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MARANDA HIGH SCHOOL

Kenya Certificate of Secondary Education
END TERM 1 EXAM 2022

233/1 **CHEMISTRY PAPER 1**

TERM ONE **JUNE 2022** **TIME: 2Hours**

SUGGESTED MARKING GUIDE

Name: .....Adm No: .....

Class: N/A.....Candidate's Signature: ..... Date:29 /6/2022.

FORM 3 CHEMISTRY EXAMS 2022
Kenya Certificate of Secondary Education (KCSE)

INSTRUCTIONS TO CANDIDATES

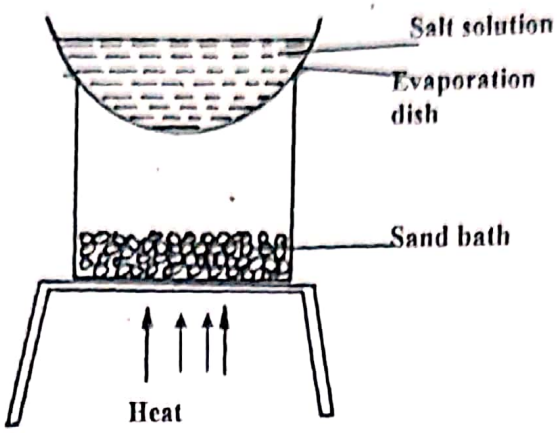
- Write your name and ADM Number in the spaces provided above.
- Sign in the spaces provided above.
- Answer **ALL** questions in the spaces provided.
- All workings **MUST** be clearly shown where necessary and non programmable calculator can be used
- This paper consists of **11** Printed pages.

Candidates should check the question paper to ensure that all the papers are printed as indicated and no questions are missing

FOR EXAMINERS USE ONLY.

Question	Maximum Score	Candidates Score
1 – 27	80	

1. A form 1 student carried out the separation as shown in the set-up below:-



(i) Identify the method above (1mk)

Evaporation

(ii) Give one of its disadvantages (1mk)

Uses a lot of fuel / only solute can be obtained but solvent escape to the atmosphere

(iii) Name a mixture which can be separated by the set-up above (1mk)

Sodium chloride / any soluble salt and water

2. In an experiment, ammonium chloride was heated in test-tube. A moist red litmus paper placed at the mouth of test first changed blue then red. Explain these observations: - (3mks)

$NH_3 = 17$ g $HCl = 36.5$ g

NH_4Cl decomposes on heating to produce, NH_3 and HCl (g), the NH_3 (g) is lighter than HCl hence diffuses faster and change moist red litmus paper to blue, HCl is denser hence diffuse at a slower rate, changes blue litmus paper to red

3. Some two elements are represented as:

$^{16}_{8}X$ and $^{27}_{13}Y$

(a) How many protons does X have? (1mk)

8 ✓1 (protons number same as atomic number)

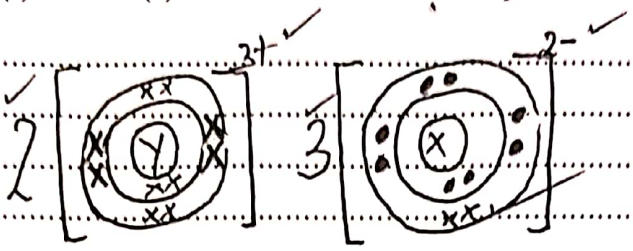
(b) How many neutrons does Y have? (1mk)

