

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

233/2
CHEMISTRY
PAPER 2
THEORY
SEPTEMBER, 2021
TIME: 2 HOURS

Candidate's Signature
Date:

MOMALICHE 3 CYCLE 8-2021

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

- Write your name, admission no and Index number in spaces provided above.
- Sign and write the date of examination in the spaces provided.
- Answer all the questions in the spaces provided .
- KNEC Mathematical tables and silent electronic calculators may be used.
- All working must be clearly shown where necessary.
- Candidates should answer the questions in English.

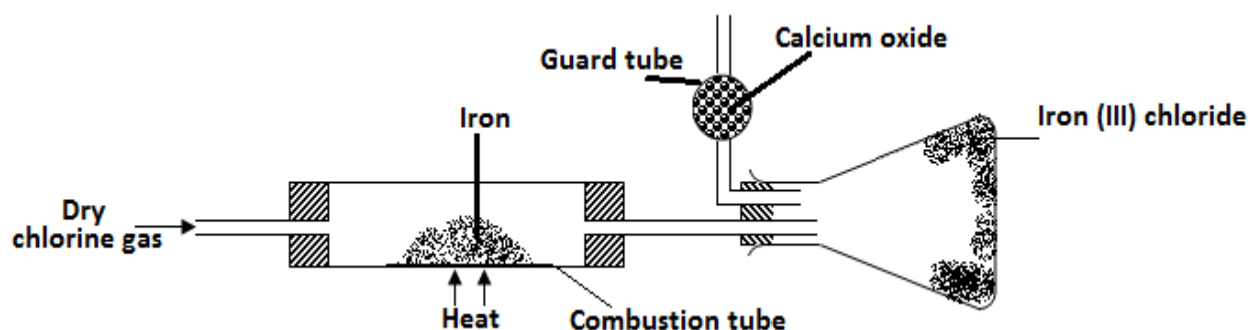
For Examiners Use Only

Question	Maximum score	Candidate's score
1	10	
2	12	
3	11	
4	14	
5	12	
6	10	
7	11	
Total score	80	

This paper consists of 13 printed pages. Candidates should check to ascertain that all pages are printed as indicated and that no questions are missing.

1.(a) Give the name of **one** reagent which when reacted with concentrated hydrochloric acid produces chlorine gas.
(1mk)

(b) A student set out to prepare iron (III) chloride using apparatus shown in the diagram below



(i) Explain why it is necessary to pass chlorine gas through the apparatus before heating begins?
(1mk)

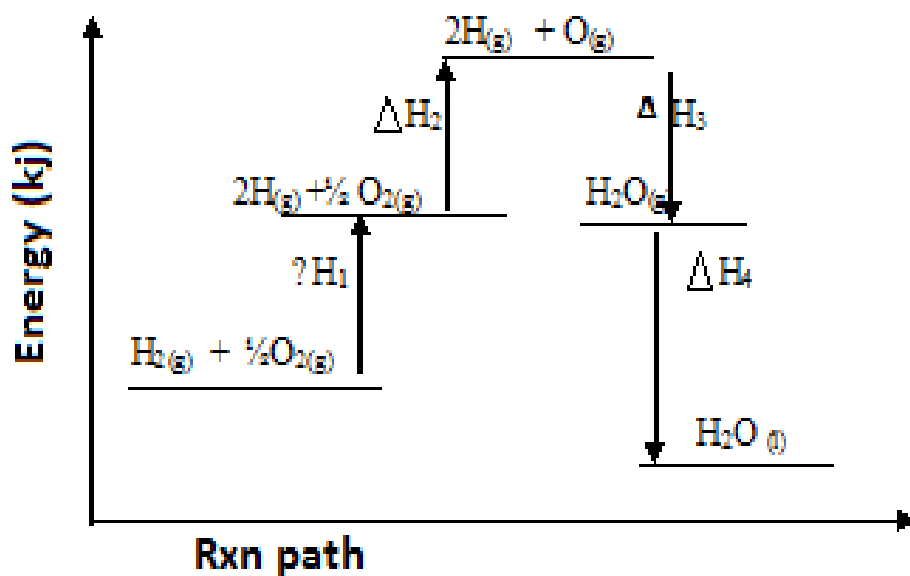
(ii) Why is calcium oxide most preferred to calcium (II) chloride.
(1mk)

