MARKING GUIDE 2023

Name: .....

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545/2
CHEMISTRY
Paper 2
July/August 2023
2 hours

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KAMPALA INTEGRATED SECONDARY SCHOOLS EXAMINATIONS BUREAU

KAMSSA

KAMSSA JOINT MOCK EXAMINATIONS

Uganda Certificate Of Education

CHEMISTRY

2 hours

Paper 2

Instructions to candidates

- Section **A** consists of **10** structured questions. Answer **all** questions in this section.
- Answers to these questions **MUST be** written in the spaces provided.
- **SECTION B -** Consists of **4 semi**-structured questions. Attempt **any two** questions from this section. Answers to the question must be written in the answer booklets provided.
- (1 mole of gas occupies **24litres** at room temperature)
- (1 mole of gas occupies **22.4litres at s.t.p)**

EXAMINERS USE ONLY

1	2	3	4	5	6	7	8	9	10	11	12	13	14	Total

Turn Over

SECTION A (Attempt all questions in

1. Name one process by which the components of the following mixtures can be separated.
(06 marks)

Mixture	Process
Water and petrol	Use of separating funnel.
Iron filings and charcoal dust	Use of a magnet
Copper(ii) sulphate and sand	Filtration
Calcium chloride and iodine	Sublimation method
Water and common salt	Evaporation method / crystallization
Dyes in ink	Chromatography.

06

2. The number of electrons, protons and neutrons in atoms **R**, **S**, **T** and **U** are shown in the table below. The letters used are not the usual chemical symbols for the elements.

Atoms	electrons	Protons	Neutrons
R	16	16	16
S	8	8	6
T	13	13	13
U	**X**	16	17

a) Determine;

i. The value of **X**.

(0½ mark)

16 ✓ ½

.....

.....

.....

ii. The approximate relative atomic mass of **T**

(0½ mark)

13 + 13 = 26 ✓ ½

.....

.....

b) Write the electronic configuration of the following ions of the atoms above.

i. T^{3+}

(0½ mark)

2 : 8 ✓ ½

Accept 2,8 or 2)8

.....

i. R^{2-}

(0½ mark)

2 : 8 : 8 ✓ ½

Accept 2,8,8 or 2)8)8

.....

c) Which of the above atoms are **isotopes**? Give a reason to support your answer.

Atoms; *(0½ mark)*

R and T ½

Reason; *(01 mark)*

Same number of protons, different number of neutrons 01

d) Write the formula of the compound formed when **S** is reacted with **T** *(01 mark)*

S_3T_2 01 Accept T_2S_3

3. a) Hydrogen chloride can be prepared from potassium chloride.

i) Name other reagent that is reacted with potassium chloride to produce hydrogen chloride gas. *(0½ mark)*

Concentrated Sulphuric acid ½

ii) Write an equation for the reaction leading to the formation of hydrogen chloride gas. *(01½ marks)*

$2KCl_{(s)} + H_2SO_{4(l)} \longrightarrow K_2SO_{4(aq)} + 2HCl_{(g)}$ 1½

b) Write an equation for the reaction between hydrogen chloride and; *(01½ marks)*

i. Silver nitrate solution.

$AgNO_{3(aq)} + HCl_{(g)} \longrightarrow AgCl_{(s)} + HNO_{3(aq)}$ 1½

ii. Iron in the presence of water. *(01½ marks)*

$Fe_{(s)} + 2HCl_{(aq)} \longrightarrow FeCl_{2(aq)} + H_{2(g)}$

4. Copper (ii) sulphate solution was electrolyzed using carbon electrodes.

a) State what was observed at the;

i. Cathode *(01 mark)*

Brown solid 01

ii. Anode *(01 mark)*

Bubbles of a colourless gas that relights a glowing splint evolved 01

b) Explain your observation at the cathode. **(01½ marks)**

Copper (II) ion being lower than Hydrogen in the electrochemical series, it is discharged in preference to hydrogen ions hence depositing brown solid at the cathode (copper atom). (1½)

c) Write equation(s) for the reaction(s) that took place at the anode. **(01½ marks)**

