

Name:

Signature: School:

545/2
CHEMISTRY
Paper 2
Jul / Aug. 2019
2 hours



UGANDA TEACHERS' EDUCATION CONSULT (UTEC)

Uganda Certificate of Education

CHEMISTRY

Paper 2

2 hours

INSTRUCTIONS TO CANDIDATES:

*Section A consists of 10 structured questions: Answer ALL questions in this section. Answers to the questions **must** be written in the spaces provided.*

*Section B consists of 4 semi – structured questions. Answer only **two** questions from this section. Answers to the questions **must** be written in the answer booklets provided.*

In both sections all working must be shown clearly.

Where necessary

[Zn = 65, O = 16, H = 1, Pb = 207]

1 mole of a gas occupies 22.4 dm^3 at s.t.p

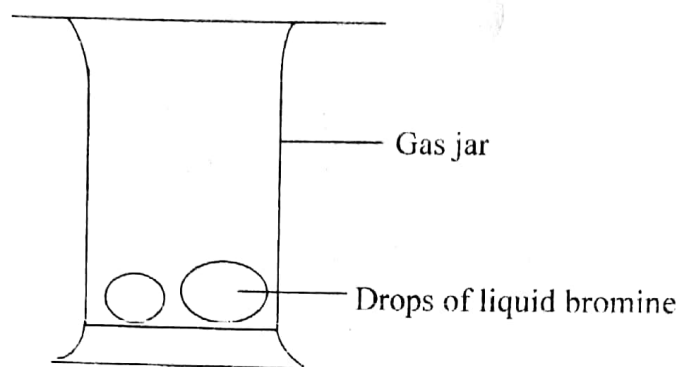
1 mole of a gas occupies 24 dm^3 at room temperature

For Examiner's use only														
1	2	3	4	5	6	7	8	9	10	11	12	13	14	TOTAL

SECTION A: (50 MARKS)

Answer ALL questions in this section

1. A few drops of liquid bromine were placed at the bottom of a gas jar on top of which was placed a cover glass. The set up was left to stand for about 30 minutes as shown below;



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

.....
.....

- (b) Name the process that was investigated. (01 mark)

.....
.....

- (c) Define the process you have named in (b) above. (01 mark)

.....
.....

- (d) State what the process you have named in (b) demonstrates about the nature of matter. (01 mark)

.....
.....

2. Rust is a substance formed by a natural process on the surface of a metallic element.
(a) (i) Name the metallic element in which rust can be formed. ($\frac{1}{2}$ mark)

.....
.....

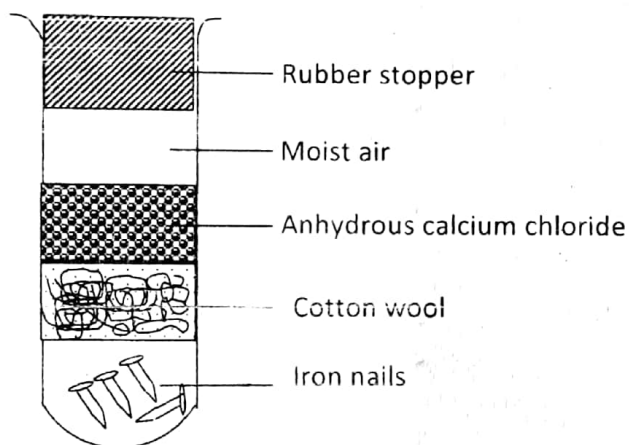
(ii) Write the chemical name and formula of rust.

(01 mark)

(iii) State the condition(s) that are necessary for rust to be formed.

(01 mark)

(b) The diagram in the figure below shows a setup of apparatus that was used to investigate one of the condition(s) at which rust is formed.



State:

(i) the condition necessary for rusting that was being investigated.

($\frac{1}{2}$ mark)

(ii) the role of anhydrous calcium chloride in the experiment.

($\frac{1}{2}$ mark)

(iii) what was observed if the set up was left to stand for about three days.

($\frac{1}{2}$ mark)

- (c) Give **one** method that can be used to stop the formation of rust on the element you have named in (a) (i). (½ mark)

.....
.....

3. The table below shows the number of protons, neutrons and electrons of atoms P, Q, R and S.

Atom	Protons	Neutrons	Electrons
P	8	8	8
Q	12	12	12
R	20	20	20
S	17	18	17

- (a) State two atoms that belong to the same;

(i) Group

(01 mark)

.....
.....

