

NAME _____ CLASS _____ INDEX NO _____

SIGNATURE _____ DATE _____

233/2: CHEMISTRY

PAPER 2

TIME: 2HRS

NAMBALE ACK DIOCESE JOINT EXAMINATION 2021

Kenya Certificate of Secondary Education

INSTRUCTIONS TO CANDIDATE

- Write your name and admission number in the spaces provided.
- Sign and write the date of examination in the spaces provided
- Answer all the questions in the spaces provided
- All working must be shown where necessary
- Electronic calculators and mathematical tables may be use.

FOR EXAMINERS USE ONLY

Questions	1	2	3	4	5	6	7	Total score
Max score	12	13	10	15	10	10	10	80
Candidates score								

This paper consists of 11 Printed pages.

1. The table below gives information about some elements. The letters do not represent the actual symbols of the elements. Study the information and answer the questions that follow.

Element	Atomic radius(nm)	Ionic radius nm	Formula of oxide	Melting point(^o c)
M	0.364	0.421	M ₂ O	-119
K	0.830	0.711	KO ₂	837
P	0.592	0.485	P ₂ O ₃	1466
R	0.381	0.446	R ₂ O ₃	242
Q	0.762	0.676	QO	1054

a) Identify two elements that are non-metals. Give a reason? (2mks)

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b) I) State the valency of elements Q and R. (1mk)

Q.....

R.....

II)Write a formula of a compound formed when Q combines with M. (1mk)

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III) What type of bond exists between Q and K. (1mk)

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c) The melting point of the oxide of R is lower than that of the oxide of P. Explain. (2mks)

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d) Identify two elements that would react with each other most vigorously. Give a reason(2mks)

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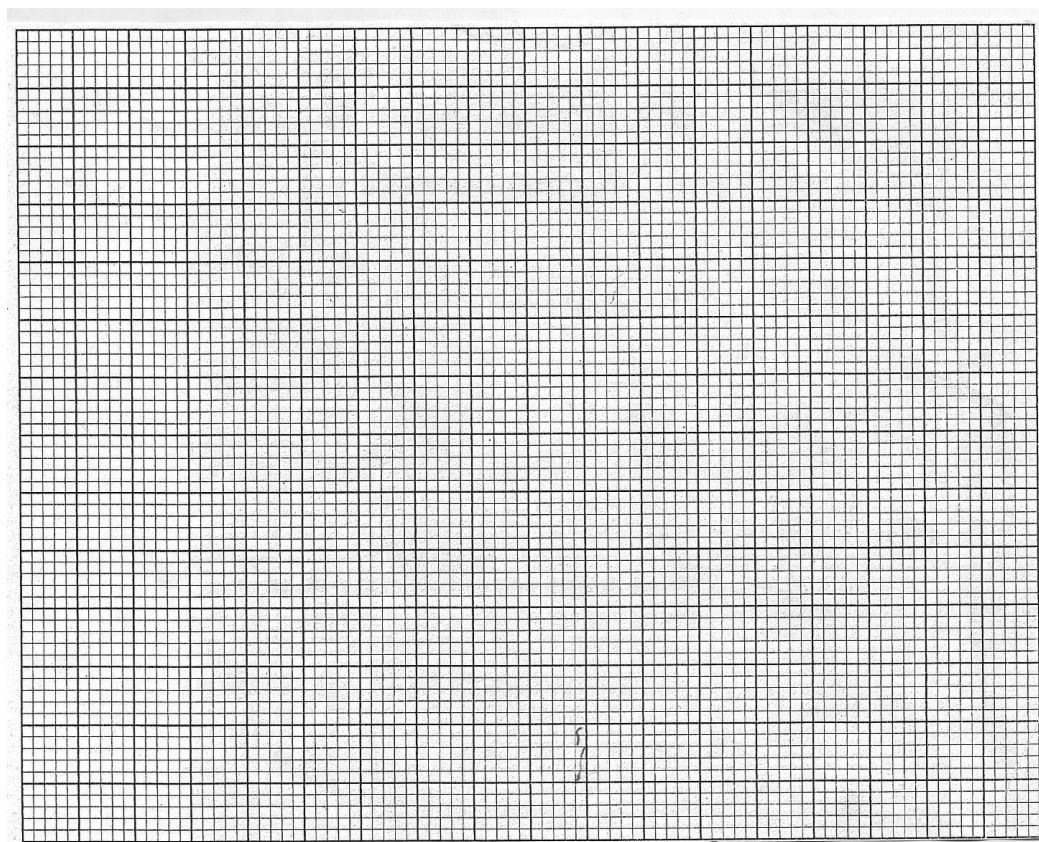
e) Element P would be suitable for making utensils for boiling water. State two properties that make the element suitable for the use. (2mks)

