ta Tantalum 181	74 W Tungsten 184	75 Re Rhenium 186	76 Os Osmium 190	77 Ir Iridium 192	78 Pt Platinum 195	79 Au Gold 197	80 Hg Mercury 201	81 Tl Thallium 204	82 Pb Lead 207	83 Bi Bismuth 209	84 Po Polonium 210	85 At Astatine 210	86 Rn Radon 222
87 Fr Francium 223	88 Ra Radium 226	89 Ac Actinium 227	104 Unq Unnil-quadium 257	105 Unp Unnil-pentium 260	106 Unh Unnil-hexium 263	107 Uns Unnilseptium 262	108 Uno Unniloctium 265	109 Une Unnilennium 266									

58 Ce Cerium 140	59 Pr Praseo-dymium 141	60 Nd Neodymium 144	61 Pm Promethium 147	62 Sm Samarium 150	63 Eu Europium 152	64 Gd Gadolinium 157	65 Tb Terbium 159	66 Dy Dysprosium 163	67 Ho Holmium 165	68 Er Erbium 167	69 Tm Thulium 169	70 Yb Ytterbium 173	71 Lu Lutetium 175
90 Th Thorium 232	91 Pa Protactinium 231	92 U Uranium 238	93 Np Neptunium 237	94 Pu Plutonium 244	95 Am Americium 243	96 Cm Curium 247	97 Bk Berkelium 247	98 Cf Californium 249	99 Es Ein-steinium 254	100 Fm Fermium 253	101 Md Mendele-vium 256	102 No Nobelium 254	103 Lr Lawrencium 257

Reference: Chang, Raymond (1991). Chemistry. McGraw-Hill, Inc.

CHAPTER 2: THE STRUCTURE OF THE ATOM

<table>
<tr><th>Questions and sample answers by candidates</th><th>The correct/accurate answer</th></tr>
<tr><td>1. Drawing Diagrams
Choose the correct drawings for the arrangement of particles in the solid state
  </td><td>Minimum 3 layers of atoms
Same size of atoms
Atoms do not overlap</td></tr>
<tr><td>2. Explain why temperature does not change when ice melts.

Wrong ans:
Because heat is used to increase the distance between particles</td><td>Because heat energy is absorbed to overcome the attractive forces between the water molecules</td></tr>
<tr><td>3. An experiment is carried out to determine the melting point of a compound X. Figure 2.20 shows the set-up of apparatus. Powder of compound X is heated in a water bath. The temperature of X is recorded every minute, from 70 °C to 95 °C. The results of the experiment are shown in table below.

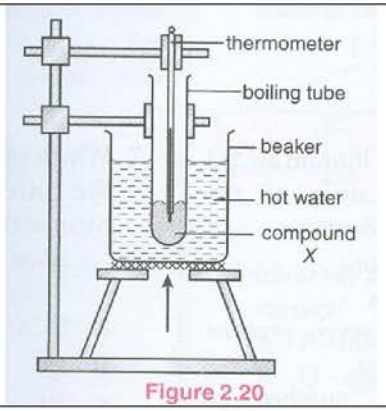
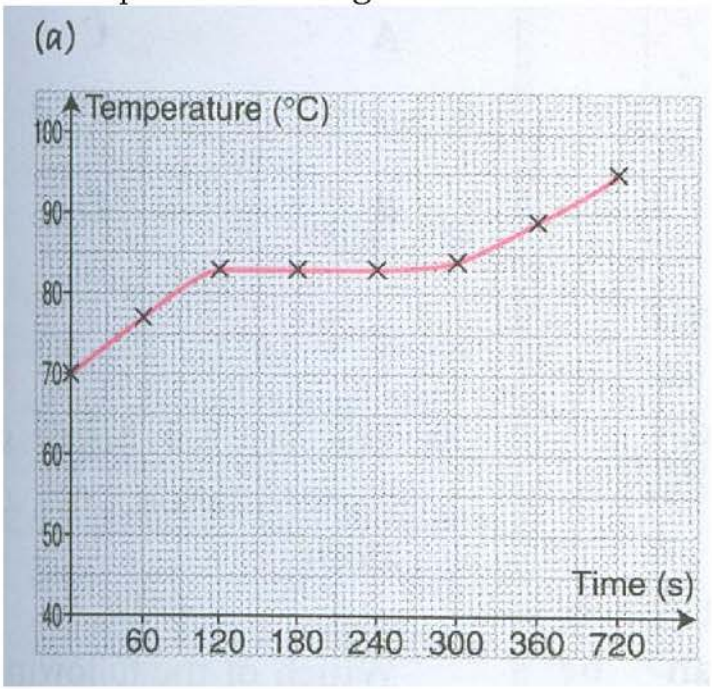
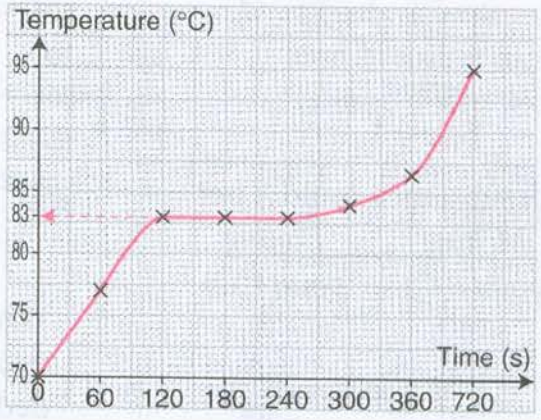
<table>
<tr><th>Time, s</th><th>Temperature, °C</th></tr>
<tr><td>0</td><td>70.0</td></tr>
<tr><td>60</td><td>77.0</td></tr>
<tr><td>120</td><td>83.0</td></tr>
<tr><td>180</td><td>83.0</td></tr>
<tr><td>240</td><td>83.0</td></tr>
<tr><td>300</td><td>84.0</td></tr>
<tr><td>360</td><td>89.0</td></tr>
<tr><td>420</td><td>95.0</td></tr>
</table>


Figure 2.20</td><td></td></tr>
</table>

(a) Plot a graph of the temperature of X against time



The y-axis scale is too small. The graph should occupy at least $\frac{1}{3}$ of the space provided in the graph paper.



(b) Based on the graph in (a), what is the melting point of X? Show how you get the answer.
83

83°C.
Must be marked on the graph drawn in (a)

Correct answer

(c) Explain why there is no change in temperature from 120s to 240s.
The heat absorbed is used to overcome the forces of attraction between the particles of X.

Arrangement of particles not asked for.
Must state change in movement
The particles both vibrate and rotate faster at their fixed positions.

(d) State the movement of particles X between 60 s to 120 s.
The particles are closely packed and vibrate at their fixed position

Correct

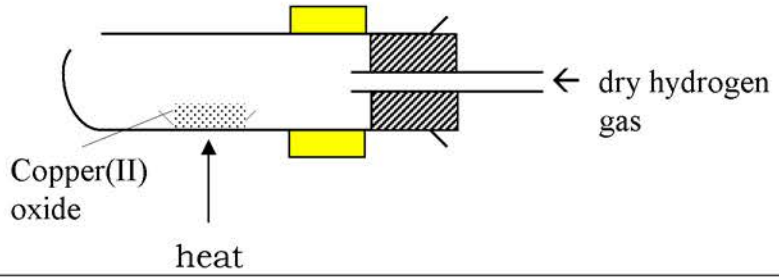
(e) What is the reason for using a water bath?
Water bath is used to heat X evenly/ uniformly

CHAPTER 3: CHEMICAL FORMULAE AND EQUATIONS

1. Drawing Diagrams

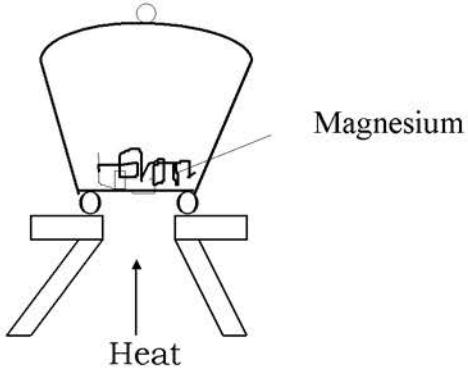
Correct the mistakes found in the drawings below:

(a) Experiment to determine the empirical formula of copper oxide:



- Position of cork//stopper
- No gas outlet
- No heating
- No support

2. Experiment to determine the empirical formula of magnesium oxide.



- Direct heating//without wire gauze
- Heat

3. An experiment is carried out to determine the empirical formula of magnesium oxide. The results of the experiment are recorded.

Mass of crucible + lid	= 26.8 g
Mass of crucible + lid + magnesium ribbon	= 29.2 g
Mass of crucible + lid + magnesium oxide	= 30.8 g

a) What is meant by empirical formula? The empirical formula is the chemical formula that shows the smallest/simplest ratio of the elements	**The empirical formula is chemical formula that shows the smallest/simplest whole number ratio of the number of atoms of each element in the compound.**
b) Based on the results, i) calculate the mass of magnesium that has reacted ii) calculate the mass of oxygen that has reacted iii) calculate the number of moles of magnesium and oxygen that have reacted	
i) mass of magnesium = 29.2 – 26.8 = 2.4	**No unit. Must be 2.4 g**
ii) 1.6 g	***Steps in calculating must be shown.*** **Mass of oxygen = 30.8 -29.2** **= 1.6 g**
iii) Number of moles of magnesium =2.4/24 = 0.1 mol	***Correct***
Number of moles of oxygen = 1.6/16 = 0.1 mol	***Correct***
c) Determine the empirical formula of magnesium oxide. The simplest whole number mole ratio of magnesium atom: oxygen atom = 0.1 : 0.1 = 1 : 1	**Not complete. The empirical formula of magnesium oxide is MgO** **Oxygen gas exists as molecules, O2** **$2Mg + O_2 \rightarrow 2MgO$**
d) Write a balanced equation for the reaction $Mg + O \rightarrow MgO$	
e) Why is the crucible lid lifted once in a while in the experiment? Wrong ans: To allow the white fumes to escape.	To allow air to enter the crucible/ To ensure complete combustion of the magnesium ribbon

