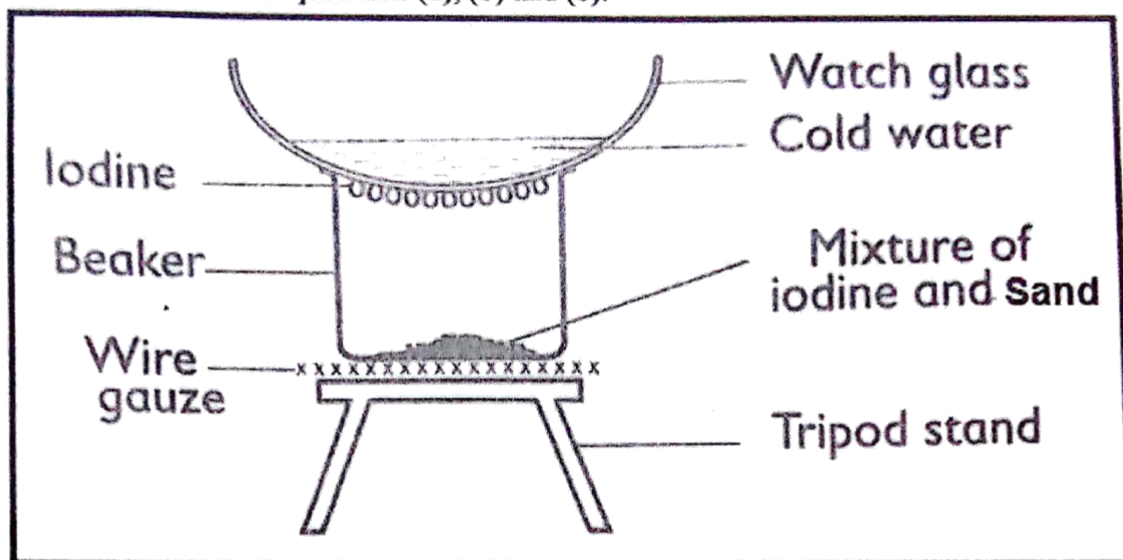


CHEMISTRY
FORM 3
PAPER 1
MARKING SCHEME



1. The diagram below represents a separation method effective in obtaining iodine crystals from a mixture of sand and iodine. Use it to answer questions (a), (b) and (c).



- a) Identify the necessary condition for the process to take place effectively.

(1 mark)

Heating / source of heat

Gentle heating / Extreme warming

- b) Name two substances that can undergo the above process of separation other than iodine.

(2 marks)

- Benzoic Acid

- Ammonium chloride

- Iron (III) chloride

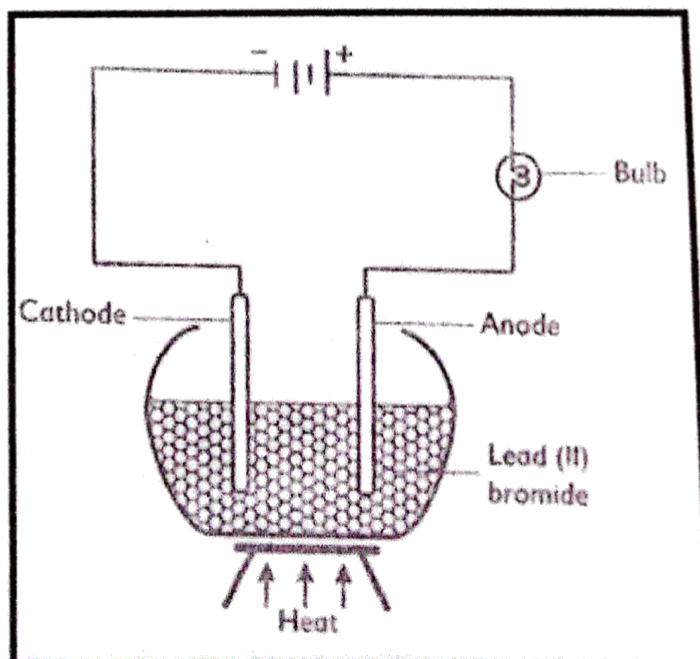
- solid carbon (iv) oxide - aluminium chloride

- c) What is the purpose of the cold water in the above set up.

