MUMIAS WEST SUBCOUNTY JOINT EXAMINATIONS-2022

233/2: Chemistry Paper 2-Theory

Time: 2 Hours

Name: ……..… Index No: ……

Sign: ……. Date:…….

For Examiners use only

Question	Max Score	Student's Score
1	12	
2	13	
3	13	
4	11	
5	10	
6	10	
7	11	
Total	80	

Instructions to candidates

1. Write your name, index number, signature and date in the spaces provided above.
2. Attempt all questions in the spaces provided on the question paper.
3. All working must be clearly shown.
4. Mathematical tables and non-programmable electronic calculators may be used.

1. The table below gives information on four elements represented by letters K, L, M and N. Study it and answer the questions that follow. The letters do not represent the actual symbols of the elements.

Element	Atomic number	Electron arrangement	Atomic radius (nm)	Ionic radius (nm)
K		2,8,2	0.136	0.065
L	17		0.099	0.181
M		2,8,8,1	0.203	0.133
N	20		0.174	0.099

a) Complete the table by filling in the missing atomic numbers and electron arrangements (2mrks)

b)) Which two elements have similar properties? Explain (2mks)

c)) What is the formula of the oxide of M? (1mk)

d) Which element is a non-metal? Explain (2mks)

e) Which one of the elements is the strongest reducing agent? Explain (2mks)

f) Explain why ionic radius of N is less than that of M (1mk)

g) Explain why the ionic radius of L is bigger than its atomic radius (2mks)

2. a) Define the term molar enthalpy of neutralization.. (1mrk)

b) In an experiment to determine the molar enthalpy of neutralization, 25.0cm^3 of 2M sulphuric (VI) acid was added to 50cm^3 of 2M sodium hydroxide in a lagged plastic beaker. The mixture was stirred with a thermometer and the final temperature attained recorded. The full results obtained in the experiment were as follows;

volume of 2M sulphuric VI acid used	25.0cm^3
initial temperature of the acid, T_1	19.0^{0}C
volume of 2M sodium hydroxide used	50.0cm^3
initial temperature of the hydroxide, T_2	21.0^{0}C
final temperature attained T_4 =	27.5^{0}C

Given that the specific heat capacity of the mixture, c=4.2kJ/kg/K and that the density of the mixture is 1g/cm^3, use the results above to answer the following questions.

i) Find T_3, the common initial temperature. 1mrk

ii) Calculate the heat change during the experiment. 3mks

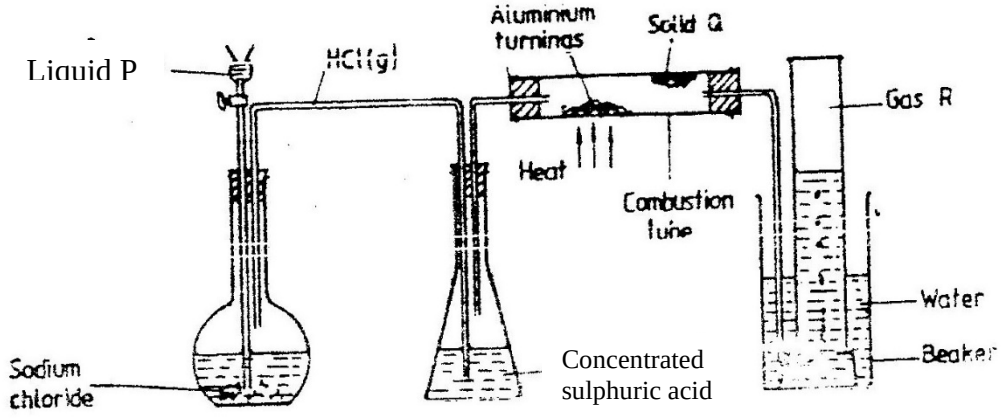
iii) Work out the molar heat of neutralization 3mrks

iv) Write the thermochemical ionic equation for this process 1mrk

v) Draw the energy level diagram for the process. 2mrks

vi) State any two sources of error in this experiment. 2mrks

3. In an experiment hydrogen chloride gas was prepared and reacted with aluminium turnings to form a solid Q and gas R as shown in the diagram below.