27 - 13 = 14 ✓1

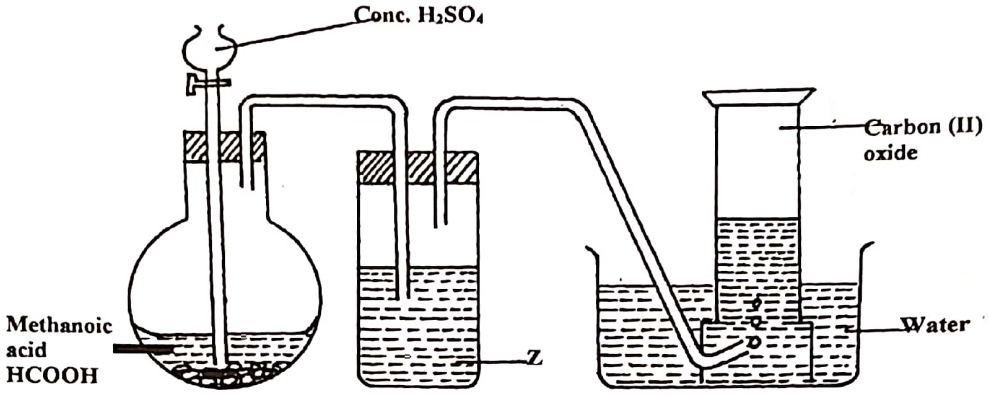
Vincent / Elijah

A.B.C.G.K.P M.Or.V.Y.W.

(c) Using dot(.) and cross(x) draw the structure of the compound formed between X and Y (1mk)



4. The apparatus illustrated below were used to prepare and collect carbon (II) Oxide in the laboratory



(a) State the condition necessary for this reaction to occur (1mk)

The reaction take place at room temperature ..... reject heat .....

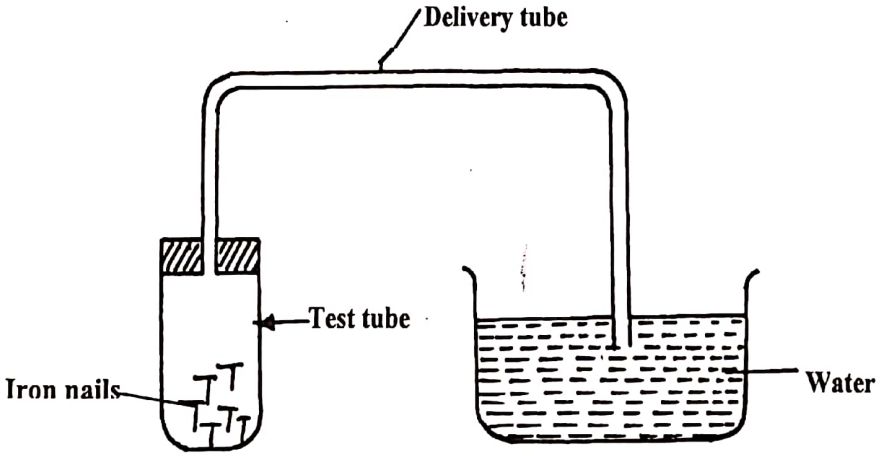
(b) Identify Z and state its role in this reaction (1mk)

Conc. sodium hydroxide/Conc. potassium hydroxide/$Ca(OH)_2$ (reject if no conc) ....

(c) Write an equation for the reaction taking place in the flask (1mk)

$HCOOH_{(aq)} \xrightarrow{Conc.\ H_2SO_4} CO_{(g)} + H_2O_{(l)}$

5.Study the set-up below and answer the questions that follow: -



(a) State two observations that would be made after one week. Explain (2mks)

Iron nails turns brown ½ - Iron nails reacts with oxygen and water to form rust which is brown ½

water rises up in the delivery tube/water level drops in the trough (any ½ mk),

oxygen has been used up in the rusting of iron nails hence water rises up to take the space of oxygen.

