Candidate's Name: KIBUGO DENNIS.....

Signature.....

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545/2
CHEMISTRY
Paper 2
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Paper 2

2 hours

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. Answer any* ***two*** *questions from this section. Answers to the questions* ***must*** *be written in the answer booklet(s) provided.*

In both sections **all** *working must be clearly shown.*

Where necessary use;

[H =1; C = 12; N =14; O = 16; Na =23; S = 32; Cl = 35.5]

1 mole of gas occupies 24 *l* at room temperature.

1 mole of gas occupies 22.4 *l* at s.t.p.

For Examiners' Use Only														
1	2	3	4	5	6	7	8	9	10	11	12	13	14	Total

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SECTION A (50 MARKS)

Answer **all** *questions in this section.*

1. (a) Write the chemical name of rust. *(01 mark)*

Hydrated iron(III) oxide ✓ 01

(b) State the conditions necessary for rusting to occur. *(02 marks)*

Presence of Oxygen. ✓

Presence of water. ✓ 02

(c) Figure 1 shows a set-up of apparatus that was used to investigate a condition necessary for iron nails to rust.

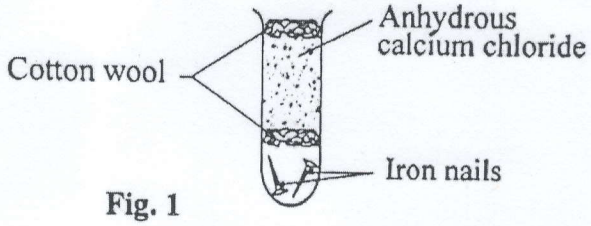

Fig. 1

State the condition that was being investigated. *(01 mark)*

Water ✓ Accept; -Moisture -Moistured air. 01

(d) State;

(i) **one** disadvantage of rust. *(01 mark)*

- Makes sharp objects made of iron to become blunt.

Accept any equivalence. Rej; without iron.

(ii) **one** method of preventing rusting. *(01 mark)*

- Oiling the iron metal. ✓

Accept: -Electroplating -Painting -Enamelling -Use of stainless steel -Galvanising

Rej; By not leaving the iron metal outside.

2. Table 1 shows the mass numbers and atomic numbers of elements *W*, *X* and *Y*. Study the table and answer the questions that follow.

Table 1

Element	Mass number	Atomic number
W	24	12
X	14	7
Y	39	19

(a) State the number of;

(i) electrons in the atom of element *Y*. *(01 mark)*

19. ✓ 01

(ii) neutrons in the atom of element *Y*. *(01 mark)*

20. ✓ 01

(b) Write the electronic configuration of the ion that can be formed by the atom of element *Y*. *(01 mark)*

2:8:8 ✓ 01 Accept; 2,8,8 Also; 2)8)8

(c) Identify the group in the Periodic Table to which element *X* belongs. *(01 mark)*

Group(V) ✓ 01 Accept; Group five / Group 5

(d) Element *W* reacted with element *X* to form a compound *Z*. State the type of bond in *Z*. *(01 mark)*

Ionic bond. ✓ 01 Accept; Electrovalent bond.

3. (a) A metallic element *T*, reacts with nitrogen to form a compound with the formula T_3N_2.

(i) State the valency of *T*. *(½ mark)*

2. ✓ Accept; two 01½

(ii) Write equation for the reaction between *T* and chlorine. *(1½ mark)*

$T_{(s)} + Cl_{2(g)} \longrightarrow TCl_{2(g)}$ ✓✓ 01½

(b) 3.2 g of *T* reacted completely with 600 cm^3 of nitrogen at s.t.p. Determine the atomic mass of *T*.

(1 mole of a gas occupies 22.4 dm^3; T reacts with nitrogen in the ratio 3:1) *(02 marks)*

From stoichiometric ratio;

1mole of N_2 reacts with 3moles of T.