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2. a) The table below gives the solubility of hydrated Copper (II) Sulphate in mol dm^{-3} at different temperatures.

Temperature($^{\circ}\text{C}$)	Solubility (mol dm^{-3})
15	6×10^{-2}
40	12×10^{-2}
60	16×10^{-2}
80	22×10^{-2}
90	27×10^{-2}
100	30×10^{-2}

- i. On the grid provided plot a graph of solubility of Copper(II) Sulphate (vertical axis) against temperature. (3mks)



- ii. From the graph, determine the mass of copper(II) Sulphate pentahydrate deposited when the solution is cooled from 90^oc to 60^o. (Cu=64, S=32, O=16, H=1). (3mks)

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b). In an experiment to determine the solubility of sodium chloride ,5.0 cm³ of a saturated solution of sodium chloride weighing 5.35g were placed in a volumetric flask and diluted to a total volume of 250cm³.

25.0 cm³ of the dilute solution of sodium chloride completely reacted with 24.1 cm³ of 0.1 M silver nitrate solution.



Calculate;

- i. Moles of silver nitrate in 24.1cm³ of solution. (1mk)

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- ii. Moles of sodium chloride in 25.0cm³ of solution. (1mk)

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- iii. Moles of sodium chloride in 250cm³ of solution. (1mk)

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- iv. Mass of sodium chloride in 5.0cm³ of saturated chloride solution (Na=23.0 Cl=35.5). (1mk)

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v. Mass of water in 5.0 cm^3 of saturated solution of sodium chloride. (1mk)

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vi. The solubility of sodium chloride in g/100 g of water. (2mks)

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3. In order to find the portion by volume of one of the main constituents of air, a sample of air was passed through two wash bottles; the first containing aqueous sodium hydroxide and the second containing concentrated Sulphuric (VI) acid and was then collected in a gas syringe. a) Suggest a reason for passing air through:

i. Aqueous sodium hydroxide. (1mk)

.....

ii. Concentrated Sulphuric (VI) acid. (1mk)

.....

b) The volume of the gas collected in the syringe was 80 cm^3 . This was passed several times over hot copper powder until no further contraction of volume took place. After cooling to the original temperature, the volume was found to be reduced to 63.2 cm^3 .

i. Explain the change in appearance of copper powder as the experiment progressed. (2mks)

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ii. Calculate the percentage of the air used up. (2mks)

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iii. Name the main gas remaining in the syringe. (1mk)

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iv. Explain the purity of the main gas remaining in the syringe. (2mks)

