



**JARAMOGI OGINGA ODINGA UNIVERSITY OF SCIENCE AND TECHNOLOGY**  
**SCHOOL OF BIOLOGICAL, PHYSICAL, MATHEMATICS & ACTUARIAL**  
**SCIENCES**

**UNIVERSITY EXAMINATION FOR THE DEGREE OF BACHELOR OF**  
**EDUCATION (SCIENCE)**

**1<sup>ST</sup> YEAR 1<sup>ST</sup> SEMESTER**

**MAIN CAMPUS**

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**COURSE CODE: SPB 9101**

**COURSE TITLE: BASIC CHEMISTRY I**

**EXAM VENUE: STREAM: (BEd. Science)**

**DATE: EXAM SESSION:**

**TIME: 2:00HRS**

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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**

$R = 0.0821 \text{ L atm. K}^{-1}\text{mol}^{-1}$

Molar mass of  $\text{N}_2 = 28 \text{ g/mol}$

Molar mass of  $\text{O}_2 = 32 \text{ g/mol}$

**INSTRUCTIONS: Answer Question 1 and any other TWO questions**

**QUESTION ONE (30 marks)**

- a) (a) Define the following terms;
- (i) Effusion
  - (ii) Grahams law of diffusion
  - (iii) Boyles law
  - (iv) Saturated solution
  - (v) Colligative property
  - (vi) Ideal gas [12 marks]
- (b) Identify the half equation that undergoes oxidation and reduction in the following; [4 marks]
- $$\text{MnO}_4^- + \text{I}^- \rightarrow \text{Mn}^{2+} + \text{I}_2$$
- (c) Balance the following chemical equations: [2 marks]
- $$\text{C}_2\text{H}_5\text{OH}_{(aq)} + \text{O}_2_{(s)} \rightarrow \text{CO}_2_{(aq)} + \text{H}_2\text{O}$$
- $$\text{Na} + \text{Cl}_2 \rightarrow \text{NaCl} \quad [2 \text{ marks}]$$
- (d) Discuss any **THREE** factors affecting the rate of dissolution of solids. [6 marks]
- (e) Differentiate between;
- i) Chemical and physical property of matter
  - ii) Unsaturated and saturated solution [4 marks]

**QUESTION TWO (20 marks)**

- (a) Derive the expression of density using the ideal gas law. [6 marks]
- (c) 1.0 g of air consists of approximately 0.28 g of nitrogen and 0.72 g of oxygen. Calculate the partial pressures and the total pressure when this sample occupies a 4 L vessel at 20 °C. [7 marks]
- (d) A quantity of gas at 10 °C and 1 atm pressure occupied a volume of 200 cm<sup>3</sup>. What volume will it occupy at -20 °C at constant pressure? [3 marks]
- (e) One mole of an ideal gas occupies 12 litres at -5 °C. What is the pressure of the gas? [4 marks]

**QUESTION THREE (20 marks)**

- (a) The oil produced from eucalyptus leaves has a density of 0.45 g/L at -4 °C at a pressure of 70 Torr. Calculate the molecular mass in g/L of the eucalyptus oil. [5 marks]
- (b) Briefly state the **FOUR** colligative properties. [4 marks]

(d) Hydrogen balloon has a volume of 15 L at a pressure of 1.5 atm. Calculate the volume of the balloon when it rises to a height of 2000 m above the sea level, where the atmospheric pressure is 0.8 atm at the same temperature. [3 marks]

(e) Differentiate between;

i) A voltaic and an electrolytic cell [4 marks]

ii) Cathode and anode [4 marks]

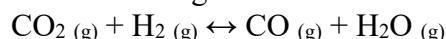
#### QUESTION FOUR (20 marks)

(a) Briefly define an ideal solution. [3 marks]

(b) Briefly show how the ideal gas law can be derived from basic gas laws. [5 marks]

(c) It requires 72 seconds for 1.5 L of an 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? [6 marks]

(d) Consider the following reaction



Calculate the equilibrium constant, K<sub>c</sub> for the above system if 0.8 moles of CO<sub>2</sub>, 0.98 moles of H<sub>2</sub>, 0.92 moles of CO and 0.36 moles of H<sub>2</sub>O were present in a 1.5 L reaction vessel at equilibrium. [6 marks]

#### QUESTION FIVE (20 marks)

a) Discuss any **THREE** factors that affect the position of a chemical equilibrium. [6 marks]

b) Differentiate between combustion and combination reactions [4 marks]

c) Find the volume of 85 g of oxygen at 25 C and 500 Torr. [4 marks]

d) State the **THREE** main applications of the equation of state. [3 marks]

e) Using an example differentiate between a physical and chemical change. [3 marks]