PERAMIHO GIRLS' SECONDARY SCHOOL

FORM THREE FITNESS TEST – SERIES 3

032 CHEMISTRY

Time: 2:30 Hours August, 2024

Instructions

1. This paper consists of sections **A**, **B** and **C** with a total of **eleven (11)** questions.
2. Answer **all** questions from sections **A** and **B** and **two** questions from section **C**.
3. Non-programmable calculators are allowed in the examination room.
4. For your calculations, show clearly the manipulation of units.
5. The following constants may be used;
   - Avogadro's constant, $N_A = 6.022 \times 10^{23}$ mol^{-1}
   - 1 L = 1 dm^3 = 1000 cm^3
   - GMV = 22.4 dm^3/mol or 22400 cm^3/mol
   - Density of water, ρ_w = 1000 kg/m^3
   - Atomic masses: N = 14, O = 16, Na = 23, Mg = 24, S = 32, Cl = 35.5, K = 39

SECTION A: (16 Marks)

Answer **all** questions in this section

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

(i) A sample of a solid compound **X** was strongly heated in a test tube; no observable changes were noted during heating. When dilute nitric acid was added to a sample of solid compound **X** some effervescence was observed. The gas produced form a white precipitate with lime water. Compound **X** is likely to be;
A. Zinc nitrate B. Copper(II) carbonate
C. Potassium carbonate D. Magnesium chloride

(ii) Why a burning splint burns more vigorously in pure oxygen than in air?
A. Oxygen is a catalyst for combustion
B. Oxygen is a product of combustion
C. The concentration of oxygen is higher in pure oxygen than air
D. The low concentration of oxygen in pure oxygen catalyzes combustion.

(iii) Which gas is produced when dilute nitric acid reacts with magnesium metal;
A. Nitrogen B. Hydrogen C. Oxygen D. Nitrogen dioxide

(iv) What name is given to the force of attraction that holds atoms together to form a molecule? A. Chemical change B. Chemical bond C. Friction D. Centripetal force

(v) The following atoms cannot exist freely as a single atom except;
A. Sodium B. Chloride C. Argon D. Magnesium

(vi) Sea water contains various salts. Which salts is present in the greatest proportion?
A. Magnesium chloride B. Calcium chloride
C. Magnesium sulphate D. Sodium chloride

(vii) A lab. Technician wanted to transfer some chemical from the wincher bottle to small bottlers for her students to do an experiment. The smaller bottles are called
A. Storing bottles B. Wash bottles C. Reagent bottles D. Chemical bottles

(viii) If you want the Bunsen burner to have the same flame colour as the candle flame, you must.
A. Have air hole completely opened B. Turn on a large supply of gas
C. Have air hole completely closed D. Have completely removed the barrel

(ix) What factor enable powdered marble chips to react fast with dilute hydrochloric acid? A. Temperature B. Surface area C. Catalyst D. Pressure and volume.

(x) To produce the greatest amount of hydrogen in short time, one would react,
A. 1g of magnesium ribbon with 10 cm^3 of 0.5 M H_2SO_4
B. 1g of magnesium ribbon with 40 cm^3 of 0.5 M H_2SO_4
C. 1g of magnesium powder with 40 cm^3 0.5 M H_2SO_4
D. 1g of magnesium powder with 20 cm^3 of 1.0 M H_2SO_4

2. Match the solutions in **List A** with their corresponding **pH** values in **List B** by writing the letter of the most correct response beside the item number in the answer sheet(s) provided.

List A	**List B**
(i) Strong acid	**A.** 7.0
(ii) Strong alkali	**B.** 8.20
(iii) Neutral solution	**C.** 2.10
(iv) Weak acid	**D.** 14.0
(v) Weak alkali	**E.** 5.30
(vi) Very strong alkali	**F.** 10.40
	G. 11.10
	H. 1.10

SECTION B: (54 Marks)

Answer **all** questions in this section

3. Lack of safe and clean water for industrial and domestic purposes is a serious problem in most urban and rural areas in Tanzania. One of the major causes of this is the pollution of sources of water due to the addition of soluble compounds of calcium and magnesium which cause hardness in water.
(a) Explain three methods that could make such water useful
(b) Give three economic disadvantages of using such water domestically and industrially.
(c) State three advantages of using such water. **(09 marks)**

4. (a) State Le Chatelier's principle. **(01 mark)**

(b) When a reaction is said to be at equilibrium? Explain **(02 marks)**

(c) In the industrial preparation of Sulphur trioxide equilibrium is established between sulphur dioxide and oxygen gas as follows;

$$2SO_2(g) + O_2(g) \rightleftharpoons 2SO_3(g) \quad \Delta H = -94.9 \text{ kJ/mol}$$

(i) How would you adjust temperature and pressure to maximize the proportion of the product at equilibrium? **(02 marks)**

(ii) Why is it unfavorable to work with very high pressure and very low temperature in contact process? **(02 marks)**

(iii) What catalyst is used to speed up the rate of formation of sulphur trioxide before attaining equilibrium? **(02 marks)**

5. (a) **M** is a metal above hydrogen in the reactivity series and its oxides has the formula **M_2O**. This oxide when dissolved in water forms the corresponding hydroxide which is good conductor of electricity.

