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   **Thursday, 05th October 2015 p.m.**

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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:
        H = 1,   Li = 7,   C = 12,   O = 16,   Na = 23,   Al = 26,   Cl = 35.5,   K = 39,   Cu = 63.5
        Avogadro's number = 6.02 x 10^{23}.
        GMV at s.t.p. = 22.4 dm^3.
        1 faraday = 96,500 coulombs.
        Standard pressure = 760 mm Hg.
        Standard temperature = 273 K.
        1 litre = 1 dm^3 = 1000 cm^3.

SECTION A (20 marks)

Answer **all** questions in this section.

1. For each of the items (i) - (x), choose the correct answer among the given alternatives and write its letter beside the item number in the answer booklet provided.

(i)   The mass number of a carbon atom that contains six protons, eight neutrons, and six electrons is

A   6   B   14   C   8
D   12   E   20.

(ii)   How many moles of oxygen are required for the complete combustion of 2.2 g of C_3H_8 to form carbon dioxide and water?

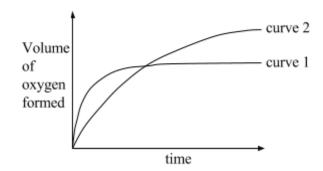A   0.050 moles   B   0.15 moles   C   0.25 moles
D   0.50 moles   E   0.025 moles.

(iii)   In the graph below, curve 1 was obtained from the decomposition of 100 cm³ of 1.0M hydrogen peroxide solution catalysed by manganese (IV) oxide, $2H_2O_2 \rightarrow 2H_2O + O_2$.

Which alteration/change to the original experimental conditions would produce curve 2?
A   Lowering the temperature
B   Using less manganese IV oxide
C   Increasing the temperature
D   Adding some 0.1 M H_2O_2
E   Using a different catalyst.

(iv)   How long must a current of 4.00 A be applied to a solution of $Cu_{(aq)}^{2+}$ to produce 2.0 grams of copper metal?

A 2.4×10^4s   B 1.5×10^3s   C 7.6×10^2s
D 3.8×10^2s   E 12×10^4s.

(v)   Which of the following hydrocarbons does NOT belong to the same homologous series as the others?

A CH_4 B C_3H_8 C C_4H_{10}
D C_6H_{12} E C_2H_{12}.

(vi)   A solution of pH 1.6 is best described as
     A   weak acid   B   strong base   C   weak base
     D   strong acid   E   neutral solution.

(vii)   Which among the following equations correctly shows the reaction between chlorine gas and water?

   A $Cl_{2(g)} + H_2O_{(l)} \rightarrow Cl_{2(g)}$

   B $2Cl_{2(g)} + 2H_2O_{(l)} \rightarrow 4Cl^-_{(aq)} + O_{2(g)} + 2H_{2(g)}$

   C $Cl_{2(g)} + H_2O_{(l)} \rightarrow HCl_{(aq)} + HOCL_{(aq)}$

   D $2Cl_{2(g)} + 2H_2O_{(l)} \rightarrow 2HOCl_{2(aq)} + H_{2(aq)}$

   E $2Cl_{2(g)} + 3H_2O_{(l)} \rightarrow Cl_{2(g)} + 2H_3O^+$.

(viii)   Hygroscopic and deliquescent substances can be used as
     A   oxidising agents   B   drying agents   C   reducing agents
     D   weak electrolytes   E   catalyst.

(ix)   Which among the following pair of substances are allotropes?
     A H_2O and H_2O_2 B ^{12}C and ^{14}C C P_4 and P_8
     D H_2 and $2H^+$ E H^+ and H_3O.

(x)   Water can be obtained from a solution of common salt by
     A   evaporation   B   simple distillation   C   filtration
     D   condensation   E   fractional distillation.

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.

LIST A	LIST B
(i) Its hydroxide is used in soil treatment.	A Barium
(ii) It is obtained from its ore in the blast furnace.	B Lithium
(iii) It gives a lilac colour when placed in a non-luminous flame.	C Iron
(iv) It forms an insoluble sulphate.	D Potassium
(v) It is in the same group in the periodic table with nitrogen.	E Oxygen
(vi) It reacts with hydrogen to form a compound which is a liquid at room temperature.	F Fluorine
	G Sulphur
(vii) It is used in filament lamps.	H Argon
(viii) It is the strongest oxidizing agent among the halogens.	I Phosphorus
(ix) It exists in three main forms.	J Sodium
(x) Its chloride is added to food in order to give taste.	K Magnesium
	L Carbon
	M Neon
	N Silicon
	O Calcium

SECTION B (54 marks)

Answer **all** questions in this section.

3. (a) (i) State two conditions required for iron to rust.
        (ii) List two methods which are used to prevent rusting of iron.

