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

032/1

CHEMISTRY PAPER 1
(For Both School and Private Candidates)

TIME: 3 Hours

8 November 1999 A.M

INSTRUCTIONS

1. This paper consists of Sections A, B and C.
2. Answer ALL the questions in Sections A and B and THREE (3) questions, including question 6, from Section C in the answer booklet provided.
3. The marks intended for Section A and for each question, or part of it, are indicated in brackets.
4. Remember to write your Examination Number on every page of your answer booklet.
5. Wherever necessary the following constants may be used.
   (a) Atomic masses

   $H = 1$, $C = 12$. $N = 14$, $0 = 14$, $Na = 23$, $Cl = 35.5$, $Ca = 40$, $Cu = 63.5$, $Zn = 65$, $Ag108$, $Pb = 207$.

   (b) Avogadro's Number $= 6.02 \times 10^{23}$
   (c) 1 Faraday $= 96,500C$
   (d) Gas Molar Volume at s.t.p $= 22.4dm^3$

This paper consists of 8 printed pages

This section consists of fifteen multiple – choice items. Answer ALL the items.

1 Choose the letter corresponding to the correct response from the five given options, then write it on the first page of your answer booklet in serial order.

    (i)   Steam and methane can react and produce hydrogen according to the following equation:

$$CH_{4(g)} + H_2 O_{(g)} \rightarrow CO_{(g)} + 3H_{2(g)}$$

The volume of methane needed to produce $150cm^3$ of hydrogen at the same conditions will be:

    A. $25cm^3$ B. $50cm^3$ C.$75cm^3$
    D. $100cm^3$ E. $150cm^3$

    (ii)   The common property for all carbonates and hydrogen is that they:
    A. are soluble in cold water
    B. decompose on heating
    C are colourless chemical substances
    D. react with dilute nitric acid
    E. are not soluble in cold water .

    (iii)   The equation which represents Haber's process is shown below:
    $N_{2(g)} + H_{2(g)} \rightarrow NH_{3(g)}$ (exothermic reaction)

The rate of formation of ammonia gas can be increased by:
    A. increasing the temperature
    B. decreasing the concentration of nitrogen
    C. decreasing the concentration of hydrogen
    D. increasing the amount of catalyst
    E. increasing the volume of the container

    (iv)   What are the products of electrolysis of aqueous sodium (1) chloride using platinum electrodes?
    A. Sodium and chlorine
    B. Hydrogen and oxygen
    C. Hydrogen and chlorine
    D. Oxygen and chlorine
    E. Platinum and oxygen

    (v)   Why is magnesium (II) chloride a deliquescent compound?
    A. It is easily decomposed by heat
    B. It has a low boiling point
    C. It is readily fusible
    D. It absorbs water from the atmosphere
    E. It easily gives away water of crystallization

    (vi)   The relative atomic mass of aluminium is 27. Its atomic number is 13. Therefore this element has
    A. 13 neutrons
    B. 14 electron
    C, 14 protons
    D. 14 neutrons
    E. 27 electrons

    (vii)   One of the following chemical formulae does not represent a carboxylic acid.
    A. $C_5H_{11}COOH$
    B. C_3H_9COOH
    C. C_4H_9COOH
    D. C_3H_7COOH

(viii) How many atoms are there in 8g of lead (II) sulphate?
  A. 1.59×10^{23} atoms
  B. 1.59×10^{19} atoms
  C. 1.59×10^{21} atoms
  D. 1.59×10^{22} atoms
  E. 1.59×10^{25} atoms

(ix) The following is one of the characteristic properties of non-metals.
  A. They are electronegative in nature
  B. They behave as reducing agents
  C. They form cations by gaining electrons
  D. They do not react with acids
  E. They form anions by loss of electrons.