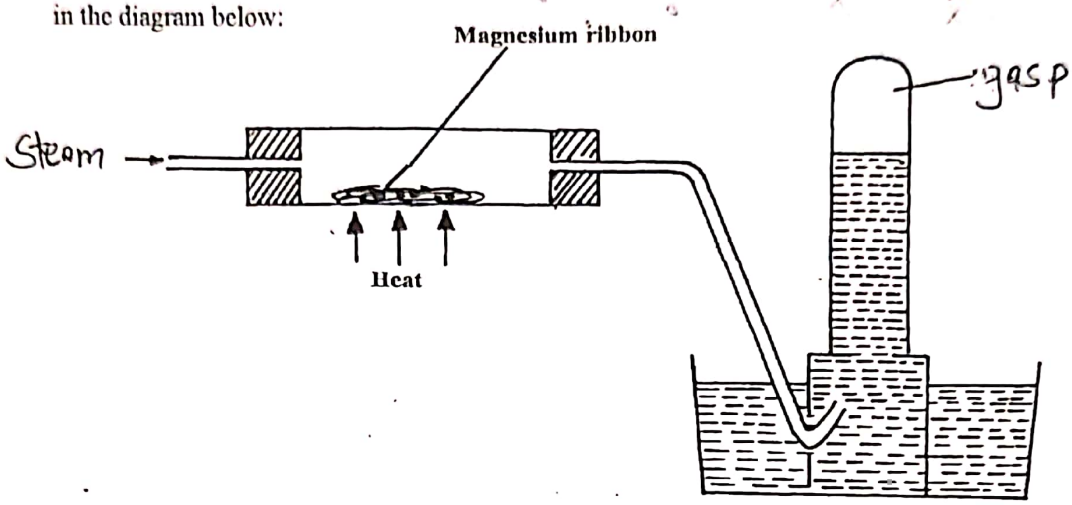
Imbuga / Patricia

(b) Write the chemical equation of the reaction taking place in the test-tube (1mk)

$4Fe_{(s)} + 3O_{2(g)} + 2H_2O_{(l)} \longrightarrow 2Fe_2O_3 \cdot 2H_2O_{(s)}$

(Accept only balanced chemical equation & wrong state symbols denotes $\frac{1}{2}$mk) — rules apply.

6. Gas P was passed over heated magnesium ribbon and hydrogen gas was collected as shown in the diagram below:



(i) Name gas P... Hydrogen ..... (1mk)

(ii) Write an equation of the reaction that takes place in the combustion tube (1mk)

$Mg_{(s)} + H_2O_{(g)} \longrightarrow MgO_{(s)} + H_{2(g)}$

(iii) State **one** precaution necessary at the end of this experiment (1mk)

- Steam is passed through the combustion tube before heating is commenced to drive out air that was initially in the combustion tube
- delivery tube should be removed before heating is stopped to prevent water being sucked into the combustion tube

7. 15.0cm^3 of ethanoic acid (CH_3COOH) was dissolved in water to make 500cm^3 of solution. Calculate the concentration of the solution in moles per litre

(C=12, H = 1, O = 16, density of ethanoic acid is 1.05g/cm^3) (3mks)

RMM(CH_3COOH) = 60 ✓½

Mass of ethanoic = D × V = 1.05 × 15 = 15.75 g ✓½

Moles of 500cm^3 soln = $\frac{15.57}{60}$ = 0.2625 ✓1

Molarity = $\frac{1000 \times 0.2625}{500}$ = 0.525M ✓½ (½mk for wrong unit)

Obonyo | Alago

A, B, C, G, R, M | Or, Y, W, V, P

8. (a) Identify two substance that are reacted to regenerate ammonia gas in the Solvay process (2mks)

Calcium hydroxide/slaked lime $Ca(OH)_2$

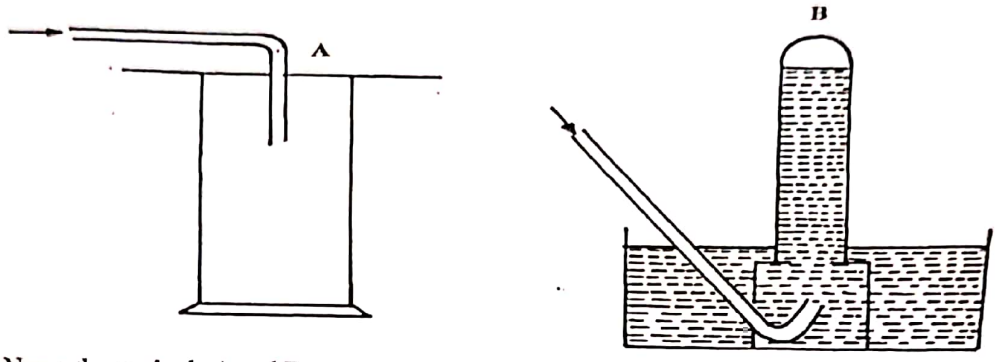
Ammonium chloride (NH_4Cl) (accept the formula)

