

THE UNITED REPUBLIC OF TANZANIA  
NATIONAL EXAMINATIONS COUNCIL  
CERTIFICATE OF SECONDARY EDUCATION EXAMINATION

032/1

CHEMISTRY 1  
(For Both School and Private Candidates)

Time: 3 Hours

Friday, 04<sup>th</sup> November 2016 a.m.

Instructions

1. This paper consists of sections A, B and C.
2. Answer **all** questions in this paper.
3. Calculators and cellular phones are **not** allowed in the examination room.
4. Write your **Examination Number** on every page of your answer booklet(s).
5. The following constants may be used.

Atomic masses:

C = 12,      O = 16,      Mg = 24,      Al = 26,      S = 32,      Cl = 35.5,  
Mn = 55,      Fe = 56,      Cu = 63.5.

Avogadro's number =  $6.02 \times 10^{23}$ .

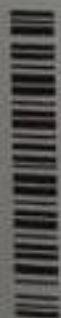
GMV at s.t.p =  $22.4 \text{ dm}^3$ .

1 faraday = 96,500 coulombs.

Standard pressure = 760 mm Hg.

Standard temperature = 273 K.

1 litre =  $1 \text{ dm}^3 = 1000 \text{ cm}^3$ .



### SECTION A (20 Marks)

Answer all questions in this section.

1. For each of the items (i) – (x), choose the correct answer from the given alternatives and write its letter beside the item number in the answer booklet provided.
- (i) Which of the following is True about the following equilibrium?  $\text{H}_2\text{O}_{(l)} \rightleftharpoons \text{H}^+_{(aq)} + \text{OH}^-_{(aq)}$
- A Water molecules have stopped changing into ions.
  - B Water molecules have all changed into ions.
  - C Concentrations of water molecules and ions are equal.
  - D Concentrations of water molecules and ions are constant.
  - E Water molecules are moving slow.
- (ii) The property of metal to be drawn into wires is called
- A conductivity
  - B malleability
  - C ductility
  - D decorating
  - E expansion.
- (iii) If a steady current of 2 amperes was passed through an aqueous solution of iron (II) sulphate for 15 minutes, the mass of iron deposited at the cathode will be
- A 30 g
  - B 56 g
  - C 0.54 g
  - D 28 g
  - E 0.52 g
- (iv) What will happen when zinc is placed in aqueous copper (II) sulphate?
- A Copper atoms are oxidised
  - B Zinc atoms are oxidised
  - C Copper ions are oxidised
  - D Zinc ions are oxidised
  - E Sulphur atoms are oxidised.
- (v) Which of the following pair of gas can be prepared in the laboratory and collected over water?
- A Oxygen and Ammonia
  - B Hydrogen and Hydrochloric acid
  - C Hydrogen and Oxygen
  - D Oxygen and Hydrogen chloride
  - E Hydrogen and Ammonia.
- (vi) Two substances are allotropes of carbon if
- A both reduce heated iron (III) oxide to iron
  - B have different crystalline structure
  - C have equal masses
  - D have equal shape
  - E have the same arrangement of atoms.
- (vii) The apparatus suitable for measuring specific volumes of liquids is called
- A Burette
  - B Volumetric flask
  - C Pipette
  - D Measuring cylinder
  - E Graduated beaker.
- (viii) Which among the following the reaction,  $\text{Cu}^{2+}_{(aq)} + \text{Zn}_{(s)} \longrightarrow \text{Zn}^{2+}_{(aq)} + \text{Cu}_{(s)}$  represents?
- A Synthesis.
  - B Precipitation.
  - C Neutralization.
  - D Displacement.
  - E Decomposition.

- (ix) The occurrence of two or more compounds with the same molecular formula but different molecular structures is known as
- A Amphoterism                      B Isomerism                      C Allotropy  
 D Polymorphism                      E Isotopy.
- (x) Which of the following sets of symbols represent isotopes of a single element?
- A  $^{16}_8\text{X}$ ,  $^{17}_8\text{X}$ ,  $^{18}_8\text{X}$                       B  $^{16}_3\text{Z}$ ,  $^{17}_4\text{Z}$ ,  $^{18}_5\text{Z}$   
 C  $^{16}_7\text{P}$ ,  $^{16}_8\text{P}$ ,  $^{16}_9\text{P}$                       D  $^{16}_7\text{K}$ ,  $^{17}_8\text{K}$ ,  $^{18}_9\text{K}$   
 E  $^{16}_7\text{U}$ ,  $^{16}_8\text{U}$ ,  $^{18}_{10}\text{U}$ .