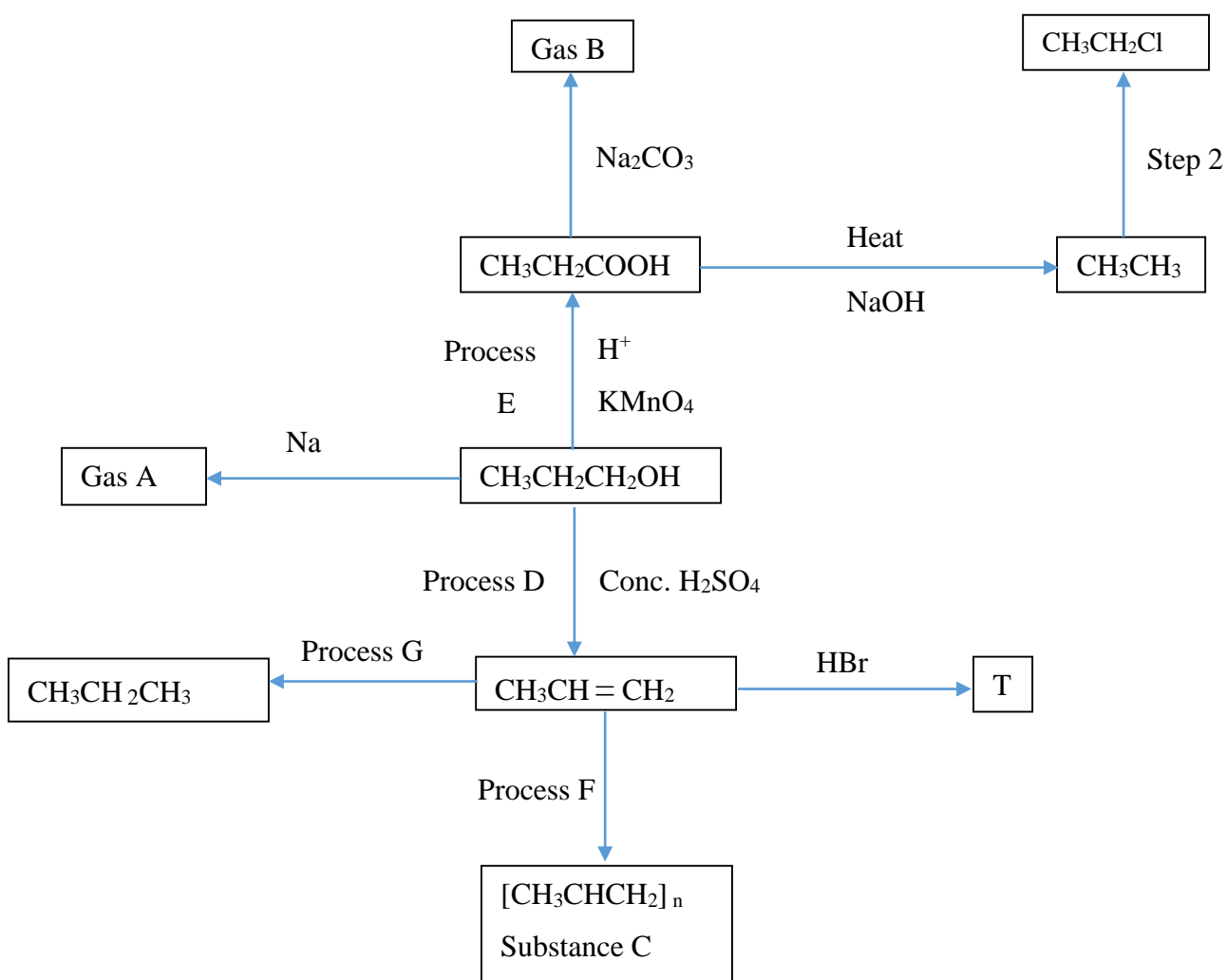
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c) A piece of sodium metal was exposed to air for some time. Write an equation for any one reaction that occurred. (1mk)

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4. Study the flow chart below and answer the questions that follow.



a) Name:

I. Gas A (1mk)

II. Gas B (1mk)

III. Substance C (1mk)

b) Give the structural formula and name of **T** (2mks)

Structural Formula

Name.....

c) Identify process

D (1mk)

E (1mk)

F (1mk)

G (1mk)

d) Name the condition and reagent for Step 2 (2mks)

Condition

Reagent

e) Write equation for the complete combustion of the product of process G. (1mk)

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f) To what class of compounds does the products of process D and E belong?