(x) Each of the following constitutes one mole except:
  A. Avogadro's constant of electrons
  B. 2g of hydrogen molecules
  C. 48g of carbon dioxide atoms
  D. 19g of hydroxonium ions
  E. 98g of sulphuric acid

(xi) The empirical formula of a compound is found to be CH_2 by analysis. If the relative molecular mass of the compound is 42g, the molecular formula of this compound will be:
  A. C_3H_6
  B. C_2H_4
  C. C_2H_4
  D. C_3H_8
  E. C_6H_{12}

(xii) What is the name of a gas produced when dilute hydrochloric acid is dropped slowly on an egg's shell?
  A. Hydrogen chloride
  B. Sulphur dioxide
  C. Hydrogen sulphide
  D. Carbon dioxide
  E. Carbon disulphide

(xiii) One of the following organic compounds is not saturated.
  A. C_5H_{12}
  B. C_2H_4
  C. C_3H_8
  D. $C_{10}H_{22}$
  E. C_7H_{12}

(xiv) What is the mass of one mole of sodium nitrate required to be heated so as to produce one mole of oxygen gas?
  A. 4.8g
  B. 8.5g
  C. 16g
  D. 48g
  E. 85g

(xv) The function of limestone in the extraction of iron in the blast furnace is to:
  A. reduce the iron oxide
  B. precipitate earth materials to slag
  C. remove carbon monoxide
  D. separate molten iron from impurities
  E. lower the temperature of the blast furnace

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SECTION B (40 marks)

Answer ALL the questions in this section

2. (a) Define the following terms:
   (i) Empirical formula.
   (ii) Molecular formula.

   (1 marks)

   (b) If the molecular formula of calcium (II) sulphate is $CaSO_4$, what is the percentage of oxygen in this compound? (3 ½ marks)

   (c) Given that the molar mass of compound X is 106 and its percentage by composition of its constituent elements is

   Na = 43.5%
   C = 11.3%
   O = 45.3%

   Calculate the:-
   (i) empirical formula and
   (ii) molecular formula of the compound.

   (5 ½ marks)

3. (a) What is the meaning of
   (i) allotropy
   (ii) an isotope.

   (2 marks)

   (b) You are provided with a list of four atoms whose mass numbers and atomic number have been indicated.

   $$_{17}^{37}X \; , \; _{17}^{35}Y \; , \; _{16}^{32}W \; , \; _{16}^{32}Z$$
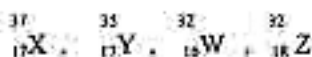
   (i) Which of the atom(s) above represent isotope(s)?
   (ii) What is the number of protons in X
   (iii) What is the number of neutrons in Y

   (3 marks)

   (c) Explain why graphite can be used as an electrode as well as a lubricant but diamond cannot.

   (5 marks)

4. (a) Study the following structural formulae carefully, then state the homologous series to which each of compounds A, B and C belongs
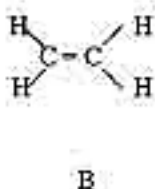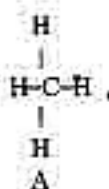
   (3 marks)

   (b) Write balanced chemical equations for the reactions between:

   (i) A and chlorine in the presence of sunlight
   (ii) B and hydrogen chloride
   (iii) B and sodium metal

   (3 marks)

   (c) Write the structures of the following organic compounds:
   (i) 2,4 – dimethyl hexane
   (ii) 1,2 – dichloroethane
   (iii) But – 2 – ene
   (iv) Pent – 2 – yne

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5. (a) With the help of balanced chemical equations where necessary explain the following observations:-
   (i) Sugar turns black when concentrated sulphuric acid is slowly poured on it.
   (ii) A bottle containing nitric acid appears yellowish brown.
   (iii) Colourless nitrogen monoxide turns brown when exposed to air.
   (iv) Fused sodium chloride conducts electricity while solid sodium chloride does not.
   (v) Yellowish brown Iron (III) chloride turns pale green when hydrogen sulphide gas is passed through it.

