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Section A

[80 marks]

Answer **all** questions.

1. Diagram 1 shows the electron arrangement of atom X, Y and Z.

$^{12}_{6}X$ $^{23}_{11}Y$ $^{35}_{17}Z$

Diagram 1

a) What is the meaning of proton number?

_____

[1 m]

b) Which element is an alkali metal?

_____

[1 m]

c) Determine the number of neutrons of atom X.

_____

[1 m]

d) Atom Y reacts with atom Z to form compound L.
Draw the electron arrangement for compound L.

[2 m]

2. Table 1.1 shows the observations of two sets of voltaic cells.

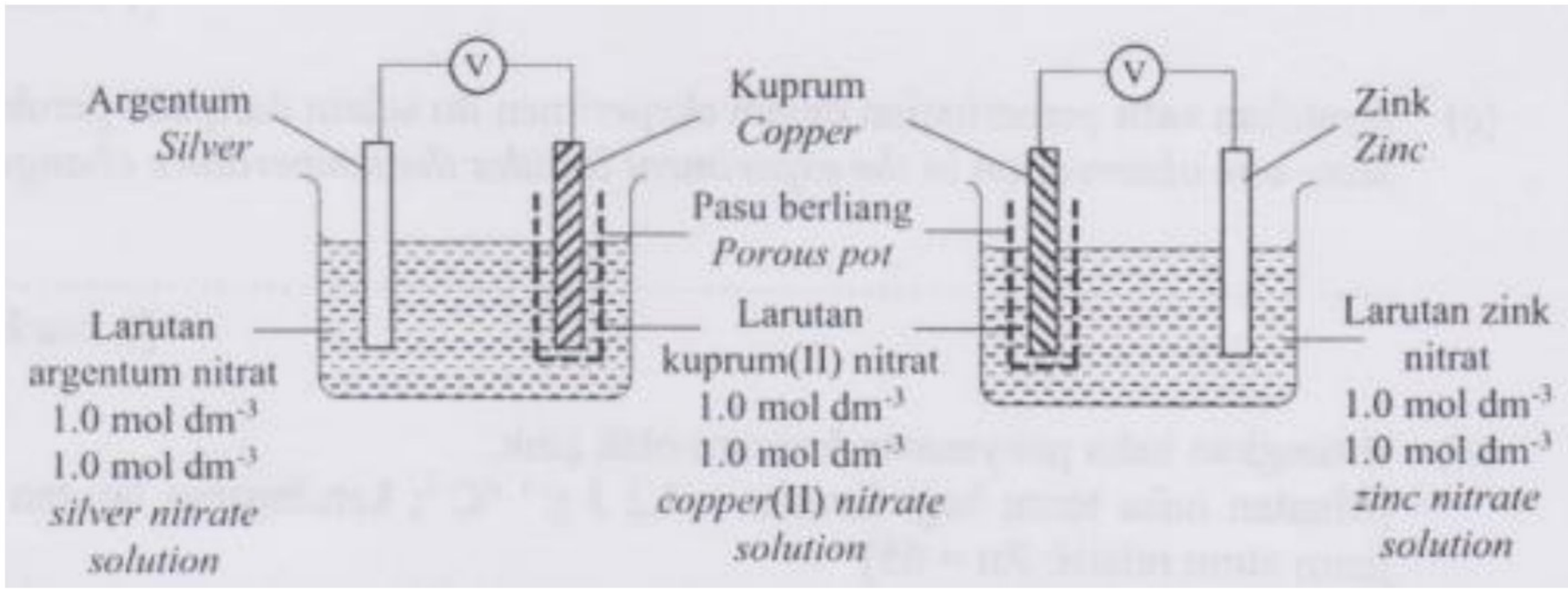
Cell I	Cell II
	
The intensity of blue colour of copper(II) nitrate solution increases.	The intensity of blue colour of copper(II) nitrate solution decreases.

Table 1.1

Persamaan sel setengah ***Half-cell equation***	**E^0 (V)** ***(298 K)***
$Zn^{2+} + 2e \rightleftharpoons Zn$	-0.76
$Ag^{+} + e \rightleftharpoons Ag$	+0.80
$Cu^{2+} + 2e \rightleftharpoons Cu$	+0.34

Table 1.2

Based on Table 1.1,

a) Identify the negative terminal in Cell I.

_____

[1 m]

b) Explain the difference in the observation of copper (II) nitrate solution in Cell I and Cell II.

_____

_____

[2 m]

c) Write the cell notation for Cell II.