$4OH^-_{(aq)} - 4e \longrightarrow 2H_2O_{(l)} + O_{2(g)}$ (1½)

5. a) Define the term empirical formula **(01 mark)**

Refers to the formula which shows the simplest ratio of the number of atoms of each kind atom present in one molecule of a compound. (01)

b) On complete combustion of 7.5g of an organic **compound M**; containing carbon, hydrogen and oxygen, 17.8g of carbon dioxide and 9.27g of water were produced. Calculate the simplest formula of the organic **compound M**. **(03½ marks)**

Mass of C in $CO_2 = \frac{12}{44} \times 17.8$

$= 4.855g$

Mass of H in $H_2O = \frac{2}{18} \times 9.27$

$= 1.03g$

Mass of $O_2 = 7.5 - (4.855 + 1.03)$

$= 1.615g$

Elements:	C	H	O
Composition by mass	4.855	1.03	1.615
moles	$\frac{4.855}{12}$	$\frac{1.03}{1}$	$\frac{1.615}{16}$
mole ratio	$\frac{0.4046}{0.1009}$	$\frac{1.03}{0.1009}$	$\frac{0.1009}{0.1009}$
	4	10	1

(3½)

Empirical formula $C_4H_{10}O$

6. Zinc powder was added to a solution of copper (ii) sulphate solution in a test tube.

a) i) State what was observed **(01 mark)**

Grey solid dissolves in the blue solution with deposition of brown solid. (01)

ii) Write an ionic equation for the reaction above **(01½ marks)**

$Zn_{(s)} + Cu^{2+}_{(aq)} \longrightarrow Zn^{2+}_{(aq)} + Cu_{(s)}$ (1½)

b) Zinc powder was added to iron (ii) sulphate solution instead of copper (ii) sulphate

i. State what was observed. *(01 mark)*

The green solution with deposition of a grey solid (01)

ii. What name is given to the reactions in (a) (i) and b(i) above? *(01 marks)*

Redox reaction (01)

7. The general formula of the **compounds P** and **Q** are; C_nH_{2n} and C_nH_{2n+2} respectively.

a) Write the molecular formula and names of **compounds P** and **Q**; for **n=3**

i. Formula of **P** *(0½ mark)*

C_3H_6 ✓ (½)

Name of **P** *(0½ mark)*

Propene ✓ (½)

ii. Formula of **Q**: *(0½ mark)*

C_3H_8 ✓ (½)

Name of **Q**: *(0½ mark)*

Propane ✓ (½)

b) State the structural difference between compounds **P** and **Q**. *(01 mark)*

P has a double bond btn 2 adjacent carbon atoms while Q contains a single bond (01)

c) i) Name one reagent which can be used to distinguish between compounds **P** and **Q** *(0½ mark)*

Bromine water ✓ (½)

Accept; Bromine liquid
Acidified potassium permanganate

ii. State what would be observed if the reagent you have named in (c) (i) was treated separately with compounds **P** and **Q**. *(01 mark)*

Observation for P;

Reddish brown liquid turns colourless (01)

Accept,
Red liquid turns c
-The purple soln turns colourle

Observation for Q;

No observable change (01)

iii. Write the equation(s) for any reaction that would take place to illustrate your observations in (c) (ii) above. *(01 mark)*

$C_3H_6(g) + Br_2(g) \rightarrow C_3H_6Br_2(g)$ ✓ ✗ ✗ (01)

8. a) When concentrated hydrochloric acid was added to manganese (IV) oxide and the mixture heated, a gas was evolved.

i. Name the gas that was evolved. *(0½ mark)*

Chlorine gas ✓ (½)

ii. Write the equation for the reaction that took place. *(01½ marks)*

$HCl(aq) + MnO_2(s) \rightarrow MnCl_2(aq) + Cl_2(g) + 2H_2O(l)$ ✓ ✓ ✓ (1½)

b) State what is observed when the gas is bubbled through;

i. Cold dilute potassium hydroxide solution. *(01 mark)*

The greenish yellow gas dissolves ✓ to form yellow solution

ii. A beaker containing moist red flowers. *(0½ mark)*

The red flowers turns white ✗ ✓ (½)

c) The gas in (a) (i) above was bubbled through a solution of sodium iodide until no further change.

