



EMBU UNIVERSITY COLLEGE

(A Constituent College of the University of Nairobi)

2015/2016 ACADEMIC YEAR

SECOND SEMESTER EXAMINATION

FOURTH YEAR EXAMINATION FOR THE DEGREE OF BACHELOR OF SCIENCE

SCH 405: FURTHER CHEMICAL KINETICS AND ELECTROCHEMISTRY

DATE: APRIL 5, 2016

TIME: 08:30-10:30

INSTRUCTIONS:

Answer Question ONE and ANY other two Questions

$$R = 8.314 \text{ J/Kmol}$$

$$Ag = 108; Cl = 35.5$$

QUESTION ONE

- a) Define the following (5 Marks)
- Activation energy
 - Complex reactions
 - Galvanic cell
 - Reaction mechanism
 - Absolute ionic mobility
- b) Differentiate between weak and strong electrolytes, giving an example of each (4 Marks)
- c) Consider a solution of 0.01 M MgCl_2 (aq) with an ionic strength of 0.030 M. Calculate the mean activity coefficient? (3 Marks)
- d) In a moving boundary experiment with 0.100 N KCl using 0.065 N LiCl as indicator solution, a constant current of 0.005893 amp was passed for 2130 seconds. The boundary

was observed to move through 5.6 cm in a tube of 0.1142 cm^2 cross section. Calculate the transport number of K^+ and Cl^- ions. (4 Marks)

e) State three applications of electrolysis (3 Marks)

f) Identify the intermediates and catalyst(if any) in the following reaction mechanism



g) State two limitations of collision theory (2 Marks)

QUESTION TWO

a) With examples, explain the following

i) Parallel reactions (4 Marks)

ii) Consecutive reactions (4 Marks)

iii) Reversible reactions (4 Marks)

b) The activation energy of a first order reaction is 50.2 kJ/mol at 25°C . At what temperature will the rate constant double? (8 Marks)

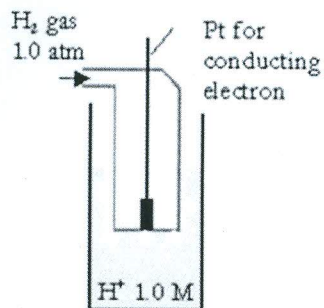
QUESTION THREE

a) Explain the Debye-Huckel theory in reference to strong electrolytes (10 Marks)

b) The specific conductance of saturated solution of silver chloride at 18°C is $1.24 \times 10^{-6} \text{ mhos}$ after subtracting that of water. The mobilities of Ag^+ and Cl^- ions at this temperature are 53.8 and 65.3 respectively. Calculate the solubility of silver chloride in grams per litre. (8 Marks)

QUESTION FOUR

- a) The figure below shows a standard Hydrogen Electrode (SHE)



- i) Explain why the SHE is important in calculating cell potentials (4 Marks)
 - ii) Write the standard half-cell equation for the SHE (2 Marks)
 - iii) Explain why it is important to use an inert electrode in the SHE and give two examples of inert electrodes (4 Marks)
- b) Describe the calomel electrode (10 Marks)

QUESTION FIVE

- a) For the reaction, $2\text{NO}_2(\text{g}) + \text{F}_2(\text{g}) \rightarrow 2\text{NO}_2\text{F}$ with a rate law = $k [\text{NO}_2][\text{F}_2]$:
- i) Write the steps for a bimolecular elementary process. (7 Marks)
 - ii) Identify which elementary process is the rate determinant and which one is the fast reaction. (3 Marks)
- b) Draw a potential-energy diagram for an uncatalyzed exothermic reaction. On the same diagram, indicate the change that results on the addition of a catalyst. Discuss the role of a catalyst in changing the rate of reaction. (10 Marks)

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