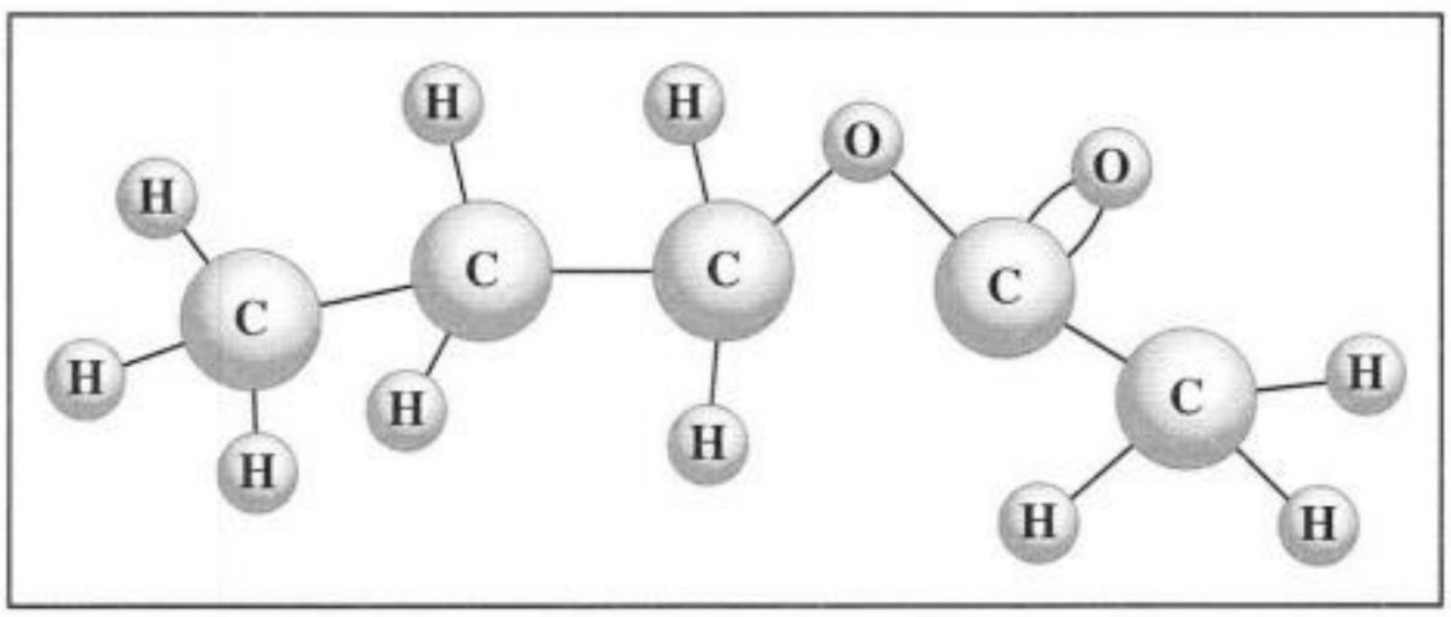
_____

[1 m]

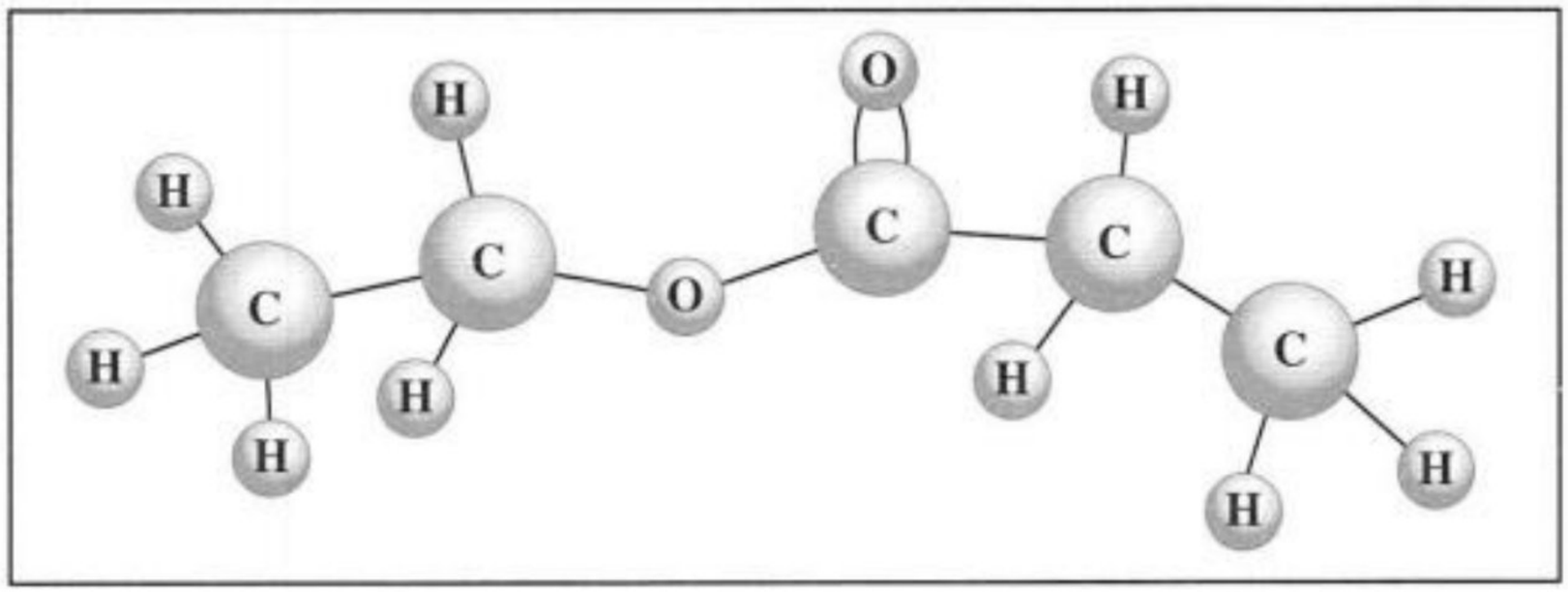
d) Referring to Table 1.2, calculate the voltage of Cell I.

