NAME: ..... Marking Scheme .....ADM NO: ..... CLASS:.....

JULY, 2024

MOKASA II JOINT EVALUATION EXAMINATION

Kenya Certificate of Secondary Education (K.C.S.E.)

CHEMISTRY PAPER ONE
233/1
TIME: 2 HOURS

INSTRUCTIONS TO CANDIDATES

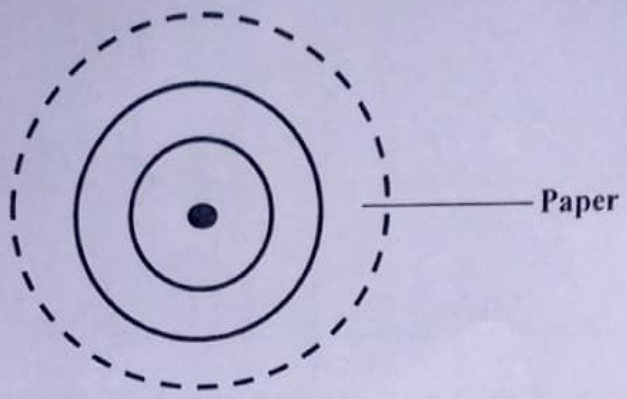
- Write your Name, Admission Number and class in the spaces provided.
- Answer all the questions in the spaces provided in the question paper.
- Mathematical tables and silent scientific calculators may be used.
- ALL the working must be clearly shown where necessary.
- This paper consists of 12 pages.

FOR EXAMINER'S USE ONLY

QUESTIONS	MAX SCORE	CANDIDATE'S SCORE
1 – 28	80	

from a green

1. An extract colouring matter was placed at the centre of a filter paper and allowed to dry. Drops of ethanol were added to the centre and eventually the following was observed.



(a) Name a process by which dilute extract can be made more concentrated. **(1mk)**

Evaporation ✓1

(b) Give the name of the process by which the circles were produced. **(1mk)**

Chromatography ✓1

(c) Explain why water is not suitable for this process. **(1mk)**

Water does not dissolve molecular substances found in the colouring matter. ✓1

2. Study the table below and answer the questions that follow.

Solution	N	P	K	L	Q
P^H	1.0	14.0	6.5	7.0	8.0

(i) Which of the solutions would be suitable for use in the manufacture of anti-acid tablets? **(1mk)**

Q. ✓1

(ii) Give a pair of the above solutions for which zinc oxide can dissolve. Give a reason. **(2mks)**

N and P ✓1

Zinc oxide being amphoteric dissolves in strong acids and alkalis. ✓1

06

3. In an experiment to prepare oxygen gas, black **solid B** was added to hydrogen peroxide solution. The oxygen produced was then used to produce **gas D** which changes orange acidified potassium dichromate (VI) to green. Gas D was prepared by heating a yellow **solid A** in oxygen.

(i) Identify

Solid B **(½mk)**

Manganese (IV) oxide. ✓½

Gas D **(½mk)**

Sulphur (IV) oxide. ✓½

(ii) Write an equation for formation of oxygen gas from the above experiment. **(1mk)**

$2H_2O_{2(l)} \xrightarrow{MnO_2} 2H_2O_{(l)} + O_{2(g)}$ ✓1

(iii) What volume of oxygen gas would be produced at r.t.p of 20 cm^3 of 2M hydrogen peroxide was used in the experiment? (M.G.V at r.t.p = 24000 cm^3) **(2mks)**

