



JARAMOGI OGINGA ODINGA UNIVERSITY OF SCIENCE AND TECHNOLOGY

UNIVERSITY EXAMINATIONS 2012/2013

**1ST YEAR 1ST SEMESTER EXAMINATIONS FOR THE DEGREE OF BACHELOR OF
SCIENCE IN COMMUNITY HEALTH AND DEVELOPMENT & BACHELOR OF SCIENCE
IN PUBLIC HEALTH**

(KISUMU LEARNING CENTRE)

COURSE CODE: SCH 3111

COURSE TITLE: BASIC PHYSICAL CHEMISTRY

DATE: 18/4/2013 TIME: 11.00-13.00PM

DURATION: 2 HOURS

INSTRUCTIONS

1. This paper contains TWO sections.
2. Answer ALL questions in section A (Compulsory) and ANY other Two questions in section B.
3. Write all answers in the booklet provided.

Useful information

1 Faraday = 96500 coulomb

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

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

SECTION A: ANSWER ALL QUESTIONS (30 MARKS)

QUESTION 1

- a) Explain the following terms; (10 marks)
- i) Reversible reactions
 - ii) Chemical equilibrium
 - iii) Stoichiometry
 - iv) Conductivity
 - v) Ideal gas
- b) State the **FIVE** postulates of the Kinetic Theory from which gas laws are derived. (2½ marks)
- c) Briefly discuss how the following factors influence the rate of a chemical reaction;
- i) Temperature (5 marks)
 - ii) Catalysis (5 marks)
- d) Distinguish between a voltaic and a galvanic cell. (3 marks)
- e) i) State the Le Chatelier's principle. (1½ marks)
- ii) 1 mole of hydrogen iodide is allowed to dissociate in a 1.0 dm^{-3} vessel at 440°C . After equilibrium was established, only 0.78 moles was found. What is the equilibrium constant for this reaction at this temperature? (3 marks)

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

QUESTION 2

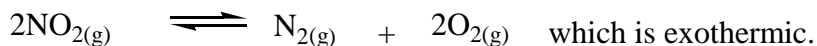
- a) Define the following terms; (10 marks)
- i) Order of a reaction
 - ii) Real gas
 - iii) Half-life of a reaction
 - iv) Resistivity
 - v) Synthesis reactions
- b) Distinguish between the following pairs of terms; (6 marks)

- (i) Rate constant and velocity constant
- (ii) Rate determining step and molecularity
- (iii) Spontaneous and non-spontaneous reaction
- (iv) Endothermic and exothermic reactions

b) Give a sketch of the electrochemical cell you would use in the laboratory to study the redox process between solutions of copper sulphate and zinc sulphate. (4 marks)

QUESTION 3

(a) Consider the reaction



A vessel contains $\text{NO}_{2(g)}$, $\text{N}_{2(g)}$ and $\text{O}_{2(g)}$ at equilibrium. Predict how each of the following stresses will affect the equilibrium position.

- (i) $\text{O}_{2(g)}$ is added (2marks)
- (ii) $\text{NO}_{2(g)}$ is added (2marks)
- (iii) $\text{N}_{2(g)}$ is removed (2marks)
- (iv) The volume is halved (2marks)
- (vi) The temperature is increased (2marks)

(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 atmospheres. One of the flasks is then immersed in a hot oil bath 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)

QUESTION 4

- a) Give the definition of reaction rate from first principles (2 marks)
- b) Rate of a reaction can be represented by the following equation:

$$\text{Rate} = \frac{d[\text{R}]}{dt}$$

Derive the differential form of above rate law. (4 marks)

- c) What is the significance of studying chemical kinetics? (4 marks)
- c) Sketch the isobar and the isotherm that defines Charles' and Boyle's laws respectively. (4 marks)
- d) Briefly discuss the methods that can be applied in monitoring rate of a chemical reaction of the following types;
 - (i) Coloured product
 - (i) Ionic substances (6marks)

QUESTION 5

a) 5 moles of ethanol (C₂H₅OH), 6 moles of ethanoic acid (CH₃COOH) 6 moles of ethylacetate (CH₃COOC₂H₅) and 4 moles of water (H₂O) 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) Briefly explain how the following factors affect the rate of a chemical reaction:

- (i) Nature of reactants
- (ii) Physical state of reactants (6 marks)

c)

c) If P₁, V₁ and T₁ are the values of pressure, volume and temperature respectively for any definite quantity of gas, and if P₂, V₂ and T₂ are another set of desired conditions, show that

$$\frac{P_1 V_1}{T_1} = \frac{P_2 V_2}{T_2} \quad (4 \text{ marks})$$

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