2. Match the items in List A with the responses in List B by writing the letter of the correct response beside the item number in the answer booklet provided.

| List A   | List B                        |
|--|-------------------------------|
| (i) Atoms of the same element that contain different numbers of neutrons.      | A Atomic number<br>B Electron |
| (ii) The elements that display both metallic and non-metallic characteristics. | C Radical<br>D Metalloids     |
| (iii) Sub atomic particle NOT found in the nucleus of the atom.                | E Isotopes<br>F Mass number   |
| (iv) The number of protons found in the nucleus of the atom.                   | G Neutron                     |
| (v) The total number of protons and neutrons in the nucleus of the atom.       | H Allotropes<br>I Noble gases |
| (vi) The number of unpaired electrons on an atom.                              | J Period                      |
| (vii) The elements which are incredibly stable and rarely react.               | K Group                       |
| (viii) The non-metals that form diatomic molecules.                            | L Proton                      |
| (ix) Sub atomic particle with no charge.                                       | M Valence                     |
| (x) A group of atoms with unpaired electrons.                                  | N Atomic radii<br>O Halogens  |

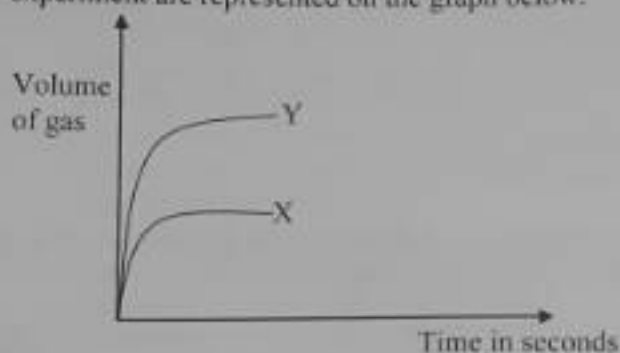
### SECTION B (54 Marks)

Answer all questions in this section.

3. (a) Give the meaning of the following terms:
- (i) Soil pH.  
 (ii) Liming.
- (b) (i) Explain why sulphur and its compounds are removed from fuels before they are burned.

- (ii) Describe how sulphur dioxide is changed into sulphur trioxide. Give the reaction conditions and the equation(s).

4. (a) Differentiate dilute hydrochloric acid from dilute sulphuric acid.
- (b) John measured the volume of gas produced when 5 g of two chemicals X and Y were added separately to hydrogen peroxide under identical conditions. His results for this experiment are represented on the graph below.



John claimed that Y is a better catalyst than X. His partner Steven did not agree.

- (i) Why does Steven think that John's conclusion is wrong?
- (ii) After the experiment, Steven recovered 5 g of X and 1 g of Y from the two experiments. He claimed that this shows that John was wrong. Does Steven's claim true? Give a reason.
5. (a) Give the name of the type of reaction represented by each of the following chemical equations.
- (i)  $C_3H_{8(g)} + 5O_{2(g)} \longrightarrow 3CO_{2(g)} + 4H_2O_{(l)}$
- (ii)  $2Pb(NO_3)_{2(s)} \xrightarrow{\Delta} 2PbO_{(s)} + 4NO_{2(g)} + O_{2(g)}$
- (iii)  $Zn_{(s)} + CuSO_{4(aq)} \rightarrow ZnSO_{4(aq)} + Cu_{(s)}$
- (b) 25 cm<sup>3</sup> samples of water A, B, C and D were tested with soap solution. The volume of soap solution required to produce a lather that lasted for a minute was recorded. Fresh samples of each were boiled and tested again with soap solution. The results are shown in Table 1.

Table 1

| Water sample | Volume of soap solution required (cm <sup>3</sup> ) before boiling | Volume of soap solution required (cm <sup>3</sup> ) after boiling |
|--------------|--|---|
| A            | 5.0  | 5.0   |
| B            | 1.0  | 1.0   |
| C            | 11.0   | 8.0   |
| D            | 9.0  | 1.0   |

- (i) Which sample probably contains temporary hardness of water only?
- (ii) Which sample probably contains both permanent and temporary hardness of water? Give a reason for your answer.