(1 mark)

To cool the vapour back to solid hence deposition.

2. The electrolysis of lead (II) Bromide can be investigated using the following apparatus.



i) State what is observed at the;

(2 marks)

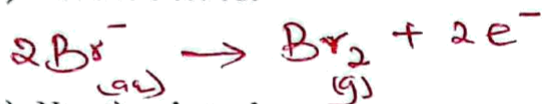
a) Positive electrode — Anode
Brown vapour seen

b) Negative electrode — Cathode
Grey solid beads are deposited.

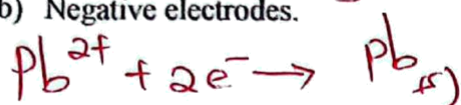
ii) Write an equation for the reactions that take place at both electrodes.

(2 marks)

a) Positive electrode



b) Negative electrodes.



3. When 3.18 g of copper (II) oxide were carefully heated in a beam of dry hydrogen 2.54 g of copper and 0.72 g of water were formed. Determine the number of moles of hydrogen atoms which combine with one mole of oxygen atom.

(4 marks)

$$\text{Mass of Oxygen} = 3.18 - 2.54 = 0.64 \text{ g}$$

$$\text{Mass of Hydrogen} = 0.72 - 0.64 = 0.08 \text{ g}$$

$$\therefore \text{Moles of Hydrogen atom} = \frac{0.08 \text{ g}}{1 \text{ g/mole}} = 0.08 \text{ mole}$$

$$\text{Moles of oxygen atom} = \frac{0.64 \text{ g}}{16 \text{ g/mole}} = 0.04 \text{ mole}$$

$\therefore$ 0.08 mole of Hydrogen atom combines with 0.04 mole of oxygen atom.

$\therefore$ 1 mole of oxygen atom combines with ~~0.04~~ 2.0 moles of Hydrogen atoms.

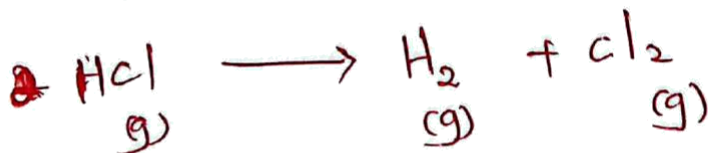
$$\frac{1.0 \times 0.08}{0.04} \text{ moles of Hydrogen atoms}$$

$$= 2.0 \text{ moles of Hydrogen atoms}$$

= 2.0 moles of Hydrogen atoms.

4. A volume of 20 litres of hydrogen chloride was completely decomposed to its constituent elements (hydrogen and chlorine). What are the volumes of the constituents.

(3 marks)



2 volumes of HCl produces 1 volume of H_2 and 1 volume of Cl_2 .

$\therefore$ 20 litres of HCl produce $\left(\frac{20 \times 1}{2}\right)$ litres of H_2 .
= 10 litres of H_2 and (20×1) litres of Cl_2 .

$\therefore$ volume of constituent elements

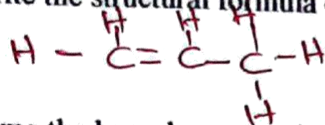
= 10 litres of H_2 and 10 litres of Cl_2 .

5. Define the following terms.

- a) Catalytic cracking - Involves breaking of long chain Alkanes (2 marks)
by passing them over a catalyst at high temperature of about $400^{\circ}\text{C} - 500^{\circ}\text{C}$.
- b) Thermal cracking - Breaking of the carbon-carbon bonds in the long chain alkanes at high temperatures of $400^{\circ}\text{C} - 700^{\circ}\text{C}$ to form short chain alkanes and alkenes.