Moles of $H_2O_2 = \frac{2 \times 20}{1000}$ ✓½

$= 0.04$ moles

Moles of $O_2 = \frac{0.04}{2} = 0.02$ ✓½

1 mole → 24000

$\therefore 0.02 \times 24000$ ✓½

$= 480\ cm^3$ ✓½

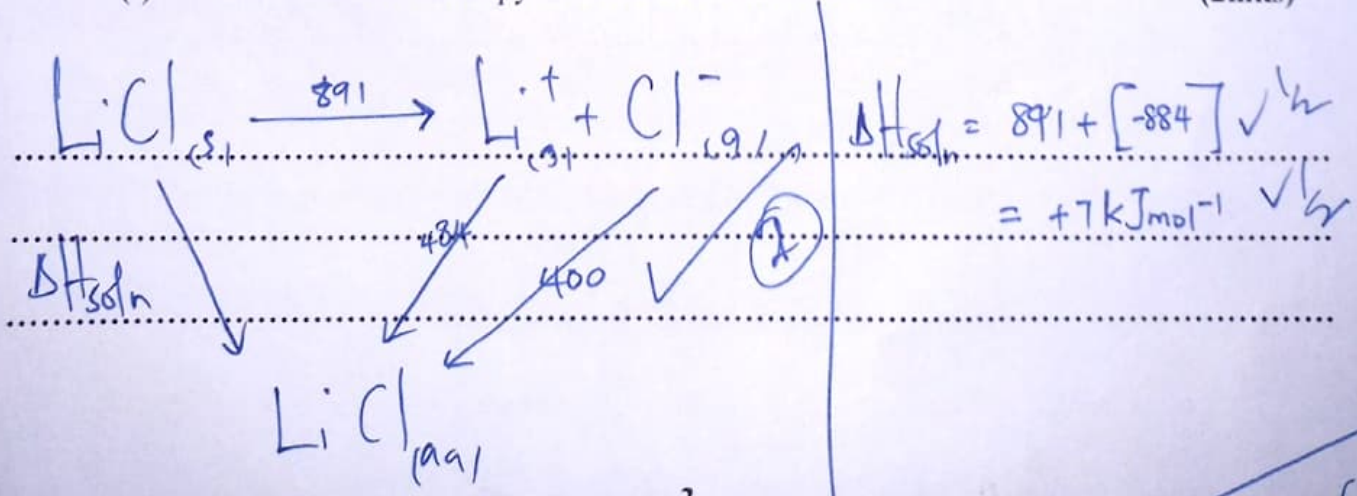
4. Given:

ΔH_{latt} LiCl $= 891\ kJmol^{-1}$

ΔH_{hyd} $Li^+_{(g)} = 484\ kJmol^{-1}$

ΔH_{hyd} $2Cl^-_{(g)} = 800\ kJmol^{-1}$

(i) Determine the enthalpy of solution of lithium chloride. **(2mks)**



$\Delta H_{soln} = 891 + [-884]$ ✓½

$= +7\ kJmol^{-1}$ ✓½

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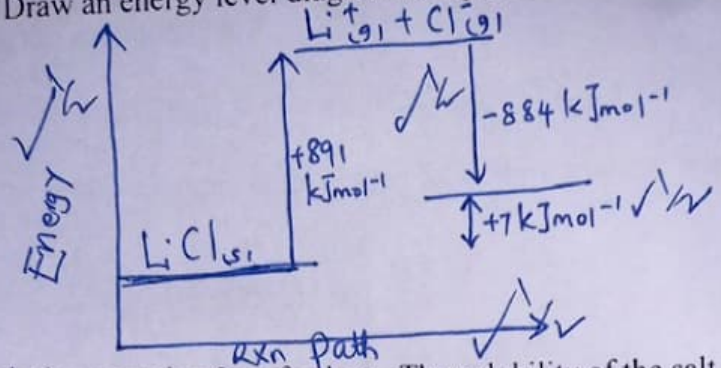
(ii) Draw an energy level diagram to represent the above information **(2mks)**



5. 65 g of a solution contains 5 g of solute. The solubility of the salt is 25 g per 100cm^3 of water at 20 ^{0}C. 30 g of the salt was added to the solution at 20 ^{0}C. Determine the mass of the salt that remained undissolved. **(3mks)**