6. (a) Write the structural formula for the following compounds:
- (i) But-2-ene.

- (ii) Pent-2-yne.
- (iii) 1, 2 dichloroethane.
- (iv) 2, 4 dimethylhexane.

(b) Briefly explain what will be observed when silver nitrate solution is added to aqueous solution of sodium chloride.

7. (a) Determine the empirical formula of a substance that has the following composition by mass; 49.5% manganese and 50.5% oxygen.

(b) Give one reason why aluminium is chosen to make each of the following items:

- (i) Cooking foil.
- (ii) Overhead electric cables.
- (iii) Window frames.

8. (a) Identify and state the environmental problem caused by the gas which is released from the blast furnace in the extraction of iron from its oxide.

(b) (i) Draw a labelled diagram of a simple electrolytic cell which show how copper is purified.

(ii) Write balanced ionic equations to show the electrode reactions which occur when copper is purified.

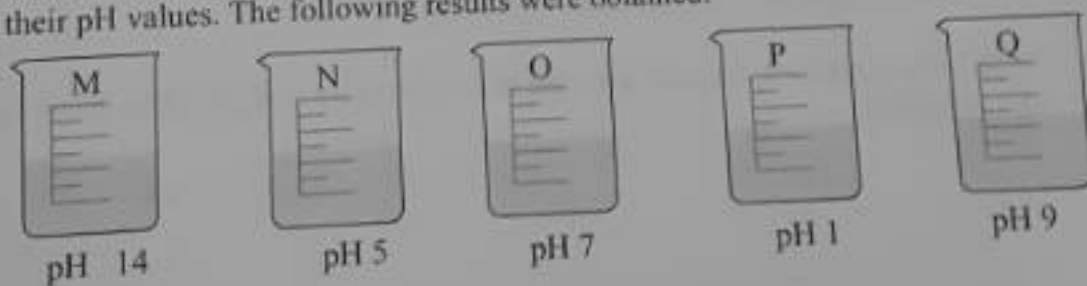
9. (a) Name two elements which are expected to show similar chemical reactions with magnesium. What is the basis for your choice?

(b) State the main raw material and the process involved in the manufacture of the following products:

- (i) Wood charcoal.
- (ii) Coke.
- (iii) Lampblack.

10. (a) Give two chemical tests of water and the expected result to be observed.

(b) A student tested five solutions M, N, O, P and Q with a universal indicator solution to find their pH values. The following results were obtained:



Which of the above solutions was?

- (i) Neutral solution.
- (ii) Strong acid.
- (iii) Strong alkali.
- (iv) Weak acid.

11. (a) State the meaning of the following and give one example in each case.

- (i) Amphoteric oxide.

- (ii) Acidic oxide.
- (b) A student investigated different reactivity of a set of metals by placing pieces of each metal in metal nitrate solution. Table 2 shows some of the results.

Table 2

| Solution          | Aluminium | Barium | Lithium | Magnesium |
|-------------------|-----------|--------|---------|-----------|
| Aluminium nitrate | X         | √      |         | √         |
| Barium nitrate    |           | X      | √       | X         |
| Lithium nitrate   | X         |        | X       |           |
| Magnesium nitrate | X         | √      | √       | X         |

Where: √ = reaction observed and X = no reaction.

- (i) Use the results given to arrange the metals in order of reactivity starting with the most reactive metal.
- (ii) Use the reactivity series in 11 (b) (i) to complete Table 2.

### SECTION C (26 Marks)

Answer **all** questions in this section.

12. Explain five methods to prevent terrestrial pollution.
13. 0.48 g of a metal, **M** was placed in a test tube and hot copper (II) sulphate solution was added to it and stirred until the reaction stopped. The metal (**M**) displaced copper from copper (II) sulphate solution. Copper was filtered, washed with water, dried at 100°C and the mass found to be 1.27 g. Given that, the balanced chemical reaction that occurred is  $M_{(s)} + CuSO_{4(aq)} \rightarrow MSO_{4(aq)} + Cu_{(s)}$ .
- (a) Calculate;
- the number of moles of copper that were formed and the number of moles of **M** that were used in the reaction.
  - the relative atomic mass of **M** and hence identify metal **M**.
- (b) State the appearance of the metal formed (Cu).
- (c) With ionic equations, explain why the reaction can be considered to involve both oxidation and reduction.

6.25g 0.01  
 127  
 63.55g