6. A hydrocarbon Q was found to decolourize potassium manganate (VII) solution. When two moles of Q are burnt completely, six moles of carbon (IV) oxide and six moles of water are formed.

a) Write the structural formula of Q. (1 mark)



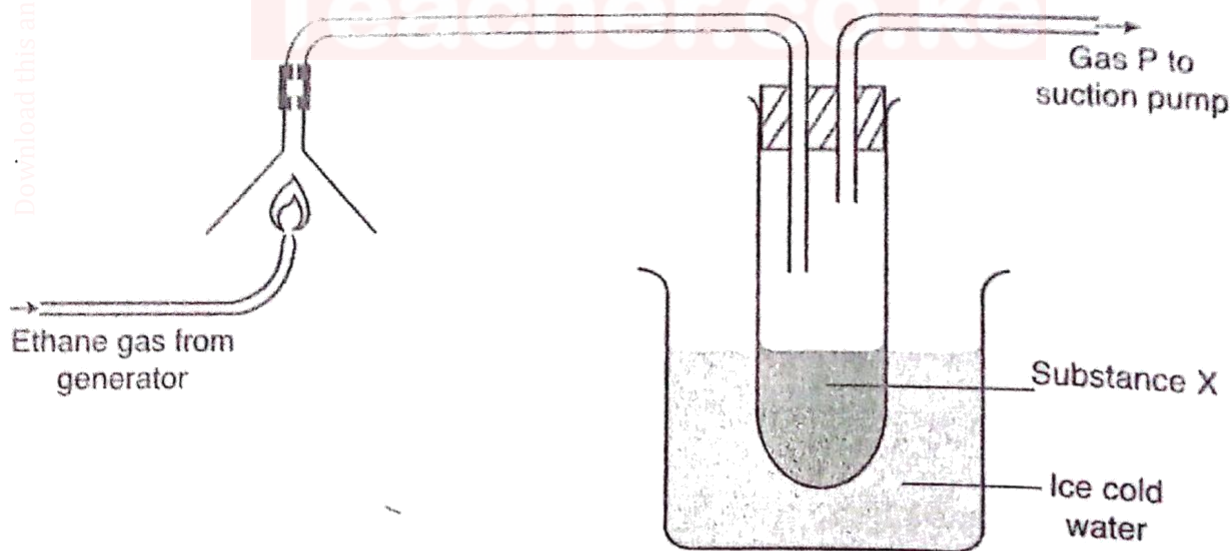
b) Name the homologous series to which Q belongs. (1 mark)

Alkenes

c) Name one industrial source of Q. (1 mark)

Cracking of Alkanes

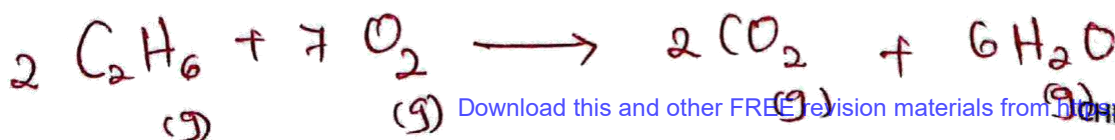
7. The diagram below shows the combustion of ethane gas.



a) Identify substance x. (1 mark)

Water

b) Write the equation for the complete combustion of ethane gas. (2 marks)



c) What is the purpose of the ice cold water in the experiment? (1 mark)

To cool any vapour produced during burning

d) The pH of substance x was found to be less than 7. Explain this observation. (2 marks)

Some of the carbon (IV) oxide produced dissolves in the condensed water vapour. Hence the solution is weakly acidic.

8. If compound x is heated, a red brown gas is evolved and yellow residue is left on cooling. Name the

i) Red-brown gas. (1 mark)

Nitrogen (IV) oxide (NO_2)

ii) The ions present in the residue. (1 mark)

Pb^{2+} and O_3^{2-} ions.

iii) Compound x. (1 mark)