(i) What kind of bond exists between **M** and **O**? **(01 mark)**

(ii) How many electrons are there in the outermost shell of **M**. **(02 marks)**

(iii) Name the group to which **M** belongs. **(02 marks)**

(b) Give reasons for the following facts;

(i) A cation is smaller than the atom from which is formed. **(02 marks)**

(ii) Anion carries negative charge. **(02 marks)**

6. (a) Briefly explain why Neon does not react with sodium. **(03 marks)**

(b) Laboratory technician allowed sodium thiosulphate solution to react with dilute hydrochloric acid. The reaction produced milky solution.

(i) Write a balanced chemical equation for the reaction occurred. **(02 marks)**

(ii) Give the name of the milky precipitates. **(02 marks)**

(iii) Provide a net ionic equation for the reaction in b (i) above and sate the spectator ions. **(02 marks)**

7. (a) Fatuma placed a large crystal of potassium permanganate in the bottom of a beaker of cold water and left it for several hours.

(i) Explain what she observed after five minutes. Explain **(01 mark)**

(ii) Describe what she observed after several hours. Explain **(01 mark)**

(iii) Name the two processes which have taken place. **(02 marks)**

(iv) From that experiment give two conclusions about matter. **(02 marks)**

(b) Calculate the degree of saturation of 50 g potassium nitrate salt in 250 cm^3 of water at room temperature, given that the density of water is 1 g/cm^3. **(03 marks)**

8. (a) (i) What is the energy value of a fuel? **(01 mark)**

(ii) Give four (4) factors that determine the choice of a good fuel. **(04 marks)**

(b) In an experiment to determine the heat value of ethanol, the heat produced by an ethanol burner was used to heat 200 cm^3 of water. The following results were obtained:

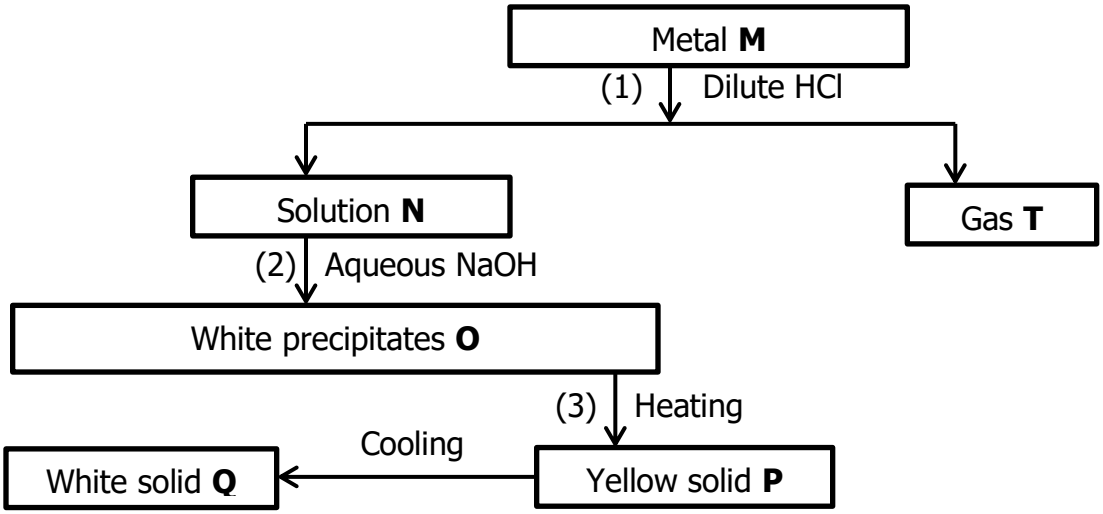
- Mass of lamp = 56.69 g
- Mass of lamp + ethanol = 59.46 g
- Initial temperature of water = 25.4 ºC
- Final temperature of water = 31.2 ºC
- Specific heat capacity of water, C = 4.18 kJ/kg/ K

Assuming there was no heat loss; calculate the heat value of ethanol. **(04 marks)**

SECTION C: (30 Marks)

Answer **two (2)** questions in this section

9. The following chart show reactions of compound of metal M. Study it carefully and answer the questions that follow:



(a) Give the name and symbol or formula of
(i) Compounds **M**, **P** and **Q** (ii) Substances **N**, **O** and **T** **(06 marks)**

(b) Write an equation of for each of the reactions which take place in step (1), (2) and (3) **(06 marks)**

(c) Give any three (3) differences between sodium carbonate and sodium bicarbonate. **(03 marks)**

10. (a) What volume of 10 M HCl and 3 M HCl should be mixed to obtain 2000 cm^3 of 6 M HCl solution? **(03 marks)**

(b) Calculate the molarity of 10 % (w/v) of sodium hydroxide solution. **(03 marks)**

(c) 2 g sample of ammonia is mixed with 4 g of oxygen according to the reaction below:

$$4NH_3(g) + 5O_2(g) \longrightarrow 4NO(g) + 6H_2O(l)$$

(i) Which is the limiting reactant? **(03 marks)**

(ii) How much excess reactant remains after the reaction has stopped? **(03 marks)**

(iii) Calculate the mass of nitrogen monoxide gas (NO) produced. **(03 marks)**

11. Explain six (6) applications of volumetric analysis in your daily life activities and chemical production industries. **(15 marks)**