22400cm^3 of N_2 react with 3moles of T

600cm^3 of N_2 will react with $\left(\frac{600 \times 3}{22400}\right)$ moles of T ✓

= 0.08036 moles of T. ✓

∴ 0.08036 moles of T weigh 3.2g

1mole of T will weigh $\left(\frac{3.2 \times 1}{0.08036}\right)$ g. ✓

= 37.08 ✓ 02

∴ Atomic mass of T is 37.08

4. Clean zinc granules were added to a solution of copper(II) sulphate.

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

The grey particles dissolved in the blue solution forming a colourless solution with brown deposits. 01

Accept; Blue colour of solution faded

(b) Explain your observation in (a). *(02 marks)*

Accept; The blue solution turns to a colourless solution. Brown solids deposited.

Zinc is higher than Copper in electrochemical series, hence Zinc displaces Copper from copper(II) sulphate solution to form colourless solution of zinc sulphate, ~~a cream~~ brown solid of copper. 02

(c) Write equation to support your answer in (b). *(1½ marks)*

$Zn_{(s)} + CuSO_{4(aq)} \longrightarrow ZnSO_{4(aq)} + Cu_{(s)}$

Accept the ionic eqn.; $Zn_{(s)} + Cu^{2+}_{(aq)} \longrightarrow Zn^{2+}_{(aq)} + Cu_{(s)}$

5. Ammonium sulphate dissolves in water according to the following equation:

$$(NH_4)_2SO_4(s) + 2H_2O(l) \rightarrow 2NH_4OH(aq) + H_2SO_4(aq)$$

(a) State what would be observed if aqueous sodium hydrogencarbonate was added to the resultant solution. *(01 mark)*

Bubbles of a colourless gas. 01

Accept; Bubbles. only

Accept; Effervescence of a colourless gas

(b) Briefly explain your answer in (a). *(04marks)*

Ammonium sulphate undergoes hydrolysis forming ammonium hydroxide, a weak base, and sulphuric acid, a strong acid. This makes the resultant solution acidic due to excess hydrogen ions than hydroxyl ions in the solution. The excess hydrogen ions react with hydrogencarbonate ions forming carbon dioxide gas, seen as bubbles, and water.

$H^+_{(aq)} + HCO^-_{3(aq)} \longrightarrow CO_{2(g)} + H_2O_{(l)}$ 04

6. The set-up of the apparatus in figure 2 was used for electrolysing silver nitrate solution.

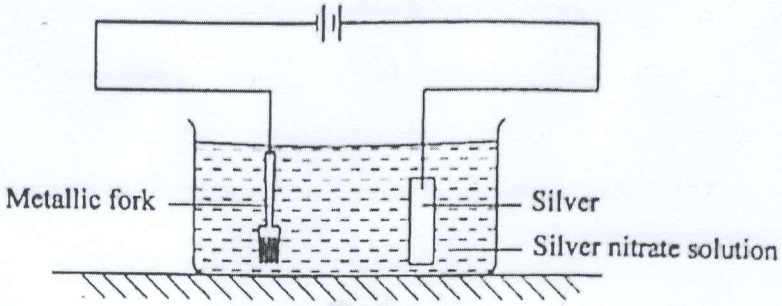

Fig. 2

(a) State what was observed on the;

(i) metallic fork. *(01 mark)*

A silver coating on a metallic fork. 01

(ii) silver. *(01 mark)*

Reduction in mass of silver. 01

(b) Write equation for the reaction that took place at the;

(i) electrode with the fork. *(01 mark)*

$Ag^{+}_{(aq)} + e \longrightarrow Ag_{(s)}$ 01

(ii) electrode with silver. *(01 mark)*

$Ag_{(s)} \longrightarrow Ag^{+}_{(aq)} + e$ 01

(c) (i) Name the process taking place at the electrode with the fork. *(½ marks)*

Electroplating 01½

Rej; Electrolysis.

(ii) State **one** use of the process in (c)(i). *(½ mark)*

To It prevents rusting on iron metals. 01½

- ~~Increasing~~ Accept { Increases the durability / Improves the appearance of a metal.

7. Lead(II) carbonate was heated until there was no further change.

(a) State what was observed. *(1½ marks)*

white powder turns into a yellow when hot and reddish brown residue on cooling. 01½

(b) Magnesium powder was added to the residue and the mixture heated strongly. Write equation for the reaction that took place. *(1½ marks)*

$PbO_{(s)} + Mg_{(s)} \longrightarrow MgO_{(s)} + Pb_{(s)}$ ✓✓ 01½

(c) The experiment in (b) was repeated using copper turning instead of magnesium powder.