(iii) What property of iron (III) chloride makes it possible to be collected as shown in the diagram
(1mk)

(iv) The total mass of iron (III) chloride formed was found to be 0.5g. Calculate the volume of chlorine gas that reacted with iron. (Fe = 56, Cl = 35.5 and molar gas volume at r.t.p is $24,000 \text{ cm}^3$)
(3mks)

- (c) When hydrogen sulphide gas passed through a solution of iron (III) chloride the following observation was made;
The colour of the solution changed from reddish brown to green and yellow solid was deposited. Explain these observations
(1mk)
- (d) State and explain the observations that would be made if a moist blue-litmus paper was placed in a gas jar full of chlorine gas
(2mks)

2. Study the energy level diagram below and answer the questions that follow.



- (a) (i) Which ΔH values have a positive sign. (1mk)

(ii) Which ΔH values have a negative sign (1mk)

(iii) What chemical changes is being represented by (2mks)

ΔH_1 -

ΔH_4 -

(b) The hydration energy of Al^{3+} and Cl^- are -4690 and -364kJ mol^{-1} respectively. The heat of solution of aluminium chloride is -332kJ mol^{-1} .

Calculate the lattice energy of aluminium chloride (2mks)

(c) When one mole of butanol is burnt. 2676kJ are liberated .

(i) Calculate the heating value of butanol. (C=12,H=1,O=16) (2mks)

(i) Write a chemical reaction for combustion of butanol.

(1mk)

(ii) Considering the following heats of combustion

$$\Delta H^{\circ}C \text{ (Graphite)} = -393\text{kJ mol}^{-1}$$

$$\Delta H^{\circ}C \text{ (H}_2\text{)}_{(g)} = -286\text{kJ mol}^{-1}$$

$$\Delta H^{\circ}C \text{ (Butanol)} = -2676\text{kJ mol}^{-1}$$

Using an energy cycle diagram, calculate the heat of formation of butanol. (3mks)

3. I) The table below shows properties of some elements represented by symbols W,X,Y and Z. Study the information in the table and answer the questions that follows

Element	No. Of protons	Atomic radius(nm)	Boiling point $^{\circ}\text{C}$
W	2	0.93	-269
X	10	1.31	-246
Y	18	1.54	-186
Z	36	1.89	-152

a) Write down the electron arrangement for elements W and X . (1mk)

b) In which group of the periodic table are the elements in the table above? Give the chemical family name of the group. (2 mks)

c) Explain why the atomic radius of W is smaller than that of X. (1mks)

d) State **one** use of element X. (1mk)

II. The section below represents part of the periodic table. Study it and answer the questions that follow. The letters are not the actual symbol of the elements.

				Q				
X			B	H		M	T	
Y		A					V	
Z							S	

(a) Select the most reactive non-metal. (1mk)

(b) Give the name of the elements occupying region A (1mk)

(c) Explain why the atomic radius of T is smaller than that of M. (2mks)

(d) Compare the electrical conductivity of elements X and B. (2mks)

4. (i) (a) Write the chemical name for rust. (1 mk)

(b) State any **two** ways of preventing rusting.
(2 mks)

(c) Give a reason why vehicles based in Mombasa rust faster than those based in Limuru. (1 mk)

(d) Oxygen to obtained by fractional distillation of liquid air. Name two other gases which are obtained during the distillation.
(1 mk)

(ii) In an experiment to determine the solubility of sodium chloride, 5cm^3 of a saturated solution of sodium chloride of mass 5.35g were placed in a volumetric flask and diluted to a total of 250 cm^3 . 25 cm^3 of the dilute solution reacted completely with 24cm^3 of 0.1 moldm^{-3} silver nitrate solution. Calculate:

(a) Moles of silver nitrate in 24cm^3 of solution. (1 mk)