100 cm^3 → 25g ✓1

∴ $\frac{60 \times 25}{100}$ ✓1

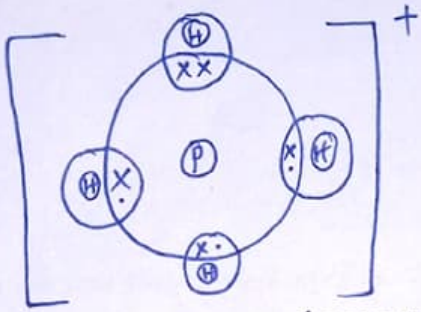
= 15g required to saturate 60g

(5g Present + 30) = 35g ✓1

∴ 35g − 15g required ✓1

= 20g undissolved. ✓1

6. Using dots (.) and crosses (X) to represent electrons show bounding in phosphonium ion (PH_4^+) **(2mks)**



✓2 or 0

7. (a) Describe how you can prepare a dry sample of ~~ammonia~~ trona ($Na_2CO_3.NaHCO_3.2H_2O$) in the laboratory, starting with sodium carbonate solid. **(2mks)**

✓Add water to sodium Carbonate. In a separate beaker, add water to Sodium hydrogen Carbonate. Stir the two and mix. ✓½

✓Heat the mixture to saturated. Once crystals form, stop heating.

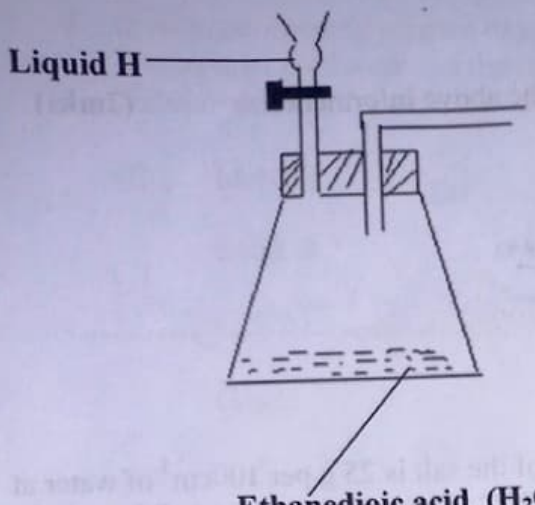
✓Allow it to cool ✓1

(b) If the crystals prepared above are left exposed overnight. It is observed that it turns into a white powder. Explain. **(1mk)**

Efflorescence takes place ✓1

10

8. The set-up below was used in the laboratory preparation of carbon (II) oxide.



Pass through NaOH soln / KOH ①
Collect over water / syringe ①

(i) Complete the set up to show how carbon (II) oxide was collected. **(2mks)**

(ii) Identify liquid (X) and state its function **(1mk)**

Concentrated sulphuric (VI) acid. Dehydrating agent. ✓✓

(iii) Write an equation for the reaction producing carbon (II) oxide gas. **(1mk)**

$H_2C_2O_{4(l)} \xrightarrow{H_2SO_{4(l)}} CO_{(g)} + CO_{2(g)} + H_2O_{(l)}$ ✓1

9. A student electrolyzed magnesium sulphate solution graphite electrodes.

(i) Calculate the amount of current required to liberate $1.2dm^3$ of the gas produced at the anode at r.t.p. (M.G.V at r.t.p = $24dm^3$, 1F = 96500C). **(3mks)**

in 1hour and 15 seconds.

Anode: $4OH^-_{(l)} \longrightarrow 2H_2O_{(l)} + O_{2(g)} + 4e^-$ ✓

$Q = It$ ✓

$3615I = 19300$ ✓½

$I = 5.3A$ ✓½

$4 \times 96500C \rightarrow 24dm^3$

$1.2dm^3 \times 4 \times 96500 / 24dm^3$ ✓

$= 19300C$. ✓

(ii) Explain the changes in concentration of the electrolyte as the electrolysis progresses. **(1mk)**

✓ the concentration of the electrolyte increases as water is removed (H^+ and OH^- are discharged)

10. (i) State Graham's law of diffusion **(1mk)**

Under the same conditions of temperature and pressure, the rate of diffusion of a gas is inversely proportional to the square root of its density

