JARAMOGI OGINGA ODINGA UNIVERSITY OF SCIENCE & TECHNOLOGY UNIVERSITY EXAMINATIONS 2012/2013

2ND YEAR 1ST SEMESTER EXAMINATION OF BACHELOR OF EDUCATION (SCIENCE)

SCHOOL BASED

COURSE CODE: SCH 201

COURSE TITLE: PHYSICAL CHEMISTRY I

DATE: 29 /8/13   **TIME: 2 .00 - 4 .00 PM**

DURATION: 2 HOURS

INSTRUCTIONS

1. This paper contains five (5) questions.

2. Answer question 1 (compulsory) and ANY other TWO questions.

3. Write all answer in the booklet provided.

Physical data constants

Molar gas constant; R = 8.314 $J.K^{-1}.Mol^{-1}$
 R = 0.0821 $Latm.K^{-1}mol^{-1}$
Avogadro constant, N_A = 6.023 X 10^{23} Mol^{-1}
Boltzmann constant, K = 1.381 X 10^{-23} $J.K^{-1}$
Planck constant, h = 6.624 X 10^{-34} $J.s$
 $P_{H2O, 27°C}$ = 25 mmHg
Cp for NH_3 = 33.1 $JK^{-1}Mol^{-1}$.
1 Cal = 4.184 Joules
1 Faraday F = 96500 coulomb
Molar gas volume V = 22.4 dm^3 = 22400 cm^3

SECTION A: ANSWER **ALL** QUESTIONS

Question1 (30 MARKS)

a) Distinguish between the following terms: (4 marks)
   (i) Isobaric and isochoric process   .
   (ii) Reversible and irreversible work
b) Write brief notes on the following: (4 marks)
   (i) Collision frequency
   (ii) Distribution of molecular velocities
c) State and explain any two postulates of the Kinetic theory.   (4 marks)
d) Discuss the principles underlying thermometric titration.   (4 marks)
e) Briefly discuss the three branches of thermodynamics.   (3 marks)
f) State the Zeroth Law of thermometry.   (2 marks)
g) The following table represents bond enthalpy terms (average bond enthalpies)
   at 298 K, in kJ mol^{-1}.

Bond	Enthalpy (Kj mol^{-1})
H-H	436
C-H	412
C-C	348
C=C	612

Use this table to answer the following questions:

i) Give the name to the enthalpy change accompanying the process shown below;

$$2H_2(g) + C(s) \longrightarrow CH_4(g)$$

(1 mark)

(ii) Calculate the enthalpy change for the process above   (4 marks)

h) Distinguish the following terms: (4 marks)
   (i)   Isolated and Open system.
   (ii) Mean square velocity and root mean square velocity.

SECTION B (40 MARKS): ANSWER ANY TWO QUESTIONS FROM THIS SECTION-EACH QUESTION CARRIES 20 MARKS

Question 2 (20 MARKS)

a) (i) State the first Law of thermodynamics: (1 mark)
    (ii) Give the differential and integral forms of the Law in 2 (a) (i) above.   (3 marks)

b) Calculate the root mean square velocity of one mole of nitrogen gas at 298 K.   (5 marks)

c) Sketch the distribution of molecular velocities of nitrogen gas at two temperatures;
    273 K and 298 K.   (4 marks)

d) (i) State **TWO** applications of Hess's Law.   (2 marks)
    (ii) Distinguish between enthalpy of formation and enthalpy of neutralization. (2 marks)

e) Explain the difference between Berthelot's and Dieterici equations.   (3 marks)

Question 3 (20 MARKS)

a) (i) Describe the dual nature of matter.   (2 marks)
    (ii) Explain the difference between an ideal and real gas.   (2 marks)

b) Explain each of the following terms as applied in thermodynamics: (4 marks)
    (i)   System   (ii) Surrounding
    (iii) Adiabatic system   (iv) Diathermic system

c) Derive the fundamental kinetic equation from first priciples.   (5 marks)

d) One mole of an ideal gas occupies 12 litres at 25°C. What is the pressure
    of the gas?   (4 marks)

e) Distinguish between an isotherm and an isobar.   (3 marks)

Question 4 (20 MARKS)

a) 2 moles of CO_2 occupies a volume of 2.64 litres at 48°C and a pressure of 18.40 atm.
    Using the;
    (i)   Ideal gas equation and
    (ii) Van der Waal's equation (a = 3.6; b= 0.0428 for CO_2). Calculate the pressure.
          Compare and comment on the results.   (4 marks)

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b) Explain each of the following terms: (4 marks)
   (i) Work (ii) Heat
   (iii) Internal energy (iv) Enthalpy
c) (i) What is the significance of the Maxwell-Boltzmann distribution Law? (2 marks)
   (ii) Give any **FOUR** terms of the Law above. (2 marks)
d) Briefly describe an experiment you would carry out to investigate Boyles Law. (4 marks)
   (4 marks)
e) 10 moles of Nitrogen gas at 300 K expands adiabatically and reversibly from a
   volume of 20 cm^3 to 50 cm^3. Calculate work done. (4 marks)

Question 5 (20 MARKS)

a) Outline the clear-cut distinction between matter in gaseous, liquid and solid states. (6 marks)
b) Write brief notes on any two generalities in thermodynamics. (4 marks)
c) Derive the fundamental Kinetic equation from the first principles. (6 marks)
d) Explain each of the following: (2 marks)
   (i) Elastic collision
   (ii) Equation of state
e) Give any **TWO** limitations of the first Law of thermodynamics. (2 marks)

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