(ii) Period

(01 mark)

.....
.....

- (b) (i) Write the formula of the compound formed between atoms of Q and S.

(½ mark)

.....
.....

- (ii) State the type of bond that would exist in the compound formed between Q and S.

(½ mark)

.....
.....

(c) Write the electronic configuration of the following ions;

(i) Q^{2+}

($\frac{1}{2}$ mark)

.....
.....

(ii) P^{2-}

($\frac{1}{2}$ mark)

.....
.....

(d) Using the outer most shell electrons only, draw a diagram to show how atoms, **R** and **S** form a compound.

(01 mark)

.....
.....
.....
.....
.....
.....

4. A compound **Q** consists of magnesium 9.8%, sulphur 13%, oxygen 26% water of crystallization 51.2%.

(a) Calculate the simplest formula of compound **Q**.

(02 marks)

.....
.....
.....
.....
.....

(b) Name compound **Q**

($\frac{1}{2}$ mark)

.....
.....

(c) To an aqueous solution of compound **Q**, was added barium nitrate solution.

(i) State what was observed. (½ mark)

.....
.....

(ii) Write an ionic equation for the reaction that took place. (1½ marks)

.....
.....

5. An organic compound, **Z** of formula C_2H_5OH , reacts with concentrated sulphuric acid to form gas, **L** that turns liquid bromine to colourless;

(a) (i) Identify gas **L**. (½ mark)

.....
.....

(ii) Write equation leading to the formation of gas **L**. (01 mark)

.....
.....

(iii) Write equation for the reaction between gas, **L** and liquid bromine.

(01 mark)

.....
.....

(b) Under certain conditions, gas **L** reacts to form a thermo plastic.

(i) Define the term "**thermoplastic**". (01 mark)

.....
.....

(ii) Write the formula and the name of the plastic formed using gas, **L**.

(01 mark)

.....
.....

- (iii) Give one use of the plastic formed using gas L. (½ mark)

6. The production of oxygen gas at a faster rate from a solution of hydrogen peroxide requires a catalyst.

- (a) (i) Name the catalyst used. (½ mark)

- (ii) Give one factor other than the catalyst that can be changed to enable the formation of oxygen at a faster rate. (½ mark)

- (iii) Write equation of the reaction leading to the formation of oxygen gas. (1½ marks)

(b) A piece of steel wool was heated in a dry current of oxygen gas.

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

- (ii) Write equation for the reaction that took place. (1½ marks)

7. (a) (i) Name one substance that can react with sulphuric acid to produce hydrogen chloride gas in the laboratory. (½ mark)

-
-

-

- $$\text{Pb}^{2+}(\text{aq}) + 2\text{Cl}^{-}(\text{aq}) \longrightarrow \text{PbCl}_2(\text{s}).$$

[illegible]

8. To an aqueous solution of salt, **G**, was added silver nitrate solution. In this reaction, a white precipitate was formed.

(a) Name;

(i) the anion in salt **G**.

(½ mark)

.....

(ii) the white precipitate.

(½ mark)

.....

(b) Write an ionic equation for the reaction between the solution of **G**, and silver nitrate.

(1½ marks)

.....

(c) Ammonia solution was separately added drop wise until in excess to aqueous solution of;

(i) Copper (II) nitrate

(ii) Magnesium nitrate

State the observations made in (i) and (ii).

(1½ marks)

(i)

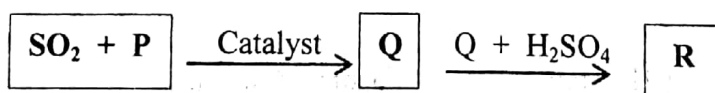
.....

(ii)

.....

(01 mark)

9. The scheme in the figure below, shows the industrial manufacture of sulphuric acid.



(a) Identify substances;

(i) P :

(½ mark)

(ii) Q :

(½ mark)

(iii) R :

(½ mark)

(b) Name the catalyst used; (½ mark)

.....
.....

(c) Write equation for the reaction leading to the formation of;
(i) **Q** (01 mark)

.....
.....

(ii) **R** (01 mark)

.....

(d) (i) State briefly how sulphuric acid is obtained from substance **R**. (½ mark)

.....
.....

(ii) Write equation(s) of the reaction(s) involved. (01 mark)

.....
.....

(iii) Give one use of sulphuric acid. (½ mark)

.....
.....