(ii) 100 cm^3 of ozone (O_3) diffused through a certain apparatus in 96 seconds. Calculate the time taken by 100 cm^3 of carbon (IV) oxide to diffuse through the same apparatus under same conditions. (O = 16.0 C = 12.0) **(3mks)**

$t_{O_3} = 96$ MM $O_3 = 16 \times 3 = 48$

$t_{CO_2} = ?$ MM $CO_2 = 44$

$\frac{t_{O_3}}{t_{CO_2}} = \frac{\sqrt{48}}{\sqrt{44}}$

$\frac{96}{x} = \frac{\sqrt{48}}{\sqrt{44}}$

$x = \frac{96\sqrt{44}}{\sqrt{48}}$

$= 91.9$ seconds

11. In an experiment to confirm the presence of nitrate ions in a solution, a student added a certain solid M followed by sodium hydroxide solution the warming. He then tested the gases produced using litmus papers.

(i) Identify solid M **(1mk)**

Aluminium (Al) / Zinc (Zn) / lead (Pb)

(ii) Complete the table below by listing down the observations that lead to the conclusion that nitrate ions were present.

Observation	Inference
Colourless gas with a pungent choking smell. Moitred litmus paper turns blue. Moist blue litmus paper remains blue **(2mks)**	NO_3^- present

12. A certain metal carbonate, QCO_3, reacts completely with 20 cm^3 of 1M hydrochloric acid according to the equation below.

$$QCO_{3(s)} + 2\,HCl_{(aq)} \longrightarrow QCl_{2(aq)} + CO_{2(aq)} + H_2O_{(l)}$$

Determine the relative atomic mass of Q is 1g of the carbonate reacted completely.
(C=12, O = 16) **(3mks)**

Moles of HCl = $\frac{1 \times 20}{1000}$ = 0.02 moles ½

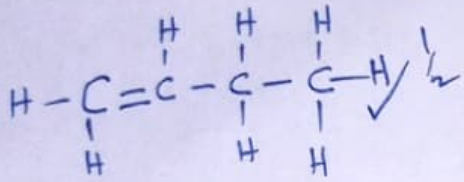
Moles of Q = $\frac{0.02}{2}$ = 0.01 mole ½

R.F.M = $\frac{\text{Mass}}{\text{moles}} = \frac{1}{0.01} = 100$ ✓½

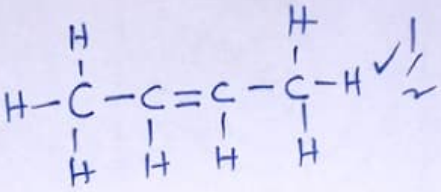
$QCO_3 = 100$ ✓½

$Q = 100 - 60 = 40$ ✓1

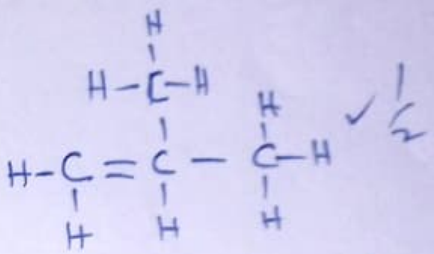
13. (a) Draw and name all the possible isomers of butene. **(2mks)**



But-1-ene ✓½



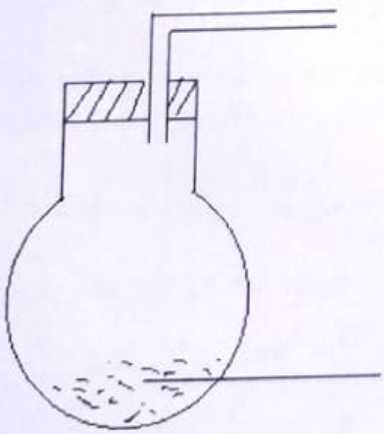
But-2-ene ✓½



2-Methylpropene. ✓½

any 2 pairs

(b) The diagram below shows an incomplete set-up of the laboratory and collection of propane.



Solid X + sodium hydroxide solid + calcium oxide

heat ✓1 (must)

Method of collection (o.r.w) = 1mk

(i) Complete the set-up to show how the gas is collected. **(2mks)**

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(ii) Identify solid X (1mk)

Sodium butanoate.