Lead (II) nitrate $\text{Pb}(\text{NO}_3)_2$

9. Explain reasons for the following;

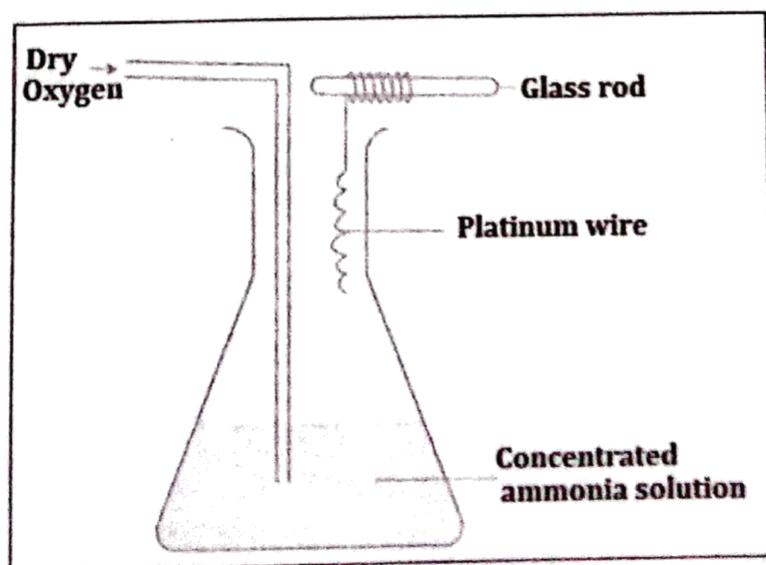
i) Nitric (V) acid is usually kept in dark brown bottles. (2 marks)

The dark brown bottles prevent the penetration of light which would otherwise cause the nitric (V) acid to decompose.

ii) Nitric (V) acid is often yellow in colour. (2 marks)

Nitric (V) acid decomposes to produce red-brown nitrogenous oxide. The NO_2 dissolves in the acid to produce yellow colouration.

10. The set up below was used to study the reaction between ammonia and air in the presence of platinum catalyst.

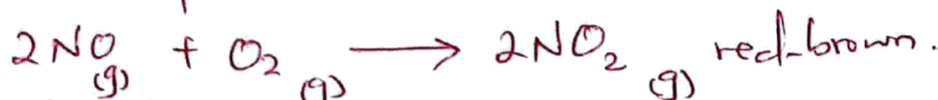


- a) The platinum wire continues to glow without further heating. Explain. (1 mark)

The reaction between ammonia and oxygen is highly exothermic.

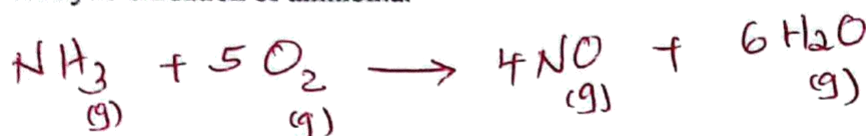
- b) Brown fumes are observed in the flask. Explain. (2 marks)

The nitrogen (II) oxide produced reacts with oxygen in the flask to produce red-brown fumes of nitrogen (IV) oxide.

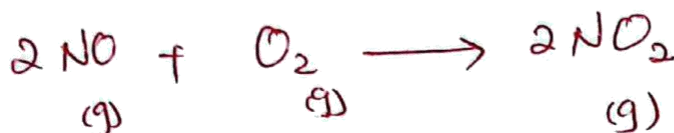


- c) Write equation for the reaction representing.

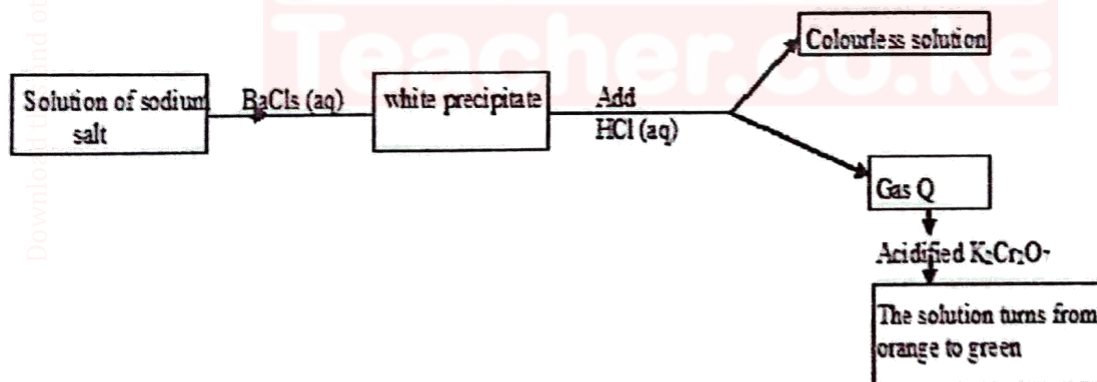
- i) Catalytic oxidation of ammonia. (2 marks)