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

No observable change. ✓ 01

(ii) Give a reason for your answer in (c)(i). *(01 mark)*

Copper is lower than lead in the reactivity series 01

hence Copper can not displace lead from lead(II) oxide

8. When ammonium chloride was mixed with potassium hydroxide and the mixture heated strongly, ammonia was evolved

(a) Write equation for the reaction leading to the formation of ammonia. *(1½ marks)*

Accept; If all state symbols are in aqueous state or all are in solid state: Rej; ½MK for wrong state symbol.

$NH_4Cl_{(s)} + KOH_{(s)} \longrightarrow NH_{3(g)} + KCl_{(s)} + H_2O_{(l)}$ ✓✓ 01½

Accept; $NH_4^+{}_{(aq)} + \bar{O}H_{(aq)} \longrightarrow NH_{3(g)} + H_2O_{(l)}$.

(b) Ammonia was bubbled through zinc sulphate solution until there was no further change.

(i) State what was observed. *(1½ marks)*

white precipitate soluble in excess forming a colourless solution. 01½

(ii) Give reason(s) for your observation(s) in (b) (i). *(02 marks)*

Zinc ions from zinc sulphate reacted with hydroxide ions of ammonia solution forming a white precipitate of zinc hydroxide. 02

Zinc hydroxide dissolves

.....

.....

9. (a) What is meant by the term **rate of reaction?** *(01 mark)*

Is the amount of products formed per unit time in a reaction ✓ 01

.....

Accept; Is the amount of reactants used up per unit time in a reaction

(b) During an experiment to determine the rate of production of carbon dioxide from calcium carbonate at room temperature, the volume of carbon dioxide varied with time as shown in the graph in figure 3.

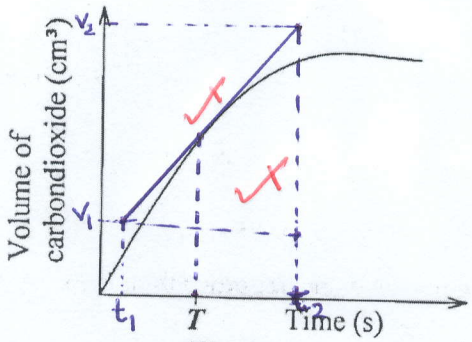

Fig. 3

01

Show how the rate of the reaction at time *T* can be determined.

(02 marks)

.....

Rate of Reaction $= \left(\frac{V_2 - V_1}{t_2 - t_1}\right)$ $cm^3 s^{-1}$ ✓ ✓ 01

.....

Deny ½ for missing or wrong Units

(c) State **two** factors other than temperature that can affect the rate of a reaction. *(02 marks)*

Surface area of the reactants. ✓

Catalyst. ✓ 02

Accept; Concentration of the reactants.

Accept; any equivalence ← Pressure, light.

10. (a) Write equation for the complete combustion of carbon. *(1½ marks)*

$C_{(s)} + O_{2(g)} \longrightarrow CO_{2(g)}$ ✓✓

0 1/2

(b) If 80 kg of charcoal cost UGX. 20,000. Calculate the cost of charcoal required to produce 163,750 kJ of heat energy.
($C = 12$; *The enthalpy of combustion of carbon* $= -393 kJmol^{-1}$)
(03 marks)

393KJ of heat is produced by 1 mole of C

∴ 393KJ of heat is produced by 12g of C

163,750KJ of heat will be produced by $\left(\frac{163,750 \times 12}{393}\right)$ g ✓✗

$= 5000$g of C ✓

But 1 Kg = 1000g.

∴ 5000g ≈ 5Kg

80Kg of charcoal cost 20,000F

5Kg of charcoal cost $\left(\frac{5 \times 20,000}{80}\right)$ F ✓✓

$= 1250$F ✓✗

∴ 1250F is required to produce 163,750KJ of heat.

(c) State **one** use of charcoal other than fuel. *(½ marks)*

- Purification of sugar (whitening) example animal sugar. ✓

0 1/2

Accept;
- Used in formation of gas masks.
- Used in formation (manufacture) of Charcoal tablets.

Rej;- Used as medicine.
- Used to brush teeth.
- Used to remove poison in alimentary canal.