CHAPTER 4: PERIODIC TABLE OF ELEMENTS

1. Neon is not reactive chemically. Explain based on the electron arrangement **Incomplete Answer** : Neon atom has an electron arrangement of 2.8.8. All the shells are fully filled with electrons	Neon atom has an electron arrangement of 2.8/ Neon atom has 8 electron in the outermost shell/Stable electron arrangements/Octet electron arrangement So neon atom does not receive, release or share electron with itself or other atom
2. Element / Nucleon number / Proton number Lithium / 7 / 3 Sodium / 23 / 11 Potassium / 39 / 19 a) (i) Write the electron arrangement of lithium 2 : 1 *(wrong)* (ii) Write the chemical formula of lithium ions Li^+ b) (i) State one similar physical property of group 1 elements They are a metals *(wrong)* (ii) Explain why group 1 elements show similar properties They have the same number of electrons *(wrong)* c) (i) Group 1 elements react with cold water vigorously. Write a balanced chemical equation for the reaction of potassium with cold water. $2K + H_2O \rightarrow K_2O + H_2$ *(wrong)*	2.1// 2, 1 Li^+ // Li^{+1}// Li^{1+} They are soft metals, that can be cut easily All elements from the same group (1) have the same number of valence electrons (1) K_2O dissolves in water to form an alkaline solution. $2K + H_2O \rightarrow 2KOH + H_2$

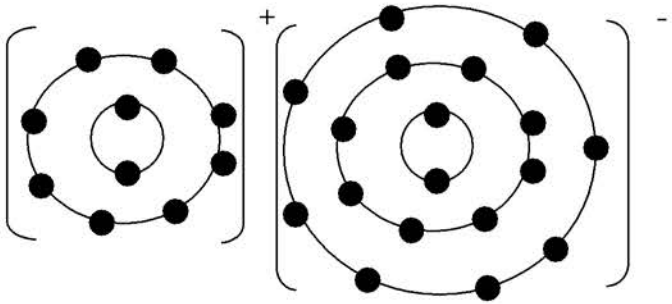
(ii) Which of the elements in Group 1 react most vigorously with cold water? Explain Potassium because it is reactive *(wrong)*	Potassium. Atomic size of Potassium is the biggest. Distance between the nucleus and valence electron is the furthest attractive forces between the nucleus and valence electron is the weakest The easiest to release its valence electron
d) How are these metals kept in the laboratory? Give a reason for your answer. They are kept in paraffin because they are reactive. *(not specific)*	They are kept in paraffin because they react easily with oxygen/water vapour in the air, may cause explosion
e) Rubidium, Rb is a group 1 element, which is located below potassium in the Periodic Table. Rubidium reacts with oxygen and chlorine to form ionic compounds. (i) Write the chemical formula of rubidium oxide (ii) Write a balanced chemical equation for the reaction of rubidium with chlorine	
(i) RbO (ii) Rb + Cl → RbCl	Rb_2O $2Rb + Cl_2 \rightarrow 2\ RbCl$ *The chlorine molecule is diatomic.*

CHAPTER 5: CHEMICAL BONDS

1. Drawing Diagrams

Correct the mistakes found in the drawings below:

Element J (proton number 11) and element M (proton number 17) react to form a compound. Draw the electron arrangement for the compound formed.



- Nucleus
- Charge of ions
- Label

2.

Particles	Electron arrangement
X	2.6
Y	2.8.1

(a)What is the formula of the compound formed between X and Y

Wrong answer:

XY_2

Y_2X

(b) Give one chemical property of the compound formed

Wrong answer:

It dissolve in water but cannot dissolve in organic solvent

It show basic properties/It react with acid to form salt and water only

3. Table below shows the subatomic composition of a few particles.

Particles	Number of protons	Number of neutrons	Number of electrons
U^+	3	4	
V	6	6	6
W^{2-}	8	8	
Y	9	10	9
Z	11	12	11

a) What is the number of electrons in U^+?
3

Number of electrons left is 2 because 1 electron has been released to form the cation.

b) What is the electron arrangement of ion W^{2-}?
2.6

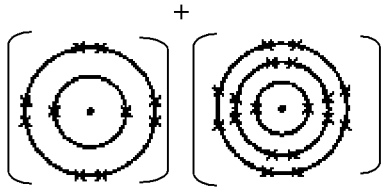
There are a total of 10 electrons since 2 electrons have been gained to achieve a charge of -2.
Electron arrangement is 2.8

c) Y and Z atoms combine to form a compound.
(i) What is the chemical formula of the compound?
YZ

The positive ion is written before the negative ion.
Should be ZY

(ii) Draw the electron arrangement for the particles found in the compound.

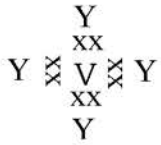
All the valence electrons for each atom must be shown.



Ion Z^+ Ion Y^-

d) V and Y atoms combine to form a compound.
(i) What is the type of bond found in the compound?
Covalent bond

(ii) Draw Lewis structure for the compound formed.
Incomplete



e) Compare two physical properties of the compound in (c) and (d)
Wrong/inaccurate answer

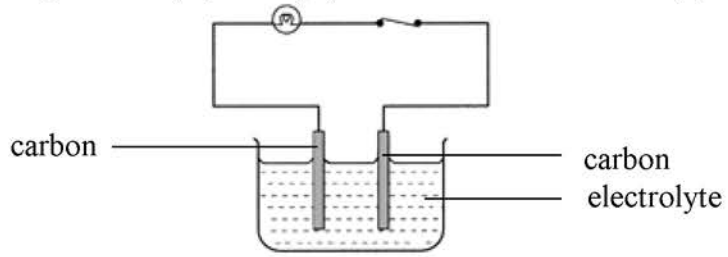
- The compound in (c) is soluble in water and the compound in (d) is soluble in organic solvents

- The compound in (c) conducts electricity but the compound in (d) does not conduct electricity

The compound in (c) is soluble in water but not in organic solvents. The compound in (d) is insoluble in water but soluble in organic solvents.

The compound in (c) conducts electricity in molten or aqueous solution, but not in solid form.
The compound in (d) does not conduct electricity in any physical state

f) Draw a diagram for the apparatus set-up to compare one of the physical properties of the compounds (c) and (d) that is mentioned in (e)



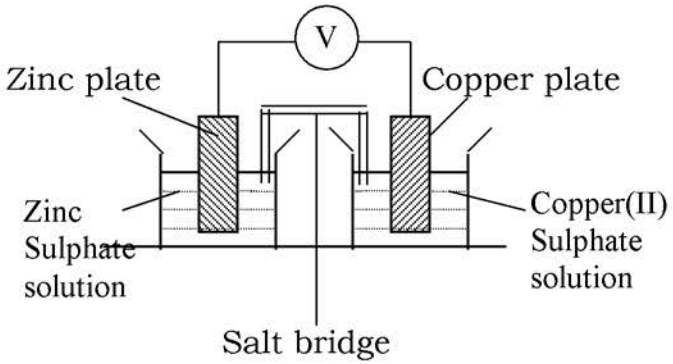
Bulb (A) must be include in circuit.
If molten state used "heat"

CHAPTER 6: ELECTROCHEMISTRY

1. Drawing Diagrams

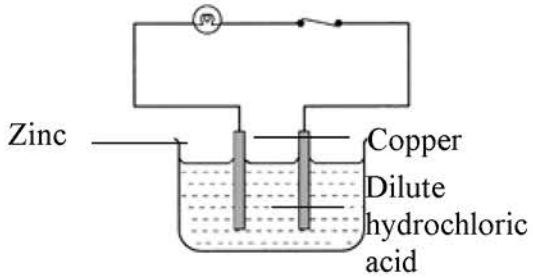
Correct the mistakes found in the drawings below:

Diagram of a **chemical** cell



- Voltmeter/ galvanometer
- Salt bridge

Diagram of a chemical cell



the solution – dash line

3. Explain why lead(II) bromide can conduct electricity in molten state but not in the solid state **Incomplete Answer:** Because **Pb^{2+}** and **Br^-** ions can move freely in the molten state **Wrong answer:** Because lead(II) bromide can move freely in molten state	Because Pb^{2+} and Br^- ions can move freely in the molten state but these ions cannot move freely in the solid state
4. Explain why molten lead(II) bromide can conduct electricity but molten naphthalene does not conduct electricity **Inaccurate Answer:** Because molten lead(II) bromide is an ionic compound whereas molten naphthalene is an covalent compound	Because Pb^{2+} and Br^- ions can move freely in the molten state but molten naphthalene consists of molecules, hence no free moving ions
5. The electrolysis of copper(II) sulphate solution is carried out using copper electrodes (a) What is observed at the anode? **Inaccurate answer:** The copper electrode corrodes (b) Explain why the intensity of the blue colour does not change **Inaccurate answer:** Because the concentration of Cu^{2+} ions does not change. Rate of change of Cu^{2+} to Cu metal is the same as the rate of change of Cu to Cu^{2+}	Mass of anode/copper decreases/anode becomes thinner/smaller Because concentration of Cu^{2+} ions does not change/remains unchanged. Rate of discharge of Cu^{2+} is the same as rate of ionization of copper at the anode/discharge of Cu^{2+} ions at the cathode are replaced by formation of Cu^{2+} ions at anode

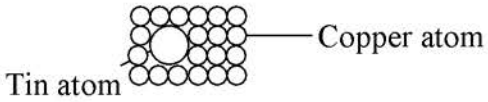
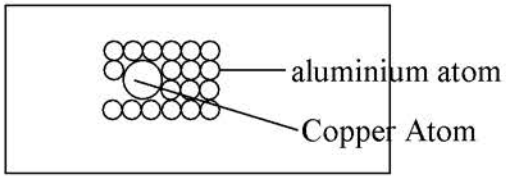
CHAPTER 7: ACIDS AND BASES

1. $Zn + 2HCl \rightarrow ZnCl_2 + H_2$ (a) What can you observed from the reaction above? **Wrong answer :** Gas is given out (b) Suggest a method to collect the gas given out at 30 second interval **Inaccurate Answer:** Let the gas flowed into a burette filled with water	 Effervescence occurs/Size of zinc gets smaller/The container feel hot Displacement of water in the burette /Bubble the gas into a burette, filled with water, inversed inside a water troughs filled with water
2. Explain why hydrogen chloride shows acidic properties in aqueous solution **Inaccurate answer:** Hydrogen chloride decomposes to produce H^+ ions when it dissolves in water	 Hydrogen chloride ionises/dissociates to produce H^+ ions when it dissolves in water

