



**JARAMOGI OGINGA ODONGA UNIVERSITY OF SCIENCE AND TECHNOLOGY**  
**SCHOOL OF PHYSICAL, BIOLOGICAL, MATHEMATICS AND ACTUARIAL SCIENCE**  
**UNIVERSITY EXAMINATION FOR THE DEGREE OF BACHELOR OF SCIENCE**  
**(COMMUNITY HEALTH)**  
**1<sup>ST</sup> YEAR, 1<sup>ST</sup> SEMESTER**  
**ACADEMIC YEAR 2022**  
**MAIN REGULAR**

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**COURSE CODE: HPD 1107**

**COURSE TITLE: APPLIED CHEMISTRY**

**EXAM VENUE:**

**DATE:**

**TIME:**

**EXAM SESSION:**

**STREAM:**

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**INSTRUCTIONS:**

- 1. Answer question 1 (Compulsory) in section A and ANY other 2 questions in Section B.**
- 2. Candidates are advised not to write on the question paper.**
- 3. Candidates must hand in their answer booklets to the invigilator while in the examination room.**

**Useful data**

Molar mass of N = 14 g/mol

Molar mass of O = 16 g/mol

Molar mass Al = 27 g/mol

Molar mass of Na = 23 g/mol

Molar mass H = 1.01 g/mol

Molar mass of Cl = 35.5 g/mol

Molar mass of C = 12 g/mol

**SECTION A**  
**Question 1 (30 Marks)**

- a) Define the following terms;
- i. Buffer solution
  - ii. Chemical bonding
  - iii. Stoichiometry
  - iv. Neutrons [8 marks]
- b) Balance the following chemical equations.
- i.  $\text{SO}_2 + \text{O}_2 \rightarrow \text{SO}_3$
  - ii.  $\text{C}_2\text{H}_6 + \text{O}_2 \rightarrow \text{CO}_2 + \text{H}_2\text{O}$  [4 marks]
- c) In a given laboratory sample we have 24.5 g of hydrogen gas reacting with oxygen gas, determine the number of moles of water formed. [3 marks]
- d) Balance the following redox reaction; [6 marks]
- $$\text{ClO}_3^- + \text{SO}_2 \rightarrow \text{SO}_4^{2-} + \text{Cl}^-$$
- e) A gas with a volume of 4 litres at a pressure of 205 torr is allowed to expand to a volume of 14 litres. What is the pressure in the container if the temperature remains constant? [3 marks]
- f)  $\text{HCl (aq)} + \text{Al}_2 \text{ (s)} \rightarrow \text{AlCl}_3 \text{ (aq)} + \text{H}_2 \text{ (g)}$   
If 20 g of HCl and 13.5 g of Al are put into a reaction vessel.
- i. What is the yield of  $\text{AlCl}_3$  produced by this reaction? [3 marks]
  - ii. Which reagent is in excess and by how many moles? [3 marks]

**SECTION B**  
**Question 2 (20 Marks)**

- a) Industrially, ammonia is manufactured by the reaction  $\text{H}_2 \text{ (g)} + \text{N}_2 \text{ (g)} \rightleftharpoons \text{NH}_3 \text{ (g)}$ . Find the moles of  $\text{NH}_3$  produced if 0.018 g of  $\text{H}_2$  was consumed. [3 marks]
- b) Briefly define the following as in the periodic table;
- i. Family having elements with 7 electrons in the outermost shell
  - ii. The group of elements having zero valency [2 marks]
- c) Briefly differentiate between metathesis and decomposition reactions and provide examples in each case. [4 marks]
- d) Distinguish between;
- i) Molarity and molality
  - ii) Oxidation and Oxidation number [4 marks]

- e) Briefly describe the following as used in the periodic table.
- i. Alkaline earth metals [2 marks]
  - ii. Metalloids [2 marks]
- f) A sample of Carbon dioxide in a pump has a volume of 21.5 mL and it is at 50 °C. When the amount of gas and pressure remain constant, find the new volume of Carbon dioxide in the pump if the temperature is increased to 75 °C. [3 marks]

### Question 3 (20 Marks)

- a) Propanol burns in air to form carbon dioxide and water as shown in the following chemical equation;  $C_3H_8(g) + O_2(s) \rightarrow CO_2(aq) + H_2O(g)$   
Balance the equation and determine the mass of water produced in this reaction if the mass of oxygen used was 3.6 g. [4 marks]
- b) Name the following with reference to the elements of Modern Periodic Table.
- i) The number of electron shells in elements of period 2. [2 marks]
  - ii) The group of elements having four valence electrons. [2 marks]
- c) The volume of a sample of chlorine gas at a temperature of 200 °C and 15 atm was 350 mL. Calculate the temperature at which the volume of the gas would be 250 mL at 15 atm? [3 marks]
- d) Discuss any **THREE** factors affecting the rate of dissolution of solutes. [6 marks]
- e) A researcher was using 7 g of nitrogen gas at 27 °C and 750 mmHg pressure for his work. Determine the volume of the gas used. [3 marks]

### Question 4 (20 Marks)

- a) Distinguish between a completely immiscible liquid and a partially immiscible liquid. Give an example in each case. [4 marks]
- b) In gaseous state, there are parameters that define the state of a gas. Briefly state them. [2 marks]
- c) It requires 50 seconds for 2.5 L of unknown gas to effuse through a porous wall and it takes 84 seconds for the same volume of N<sub>2</sub> gas to effuse at the same temperature and pressure. What is the molar mass of the unknown gas? [3 marks]
- d) Determine the oxidation of the following underlined elements;
- i. Fe<sub>2</sub>O<sub>3</sub> [2 marks]
  - ii. OF<sub>2</sub> [2 marks]

- e) Determine the mole fraction of hydrochloric acid and sodium hydroxide for a solution containing 80 g of HCl dissolved in 60 g of NaOH? [3 marks]
- f) Briefly show an ideal gas equation is derived from basic gas principles. [4 marks]

**Question 5 (20 marks)**

- a) Distinguish between;  
i) Charles law and Boyles law  
ii) Equation of state and chemical equation [4 marks]
- b) Using equations, distinguish between Graham's law of effusion and Graham's law of diffusion? [3 marks]
- c) Briefly describe the **FOUR** colligative properties of solutions. [6 marks]
- d) A dextrose (also called D-glucose,  $C_6H_{12}O_6$ ) solution with a mass of  $2.0 \times 10^2$  g has 15.8 g of dextrose dissolved in it.  
i. What is the moles of dextrose? [2 marks]  
ii. What is the mass percent of dextrose in the solution? [2 marks]
- e) Briefly define an ideal solution. [3 marks]