D (1mk)

E (1mk)

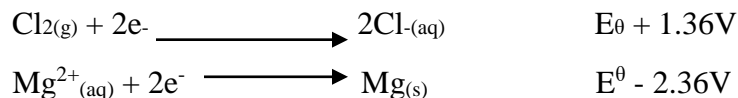
g) If the relative molecular mass of C is 63,000, determine n (C = 12, H = 1) (1mk)

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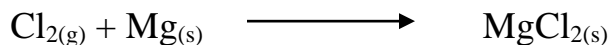
5. a) The standard electrode potential for the elements chlorine and magnesium are: -



i. Which one of the two elements will act as an oxidizing agent? Explain. (2mks)

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ii. Calculate the electromotive force of a cell where the overall reaction is: - (1mk)



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b) The table below gives the reduction standard electrode potentials for divalent metals.

The letters are not their actual symbols. Use them to answer the questions that follow: -

<u>Metal</u>	<u>E^θ (volts)</u>
P	+1.50
Q	- 0.44
R	+0.34
S	+0.76

i. Select **two** metals whose half cells can produce the highest voltage when connected.

.....(1mk)

ii. Draw a well labelled diagram of electrochemical cell formed by half-cells of metals **P** and **Q**. (2mks)

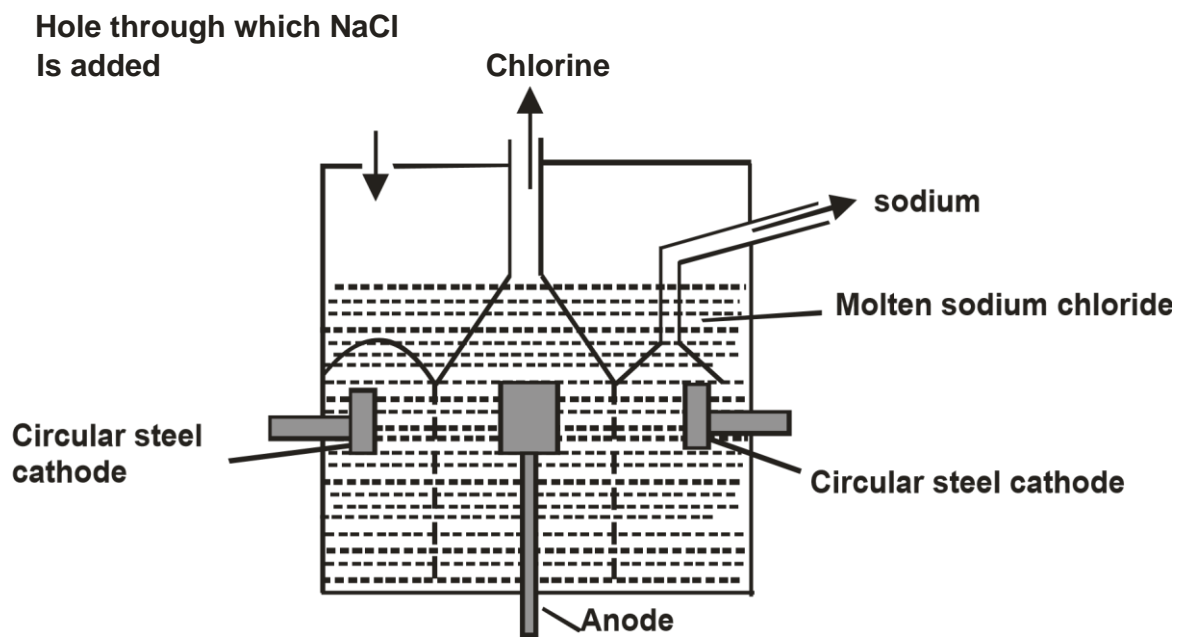
iii. Calculate the voltage produced by the cell in (ii) above. (1mk)

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c) When nitrate solution of a certain metal **X** was electrolysed, 1.174g of metal **X** was deposited by a current of 4 amperes flowing for 16minutes. Determine the formula of the metal nitrate. (1F= 96,500, R.A.M of **X**= 59). (3mks)

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6. a) Below is a simplified diagram of the Down's cell used for the manufacture of sodium. Study it and answer the questions that follow.



i. What material is the anode made of? Give a reason. (2mks)

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ii. What precautions is taken to prevent chlorine and sodium from re-combining.