CHAPTER 8: SALTS

1. $AgNO_3 + NaCl \rightarrow AgCl + NaNO_3$ How can you obtain a dry silver chloride salt from the above reaction? **Inaccurate Answer:** Filter the products	Filter the mixture and rinse the residue with distilled water, then dry/press the residue, between filter paper.
2. What is observed when lead(II) carbonate is heated? **Wrong Answer:** Carbon dioxide is released/Lead(II) carbonate is brown when hot and yellow when cold	The product/residue is brown when hot and yellow when cold
3. $PbCO_3 \rightarrow PbO + CO_2$ Give a test for the gas produced in the reaction? **Inaccurate Answer:** Test the gas with lime water, lime water turns chalky.	Bubble the gas into lime water, lime water turns chalky

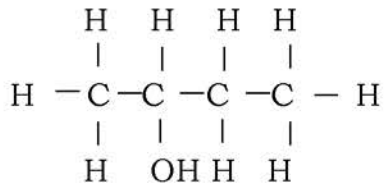
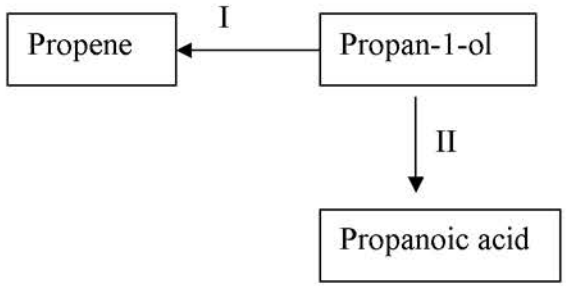
CHAPTER 9: MANUFACTURED SUBSTANCES IN INDUSTRY

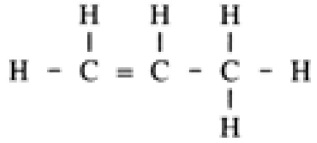
1. Drawing Diagrams Correct the mistakes found in the drawings below: Arrangement of particles in bronze alloy.  	More than two layers of atom
2. Why does duralumin which contains 95 % aluminium and 4 % copper is harder than aluminium? **Inaccurate Answer**: Aluminium atoms cannot slide over each other due to the presence of added metallic atoms of different size. Draw the arrangement of particles in duralumin.  	The size of copper atom is bigger than aluminium atom. So copper atoms will disrupt the orderly layered arrangement of atoms hence reducing sliding of layers of atom.

CHAPTER 10: RATE OF REACTION

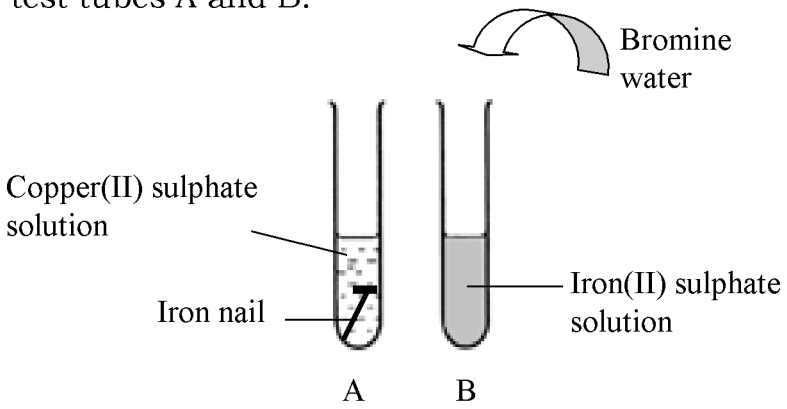
1. A bit of manganese(IV) oxide powder is added to hydrogen peroxide solution in a test tube. Give a test to identify the gas given out **Inaccurate answer:** Used a glowing wooden splinter. The glowing wooden splinter rekindles	A glowing wooden splinter is inserted in the test tube. It rekindles / burst into flame
2. Applications of Rate of Reaction - Flour suspended in the air in flour mills can burn very rapidly in an explosion	Because the flour has large total surface area, so the rate of combustion is high
- Mixture of methane and air in mines can burn rapidly in an explosion.	Because the concentration of methane is high, so the rate of combustion is high.
- Acid rain corrodes buildings and metal structures slowly	Because the concentration of the acid in the rain is very low, so the rate of corrosion is low
- Catalysts are used in many industrial reactions	Because the reactions are much faster, so lower temperatures can be used and this save cost

CHAPTER 11: CARBON COMPOUND

1. Drawing Diagrams Correct the mistakes found in the drawings below: Structure formula of alcohol. 	➧ Bond between C-O
2. Give one chemical test how to distinguish between butene and butane. **Inaccurate answer:** Add bromine water to butane and butene in two separate test tubes. Butene decolourized the bromine water	Add bromine water to butane and butene in two separate test tubes. Butene decolourized the brown bromine water but butane does not changed the brown bromine water
3.  The flow chart above shows the conversion of propan-1-ol to another organic compounds.	

a) Propan-1-ol is converted to propene in reaction I. i) Write the structural formula for propene C_3H_6 ii) Describe briefly how to convert propan-1-ol to propene in the laboratory **Inaccurate answer:** Propan-1-ol is heated with aluminium oxide b) i) Name process II Oxidation ii) State the reagent used in process II Potassium manganate(VII)	 Propan-1-ol vapour is passed through heated aluminium oxide at 350°C ***Correct*** Acidified potassium manganate(VII).

CHAPTER 12: OXIDATION AND REDUCTION

1. Why must powdered carbon be mixed evenly with zinc oxide powder before being heated? **Inaccurate answer:** So that reaction takes placed evenly/reaction takes place easily/reactants react completely	So that the reaction is complete/goes to completion
2. Figure below shows the apparatus set-up to investigate the redox reactions in test tubes A and B.  a) State two observations obtained from test tube A Copper is formed *(wrong)* The solution turned pale green *(incomplete)* b) Write two half equations to show the electron transfer in test tube A Cu^{2+} → Cu + 2e *(wrong)* Fe + 2e → Fe^{2+} *(wrong)* c) What is meant by oxidizing agent in terms of electron transfer? Oxidising agent is the substance that is reduced in the reaction d) State two observations obtained from test tube B Bromine water decolourized The solution turned brown	Brown solid is deposited The blue solution turns pale green Cu^{2+} + 2e → Cu Fe → Fe^{2+} + 2e Oxidising agents is substance that gains electrons in the redox reaction Brown colour of bromine water turns colourless The pale green solution turns brown

e) What is the change in oxidation number of iron in the test tube B 2 → 0 f) Name another substance can replaced bromine water in test tube B $KMnO_4$ *(Wrong)* Potassium manganate(VII) *(Incomplete)*	+2 → +3 Acidified potassium manganate(VII)// Acidified potassium dichromate(VI)

CHAPTER 13: THERMOCHEMISTRY

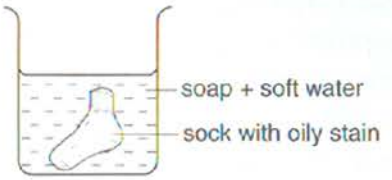
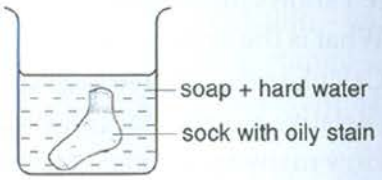
1. $HCl + KOH \rightarrow KCl + H_2O$ $\quad \Delta H = -57$ kJ mol^{-1} (a) What does ΔH represent in the equation above **Inaccurate Answer:** 57 kJ heat energy given out when 1 mole of water is formed (b) What causes the energy change in the reaction **Wrong answer:** When bond is formed when potassium chloride is produce	 57 kJ of heat energy given out when 1 mole of water is formed from the reaction between hydrochloric acid and potassium hydroxide/1 mole of hydrochloric acid react with 1 mole of potassium hydroxide to form 1 mole of water Covalent bond formed when water is produced from H^+ and OH^- ion
2. In an experiment to determine the Heat of Neutralisation, 40 cm^3 of 2.0 mol dm^{-3} sodium hydroxide is added to 80 cm^3 of 0.5 mol dm^{-3} nitric acid. An increase in temperature of 4.0 °C is recorded. (Specific heat capacity = 4.2 J g^{-1} $°C^{-1}$) (a) Calculate the heat released **Wrong Answer :** Heat released = $\frac{120 \times 4.2 \times 4}{0.02}$ = 100,800 J (100.8 kJ)	Heat released =120 x 4.2x 4J = 2016 J OH^- ions in excess. No of moles of H^+ ions reacted = $\frac{0.5 \times 80}{1000}$ = 0.04 mol

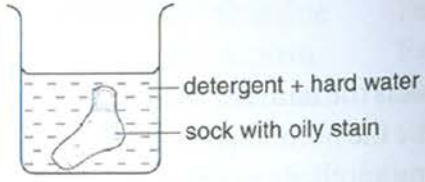
(b) Calculate the heat of neutralization **Wrong Answer :** Heat of neutralization = 100.8 kJ mol^{-1}	Heat released by 1 mol H+ ion = $\frac{2016}{0.04}$ = 50,400 J Heat of Neutralisation = -50.4 kJ mol^{-1}
(c) How much would the energy change be if the nitric acid is replaced with sulphuric acid of the same volume and concentration? Explain your answer **Inaccurate Answer:** Heat released is double. Sulphuric acid is diprotic/dibasic whereas hydrochloric acid is monoproptic.	Heat released is doubled. No of moles of H^+ ions/no of moles of OH^- ions/moles of sodium hydroxide that reacted is doubled
(d) What is the increase in temperature if 80 cm^3 of 2 mol dm^{-3} sodium hydroxide is added to 160 cm of 0.5 mol dm^{-3} nitric acid? Explain your answer **Wrong Answer:** Increase/rise in temp is 8.0 °C because heat released is doubled	Increase/rise in temp is 4.0^0C. Although the heat released is doubled , it is used to warm up a total volume that is also doubled

CHAPTER 14: CHEMICAL FOR CONSUMER

1. (a) A student washed his socks which had oily stains. Explain the cleansing action of soap on the oily stains.	➢ In water soap ionizes to form ions/anion and sodium ions ➢ The anions consists of hydrophilic part and hydrophobic part ➢ Hydrophilic part dissolve in water only but hydrophobic part dissolve in grease only ➢ The anions reduces surface tension of water, causing wetting of greasy surface ➢ During washing and scrubbing, the anions pull the grease and lifted it off the surface and break it into a small droplets (Emulsifying agent) ➢ Rinsing away the dirty water removes the grease (the dirt) and excess soap and the surface is clean.