(iii) What is the role of calcium oxide in the mixture? (1mk)

✓ to keep Sodium hydroxide dry.

14. (a) An element P consist of three isotopes with mass number 39, 40, 41 with percentage abundance of P-40 being 60%. If the R.A.M of P is 39.8, determine the percentage abundances of the other two isotopes. (2mks)

let % of P-39 be x

$39.8 = \frac{39x + (60 \times 40) + 41(40 - x)}{100}$ ✓1

$3980 = 39x + 2400 + 1640 - 41x$

$-60 = -2x \mid x = 30$ ✓½

P-39 = 30% ✓½

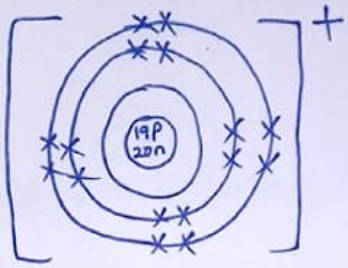
P-41 = 40 - 30 = 10%

19 ⊛

(b) If the atomic number of P is 9, illustrate the structure of an ion of P-39. (2mks)

neutrons = 39 - 19 = 20

2.8.8.1



✓ 2 or 0

15. Hydrogen sulphide gas reacts with chlorine gas according to the following equation.

$H_2S_{(g)} + Cl_{2(g)} \longrightarrow 2HCl_{(g)} + S(s)$

Use oxidation numbers to identify the reducing agent in the equation. (2mks)

S=0-2 ⟶ S=0 (increase) ✓½

Cl — Cl = 0 → −1 (decrease) ✓½

H_2S is the reducing agent ✓½

O.S of sulphur increases from −2 to 0 ✓½

16. (i) Write a balanced chemical equation for the reaction between chlorine gas and hot concentrated sodium hydroxide solution. (1mk)

$3Cl_{2(g)} + 6NaOH_{(aq)} \longrightarrow NaClO_{3(aq)} + 5NaCl_{(aq)} + 3H_2O_{(l)}$ ✓1

(ii) Give one use of the major product formed in (i) above. (1mk)

As a weedkiller / matches / explosives / calico printing ✓1

(i) Write PTFE in full. (1mk)

Polytetrafluoroethene ✓1

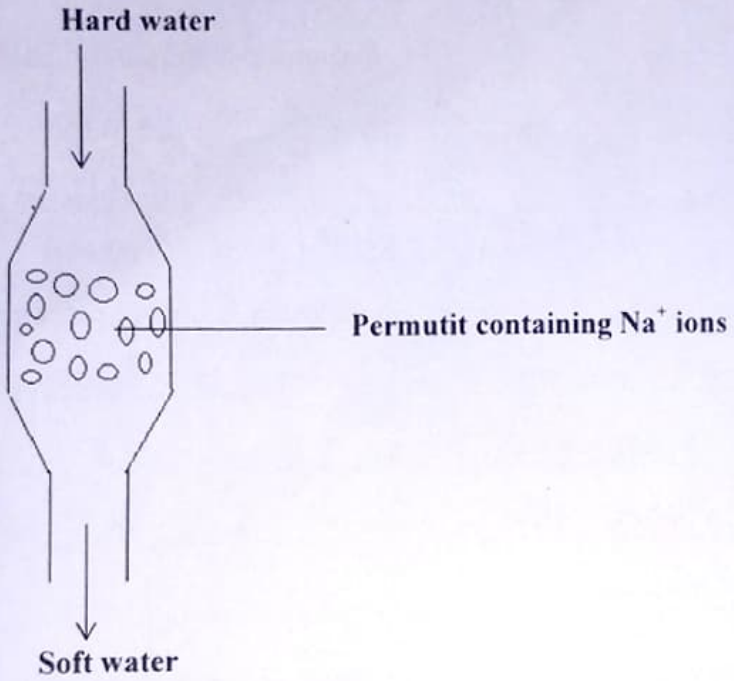
17. (a) Identify the acid in the backward reaction. Give a reason for your answer.