(i) Name: Liquid P (1mrk)

Solid Q (1mk)

Gas R (1mk)

(ii) Write the chemical equation for the reaction that takes place;
a) in the flat-bottomed flask (1mrk)

b) in the combustion tube (1mrk)

(ii) Name another substance that could serve the same purpose as the concentrated sulphuric acid. (1mk)

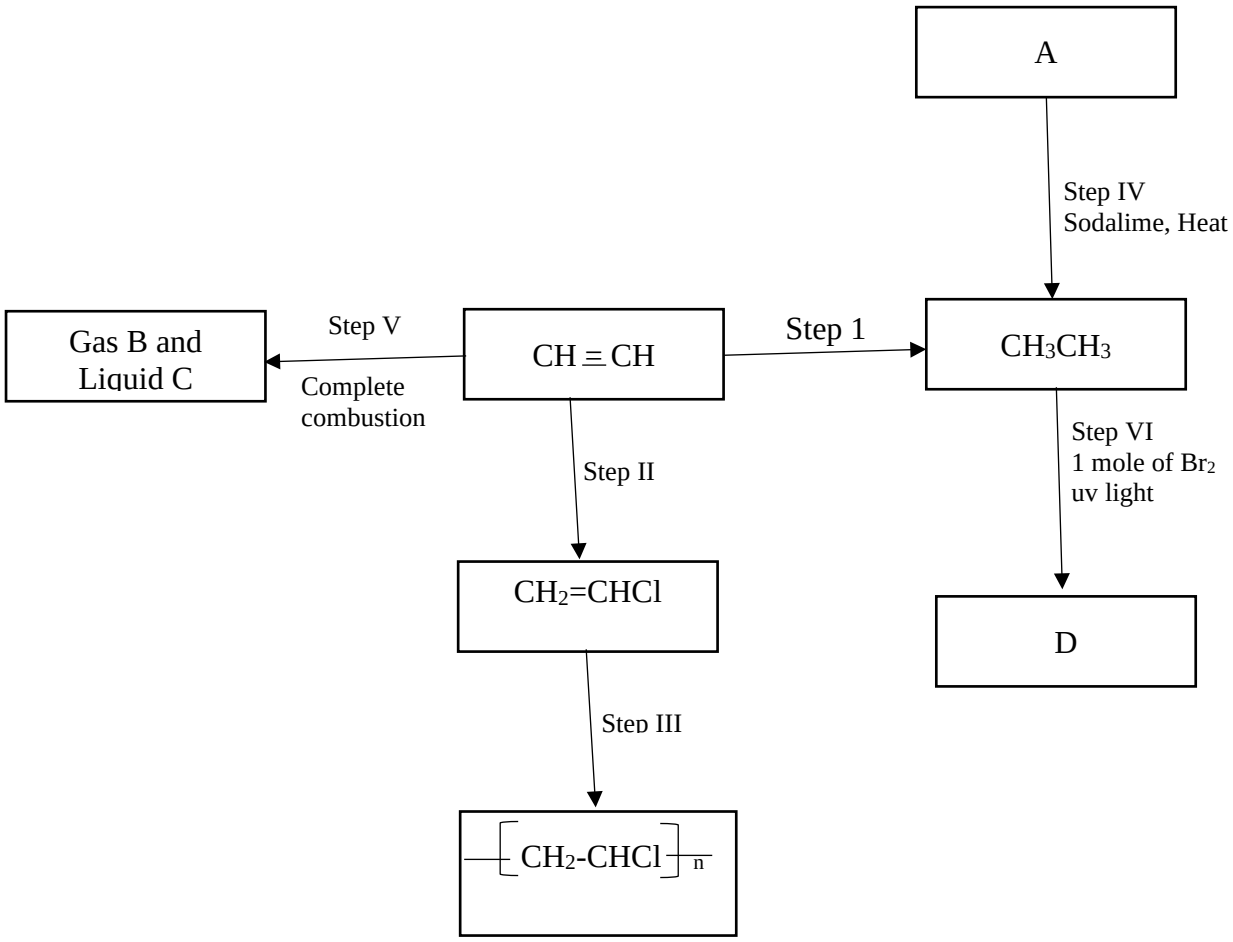
(iii) Explain the following observation. When blue litmus paper was dipped into the water in the beaker at the end of the experiment it turned red. (1mrk)