(b) Another student carried out four experiments to investigate the cleansing effect of soap and detergent on oily stains in soft water and hard water respectively.

Experiment	Experiment I	Experiment II
		
Observation	Oily stain disappears	Oily stain remains

Experiment	Experiment III	Experiment IV
		
Observation	Oily stain disappears	Oily stain disappears

Compare the cleansing effect between

(i) experiments I and II

(ii) experiment II and IV

Explain the differences in the observation.

Exp. I and II

- The oily stain disappears in Experiment I but remains oily in Experiment II.
- Hard water contains Ca^{2+} and Mg^{2+} ions which reacts with soap ions to form scum
- The formation of scum makes anions less efficient for cleaning the oily stain on the sock
- In soft water, all anions are used to clean the oily stain
- Thus, soap is only effective as a cleansing agent in soft water and ineffective in hard water

Exp. II and IV

- The sock in Experiment II remains oily but is clean in experiment IV.
- The soap anions form scum when reacts with Ca^{2+} and Mg^{2+} ions in hard water.
- The formation of scum makes anions less efficient for cleaning
- The detergent anion do not form a precipitate with Ca^{2+} and Mg^{2+} in hard water.
- Hence, detergent cleans effectively in hard water but soap does not clean effectively in hard water.

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

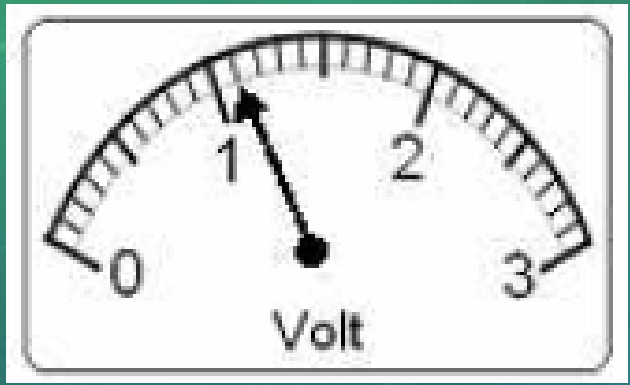
CHAPTER		YEAR							
		2006	2007	2008	2009	2010	2011	2012	2013
		Number of Questions							
Form 4									
1	Introduction to Chemistry	–	–	–	–	–	–	–	–
2	The Structure of the Atom	–	–	–	–	–	–	–	–
3	Chemical Formulae and Equations	–	–	–	–	–	–	–	–
4	Periodic Table of Elements	–	–	1	–	1	–	–	–
5	Chemical 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