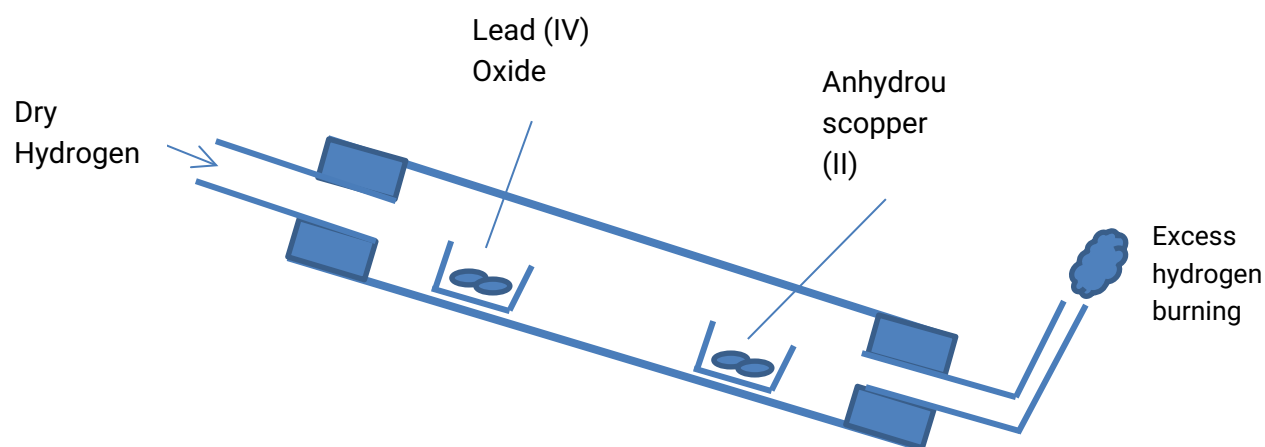
(b) Moles of sodium chloride in 25cm^3 of solution.
(2 mks)

(c) Moles of sodium chloride in 250 cm^3 of solution. (1 mk)

(d) Mass of sodium chloride in 5 cm^3 of the original saturated sodium chloride solution (1 mk)

(e) Solubility of sodium chloride. (1 mk)

(i) The apparatus below was used to investigate the effect of dry hydrogen gas on hot lead (II) oxide.



(a) What is observed in the combustion tube at the end of the experiment?
(1 mk)

(b) Why should the tube be slanting?
(1 mk)

(c) State any precaution to be observed when doing the above experiment.
(1 mk)

5. a) Read the following passage and answer the questions that follow.

A salt K was heated with slaked lime (calcium hydroxide). A colourless gas L with a characteristic choking smell and turns red litmus paper blue was evolved. A large quantity of this gas was passed through an inverted filter funnel into Copper(II)sulphate solution, and a deep blue solution M was obtained.

(i) Identify gas L
(1 mk)

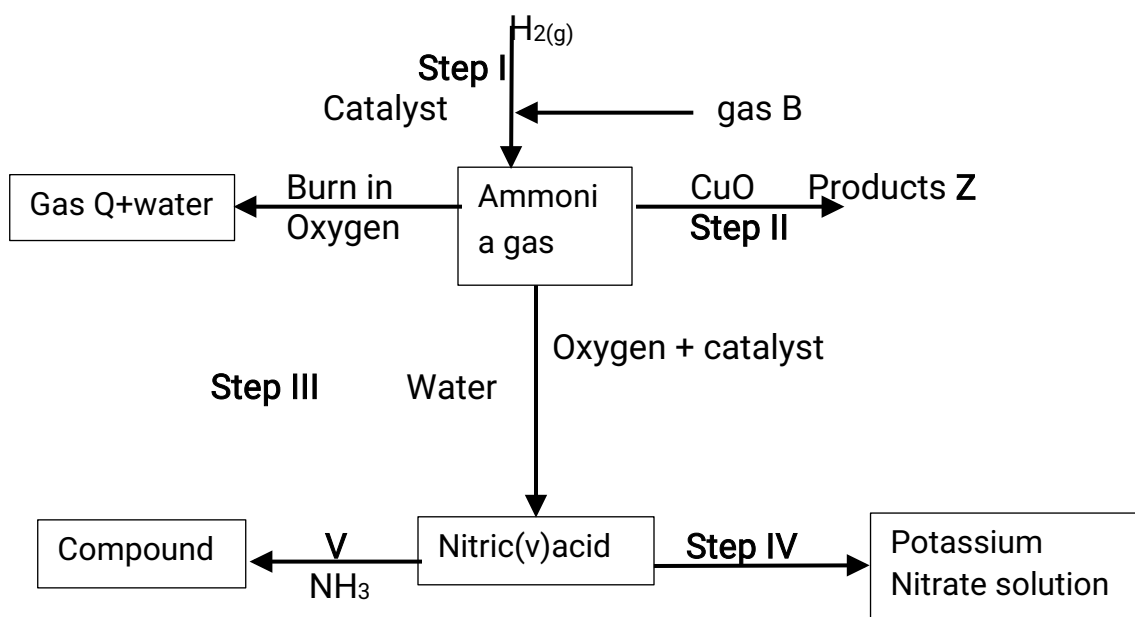
(ii) What is K most likely to be?
(1 mk)