- ii) Formation of the brown fumes. (2 marks)



11. Study the flow chart below and answer the questions that follow:



- a) Name the white precipitate. (1 mark)

Barium sulphite BaSO_3 .

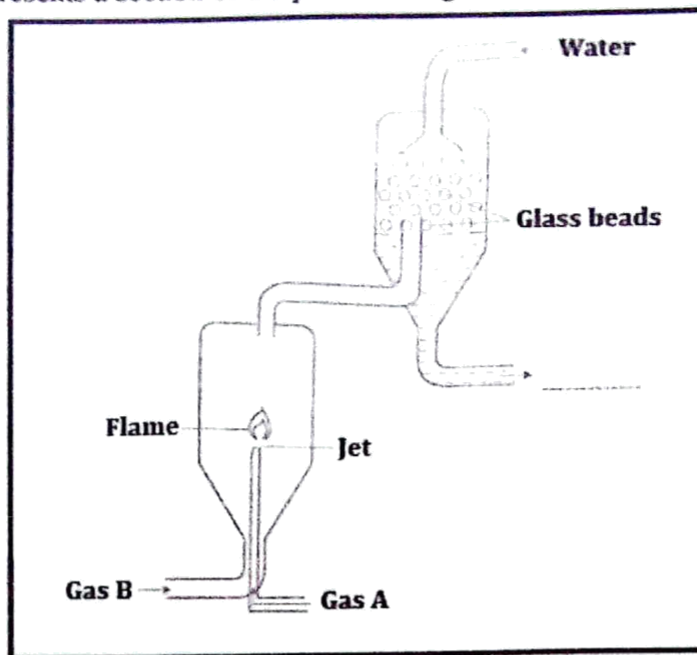
- b) Write the formula of the potassium salt. (1 mark)

potassium sulphite K_2SO_3 .

- c) Name gas Q. (1 mark)

sulphur (IV) oxide SO_2 .

12. The following diagram represents a section of the plant for large-scale manufacture of hydrochloric acid.



a) Name gases A and B.

(2 marks)

A - Dry Hydrogen

B - Dry chlorine

b) State the role of glass beads in the plant.

(1 mark)

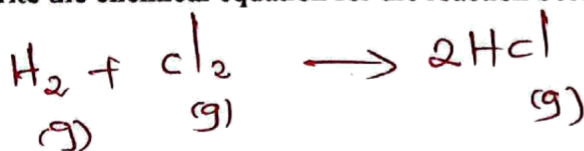
Increase the surface area over which absorption of Hydrogen chloride occurs.

c) Why is gas A introduced into the reaction through a jet?

(1 mark)

To control the amount of hydrogen mixing with chlorine in order to regulate the reaction rate. This is because a mixture of chlorine and hydrogen in nearly equal proportions react explosively.

d) Write the chemical equation for the reaction between gaseous substances represented by A and B. (2 marks)



13. Define the following terms;

a) Chemistry. - A branch of science that deals with the study of matter, its composition, reactions and properties, both physical and chemical. (1 mark)

b) Drug - A chemical substance natural / synthetic which when introduced into the body alters the normal functioning of the body. (1 mark)

c) Drug abuse. - is the use of a drug for the purpose other than the one which it was meant for or use of drug in either overdose / underdose. (1 mark)

14. Name the elements present in the following compounds.

a) Magnesium chloride.

(1 mark)

Magnesium and chlorine

b) Copper (II) carbonate.

(1 mark)

Copper, carbon and oxygen

15. Neytiri a student at Dexter Girls School was stung by a wasp while going to a French class.

a) Which type of acid was introduced in his body by the wasp sting?