(iv) Explain why solid Q collects farther away from the heated aluminium (2mks)

(v) Given that 1.35g of aluminium reacted completely with the hydrogen chloride gas, calculate
a) the mass of the product Q formed (Al=27, Cl= 35.5, H= 1) (2mrks)

b) the volume of gas R formed measured at stp. (one mole of gas occupied 22.4 litres at standard temperature and pressure.) (2mks)

4. Study the scheme given above and answer the questions that follow



(i) Name the reagents used in:

Step I ……

Step II ……. (1mrks)

(ii) Name substances; (2mrks)

A

B

C

D

(iii) Write an equation for the reaction that takes place in Step iv (3mrks

Step v

Step vi

(iv) Explain one disadvantage of the continued use of items made from the compound formed in step III (1mrk)

v) Name the type of reaction that takes place in (2mrks)
Step i

Step iii

Step v

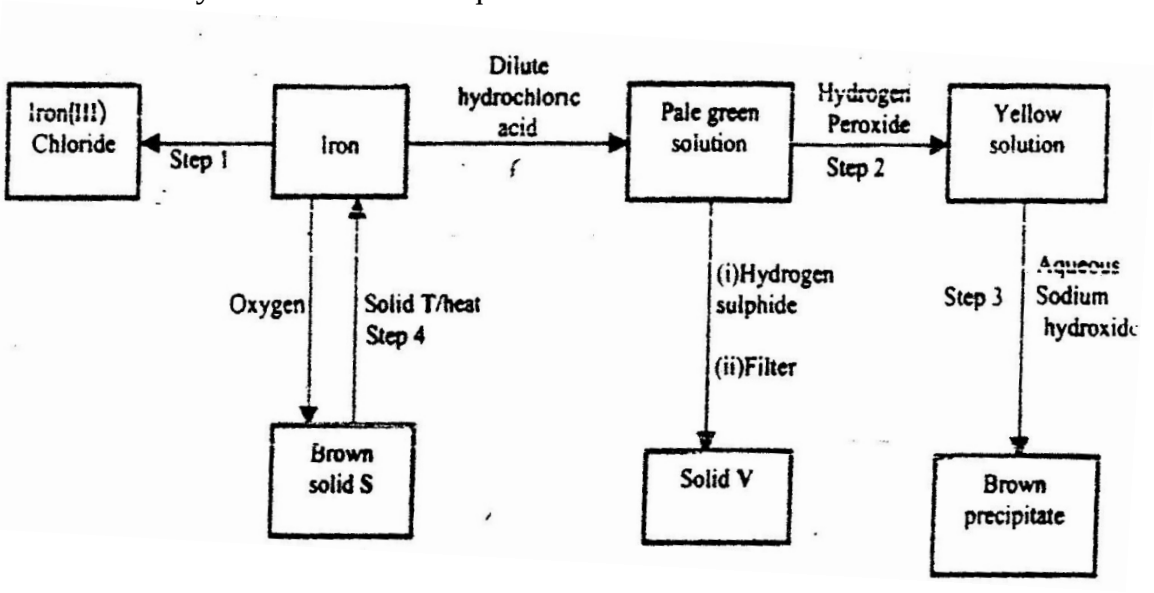
Step vi

(vi) State the conditions necessary for step ii and iii to take place (2mrks)

Step ii

Step iii

5. a) The flow chart below shows a sequence of reactions starting with iron metal. Study it and answer the questions that follow.



i) Name the reagent and state the condition necessary for the reaction in step 1. 2mrks

