JARAMOGI OGINGA ODINGA UNIVERSITY OF SCIENCE AND TECHNOLOGY

SCHOOL OF BIOLOGICAL AND PHYSICAL SCIENCES

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

2ND YEAR 1ST SEMESTER

MAIN REGULAR

COURSE CODE: SCH 201

COURSE TITLE: PHYSICAL CHEMISTRY 1

EXAM VENUE: STREAM: (BED SCI)

DATE: **EXAM SESSION:**

TIME: 2:00 HRS

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 K = 39.09 $g.mol^{-1}$
Molar mass N = 14 $g.mol^{-1}$
Molar mass O = 16 $g.mol^{-1}$
Molar mass Cl = 35.5 $g.mol^{-1}$
Molar mass H = 1.01 $g.mol^{-1}$
Molar mass of C = 12 $g.mol^{-1}$
a=6.70 L^2 $atm.mol^{-2}$,
b= 5.6 x 10^{-2} $L.mol^{-1}$
R = 8.314 $J.K^{-1}mol^{-1}$, 1 J = 1 kgm^2s^{-2}).

Answer question ONE and TWO other questions in Section B

SECTION A

QUESTION ONE (Compulsory) (30 marks)

1. (a) Define the following terms;
   (i) Equation of state
   (ii) Mean square speed
   (iii) Closed system
   (iv) Real gas
   (v) Path functions
   (vi) Isothermal reversible expansion [12 marks]

   b) Two moles of an ideal carbon dioxide gas was found to occupy 3.2 litres at -15 °C and a pressure of 18.4 atms. Calculate the pressure that would have been expected from the van der waals equation. Comment on the results. [5 marks]

   c) Deduce Charles law from kinetic gas equation. [5 marks]

   d) Differentiate between average velocity and most probale speed. [4 marks]

   e) Calculate the most probable speed of chlorine gas at 55 Torr and 237 °C. [4 marks]

SECTION B

QUESTION TWO (20 marks)

2.
   a) There are **THREE** thermodynamic systems. Briefly explain. [6 marks]

   b) Distinguish between an adiabatic system and isolated system. [4 marks]

   c) A gas at 10 atm pressure occupies a volume of 10 litres at 300 K. It is allowed to expand at the constant temperature of 300 K under a constant external pressure till the volume equilibrates at 100 litres. Calculate the work done. [4 marks]

   d) Calculate the most probable speed of ethane gas in m/s at 25 °C. [6 marks]

QUESTION THREE (20 marks)

a) State the expression for the van der waals equation. [2 marks]

i) Under which ways does it differ from the ideal gas law. [2 marks]

ii) Under what conditions is it closest to the ideal equation. [2 marks]

b) Using the kinetic theory of gases, derive the Avogadros law [4 marks]

c) State the **FIVE** postulates of the Kinetic theory of gases [10 marks]

QUESTION FOUR (20 marks)

a) One mole of an ideal gas expands isothermally and reversibly from 1 litre to 100 litres at 27°C. Calculate w, q, ΔE, and ΔH for the process. [5 marks]

b) Calculate the density of sulphur dioxide in grams per litre at 70 Torr and 30 °C. [5 marks]

c) Give two definitions of First law of thermodynamics. [2 marks]

d) Differentiate between a reversible and an irreversible system. [4 marks]

e) Using examples differentiate between an intensive and extensive properties. [4 marks]

QUESTION FIVE (20 marks)

a) Using the kinetic theory of gases derive the ideal gas law. [6 marks]

b) Calculate the root mean square velocity of carbon dioxide gas at 78 mmHg and 1000°C. [5 marks]

c) Explain clearly the meaning of the corrective terms for pressure and volume in van der waals equation. [4 marks]

d) State the first law of thermodynamics. Give its mathematical statement and explain each term involved. [5 marks]