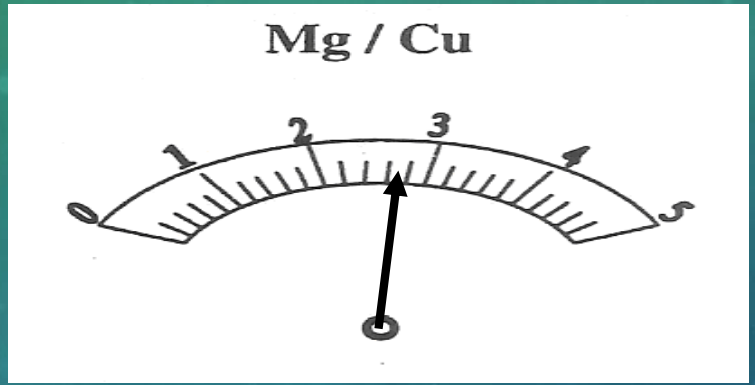
BACK TO BASIC

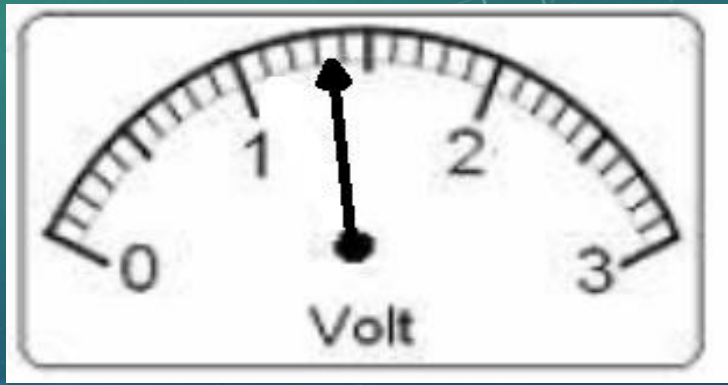
A. Apparatus Measurement

- 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

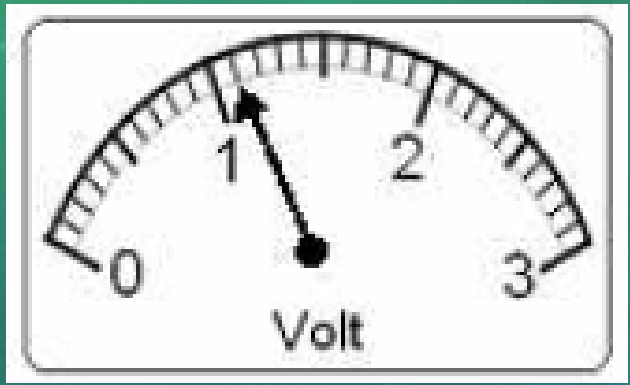


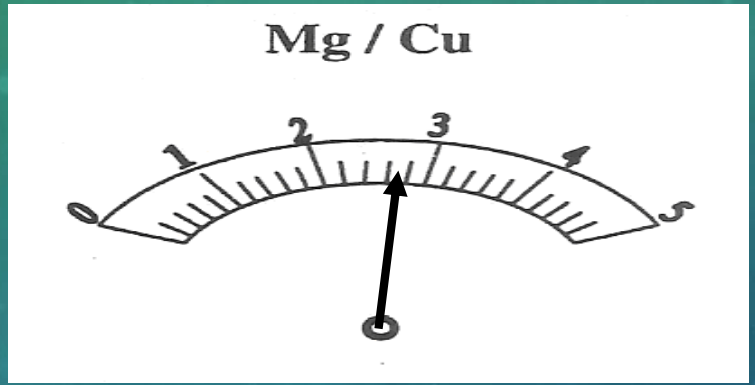


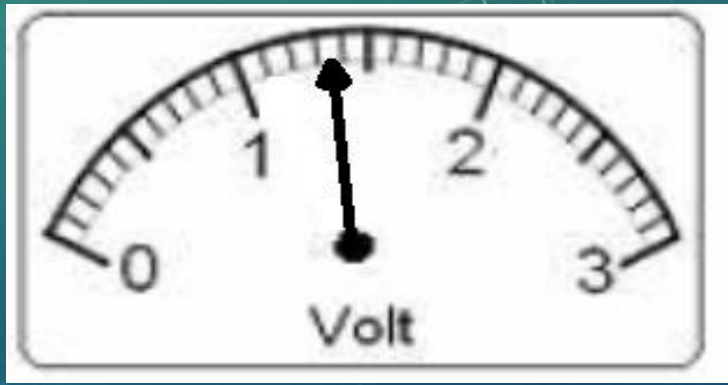


..... V	 V	 V

#VOLTMETER

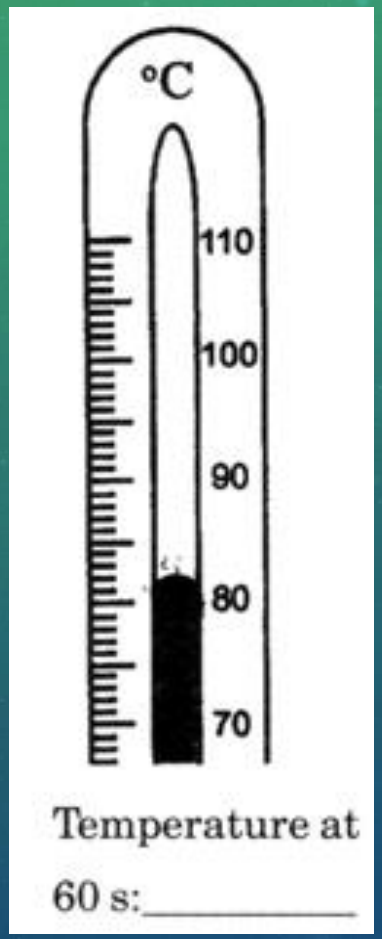






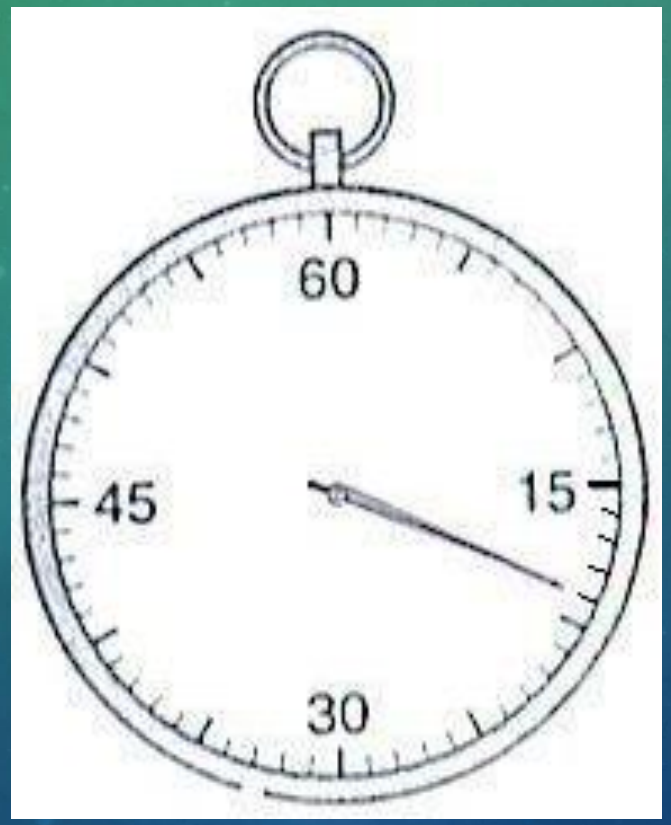
1.1 V	**2.7 V**	**1.35 V**

#THEMOMETER



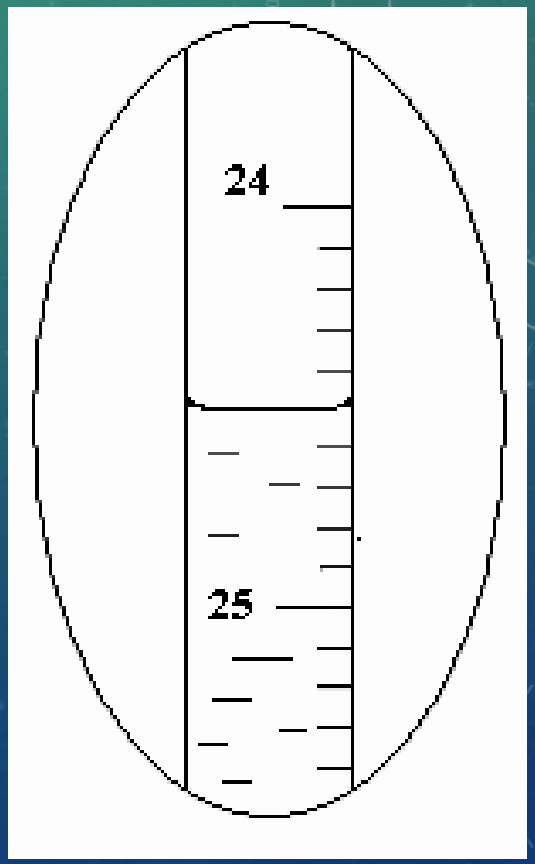
Temperature at 60 s:_____

#STOPWATCH



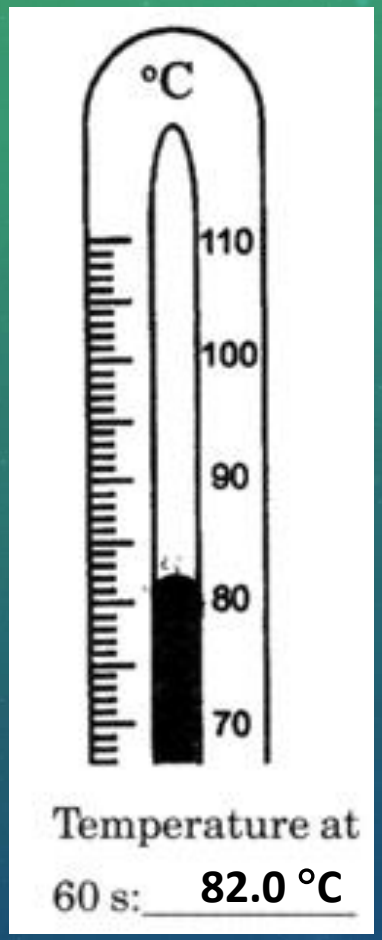
t_3 at 40°C = _____s

#BURETTE



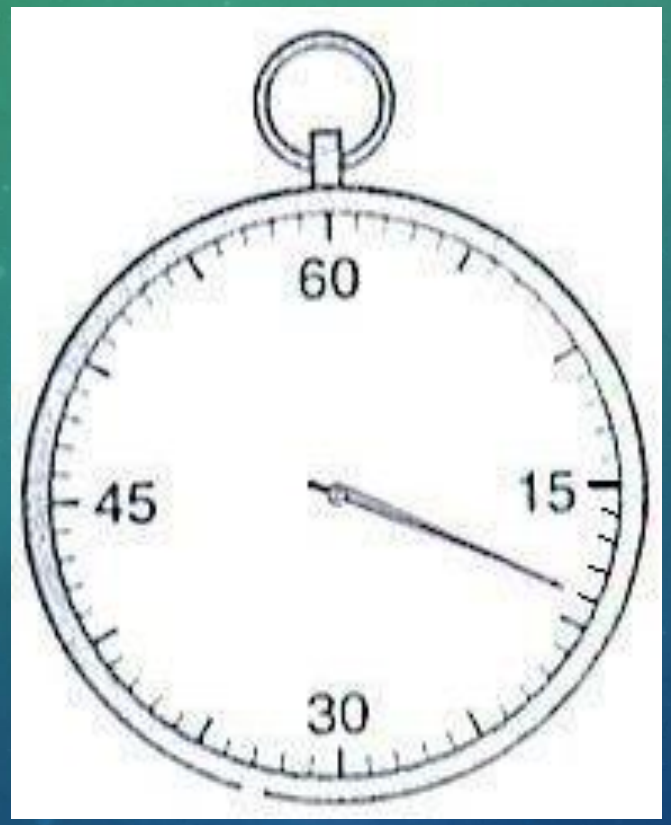
……cm^3

#THEMOMETER



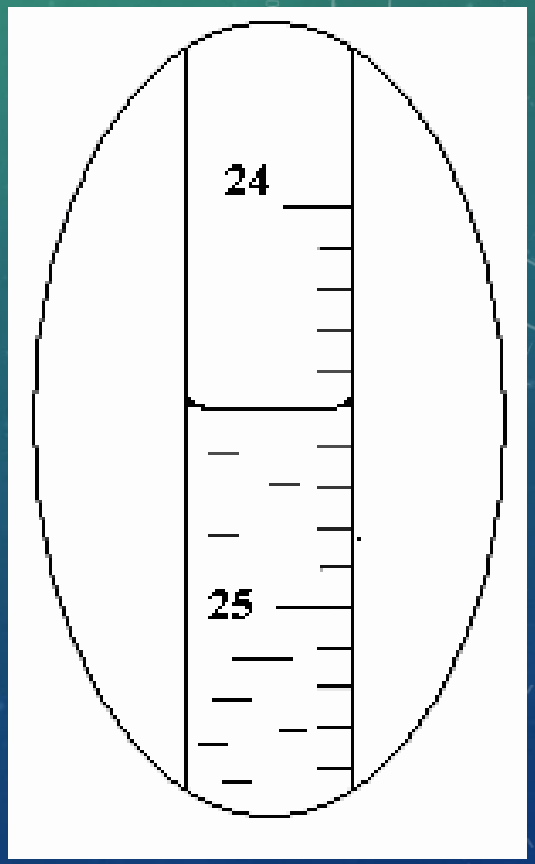
Temperature at 60 s: **82.0 °C**

#STOPWATCH



t_3 at 40°C = **19.0** s

#BURETTE



24.50 cm^3

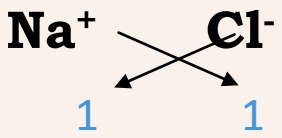
2. Formula and equation

A. #Formula

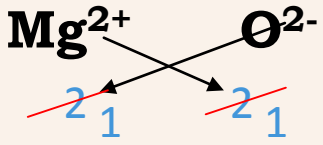
Atom	Molecule	Ion
• Single • No charge (neutral)	• Two or more atom • Round number as subscript	• Single • Has a charge (+ve or –ve)
Potassium : **K**	Oxygen : **O_2**	Potassium ion : **K^+**
Sodium : **Na**	Carbon dioxide : **CO_2**	Magnesium ion : **Mg^{2+}**
Argon : **Ar**	Ammonia : **NH_3**	Chloride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

Ionic Compound

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



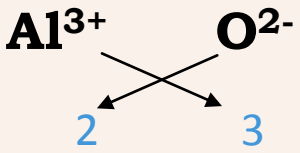
Sodium chloride : **NaCl**



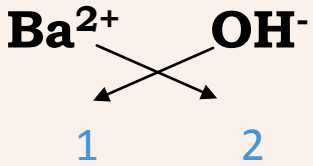
Magnesium oxide **MgO**

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 + $CuCl_2$ → $ZnCl_2$ + 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

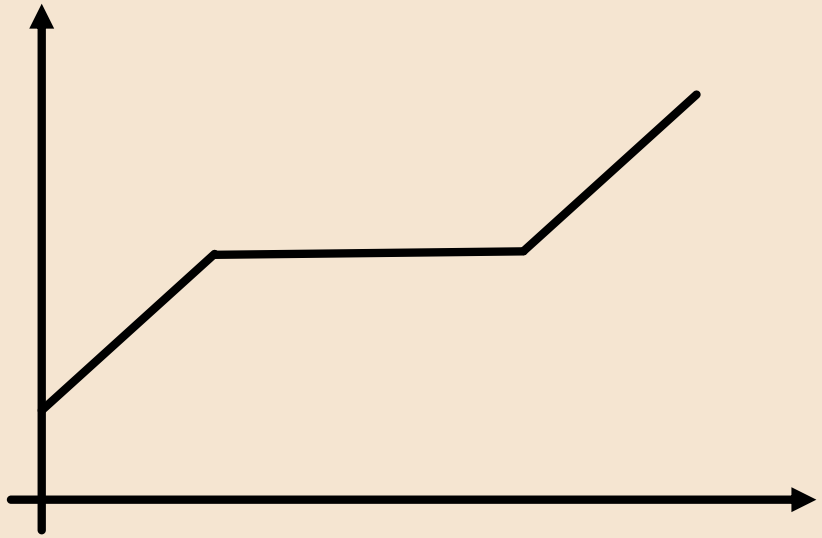
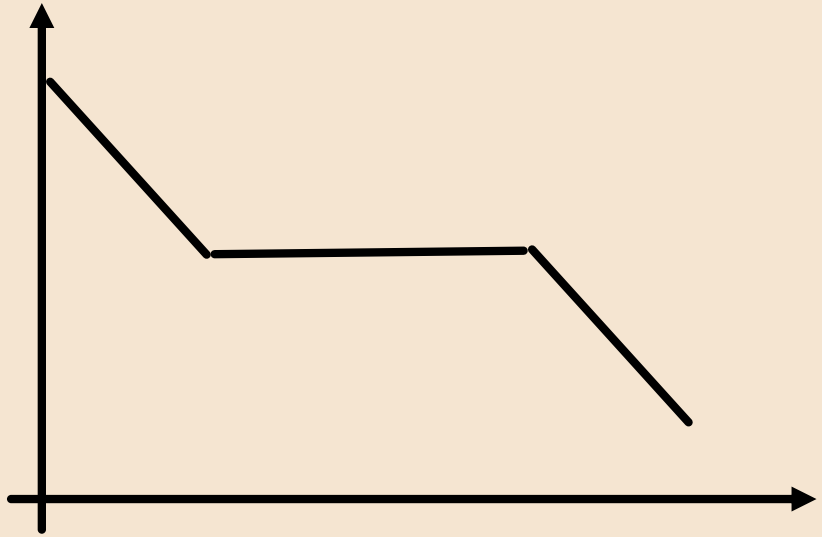
3. Heat of reaction, ΔH can be calculated by using the formula,

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.