Reagent

Condition

ii) Give the names of the following 3mrks

i) Solid S

ii) Solid V

iii) Solid T

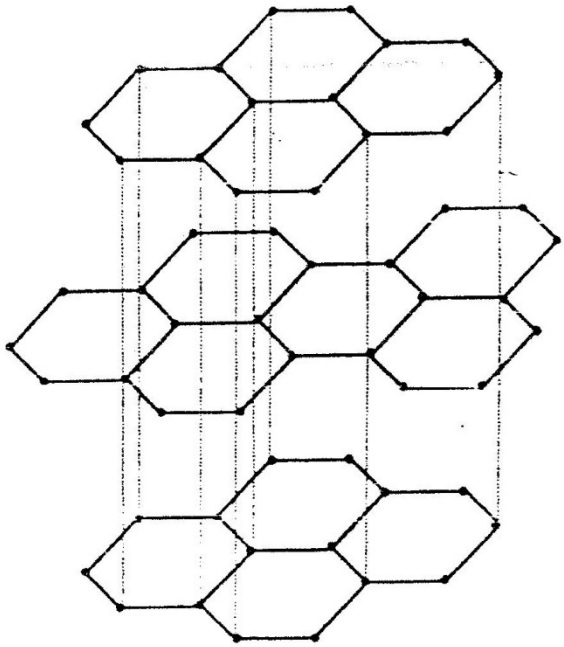
iii) Give reasons for the colour change in step 2. 1mrk

ii) Write an ionic equation for the reaction which takes place in step 3. 1mrk

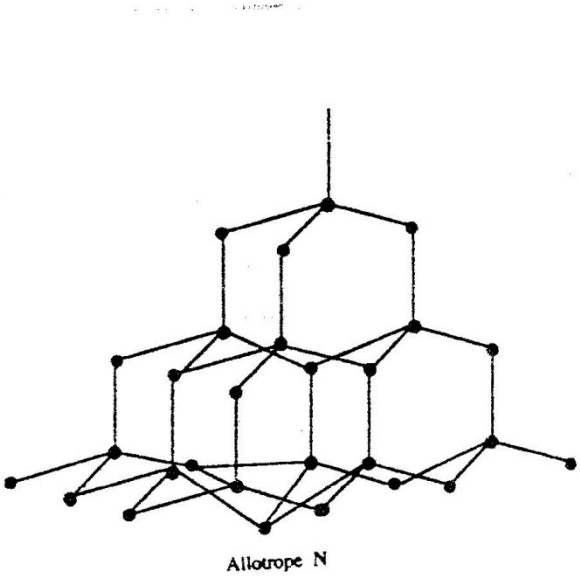
v) Name one other substance that could be used instead of sodium hydroxide in step III. 1mrk

b) In an experiment 3.36g of iron filings were added to excess aqueous copper(II) sulphate solution. Calculate the mass of copper that was deposited. (Cu = 63.5, Fe = 56.0) 2mrks

6. (a) The following diagrams show the structures of two allotropes of carbon. Study them and answer the questions that follow