i. Write equation for the reaction. *(01½ marks)*

$2NaI(aq) + Cl_2(g) \rightarrow 2NaCl(aq) + I_2(s)$ ✓ ✗ (1½)

Accept: $I^-(aq) + Cl_2(aq) \rightarrow 2Cl^-(aq) + I_2(s)$

ii. Suggest any conclusion that can be drawn from the equation you have written in (i). *(01 mark)*

Chlorine displaces iodine from its solution ✓ (01) because it's more reactive than iodine.

9. The setup of the apparatus in figure 1 was used to investigate the effect of heat on zinc

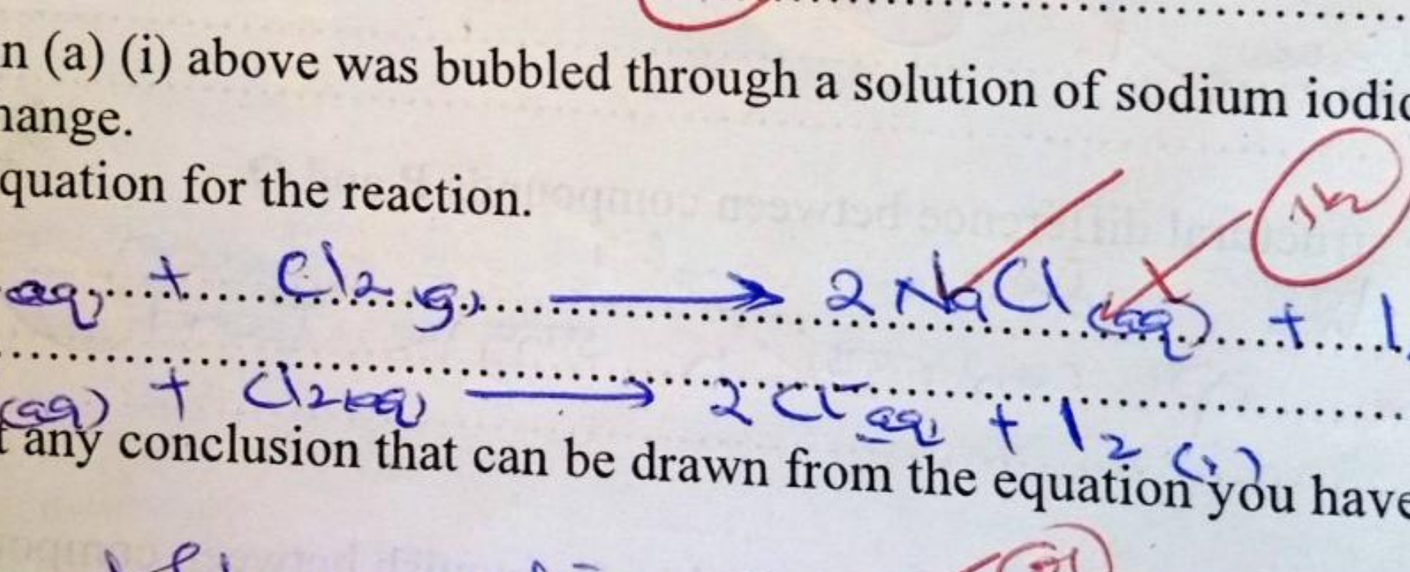

Fig. 1

(a) State what was observed in:

i. Test tube **X** *(01mark)*

White solid turns yellow when hot and white on cooling with evolution of a colourless gas

ii. Test tube **Y** *(01mark)*

The lime water turns milky

(b) Write an equation for the change that occurs in;

i. Test tube **X** *(01½marks)*

$ZnCO_{3(s)} \longrightarrow ZnO_{(s)} + CO_{2(g)}$

ii. Test tube **Y.** *(01½marks)*

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

(c) State **one** use of the solid product in b(ii). *(01mark)*

for lab preparation of CO_2 gas

10. Write equations only to show the reactions that would take place if each of the following was strongly heated in air.