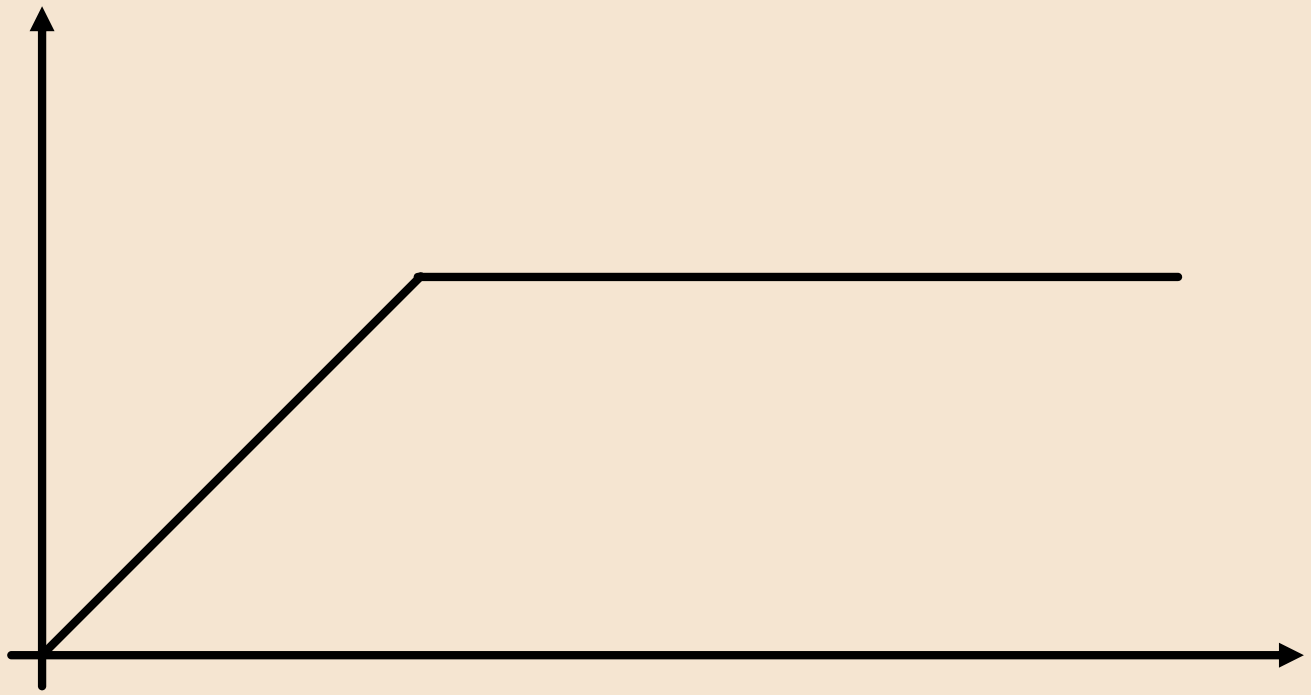
4. #Graph

##Chapter 2 – heating and cooling acetamide/ naphthalene

Heating	Cooling
	

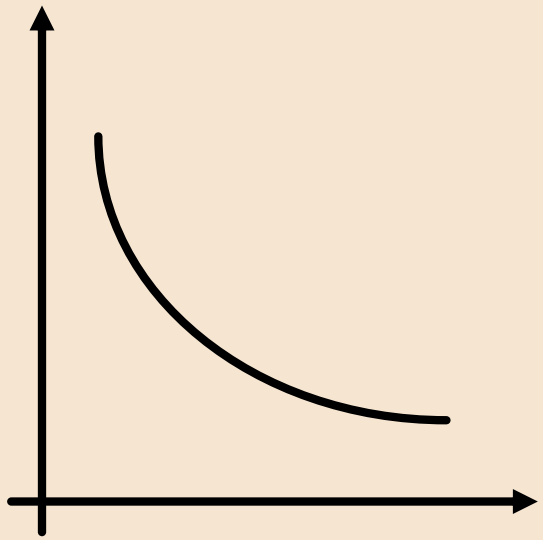
##Chapter 8 – salts

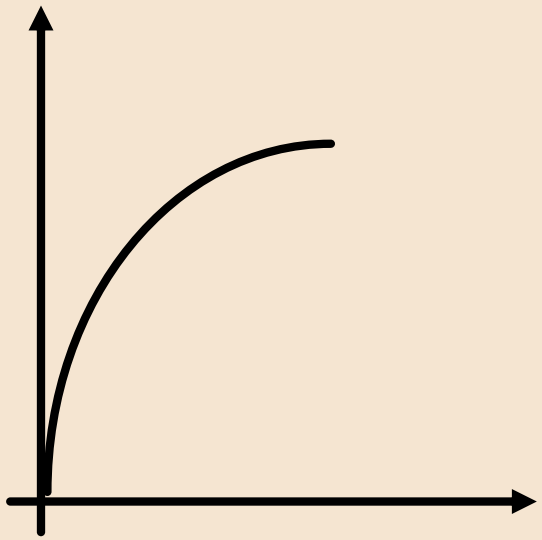
Construct ionic equation

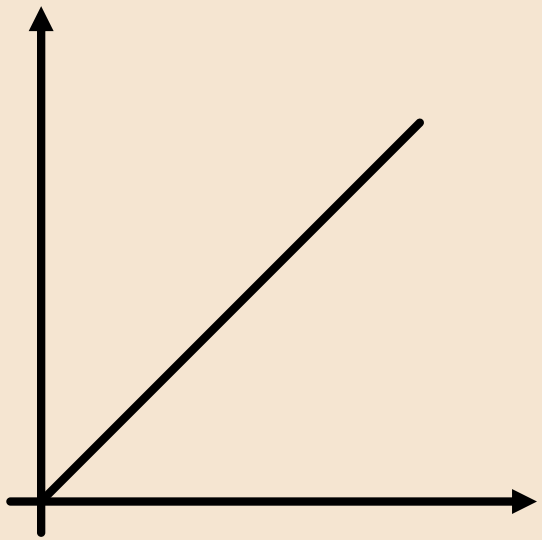


Chapter 10 – Rate of reaction

#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

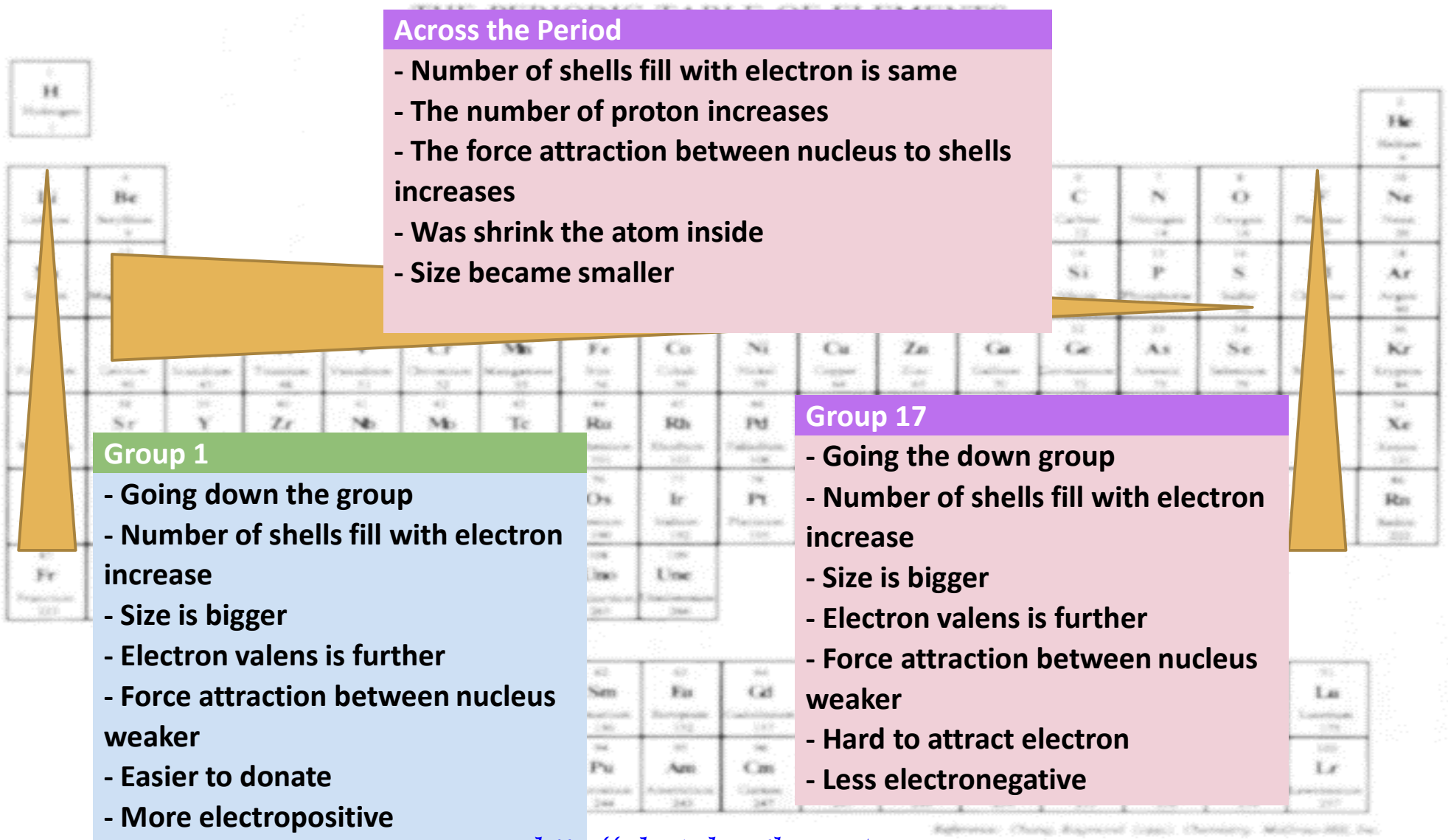
  (i) **Add** one reagent to another in a named container
  (ii) **Mix** together 2 reagents /chemicals in named container