$NH_4^+{}_{(aq)} + H_2O_{(l)} \rightleftharpoons NH_{3(aq)} + H_3O^+{}_{(aq)}$ **(2mks)**

H_3O^+ ✓1

It donates H^+ (proton) to $NH_{3(aq)}$ to form $NH_4^+{}_{(aq)}$ ✓1

18. The column below was used to soften hard water.



(i) Briefly explain how the resin works. **(1mk)**

✓as hard water passes through the resin, Ca^{2+} and Mg^{2+} attach ✓1 to the resin as loosely held Na^+ are released. (w.t.t.e)

(ii) How is the resin re-activated after some time? **(1mk)** ✓1

✓by flushing with brine [Concentrated Sodium Chloride solution]

04

19. Hydrogen chloride gas dissolved in water conducts electric current while hydrogen chloride gas dissolved in methylbenzene does not. Explain. **(2mks)**

Hydrogen chloride dissolves in water and forms H^+ ions responsible for conductivity while in methylbenzene it dissolves but remains in molecular form hence lacks H^+ ions.

20. (a) Name the chief one from which lead is extracted. **(1mk)**

Galena.

(b) State two uses of copper metal. **(2mks)**

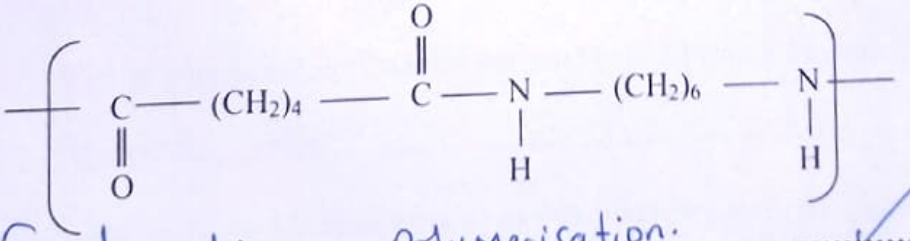
- Make overhead transmission cables.
- Make soldering wires.
- Make ornaments / coins / alloys

any 2 correct

21. Describe the process of preparation of soap. **(2mks)**

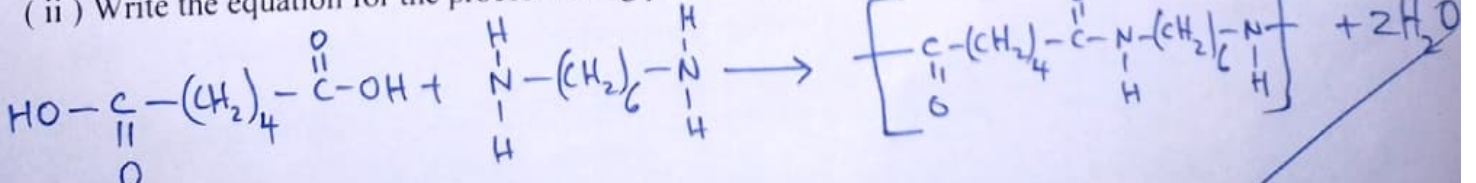
- fatty acid is mixed with alkali glycerol then boiled.
- Sodium chloride is added to precipitate soap from glycerol.
- decanted off and washed with distilled water.

22. (i) Name the type of polymerization by which the polymer nylon– 6, 6 below is formed.



Condensation polymerisation. **(1mk)**

(ii) Write the equation for the process taking place in (b) above. **(1mk)**



09

23. (a) Distinguish between nuclear fusion and nuclear fission. **(1mk)**

Nuclear fusion is the process where light nuclei combine together releasing vast amounts of energy while nuclear fission is the splitting of a heavy unstable nucleus into lighter nuclei when bombarded with a fast moving neutron. ✓1 or 0

(b) $^{Z1}_{92}U + {}^{1}_{0}n \longrightarrow {}^{94}_{38}Sr + {}^{140}_{Z_2}Sr + 2\,{}^{1}_{0}n$

