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 2019/2020

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) State the following;
   (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]