  (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**----------

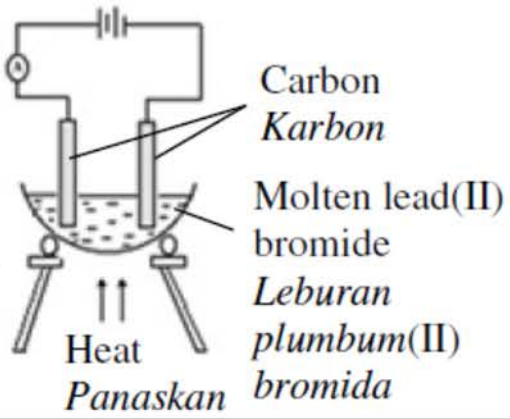
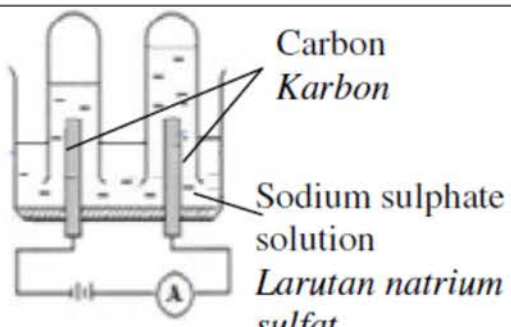
Voltaic Cell

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]

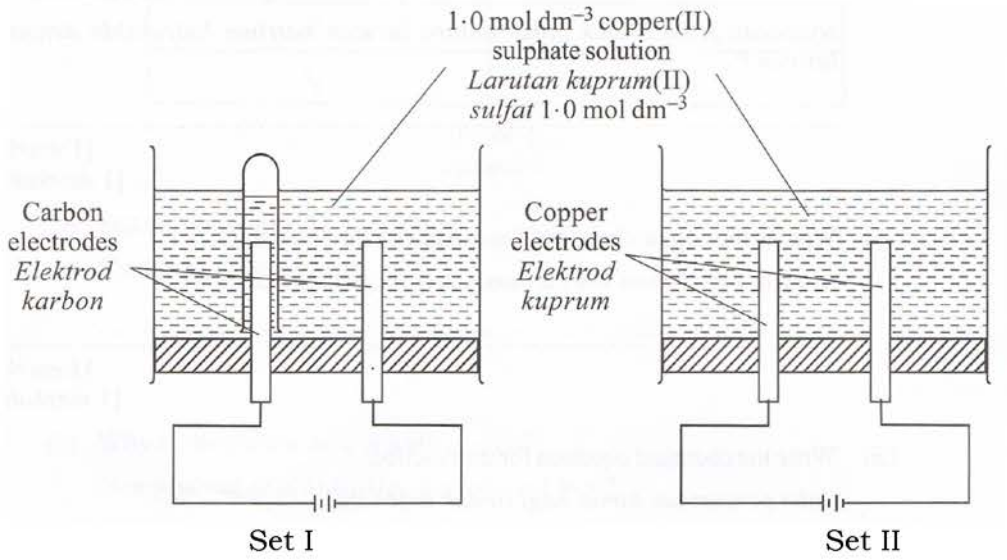
hydroxide

(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 →

.....

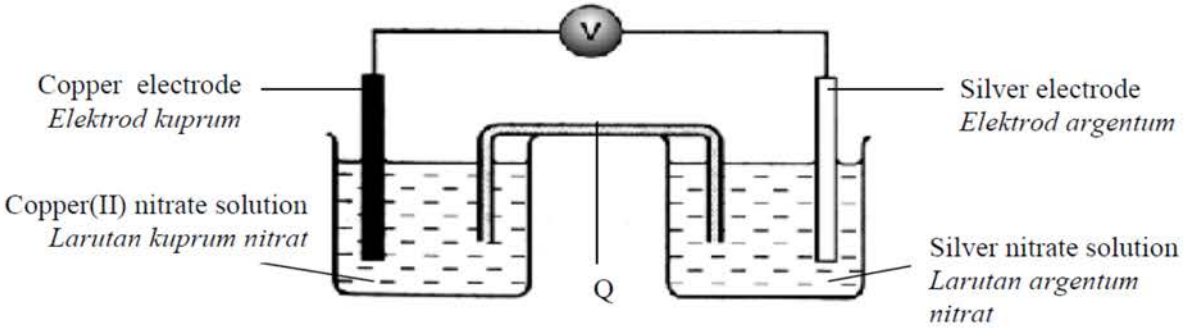
(iii). Describe briefly the **chemical test** to confirm the product at the anode. [2M]

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]

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

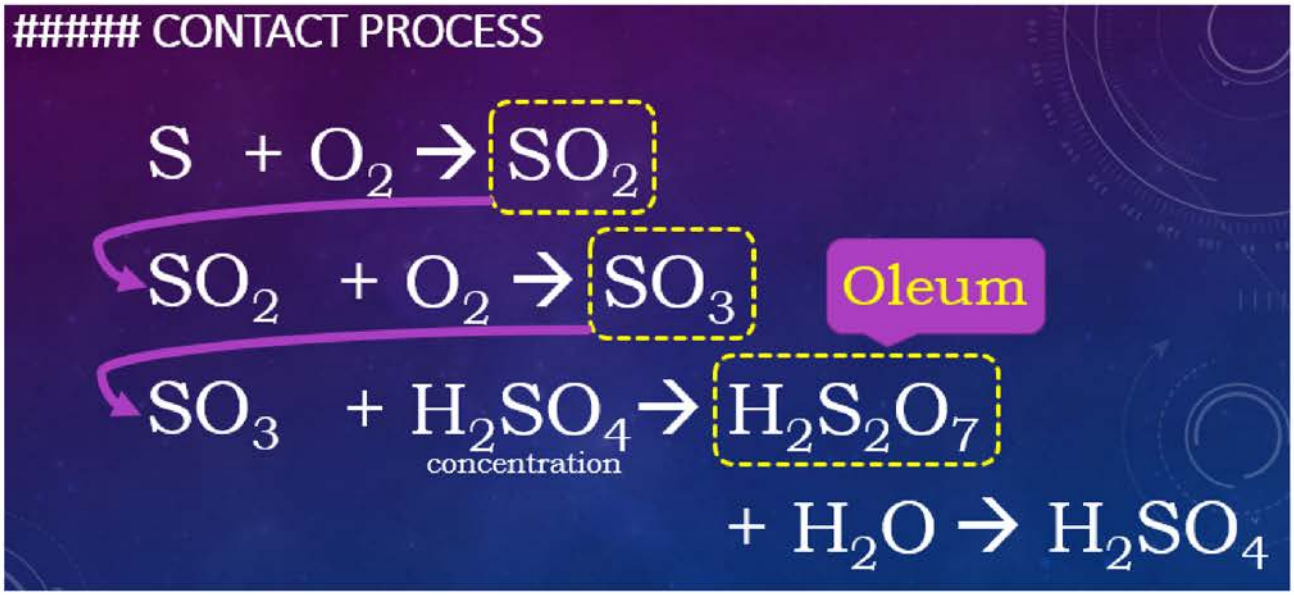
(f) If copper electrode and copper(II) nitrate solution are replaced with zinc electrode and zinc nitrate solution,

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

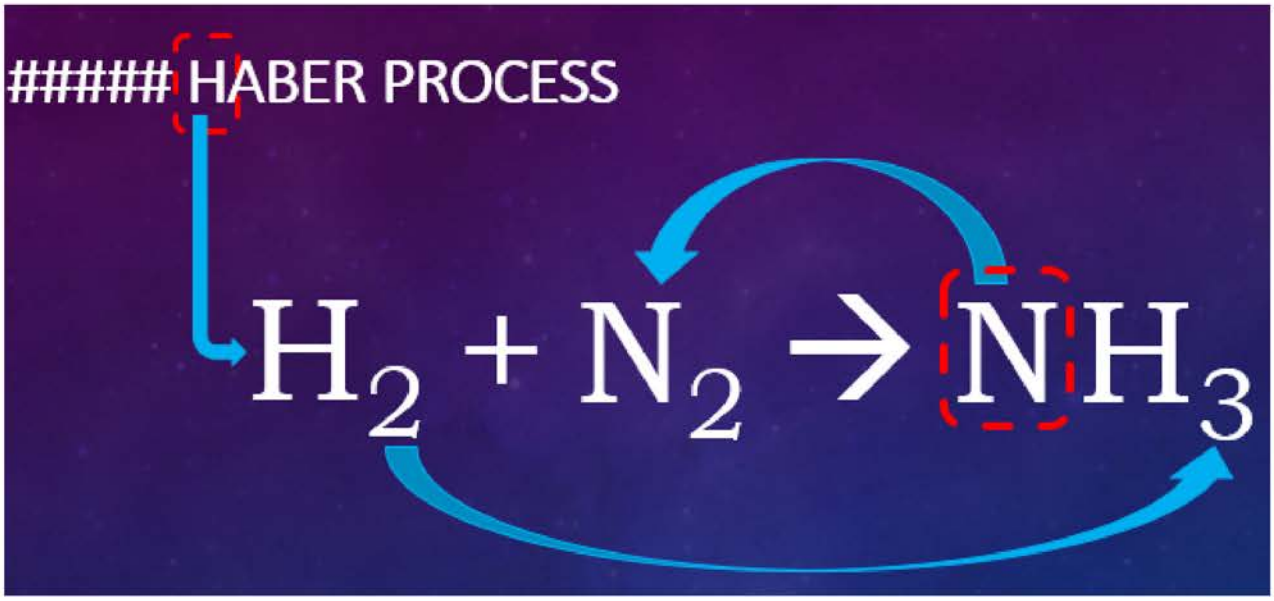
(ii) give a reason for your answer. [1M]
The distance between Zinc and Silver is bigger than the distance between Copper and silver

NOTE

A. Contact Process

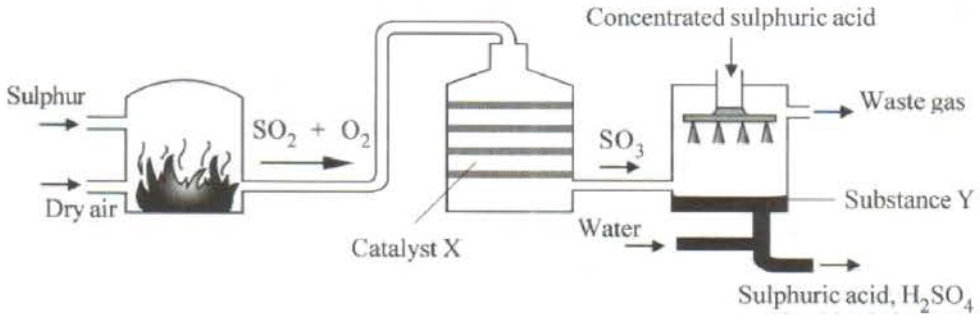


B. Haber Process



	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

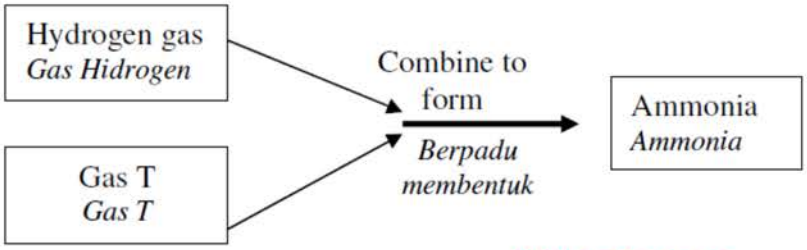
.....