[1 m]

3. Diagram 2 shows the drawing of molecular models for organic compounds I and II from the same homologous series.



Organic compound I



Organic compound II

Diagram 2

Based on Diagram 2,

a) Identify the functional group of the organic compounds I and II.

_____

[1 m]

b) State the names of the reactants that are used to produce organic compounds I and II.

Compound I: _____

Compound II:_____

[4 m]

c) The compound produced floats on top of the cold water to form two layers of colourless liquid.

Explain why.

_____

[1 m]

4. (a) Diagram 3 shows a bottle of acetone that is commonly used to remove nail polish. The chemical formula of acetone is shown in the diagram.

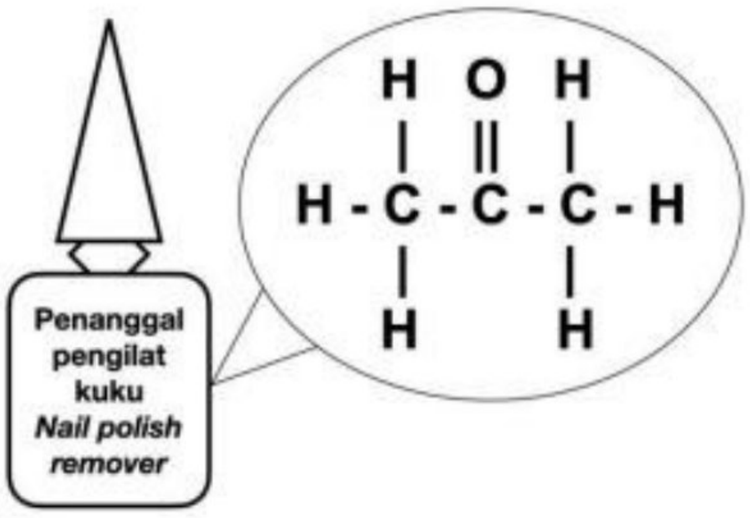


Diagram 3

i. State the type of chemical bond for acetone.

_____

[1 m]

ii. Calculate the relative molecular mass of acetone.
[Relative atomic mass: H=1,C=12,O=16]

[1 m]

iii. State one physical property of acetone.

_____

[1 m]

iv. Siti is using acetone to remove her nail polish. Explain why acetone is suitable to be used to remove her nail polish.

_____

_____

[2 m]

(b) Diagram 4 shows an apparatus set-up to study the electricity conductivity of metal. When the switch is turned on, the bulb lights up.

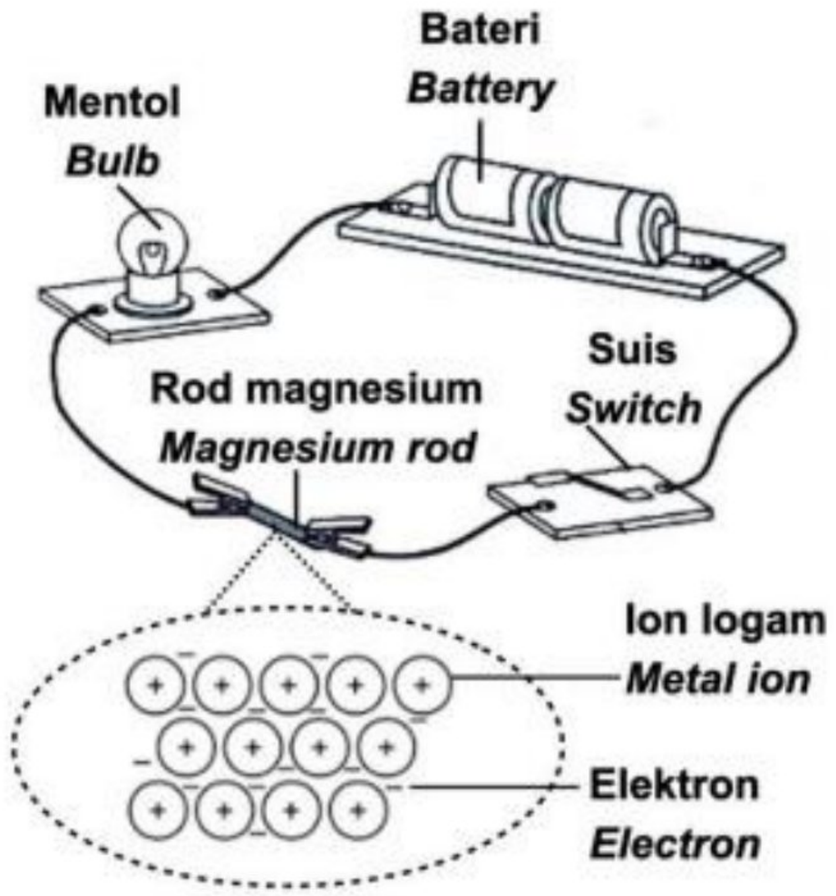


Diagram 4

Referring to the particle arrangement of metal, explain how metals can conduct electricity.

_____

_____

[2 m]

5. Diagram 5 shows the apparatus set-up by a student to carried out an experiment to determine the heat of neutralization between nitric acid and sodium hydroxide solution.