a) **$NaNO_3$** *(01½ marks)*

$2NaNO_{3(s)} \longrightarrow 2NaNO_{2(s)} + O_{2(g)}$

b) **$Na_2CO_3.10H_2O$** *(01 mark)*

$Na_2CO_3.10H_2O_{(s)} \longrightarrow Na_2CO_{3(s)} + 10H_2O_{(g)}$

c) **$Cu(NO_3)_2$** *(01½ marks)*

$2Cu(NO_3)_{2(s)} \longrightarrow 2CuO_{(s)} + 4NO_{2(g)} + O_{2(g)}$

SECTION B

*Answer **two** questions only in this section, extra – questions answered will not be marked.*

11. a) Calcium nitrate was strongly heated.

i. State what was observed. *(01½ marks)*

ii. Write the equation for the reaction that took place. *(01½ marks)*

iii. Name a gas that can be dried using the solid residue above. *(01 mark)*

iv. Calculate the total volume of the gaseous products formed at room temperature when **4.5g** of calcium nitrate is heated strongly.

(N=14, O=16, Ca=40, 1 mole of a gas at room temperature occupies 24.0 dm^3)

(03 marks)

b) The residue in (a) was dissolved in water. Write equation for the reaction that took place. (*01½ marks*)

c) Excess carbon dioxide was bubbled through the solution in (b) above.
State;

i. What is observed and write the equation(s) for the reaction(s) that took place. (*04½ marks*)

ii. One application of this reaction in gas analysis. (*01 mark*)

d) To the resultant solution in (b), soap solution was added. State what was observed. (*01 mark*)

12. a) Name any two chief ores from which iron can be extracted in the blast furnace (*02 marks*)

b) Briefly describe the reactions that lead to the formation of iron from one of the ores named above during the extraction using a blast furnace. (*06½ marks*)

c) State what would be observed and write equation for the reaction that would take place when the following gases are passed over heated red-hot iron.

i. Dry chlorine gas (*02½ marks*)

ii. Steam (*02½ marks*)

d) Dilute hydrochloric acid was added to iron filings and the mixture warmed. Write the equation for the reaction that took place. (*01½ marks*)

13. a) i). Name one substance that can be reacted with hydrochloric acid to produce Sulphur dioxide gas in the laboratory. (*01 mark*)

ii. State the conditions under which the reaction take place. (*02 marks*)

iii. Name a substance that can be used to dry Sulphur dioxide gas produced (*01 mark*)

iv. Write the equation for the reaction leading to the formation of Sulphur dioxide gas (*01½ marks*)

b) State what would be observed and explain what would happen if Sulphur dioxide is passed through a solution containing;

i. Acidified potassium dichromate (*02½ marks*)

ii. Acidified potassium permanganate (*02 ½ marks*)

c) Briefly describe how Sulphur dioxide can be converted to sulphuric acid. Your answer should include equations and conditions for the reaction(s). (*04½ marks*)

14. a) state the difference between an acid and a salt. (*02 marks*)

b) describe;

i. how a pure dry sample of lead (II) carbonate can be prepared in the laboratory. (no diagram is required) (*04 marks*)

ii. the effect of heat on lead carbonate. (*02 marks*)

c) lead (II) carbonate reacts with dilute nitric acid according to the following equation.

$PbCO_3(s) + 2HNO_3(aq) \longrightarrow Pb(NO_3)_2(aq) + CO2(g) + H2O(l)$

Calculate the mass of lead (II) carbonate that is required to react completely with $200cm^3$ 0f $0.2M$ dilute nitric acid. *(Pb=207, C=2, O=16).* (*02½ marks*)

d) State what would be observed if in a test tube containing lead (II) ions was added;

i. 3 drops of potassium iodide solution. (*0½ mark*)

ii. Ammonia solution was added dropwise until in excess. (*01 mark*)

iii. Dilute hydrochloric acid and the mixture heated then allowed to cool. (*01½ marks*)

e) Write an equation to illustrate your answer in (d) (ii) above. (*01½ marks*)

END