(iii) Write an equation for the reaction between K and slaked lime
(1 mk)

(iv) Write an ionic equation for the reaction with copper(II)sulphate forming the

deep blue solution
(1 mk)

b) Study the flow chart below and answer questions that follow:



(i) State **one** source of gas B (1 mk)

(ii) Name the catalysts used in;
mks) (2
a) Step I

Step III

(iii) Write chemical equations for reactions in;
a) Step

b) Step II

c) Step V

(iv) Identify any other gas that can be used instead of Ammonia in step II
(1 mk)

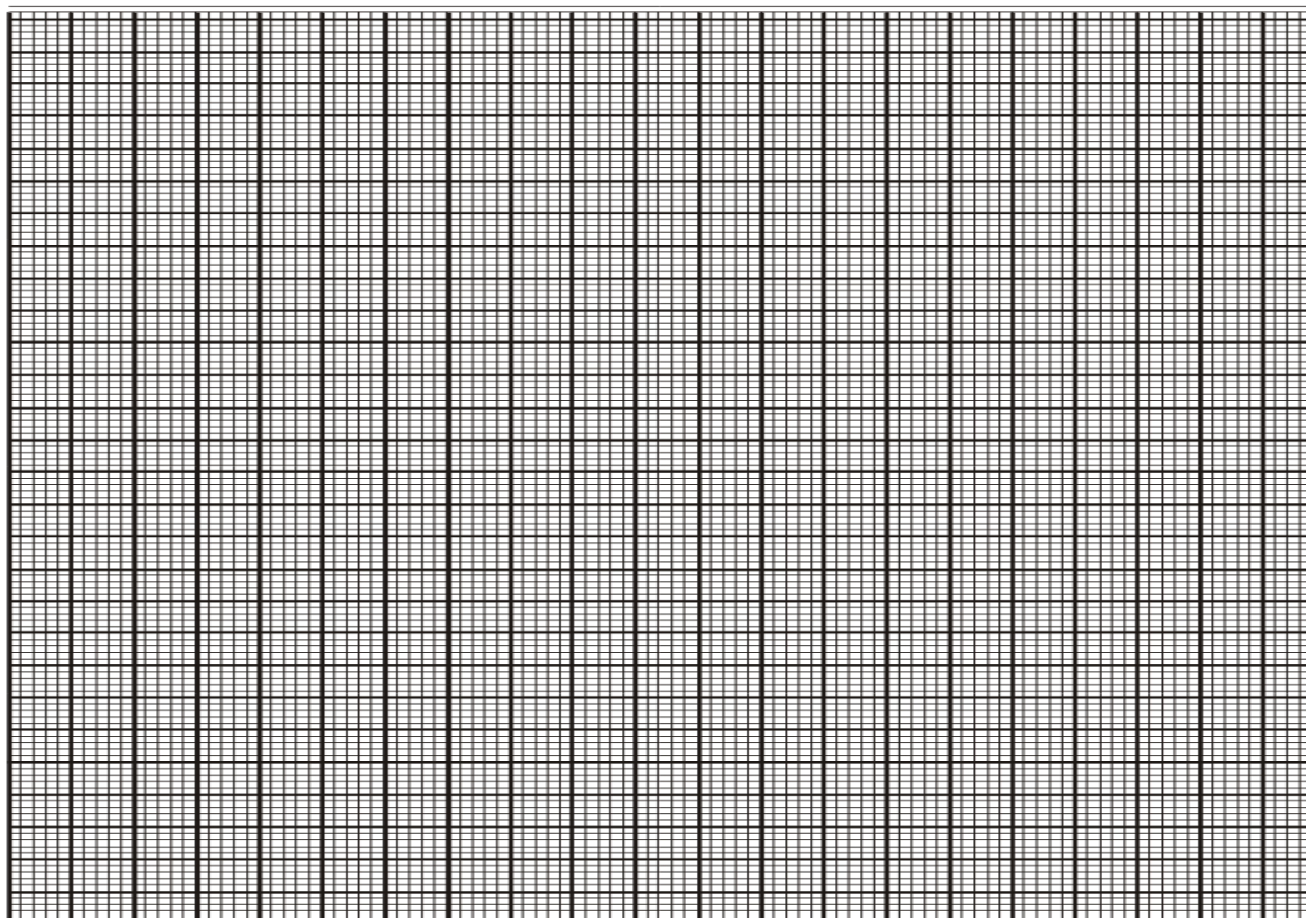
(v) State **one** use of gas Q (1mk)