(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.

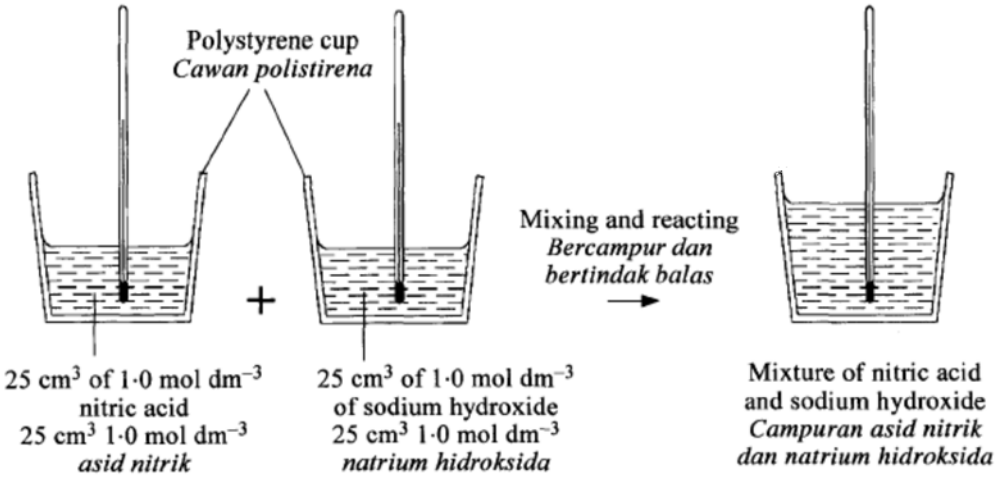


Diagram 6

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]

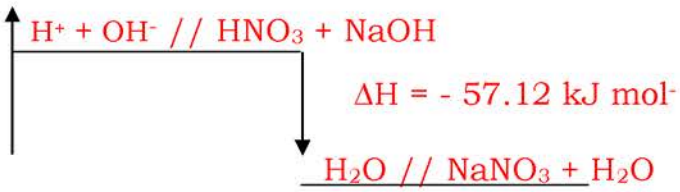
mol = MV/1000 = 1.0 X 25/1000 = 0.025 mol

(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.

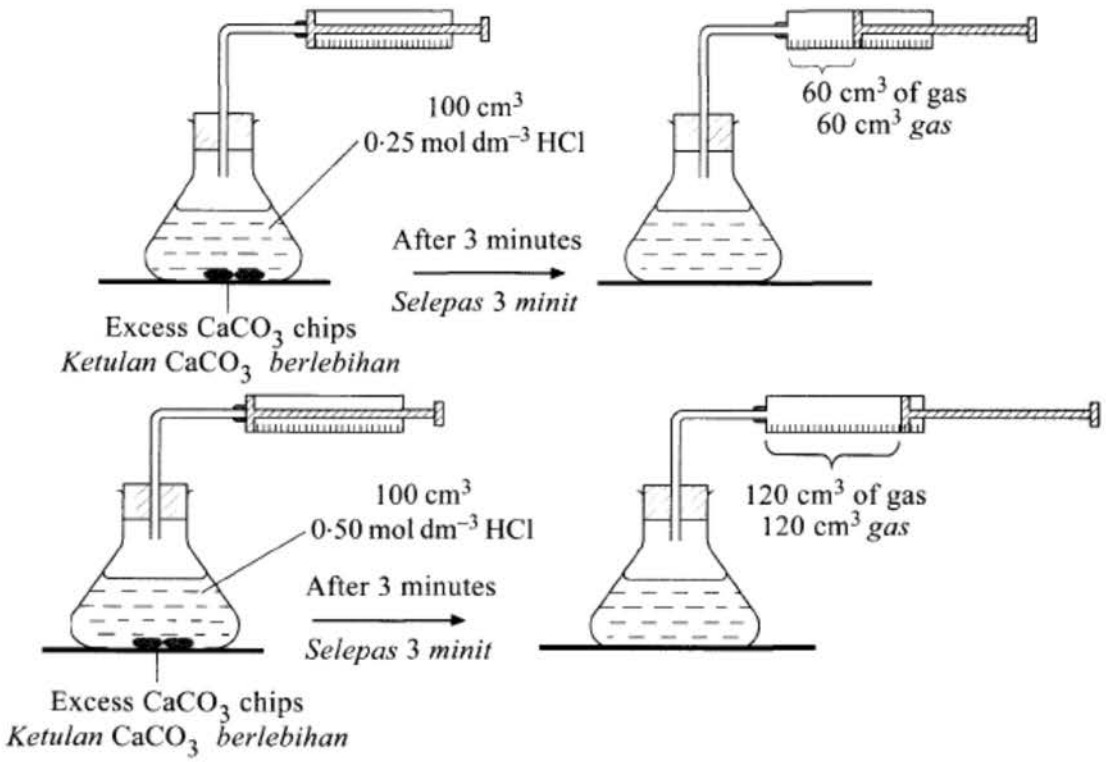
[must give what particles react with what particles.
Example H+ ion react with $S_2O_3^{2-}$ ions]

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

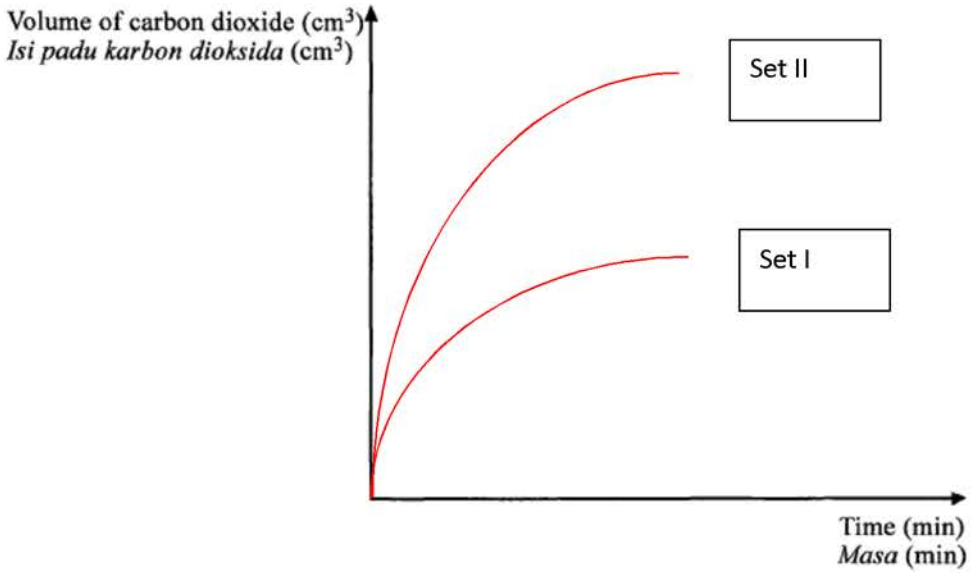
.....

(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

$$\underset{}{8H^+} + \underset{+7}{MnO_4^-} + \underset{5}{5e} \rightarrow \underset{+2}{Mn^{2+}} + 4H_2O$$

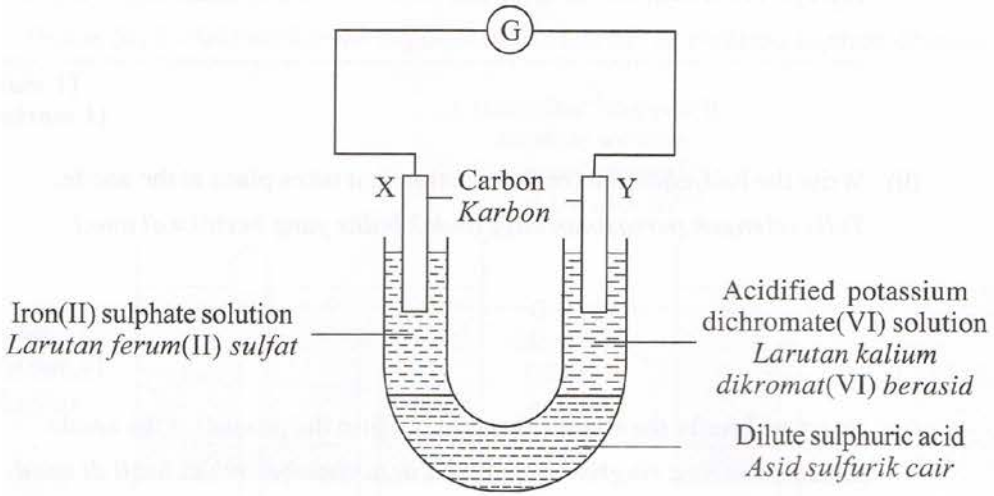
Colour : Purple to colourless

(i) ACIDIFIED POTASSIUM DICHROMATE (VI) solution

$$\underset{}{14H^+} + \underset{+6}{Cr_2O_7^{2-}} + \underset{6}{6e} \rightarrow \underset{+3}{2Cr^{3+}} + 7H_2O$$

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]