   (2 ½ marks)

   (b) Explain
   (i) Why the colour of copper (II) sulphate is sometimes blue.
   (ii) Why the blue colour of copper (II) sulphate disappears slowly when this compound is electrolysed using platinum electrodes.

   (3 marks)

   (c) The quantity of electricity passed during the electrolysis of copper (II) sulphate was 9650 coulombs. Calculate.
   (i) the number of moles of the metal deposited
   (ii) the mass of copper deposited.

   (4 ½ marks)

SECTION C (45 marks)

Answer question SIX (6) and any other two questions from this section.

6. (a) Explain the meaning of the following terms.
   (i) Soil structure
   (ii) Acidic soil
   (iii) Liming

   (3 marks)

   (b) (i) Discuss four factors which lead to soil erosion.
   (ii) Describe two ways of controlling soil erosion.

   (3 marks)

   (c) (i) Draw the carbon cycle
   (ii) What is the difference between micronutrients and macronutrients?
   (iii) Categorize the following elements as either micronutrient or macronutrient:
   sulphur, iron, chlorine, boron, potassium, copper, nitrogen and phosphorus

   (9 marks)

7. (a) What is meant by:
   (i) electrolysis
   (ii) electrolyte
   (iii) electrode?

   (b) (i) What are the three conditions that affect the discharge of ions during electrolysis?
   (ii) What happens when a solution of copper (II) sulphate undergoes electrolysis using copper electrodes?

   (6 ½ marks)

   (c) (i) Explain the meaning of Faraday's constant.
   (ii) How many coulombs are required to liberate 8_g of calcium?

   (5 ½ marks)

8. (a) Define the following:
   (i) reversible reaction
   (ii) rate of a chemical reaction
   (iii) a catalyst

   (3 marks)

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(b) Bahati attempted to prepare hydrogen gas by reacting zinc metal with sulphuric acid. In this experiment zinc metal of about 0.5 cm diameter and 0.20 moles of the acid were used. The rate of formation of hydrogen gas was found to be slow.
Explain three ways in which the rate of formation of hydrogen could be increased.

<div align="right">(6 marks)</div>

(c) From the experiment described in (b) above, if Bahati wanted $36dm^3$ of hydrogen at s.t.p., what amount of zinc metal would be required if 0.2 moles of the acid were used.

(The equation for the reaction is $Zn_{(s)} + H_2SO_{4(aq)} \rightarrow ZnSO_{4(aq)} + H_{2(g)}$)

<div align="right">(6 marks)</div>

9. Study the following table carefully.

ELEMENT	ATOMIC NUMBER
P	1
Q	8
R	11
S	17
T	12

(a) Write the electronic configuration of each of the elements in the table above.

<div align="right">(5 marks)</div>

(b) What is the valency of each of elements P, Q, R and T?

<div align="right">(4 marks)</div>

(c) Write well balanced chemical equations and name the type of bonds found in the compounds formed when each of the following elements react.
(i) Q and R
(ii) P and T
(iii) P and Q
(iv) T and Q

<div align="right">(6 marks)</div>

10. (a) Give the meaning of the following terms.
(i) Saturated solution
(ii) Hygroscopic substance
(iii) Solubility of a solute

<div align="right">(6 marks)</div>

(b) You are provided with a graph of solubility vs temperature for sodium chloride (NaCl) and potassium chlorate ($KClO_3$) as shown below:

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The graph of solubility VS Temperature

Solubility (g of solute per 100g of water)

Temperature (°C)