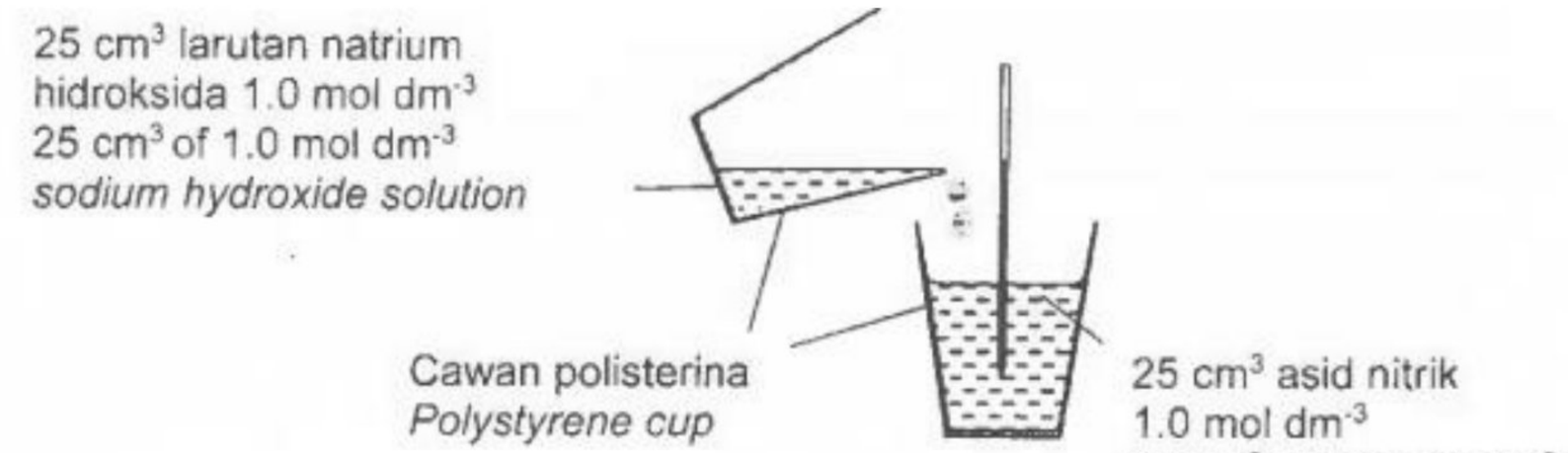


Diagram 5

The results of the experiment is shown in Table 1 below.

Description	Temperature/°C
Initial temperature of nitric acid	27.0
Initial temperature of sodium hydroxide solution	28.0
Highest temperature of the reaction mixture	34.0

Table 1

a) What is the meaning of heat of neutralization of this experiment?

_____

[1 m]

b) Based on the experiment,

i. Calculate the heat change in the reaction.

[Specific heat capacity of water, c= 4.2 $Jg^{-1}°C^{-1}$, density of water=1.0 gcm^{-3}]

[1 m]

ii. Calculate the heat of neutralization of the experiment.

[3 m]

(b) The experiment is repeated by using 25 cm^3 of 1.0 $moldm^{-3}$ of ethanoic acid to replace the nitric acid.

i. Predict the value of heat of neutralization for the experiment.

_____

[1 m]

ii. Explain your answer in (b)(i).

_____

_____

[2 m]

6. (a) Table 2 shows the information of two sets of experiments that were conducted to investigate the factor that affects the rate of reaction.

Set	Reactant	Temperature /°C
I	Excess zinc powder + 50cm^3 of 0.1 moldm^{-3} hydrochloric acid	40
II	Excess zinc powder + 50cm^3 of 0.1 moldm^{-3} hydrochloric acid	50

Table 2

Based on Table 2,

i. State the meaning of rate of reaction.

_____

[1 m]

ii. Identify the factor that affects the rate of reaction.

_____

[1 m]

iii. State one observable change in this experiment that can be used to determine the rate of reaction.

_____

[1 m]

iv. The following is the chemical equation for the reaction in the experiment.

$$Zn + 2HCl \rightarrow ZnCl_2 + H_2$$

Calculate the maximum volume of hydrogen gas produced in Set I at room condition.

[1 mol of any gas occupies $24dm^3$ at room conditions]

[3 m]

(b) Diagram 6 shows two situations of grilling 500 g of meat.