(b) Write down a balanced chemical equation for the reaction above (1mk)

$Ca(OH)_{2(aq)} + 2NH_4Cl_{(aq)} \longrightarrow CaCl_{2(aq)} + 2NH_{3(g)} + H_2O_{(l)}$

(award ½ mk for wrong/no state symbol)

9. The diagram below shows three methods for collecting gases in the laboratory



(a) Name the methods A and B (1mk)

A. Down ward delivery/upward displacement of air

B. Over water

(b) From the methods above, identify **one** that is suitable for collecting Sulphur (IV) oxide. Explain (2mks)

A-Denser than air

10. The table below gives some properties of gases D and E

GASES	Density	Effect of $H_2SO_{4(aq)}$	Effect of $NaOH_{(aq)}$
D	Lighter than air	Reacts to form a salt	dissolves without reacting
E	Heavier than air	Not affected	Not affected

(a) Describe how one would obtain a sample of gas E from a mixture of gases D and E (2mks)

Pass the mixture through H_2SO_4 to absorb D

Collect E by downward delivery/upward displacement of air

(b) Name one apparatus that can be used to measure accurate volume of gases in the laboratory (1mk)

Syringe

Dr. Getrude / HOD

A, R, B, V, M, Or Y, W, P, C, G

11.The table below shows pH values of solutions A to E

Solution	A	B	C	D	E
pH	3	14	7	6	9

Which solution;

(a) Contains the largest concentration of hydroxyl ions? (½mk)

B

(b) is likely to be a solution of Aluminium chloride (½mk)

A

(c) is likely to be a solution of carbo (II) oxide (½mk)

C

(d) is likely to be a solution of magnesium chloride (½mk)

C

12.Potassium is isotopic and has a relative atomic mass (R.A.M) of 39.5, work out the percentage abundance of each isotope. The three isotopes are, ^{39}K, ^{40}K and ^{38}K (0.01%) (3mks)

$39.5 = \frac{(39 \times x) + 40(99.99 - x) + (38 \times 0.01)}{100}$ ✓ 1

$3950 = 39x + 3999.6 - 40x + 0.38$

$3950 - 3999.6 = 39x - 40x$ ✓ 1

$-49.6 = -x$

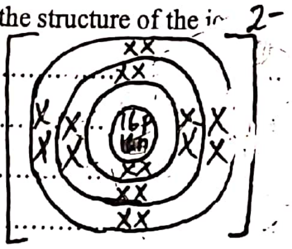
$x = 49.6$

$^{39}K = 49.6$ ✓ ½

$^{40}K = 50.01$ ✓ ½

13.An ion of element Q can be represented as $^{32}_{16}Q^{2-}$

(a) Draw the structure of the io (2mks)



✓Correct nucleus Composition ✓ 1

✓Correct energy levels & electrons with correct charge ✓ 1

✓ Charge (-) is missing/incorrect (0mk)

(b) How does its ionic radius compare with its atomic radius (1mk)

Ionic radius is greater than the atomic radius

14.The electronic configuration for elements represented by letters A, B and C are **A** 2.8.6, **B** 2.8.2, **C** 2.8.1

(a) Select the element which forms;

(i) A double charged cation. B (1mk)

Peter / Edwine

A.B.C. R.P.G. Y.N.V.M.Or

(ii) a soluble carbonate..... C .....(1mk)

(b) Which element has the shortest atomic radius (1mk)

..... A .....

