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)

1ST YEAR 1ST SEMESTER

MAIN CAMPUS

COURSE CODE: SPB 9101

COURSE TITLE: BASIC CHEMISTRY I

EXAM VENUE: STREAM: (BEd. Science)

DATE: EXAM SESSION:

TIME: 2:00HRS

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 L atm. $K^{-1}mol^{-1}$

Molar mass of N_2 = 28 g/mol

Molar mass of O_2 = 32 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]

$$MnO_4^- + I^- \rightarrow Mn^{2+} + I_2$$

(c) Balance the following chemical equations:

$C_2H_5OH_{(aq)} + O_{2\,(s)} \rightarrow CO_{2\,(aq)} + H_2O$ [2 marks]

$Na + Cl_2 \rightarrow NaCl$ [2 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^3. 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_2 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

$$CO_{2\,(g)} + H_{2\,(g)} \leftrightarrow CO_{(g)} + H_2O_{(g)}$$

Calculate the equilibrium constant, K_c for the above system if 0.8 moles of CO_2, 0.98 moles of H_2, 0.92 moles of CO and 0.36 moles of H_2O 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]