6. An experiment was carried out using magnesium ribbon and dilute hydrochloric acid of different concentrations. The time needed to produce 50cm^3 of the gas for every experiment was recorded in a table.

Concentration of HCl (moles per litre)	2.0	1.75	1.50	1.25	1.00	0.75	0.50	0.25
Time (seconds)	8.8	10.0	11.7	14.0	17.5	18.7	35.0	70.0
$\frac{1}{\text{time}}$ (Sec ⁻¹)								

(a) Complete the table above for $\frac{1}{\text{time}}$.
(4mks)

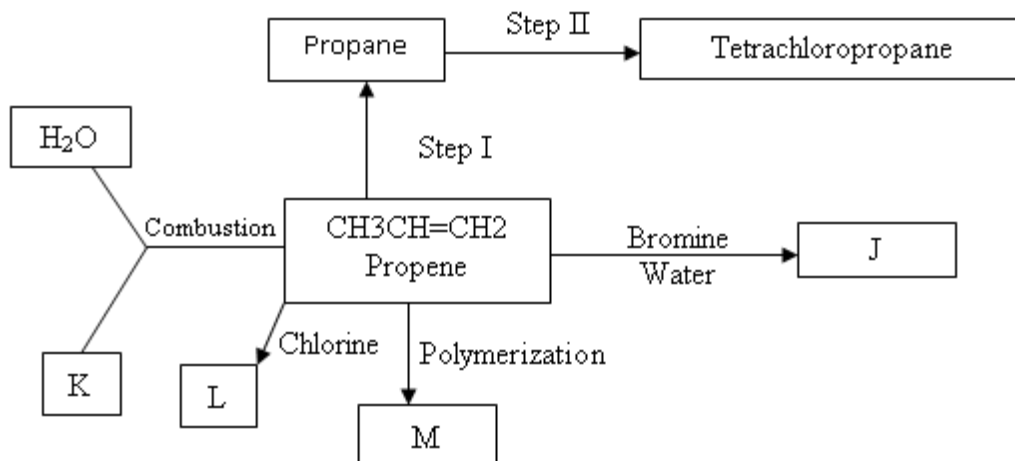
(b) Plot a graph of $\frac{1}{\text{time}}$ against concentration



c) From your graph determine the concentration needed to produce 50cm^3 of hydrogen gas when time is 15.0 seconds
(2mks)

(d) From your graph state the relationship between the rate of reaction and concentration. Give a reason.
(1mk)

7. The flow diagram below shows a reaction scheme starting from propene.



(a) Name the process in step 1 (1 Mark)

(b) State the reagent and condition necessary for step 1 to occur

Reagent:-

(1 Mark)

Condition: -

(1 Mark)

(c) Give the names of the following substances.

J-

K -

L-

M-

(2 Marks)

(d) Write the equation for the reaction that produces substance L. (1 Mark)

(e) State the type of reaction that occurs in step I. - (1
Mark)

(f) Write the equation for complete combustion of propene. (1
Mark)

(g) (i) Give **one** use of substances M. (1 Mark)

(ii) State the environmental effects of the continued use of plastics to the environment
.Explain. (2 Marks)

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