15. Describe the process of separating Sodium chloride crystals mixed with Calcium carbonate powder (3mks)

add distilled water to the mixture, stir to dissolve sodium chloride, filter to obtain ½ Calcium carbonate as residue ½ and sodium chloride as filtrate, wash the residue with distilled water and dry the residue of $CaCO_3$ between filter paper, ½ ½ Evaporate the filtrate to obtain crystals of sodium chloride, dry the crystals between filter paper

16. 0.28g of iron burns in air to form Iron (II) oxide. Calculate the mass of Iron (II) oxide formed (O=16, Fe=56) (3mks)

$2Fe_{(s)} + O_{2(g)} \longrightarrow 2FeO_{(s)}$ ½

Moles of Fe = $\frac{0.28}{56} = 0.005$ moles ½

Mole ratio 1:1 ½

Mass of FeO = $0.005 \times 72 = 0.36$g ✓ 1

17. 20.0cm^3 of NaOH solution containing 8.0gdm^{-3} were required for complete neutralization of 0.118g of a dibasic acid. Calculate the Relative Molecular Mass (R.M.M) of the acid. (Na=23, O=16, H=1) (3mks)

$H_2X_{(aq)} + NaOH_{(aq)} \longrightarrow Na_2X_{(aq)} + H_2O_{(l)}$ ½

Moles of NaOH = $\frac{8g/L}{40} = 0.2$ ½

$\frac{0.2 \times 20}{1000} = 0.004$ moles ½

Moles of acid = $\frac{0.004}{2} = 0.002$ moles ½

If 0.002 moles = 0.118g

∴ 1mole → $\frac{1 \times 0.118}{0.002} = 59$ ½ ½

Jerry | Samuel.

A, B, W, Y, R V, P, C, G, Or, M

18. A fixed mass of a certain gas has a volume 96 cm^3 at 69 °C and 700 mmHg Pressure. Find the volume the gas would occupy at s.t.p. (3mks)

$P_1 = 700 mmHg$
$V_1 = 96 cm^3$
$T_1 = 69 + 273 = 342 K$
$P_2 = 760 mmHg$
$V_2 = ?$
$T_2 = 273 K$

$\frac{P_1V_1}{T_1} = \frac{P_2V_2}{T_2}$ ✓1

$\frac{700 \times 96}{342} = \frac{760 \times V_2}{273}$ ✓1

$V_2 = \frac{700 \times 96 \times 273}{342 \times 760} = \frac{18,345,600}{259,920} = 70.58 cm^3$ ✓1

19. A student reacted Silver Nitrate and Barium Chloride solutions to prepare two salts.

(i) Write an equation for the reaction that took place (1mk)

$BaCl_{2(aq)} + AgNO_{3(aq)} \longrightarrow Ba(NO_3)_{2(aq)} + AgCl_{(s)}$

(not balanced 0mk), missing state symbol ½ mk)

(ii) Write the ionic equation for the reaction (1mk)

$Ag^+_{(aq)} + Cl^-_{(aq)} \longrightarrow AgCl_{(s)}$

(iii) Name the method above used in preparing salts mentioned. (1mk)

Precipitation / double decomposition

20. (a) Define grahams law of diffusion. (1 mark)

It states that the rate of diffusion of a given mass of a gas is inversely proportional to the square root of its density at constant temperature and pressure.

(b) 60cm^3 of oxygen gas diffused through a porous partition in 50 seconds. How long would it take for 60cm^3 of Sulphur (IV) oxide gas to diffuse through the same partition under the same partition under the same conditions? (S = 32.0, O = 16.0). (2 marks)