Allotrope M



Allotrope N

(i) Name allotrope 1mrk

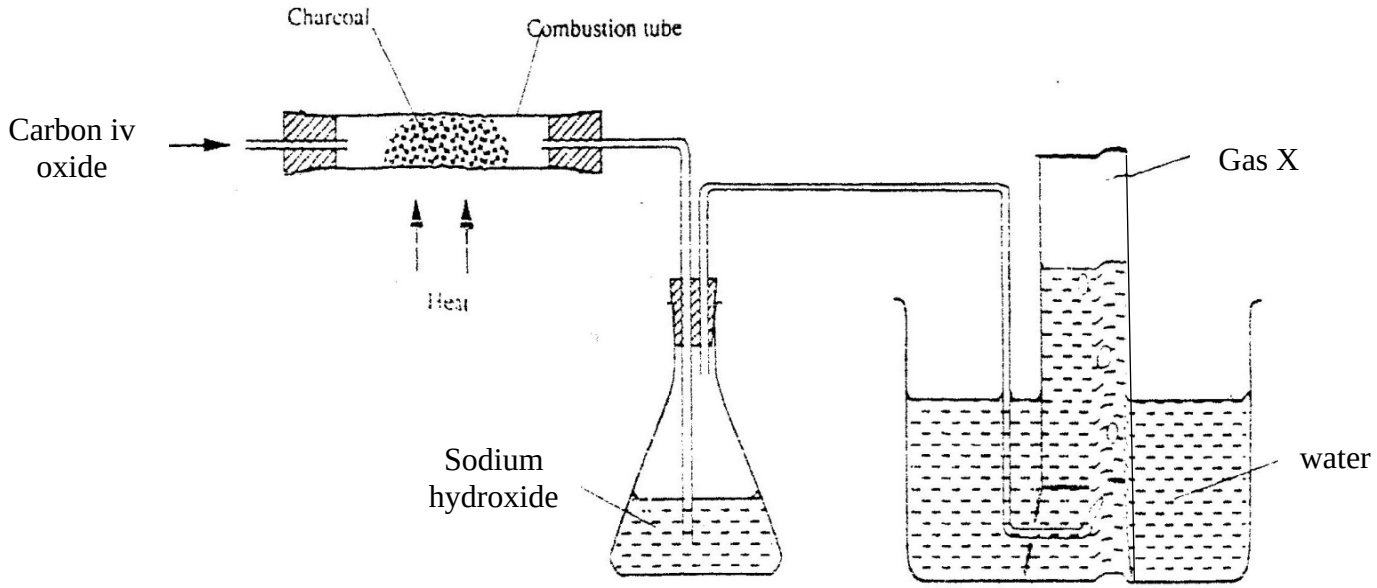
M

N

(ii) Give one use of N. 1mrk

(iii) Which allotrope conducts electricity? Explain in terms of structure and bonding 2mrks

(b) In an experiment, carbon iv oxide gas was passed over heated charcoal and the gas produced collected as shown in the diagram that follows;



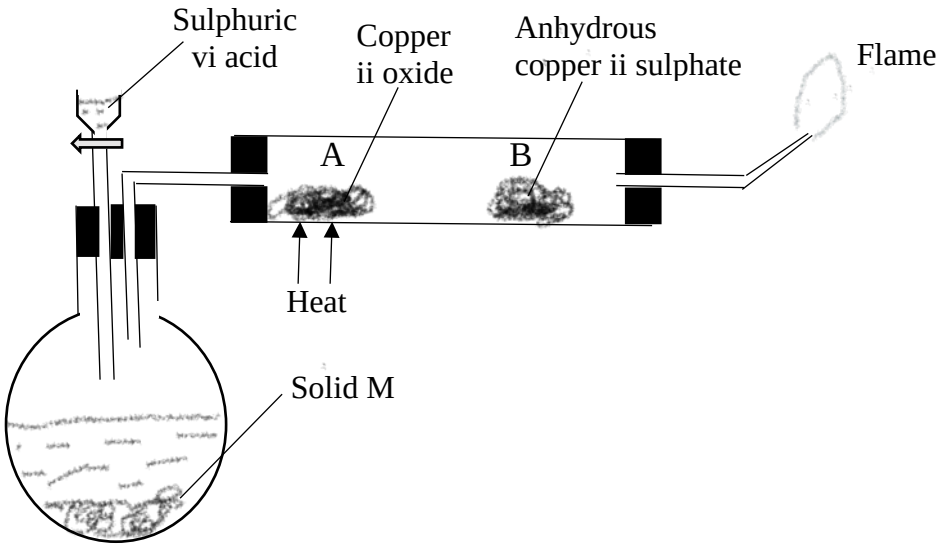
(i) Write an equation for the reaction that takes place in the combustion tube. 1mrk

(ii) State the purpose of sodium hydroxide in the set up and explain how it works using a chemical equation. 2mrks

(iii) Describe a simple chemical test that can be used to distinguish between carbon iv oxide and carbon ii oxide. 2mrks

(iv) Give one use of carbon ii oxide 1mrk

7. The diagram below is set – up used by a student in an attempt to prepare hydrogen gas and react it with hot copper ii oxide in a combustion tube.



(a) Name one suitable substance that can be used as solid M. 1mrk

(b) Write an equation for the reaction that would be expected to take place
i) in the round-bottomed flask 1mrk

ii) at A 1mrk

iii) at the flame 1mrk

c) State and explain the observations made 4mrks

i) at point A

ii) at point B

c) Explain why it is necessary to burn excess hydrogen. 1mrk

(d) Give two commercial uses of hydrogen. 2mrk