.....(1mk)

iii. Write an ionic equation for the reaction in which chlorine gas is formed. (1mk)

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b) In the Down's process, a certain salt is added to lower the melting point of sodium chloride from about 800°C to about 600°C .

i). Name the salt that is added. (1mk)

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ii). State why it is necessary to lower the temperature. (1mk)

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c). Explain why aqueous sodium chloride is not suitable as an electrolyte for the manufacture of sodium in the Downs process. (2mks)

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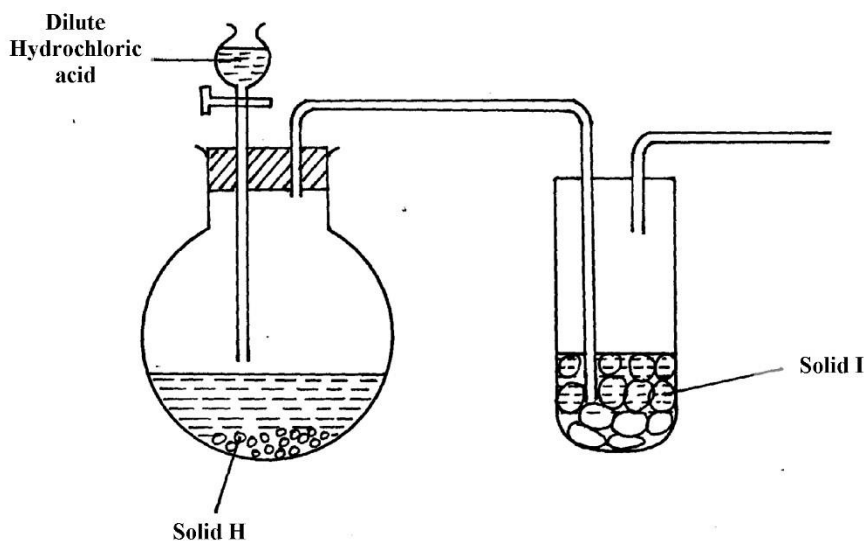
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d). State two uses of sodium metal. (2mks)

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7. The set-up below was used to prepare dry sample of hydrogen Sulphide gas



(a) (i) Complete the diagram to show how the gas was collected. (1mk)

(ii) Identify the following: - (2mks)

I. Solid H

II. Solid I

(iii) Write an equation for the reaction that occurred in the flask between solid **H** and dilute Hydrochloric acid. (1mk)

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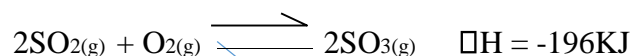
(b) When hydrogen Sulphide gas was passed through a solution of Iron (III) chloride, the following observations were made: -

(i) the color of the solution changed from reddish-brown to green and

(ii) a yellow solid was deposited. Explain the observations. (2mks)

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(c) In the manufacture of Sulphuric (VI) acid by contact process Sulphur (IV) oxide is made to react with air to form Sulphur (VI) oxide as shown: -



(i) Name the catalyst in this reaction. (1mk)

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(ii) State and explain the effect of the following changes on the yield of Sulphur (VI) oxide

I. Increasing the pressure. (1mk)

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II. Using a catalyst. (1mk)

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III. Explain why sulphur (VI) oxide gas is absorbed in concentrated sulphuric (VI) acid before dilution. (1mk)

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