$\frac{t_{O_2}}{t_{SO_2}} = \sqrt{\frac{MM_{O_2}}{MM_{SO_2}}}$ ½

$\frac{50 sec}{t_{SO_2}} = \sqrt{\frac{32}{64}}$ ½

$t_{SO_2} = \frac{50\sqrt{64}}{\sqrt{32}} = 70.72 sec$ ½

Alternative

Rate of $O_2 = \frac{60}{50} = \left(\frac{6}{5}\right) cm/sec$

Rate of $(SO_2 = \left(\frac{60}{T}\right) cm/sec$

$\frac{RO_2}{RSO_2} = \sqrt{\frac{mmSO_2}{mmO_2}}$

$\frac{\frac{6}{5}}{\frac{60}{T}} = \sqrt{\frac{64}{32}}$

$\frac{60}{T} \times 8 = \frac{6}{5}\sqrt{32}$

$T = \frac{480}{\sqrt{32}} \times \frac{5}{6}$

$T = 70.72 sec$

21. A metal Y with atomic number 11 burns in chlorine to produce a white solid X.

(a) Describe the following properties of X.

(i) Solubility. (1 mark)

Highly soluble in water.

Jesse / Rose.

M C B B G A / V Y W Or P.

(ii)Electrical conductivity. (1 mark)

Good conductor in molten and aqueous(aq) state/solution form

(b)Write an equation to show the formula of X. (1 mark)

$2Y_{(s)} + Cl_{2(g)} \longrightarrow 2YCl_{(s)}$

22.Calculate the number of hydrogen ions in 5cm³ of 0.5M phosphoric acid. (3 marks)
(L = 6.0×10^{23}).

$H_3PO_{4(aq)} \longrightarrow 3H^+_{(aq)} + PO_4^{3-}$

Moles of acid = $\frac{\text{Molarity} \times \text{volume}}{1000}$

$\frac{0.5 \times 5}{1000} = 0.0025$ moles

Mole ratio 1 : 3, H_3PO_4 : H^+

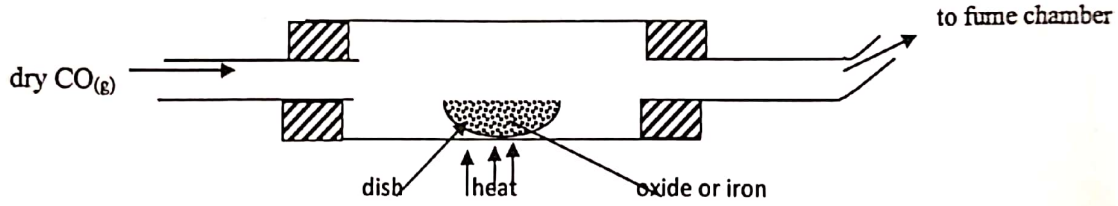
Moles of H^+ ions $= 0.0025 \times 3 = 0.0075$ moles

but 1 mole of $H^+ = 6.0 \times 10^{23}$ ions

$\therefore 0.0075 \rightarrow \frac{0.0075 \times 6.0 \times 10^{23}}{1}$ ion

4.5×10^{21}

23.Excess carbon (II) oxide gas was passed over heated sample of an oxide of iron. Study it and answer the questions below using data provided below.



Mass of empty dish = 10.98 g
Mass of empty dish + oxide of iron = 13.14g
Mass of empty dish + Residue = 12.66g
Determine the simplest formula of the oxide of iron (3 marks)
(Fe=56, O=16)