10. (a) What is the difference between an acid and an alkali? (02 marks)

.....
.....
.....

(b) The table below gives the pH values of solution **K**, **L** and **N**.

Solution	pH value	Nature of solution
K	2	
L	14	
N	5	

(i) Complete the table by indicating the nature of the solution whether acidic, alkaline or neutral. (1½ marks)

(ii) Which of the three solutions contain a common ion in them and name the ion. (01 mark)

.....
.....
(iii) Solution L was added to aqueous iron (II) sulphate solution, and the mixture left to stand in air. State what was observed. (01 mark)

SECTION B (30 MARKS)

Answer any **TWO** questions from this section

11. Marble chips can react with hydrochloric acid at room temperature to give gas **R**.

(a) (i) Identify gas **R**. (½ mark)

(ii) Write equation of the reaction that takes place. (1½ marks)

(iii) State how gas, **R**, can be tested in the laboratory. Write equation of the reaction involved. (02 mark)

(b) In an experiment to determine the rate of reaction 1M hydrochloric acid was added to 0.75g of marble chips in a flask that was quickly stoppered with cotton wool. The mixture was placed on a top pan balance. The table below shows the total loss in mass of the flask and its contents at various time intervals.

Time(s)	0	1	3	4	6	7	8	9
Total loss in mass (g)	0.00	0.22	0.59	0.73	0.92	0.97	1.00	1.00

(i) Plot a graph of total loss in mass against time. (04 marks)

(ii) From your graph, determine the total loss in mass at time, $t = 5$ seconds. (½ mark)

(iii) Explain briefly, how the rate of reaction can be determined at time, $t = 5$ seconds. (01 mark)

- (c) State and explain how the rate of the reaction would be affected if the reaction was carried out using:
- (i) Powdered marble chips. (1½ marks)
 - (ii) 2M hydrochloric acid instead of 1M hydrochloric acid. (02 marks)
- (d) Calculate the volume of gas, **R**, that was liberated in the reaction. (02 marks)
12. Iron is a useful catalyst in a certain industrial process for manufacture of gas **A**.
- (a) (i) Name gas **A**. (½ mark)
 - (ii) Write equation for the industrial reaction leading to the formation of gas **A**. (1½ marks)
 - (iii) State two other conditions other than the catalyst under which gas **A** is manufactured. (01 mark)
 - (b) Describe with the aid of equation(s) how gas, **A**;
 - (i) is prepared in the laboratory. (No diagram is required) (05 marks)
 - (ii) reacts with oxygen gas. (04 marks)
 - (c) Gas **A** was bubbled until in excess through an aqueous solution of aluminium nitrate;
 - (i) State what was observed. (½ mark)
 - (ii) Explain your observation in (c) (i) above. (2½ marks)
13. Zinc sulphate crystals can be prepared in the laboratory by reacting an oxide, **Q** with a suitable acid.
- (a) Name;
 - (i) oxide **Q** (½ marks)
 - (ii) the acid that can react with oxides, **Q** in this reaction. (½ mark)
 - (b) Describe how a dry sample of zinc sulphate can be prepared from oxide, **Q** and the acid you have named in (a). (06 marks)
 - (c) To a solution of Zinc sulphate, sodium hydroxide solution was added drop wise until in excess. State and explain the reactions that took place. (5½ marks)
 - (d) When heated, anhydrous zinc sulphate decomposes according to the equation below;

$$\text{ZnSO}_4(\text{s}) \longrightarrow \text{ZnO}(\text{s}) + \text{SO}_3(\text{g}).$$
 Calculate the volume of the gas evolved at s.t.p when 3.22g of zinc sulphate are decomposed completely. (2½ marks)

14. (a) (i) Define the term electrolysis. (01 mark)
- (ii) Explain why molten sodium chloride conducts electricity where as solid sodium chloride does not. (2½ marks)
- (b) A concentrated solution of sodium chloride was electrolyzed using graphite electrodes.
- (i) Write equation of the reaction that took place at the cathode. (1½ marks)
- (ii) Describe briefly what happens when the product formed at the cathode is passed over heated copper(II) oxide. Write equation for the reaction that takes place. (2½ marks)
- (iii) State and explain what was observed at the anode. (03 marks)
- (c) A blue litmus paper was dipped into the remaining mixture around the anode at the end of the electrolysis reaction in (b).
- (i) State what was observed. (01 mark)
- (ii) Explain your observation. (3½ marks)

END