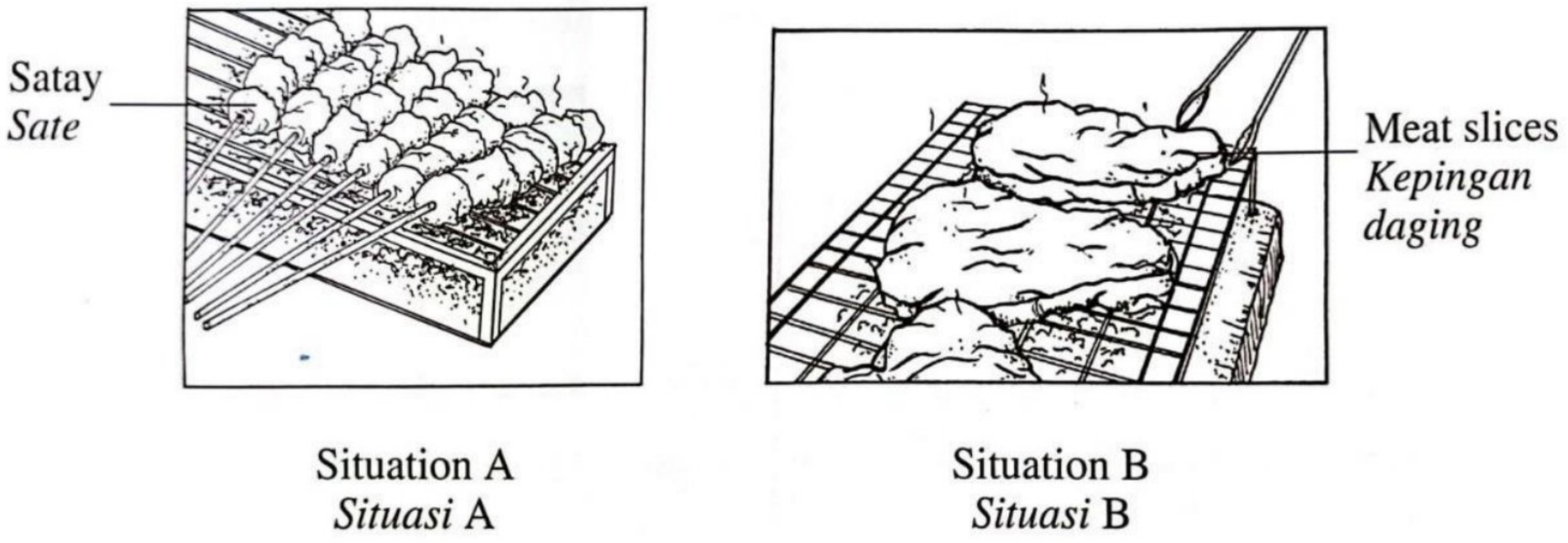


Diagram 6

In which situation will the meat cook faster? Explain.

_____

_____

[3 m]

7. Diagram 7 shows the difference in the amount of soot produced from the combustion of hexane and hexene.

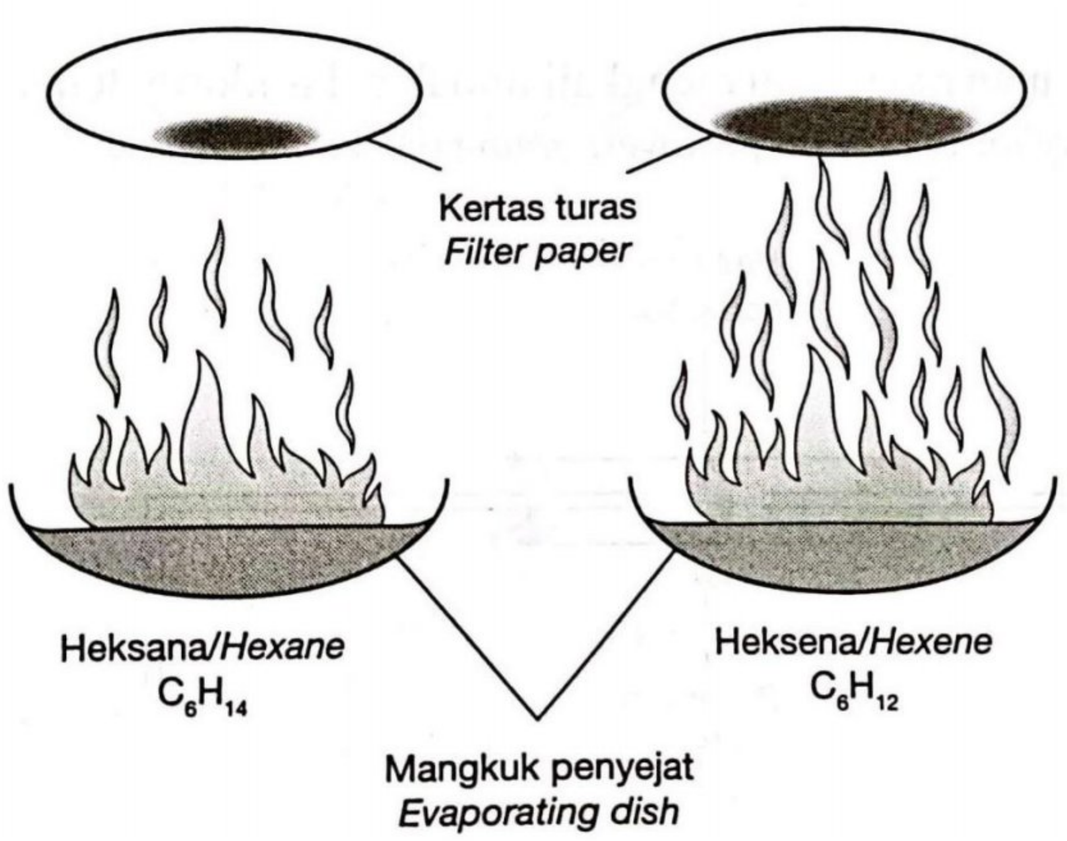


Diagram 7

a) Based on Diagram 7,

i. Compare the observations between hexane and hexene.

_____

[1 m]

ii. Explain your answer in (a)(i) based on the percentage of carbon by mass.
[Relative atomic mass: H=1,C=12,O=16]

[3 m]

b) Hexane can be prepared from hexene.

i. Name a catalyst that can be used in this reaction.

_____

[1 m]

ii. Write a balanced chemical equation in this reaction.

_____

[2 m]

c) State a confirmatory test to differentiate hexene and hexane.