Find the value of Z1 and Z2 in the nuclear equation above. **(1mk)**

$Z_1 = 94 + 140 + 2 - 1$ ✓½
$= 235$

$Z_2 = 92 - 38$ ✓½
$= 54$

(c) 100g of radioactive $^{231}_{91}$Pa was reduced to 12.5g after 81 days. Determine the half-life of Pa (2mks)

$100 \xrightarrow{t_{\frac{1}{2}}} 50 \xrightarrow{t_{\frac{1}{2}}} 25 \xrightarrow{t_{\frac{1}{2}}} 12.5$ ✓1

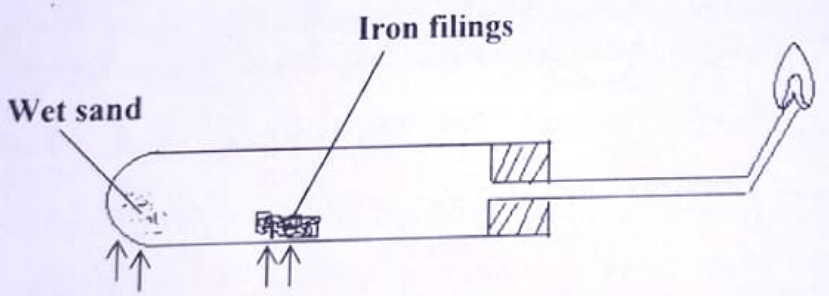
Follow through for $N = N_0\left(\frac{1}{2}\right)^{n/t_{\frac{1}{2}}}$

$3t_{\frac{1}{2}} = 81$ ✓½

$\frac{3t_{\frac{1}{2}}}{3} = \frac{81}{3}$

$t_{\frac{1}{2}} = 27$ days ✓½

24. Study the set-up below and use it to answer the questions that follow.



(i) Why is it necessary to heat the wet sand before heating the iron filings? **(1mk)**

to generate steam ✓1

(ii) Write down an equation for the reaction involving the iron filings. **((1mk)**

$3Fe_{(s)} + 4H_2O_{(g)} \longrightarrow Fe_3O_{4(s)} + 4H_{2(g)}$ ✓1

(iii) What precaution is necessary during the reaction? **(1mk)**

✓ Some hydrogen is allowed to pass before burning ✓1

07

25. A student was provided with two solutions of sodium chloride and aluminium chloride in an experiment. He accidentally removed the labels from the beakers containing the solutions. (Pearl)
* Describe how he can use potassium hydrogen carbonate to distinguish between the two solutions. **(2mks)**

Add Potassium hydrogen carbonate separately. ✓½
✓ Effervescence occurs in aluminium chloride solution because of hydrolysis. ✓1
- No effervescence is sodium chloride solution. ✓½

26. One mole of hydrazine gas (NxHy) reacts completely with oxygen to from 40 cm^3 of nitrogen gas and 80 cm^3 of steam.
(i) Determine the volume of oxygen gas used in the reaction. **(2mks)**

$N_xH_y + O_{2(g)} \longrightarrow N_{2(g)} + H_2O$

40 80 = 40 cm^3

$N_xH_y + O_2 \longrightarrow N_2 + 2H_2O$
40 40 40 80

(i) Write the equation for the reaction. **(1mk)**

~~N_xH_y~~ $N_2H_{4(g)} + O_{2(g)} \longrightarrow N_{2(g)} + 2H_2O_{(g)}$ ✓1

27. A student accidentally added potassium chloride into a mixture of zinc oxide and iron (III) chloride. Describe how you can help him obtain pure potassium chloride from the mixture. (3mks) ✓1

Heat the mixture in a beaker covered with a watch glass containing cold water. Iron (III) chloride sublimes and is collected on the watch glass. Add water to the remaining. Stir. filter to obtain zinc oxide as residue. Heat the filtrate to saturation to evaporate the water and remain with Sodium chloride.

28. Draw and name an apparatus used to support a crucible while heating in the laboratory. (1mk)

✓½

Pipe-clay triangle ✓½

END.

09