Mass of Iron 12.66 − 10.98 = 1.68g

Mass of Oxygen = 13.14 − 10.98 = 2.16g

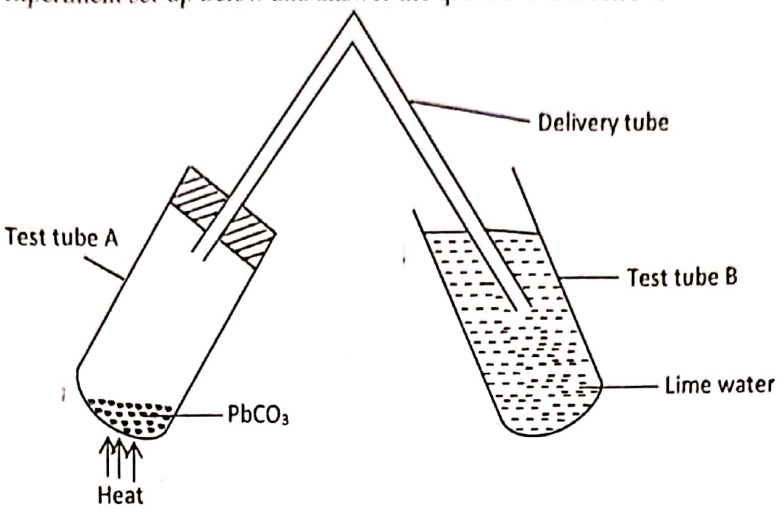
Mass of O_2 to be = 2.16 − 1.68 = 0.48g

Element	Fe	O
Mass	1.68	0.48
RAM	56	16
No. of moles	$\frac{1.68}{56}$	$\frac{0.48}{16}$
mole ratio	$\frac{0.03}{0.03} = 1$	$\frac{0.03}{0.03} = 1$

FeO

Tim / Odundo.
R A P R V / W Y G C Or M

24.Study the experiment set-up below and answer the questions that follow.



State the observations made after heating in

(i)Test tube A. (1 mark)

...brown solid which is orangen when hot & change yellow on Cooling was formed.....

(ii)Test tube B. (1 mark)

.....

White precipitate was formed.....

(iii) Write the reaction that take place in tube **B** (1 mark)

$Ca(OH)_{2(aq)} + CO_{2(g)} \longrightarrow CaCO_{3(s)} + H_2O_{(l)}$

25.Study the information in the table below and answer the questions that follow.

The letters do not represent the actual symbols of the elements.

Element	Electrical conductivity	Ductility	Action of water
A	Good	Good	No reaction
B	Good	Poor	No reaction
C	Good	Good	Reacts

Select the element which is

(a)Likely to be in group II of the periodic table.....C.....(1mark)

(b)Could be used to make electric cables.....A.....(1 mark)

(c)Likely to be graphite.....B.....(1 mark)

Joshua

26. The following two tests were carried out on chlorine water contained in two test tubes.
(a) A piece of blue flower was dropped into the first tube. Explain why the flower was bleached. (2 marks)

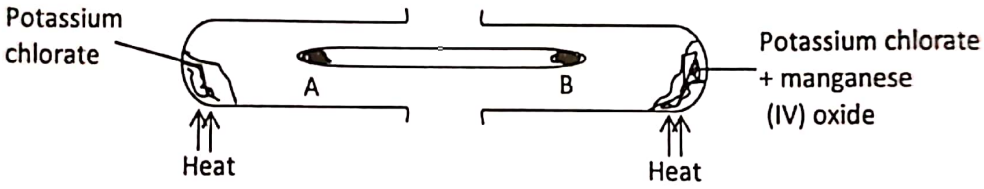
Chloric(I) acid ($HOCl$) decomposes to form atomic oxygen, oxygen combines with the blue flower decolourising it/ bleaches the blue flower ✓✓

$2HOCl_{(aq)} + dye \longrightarrow 2HCl_{(aq)} + (O + dye)$

(b) The second test tube was corked and exposed to sunlight. After a few days it was found to contain a gas that rekindled a glowing splint. Write an equation for the reaction which produced the gas. (1 marks)

$2HOCl_{(aq)} \longrightarrow 2HCl_{(aq)} + O_{2(g)}$

27. A wooden splint glowing on both ends was fixed as shown in the diagram the experiment was carried out as indicated.



(a) What will be observed on the glowing splint end A and B if heating is done at the same time. (1 mark)

end of wooden splint B relights faster than the end A

(b) Explain the observation in (a) above. (1 mark)

Manganese(IV) oxide acts as a catalyst and increases the rate of decomposition of Potassium chlorate producing oxygen

(c) One of the products in this experiment is useful to rocket scientist when going into space. State one ways in which the scientist used this product. (1 mark)

✓ liquid oxygen-hydrogen used as a rocket fuel

✓ Use oxygen for breathing since there is no oxygen in the space

GOA / Shadrack
A, B, V, R, C / G, Y, K, N, M, Or P.

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