    (b) State three properties that make aluminium useful in overhead cables.

4. (a) Give three examples in each of the following:
        (i) Solid fuel
        (ii) Gaseous fuel.

    (b) The reaction which produces methanol from carbon monoxide and hydrogen is represented by the equation $CO_{(g)} + 2H_{2(g)} \rightleftharpoons CH_3OH_{(g)}$ $\Delta H = -94kJmol^{-1}$. The reaction is carried out at high pressure to give a good yield of methanol.
        (i) Explain why increase in pressure gives a better yield of methanol.
        (ii) The value of ΔH is negative. What does this tell about the reaction?
        (iii) With a reason, state whether a high temperature or low temperature will give a better yield of methanol.

5. (a) (i) Explain, in terms of electronic configurations, why sodium and potassium elements have similar chemical properties.
        (ii) State the trend in reactivity of group I elements in the Periodic Table and give reasons for it.

    (b) Use the knowledge of periodic Table to complete Table 1.
        Table 1

S/n	Name of element	Atomic number	Electronic configuration
(i)	Lithium		
(ii)		13	
(iii)			2.8.7

6. (a) Table 2 indicates the pH values of soil for some crops to grow.
        Table 2

Crops	Soil pH
Tomato	7.0
Bean	6.0
Cabbage	5.4
Cauliflower	5.6
Celery	6.3
Lettuce	6.1
Onions	5.7
Swede	5.3
Parsley	5.1

Which crop grows best in the:
- (i) Most acidic soil?
- (ii) Least acidic soil?
- (iii) Neutral soil?

(b) Suggest one best method for separating each of the following mixtures:
- (i) Common salt and water
- (ii) Iodine and sand.
- (iii) Pieces of iron and sand.

7. (a) Briefly explain what will happen when
- (i) concentrated sulphuric acid is exposed to the atmosphere?
- (ii) iron (II) sulphate is exposed to air for a long time?
- (iii) a bottle containing $AgNO_3$ is left open?

(b) Give three applications of the process of neutralization in daily life.

8. (a) Give the names or formula of the two chemicals that would be used in the laboratory to make each of the following gases. State a simple test that could be used to identify each gas.
- (i) Oxygen.
- (ii) Hydrogen.
- (iii) Carbon dioxide.

(b) Suggest a suitable indicator for the following titrations:
- (i) Hydrochloric acid against ammonia solution.
- (ii) Sulphuric acid against sodium hydroxide solution.
- (iii) Ethanoic acid against potassium hydroxide solution.

9. (a)
- (i) What type of a chemical bond is found between fluorine atoms in a fluorine molecule?
- (ii) Name other type(s) of chemical bond formed by fluorine with other elements. Give an example of a compound in which fluorine form this type of bond.

(b) Compound X contains 24.24% carbon, 4.04% hydrogen and 71.72% chlorine. Given that, the vapour density of X is 49.5.
- (i) Calculate the molecular formula of the compound X.
- (ii) Draw and name the displayed/open structure formula of the possible isomer(s) from the molecular formula determined.

10. (a) A student tested four samples of water, each 5 cm³ from different areas of Kahama district by shaking with 3 drops of soap solution. The experiment was repeated by boiling each sample of water (5 cm³) with 3 drops of soap solution. The observations were recorded in Table 3.

Table 3

Sample	Observation with soap solution	Observation for boiled sample with soap solution
A	No later	Lather
B	Lather	Lather
C	Lather	Lather
D	No lather	No lather

  (i) Which samples contain hard water?
  (ii) Which sample contains temporary hard water? Give a reason.

 (b) Protons neutrons and electrons particles are located in the atoms; fill in the missing information in Table 4 about these particles.

Table 4

Particles	Relative mass	Relative charge	Location
Proton			
Electron	$\frac{1}{1840}$		
Neutron		0	In the nucleus

11. (a) A steady current of 2A was passed through a solution containing ions of a metal (X^{2+}) for nine minutes. The mass of metal X that was liberated were 0.3552 g. Calculate the molar mass of metal X.

 (b) Name the following compounds according to the IUPAC system.

  (i) C_5H_{12}.

  (ii) $CH_3CH_2 - \overset{\displaystyle CH_3}{\underset{\displaystyle CH_3}{C}} - CH_2OH$.

  (iii) $CH_3 - \overset{\displaystyle CH_3}{\underset{\displaystyle H}{C}} - CH_2OOH$.

SECTION C (26 marks)

Answer **all** questions from this section.

12. Describe the extraction of iron from the haematite ore and write all the chemical equations for the reactions involved in each stage of extraction.

13. Addition of inorganic fertilizers in the farm is not as important as addition of organic manure. Discuss the correctness of this statement in four points.