



JARAMOGI OGINGA ODINGA UNIVERSITY OF SCIENCE AND
TECHNOLOGY

UNIVERSITY EXAMINATION 2012/2013

1ST YEAR 1ST SEMESTER EXAMINATION FOR THE DEGREE OF BACHELOR OF
SCIENCE EDUCATION WITH IT, BIOLOGICAL SCIENCES,
PUBLIC HEALTH AND COMMUNITY DEVELOPMENT
(REGULAR)

COURSE CODE: SCH 101/3111

TITLE: BASIC PHYSICAL CHEMISTRY

DATE: 23/4/2013

TIME: 9.00-11.00AM

DURATION: 2 HOURS

INSTRUCTIONS

1. Answer ALL questions in Section A
2. Answer ANY two Questions from Section B
3. Use illustrations where possible

Useful information

1 Faraday = 96500 coulombs

Volume of molar mass of gas at s.t.p = $22.4 \text{ dm}^3 = 22400 \text{ cm}^3$

Gas constant = $0.082 \text{ L atm K}^{-1} \text{ mol}^{-1} = 8.314 \text{ J K}^{-1} \text{ mol}^{-1}$

QUESTION 1

- (a) With reference to any **FIVE** schools of thought, define the term 'Physical Chemistry.' (5 marks)
- (b) Distinguish between each of the following pairs of terms: (6 marks)
- Isobar and Isotherm
 - Gas and reaction stoichiometry
 - Spontaneous and non-spontaneous reaction
 - Velocity constant and rate equation
- (c) Give any **FIVE** postulates of the Kinetic theory. (2½ marks)
- (d) 707 cm³ of an unknown gas diffuses through a porous plug within the same time as it takes 250 cm³ of oxygen to diffuse under the same conditions of pressure and temperature. Calculate the relative molecular mass of the unknown gas. (Hint; RMM of O₂ = 32). (4 marks)
- (e) Briefly discuss any **FIVE** factors that can affect the rate of a chemical reaction (10 marks)
- (f)

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

QUESTION 2

- (a) Derive the ideal gas law. (4 marks)
- (b) The density of a gaseous compound was found to be 1.23g L⁻¹ at 330k and 150Torr. What is the molar mass of the compound? (6 marks)
- (c) State Dalton's law of partial pressures. (2 marks)
- (d) The rate of decomposition of azomethane was studied by monitoring the partial pressure of the reactant as a function of time. The data obtained at 300°C are given below:

Time (s)	Partial pressure of azomethane (mmHg)
1	284
100	220
150	193
200	170
250	150

Determine the rate constant for this reaction and verify whether the reaction is of order 1. (8 marks)

QUESTION 3

- (a) Consider the reaction



A vessel contains NO_{2(g)}, N_{2(g)} and O_{2(g)} at equilibrium. Explain briefly how each of the following stresses will affect the equilibrium position.

- O_{2(g)} is added (2marks)
- NO_{2(g)} is added (2marks)
- N_{2(g)} is removed (2marks)
- The volume is halved (2marks)

(vi) The temperature is increased (2marks)

(b) The molar conductivity of 0.100 M KCl (aq) at 298 K is $129 \text{ Scm}^2\text{Mol}^{-1}$. The measured resistance in a conductivity cell was 28.44 Ω . The resistance was 31.60 Ω when the same cell contained 0.0500 M NaOH (aq). Calculate the molar conductivity of NaOH (aq) at that concentration. (10marks)

QUESTION 4

(a) Define the following terms: (10 marks)

- (i) Equilibrium constant
- (ii) Colligative properties
- (iii) Order of a reaction
- (iv) Molar conductivity
- (v) Molecularity

(b) Explain each of the following statements:

- (i) Gases are more compressible than liquids.
- (ii) Liquids diffuse very slowly.
- (iii) If a catalyst did affect K_c/K_p , it would defy the law of conservation of energy. (3 marks)

(c) What is a redox reaction? Explain using an example. (3 marks)

(d) The lowering of vapour pressure of a solution of 108.2 g of a substance X in 1 Kg of water at 20°C is 24.79 Nm^{-2} . The vapour pressure of water at this same temperature is 2.338 kNm^{-2} . Calculate the RMM of X. (4 marks)

QUESTION 5

a) 5 moles of ethanol, 6 moles of ethanoic acid, 6 moles of ethylacetate and 4 moles of water were mixed together in a stoppered bottle at 15°C . After equilibrium was attained, the bottle was found to contain only 4 moles of the acid.

- (i) Write the chemical equation for the reaction. (2marks)
- (ii) Give the expression for the equilibrium constant for the reaction. (2 marks)
- (iii) How many moles of ethanol, ethylacetate and water were present in the equilibrium mixture? Explain your answer. (2 marks)
- (iv) If 1 mole of ethylacetate was added after the equilibrium was established, what would happen? (2 marks)
- (v) Explain the term “dynamic equilibrium”. (2 marks)

b) Two flasks of equal volumes are connected by a narrow tube of negligible volume. Initially, both flasks are 27°C and contain 0.70 moles of H_2 gas, the pressure being 0.50 atm. One of the flasks is then immersed in a hot oil bath at 127°C while the other is kept at 27°C . Calculate the final pressure and the moles of H_2 in each flask. (10 marks)

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