_____

_____

_____

[3 m]

8. Diagram 8 shows a series of test carried out on an oxide of metal R.

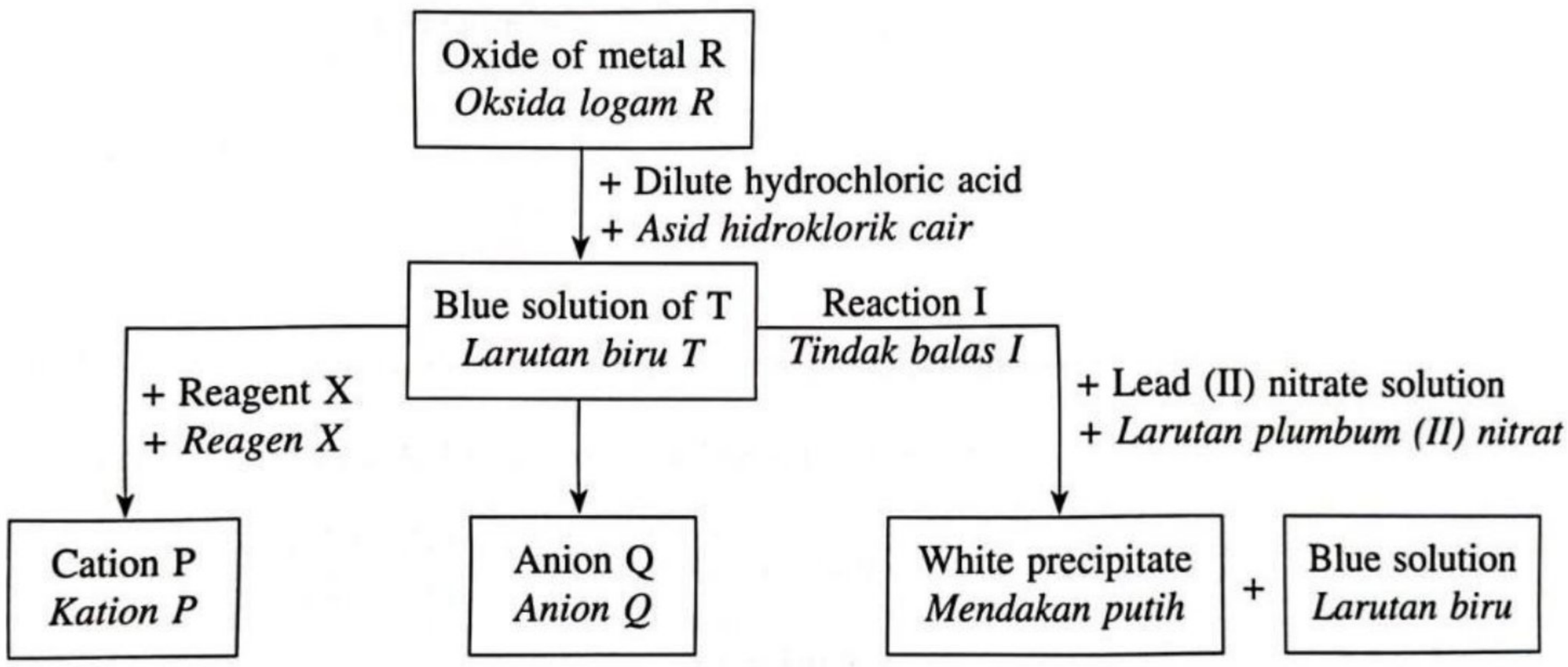


Diagram 8

a) Write the chemical equation for the reaction between oxide of metal R and hydrochloric acid.

_____

[2 m]

b) (i) Suggest reagent X used to verify cation P.

_____

[1 m]

(ii) What can be observed when solution T is added with reagent X until excess?

_____

[1 m]

c) (i) Name anion Q?

_____

[1 m]

(ii) Describe a chemical test to verify the anion Q.

_____

_____

_____

[3 m]

d) Based on Reaction I,

i. Name the reaction I.

_____

[1 m]

ii. Write the ionic equation for the formation of the white precipitate.

_____

[1 m]

Section C

[20 marks]

Answer **all** questions in this section.

1. (a) Table 3.1 shows two sets of experiment which are carried out to study the effect of other metals on rusting of iron.