(1 mark)

Formic / methanoic Acid.

b) Name a suitable substance that can be used to relieve his pain.

(1 mark)

A mild Alkali such as magnesium hydroxide.

16. State any two atmospheric pollution associated with the burning substances in air.

(2 marks)

✓ Formation of Acid rain.

✓ Global Warming as a result of green house effect.

17. State two chemical properties of water and also one chemical test of water.

(3marks)

Chemical properties: ✓ Water reacts with most metals high in the reactivity series with effervescence producing hydrogen gas ✓ Water combines with highly reactive non-metals, for instance it reacts with chlorine forming a mixture of hydrochloric Acid and chloric (I) Acid.
(Chemical test) → Add white anhydrous copper (II) sulphate → Blue
Add blue anhydrous cobalt (II) chloride → Pink.

18. Explain why hydrogen is said to be uniquely positioned in the periodic table.

(2 marks)

- Hydrogen has only one valence electron and hence it can lose an electron.
- Hydrogen can gain one electron to acquire a completely filled up outermost energy level like members of group VII d.

19. (a) What name is given to the elements that show both a metallic and a non-metallic characteristic?

(1 mark)

metalloids

(b) Give an example of such element.

(1 mark)

silicon and carbon.

24(1)

Graphite has van der Waal forces between its layers and hence the different layers in its structure can slide over each other making it a good lubricant.

20. Explain why the boiling points of halogens increase down the group.

Graphite has a strong molecular mass increase down the group resulting to the increase in the intermolecular forces of attraction hence increasing boiling points. (2 marks)

21. Graphite is used as a lubricant and as an electrode in lead acid accumulators (car battery) Explain in terms of structure and bonding what makes it possible for it to be used as stated. (2 marks)

(i) Graphite has a strong covalent bond between its atoms and hence can withstand high temperature conditions in car engines.

(ii) Graphite has one delocalized electron which conduct electrical current hence can be used as an electrode.

22. Give one anion whose salt are soluble.

(1 mark)

NO_3^- (Nitrate salts are all soluble)

23. State one application of electrolysis.

(1 mark)

- Electroplating of metals - purification of metals
- Anodizing of aluminium - Extraction of highly reactive metals such as Na (Sodium)
- Manufacture of Cl_2 , H_2 and NaOH from brine (Conc. NaCl)

24. Distinguish between a producer gas and water gas.

(2 marks)

A producer gas is a fuel which is a mixture of nitrogen gas and hydrogen gas and is formed when steam is passed over white hot coke. Water gas is a mixture of carbon (II) oxide and hydrogen gas and is formed when steam is bubbled through carbon (IV) oxide.

25. The pressure exerted by 10,000 litres gas in a sealed container is 1020 KPa at 20°C . It was found that the container might leak if the pressure exceeds 1500 KPa. At what temperature (in $^\circ\text{C}$) would 10,000 litre of gas start to leak? (3 marks)

$$\frac{P_1}{T_1} = \frac{P_2}{T_2}$$

$$1020 = \frac{1500}{T_2}$$

$$T_2 = \frac{1500 \times 293}{1020}$$

$$= 430.39 \text{ K}$$

$$= 157.88^\circ\text{C}$$

26. a) State Graham's law of diffusion.

(1 mark)

It states that the rate of diffusion of a gas is inversely proportional to the square-root of its density.

c) Represent the law mathematically.

(1 mark)

$$R \propto \frac{1}{\sqrt{d}}$$

$$R = \frac{k}{\sqrt{d}}$$

27. a) State Gay Lussac's Law.

(1 mark)

It states that when gases react, they do so in volumes that bear a simple ratio to one another and to the volumes of the product if gaseous.

c) Explain why C_4H_{10} burns with a less smoky flame as compared to C_4H_8 .

(1 mark)

- The ratio of H:C in C_4H_{10} is high as compared to the ratio of H:C in C_4H_8 .
- C_4H_{10} is more saturated compared to C_4H_8 .
- Alkanes burn with a pale blue flame while alkene burn with a yellow flame.

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