KClO₃

NaCl

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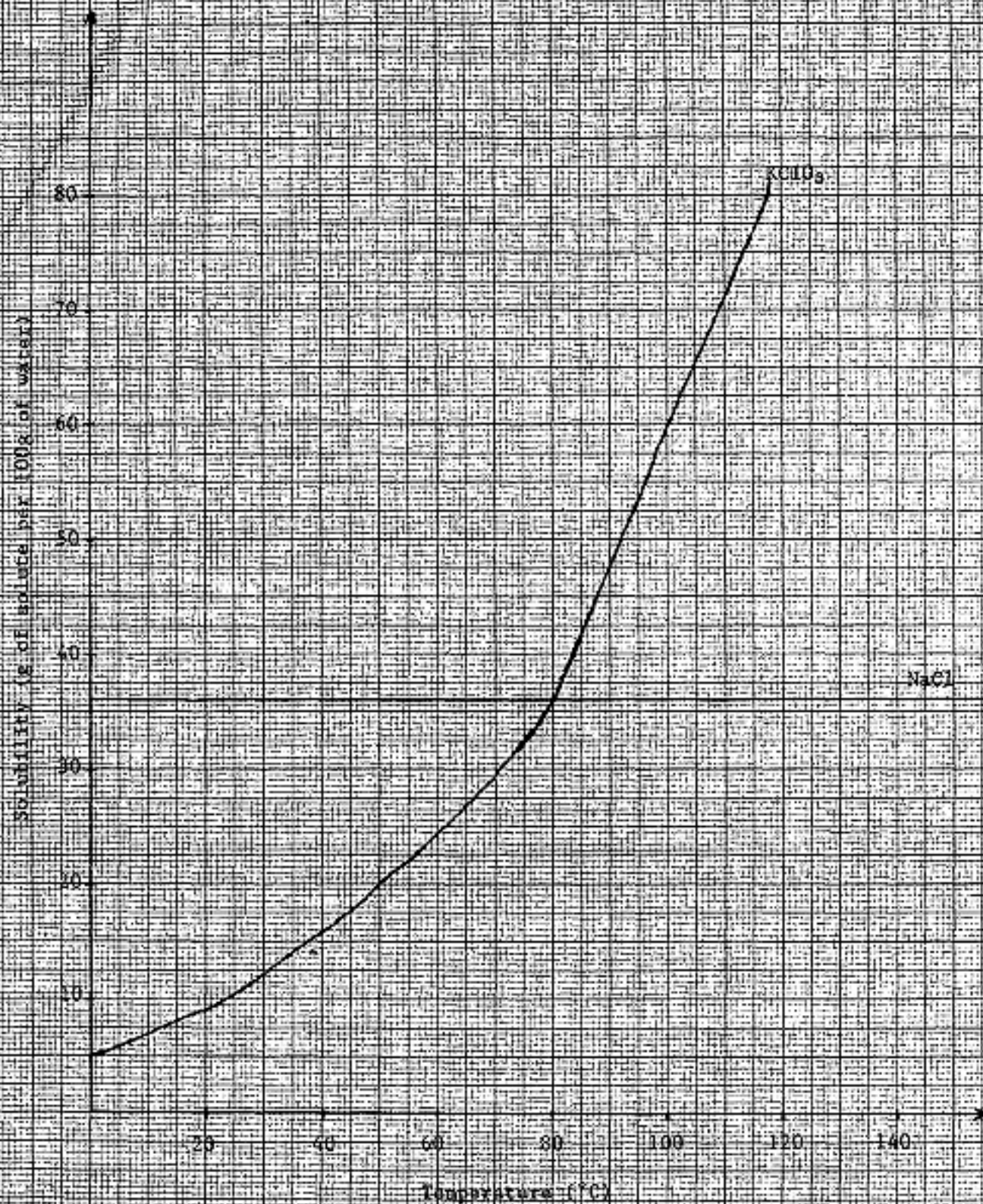
(i) At what temperature are sodium chloride (NaCl) and potassium chlorate (KClO$_3$) equally soluble in water?

(ii) Which compound becomes more soluble in water as temperature increases?

(iii) What is the maximum amount of potassium chlorate which can be dissolved in 100g of water at 70°C?

(iv) At what temperature would 10g of potassium chlorate be dissolved in water?

<div align="right">(9 marks)</div>