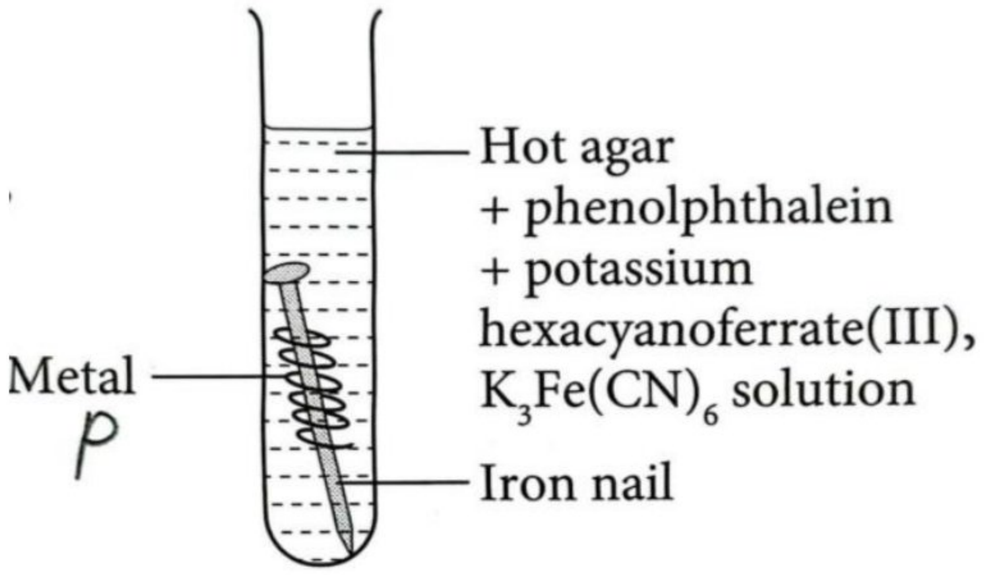
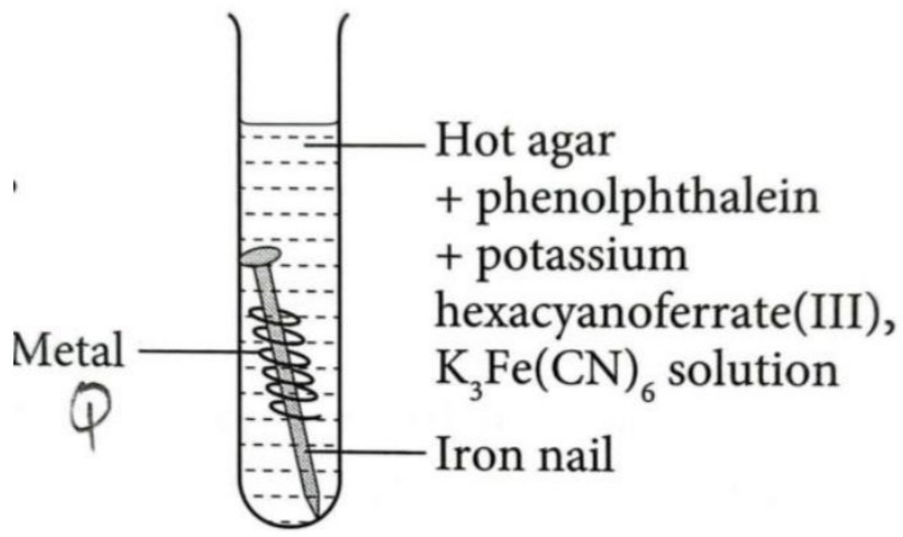
Set	Experiment	Observation
I		High intensity of dark blue colour is formed. Low intensity of pink colour is formed.
II		High intensity of pink colour is formed. No blue colour is formed.

Table 3.1

i. Based on Table 3.1, suggest metal P and Q. Write the half equations for the oxidation and reduction processes in Set I and Set II. Then, explain the difference in the observations in Set I and Set II.

[10 m]

(b) Diagram 9 shows two types of fence wire.

Covered with plastic

plated with zinc

Diagram 9

You are assigned to evaluate two types of fence wire to be installed in a house for long term use and not easily corroded. State your choice and justify your answer.

[2 m]

(c) Table 3.2 shows the equation of two reactions.

Reaction	Chemical equation
A	$Pb(NO_3)_2 + MgCl_2 \rightarrow Mg(NO_3)_2 + PbCl_2$
B	$Pb(NO_3)_2 + Mg \rightarrow Mg(NO_3)_2 + Pb$

Table 3.2

Determine whether each reaction is a redox reaction or not. Explain your answer in terms of change of oxidation number.

[4 m]

(d) The production of iron in industry through the reaction between iron ore, Fe_2O_3 and coke,C is shown in chemical equation below.

$$\mathbf{2Fe_2O_3 + C \rightarrow 4Fe + 3CO_2}$$

If the factory is able to process 480 kg iron ore a day by using excess carbon, calculate the mass of the iron produced.

[4 m]

2. (a) Diagram 10 shows how stock solution of sodium hydroxide is prepared by a lab assistant.

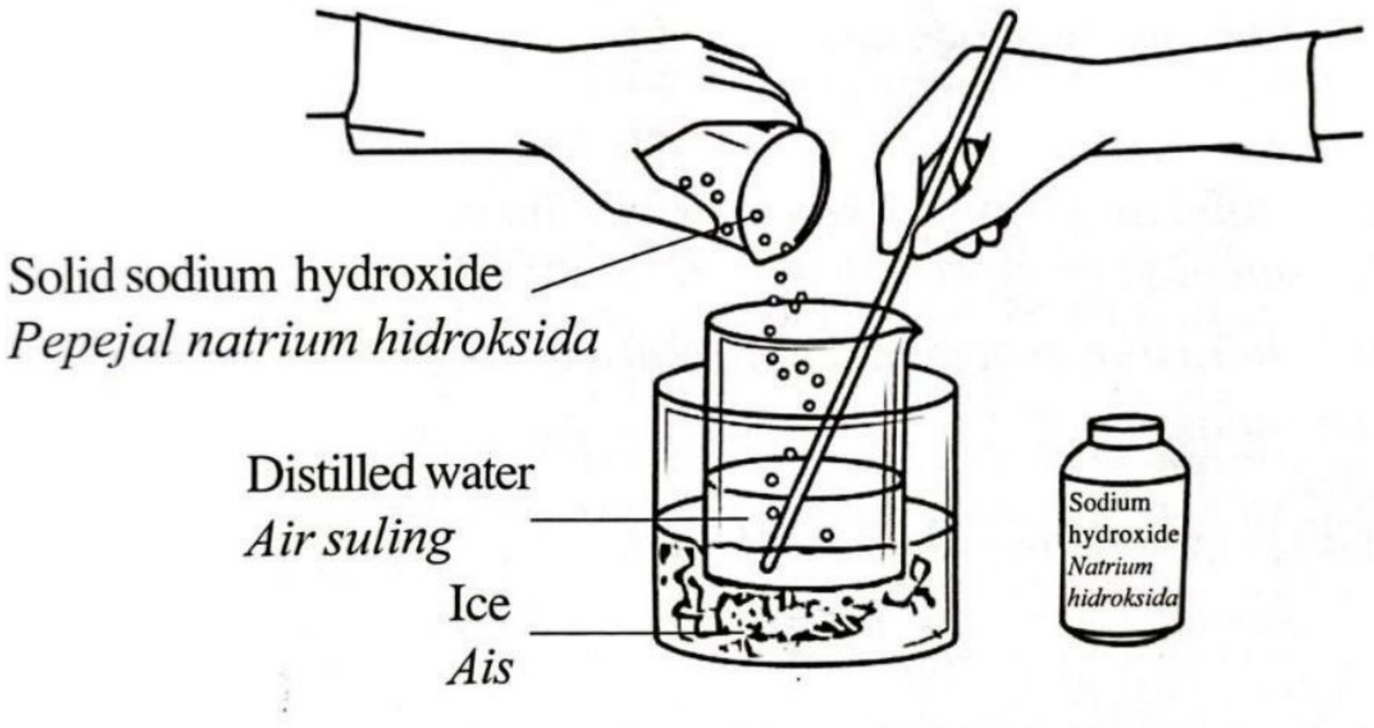


Diagram 10

Explain why the lab assistance uses ice to aid her preparation of sodium hydroxide solution. When 1 mol of solid sodium hydroxide is dissolved in water, it produces 44.51 kJ of heat.
Calculate the temperature change if 0.5 mol of solid sodium hydroxide is dissolved in 800 cm^3 of distilled water.

[4 m]

(b) Table 4 shows the heat of reaction for the reaction between hydrochloric acid, HCl with sodium carbonate, Na_2CO_3 and sodium hydrogen carbonate, $NaHCO_3$.

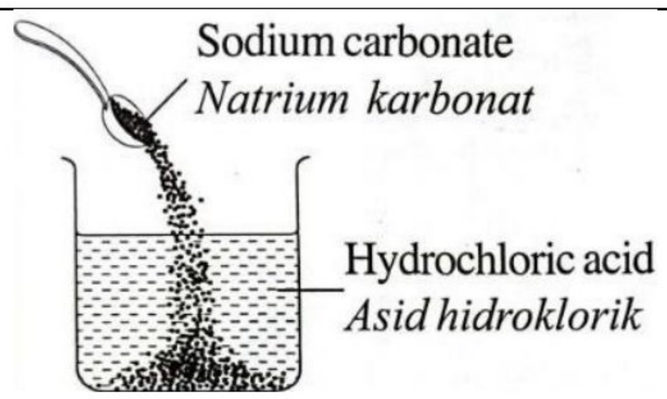
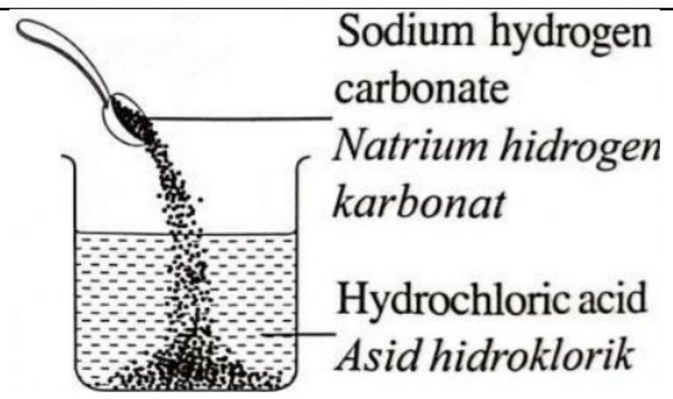
Reaction	I	II
Reactant		
Heat of reaction	-X kJmol^{-1}	+Y kJmol^{-1}

Table 4

Based on Table 4, compare Reaction I and Reaction II in terms of:

- Type of reaction
- Temperature change
- Change in the total energy content of reactants and the total energy content of products
- Formation and breaking of bond

Give another example for Reaction I and Reaction II.

[6 m]

(c) Table 5 shows the number of carbon atoms per molecule alcohol and the heat of combustion of methanol, ethanol, propanol and butanol.

Alcohol	Number of carbon atoms per molecule alcohol	Heat of combustion/kJmol^{-1}
Methanol	1	-720
Ethanol	2	
Propanol	3	-2030
Butanol	4	-2680

Table 5

(i) By using the data in Table 5, plot a graph of heat of combustion against the number of carbon atoms per molecule alcohol.
From the graph plotted, determine the value of heat of combustion of ethanol.

[5 m]

(ii) If 1.08 g of ethanol is used to heat 200 cm^3 of water, calculate

- The number of moles of ethanol and the temperature change during the reaction.
  [Relative atomic mass: C=12, H=1, O=16]
  [Specific heat capacity of water, c= 4.2 Jg^{-1}°C^{-1}, density of water=1.0 gcm^{-3}]

- Write a chemical equation for the complete combustion of propanol.

[5 m]

END OF QUESTION PAPER

Prepared by: Checked by: Certified by: