



EMBU UNIVERSITY COLLEGE
(A CONSTITUENT COLLEGE OF THE UNIVERSITY OF NAIROBI)

FIRST SEMESTER EXAMINATIONS 2014/2015

SECOND YEAR EXAMINATION FOR THE DEGREE OF BACHELOR OF SCIENCE

SCH 204: INTRODUCTION TO REACTION KINETICS AND ELECTROCHEMISTRY

DATE: DECEMBER 11, 2014

TIME: 10:30AM – 12:30PM

INSTRUCTIONS:

Answer Question ONE and ANY Other TWO Questions

QUESTION ONE

- a) Define the following concepts
- i) Molecularity
 - ii) Transference number
 - iii) Order of reaction
 - iv) Solubility product
 - v) Opposing reactions (5 marks)
- b) Give rate law expressions for first and second order kinetics. In each case, give an integrated rate law (5 marks)
- c) Calculate the emf of the following cell. Write the reaction involved (5 marks)
- $\text{Zn}/\text{Zn}(0.1\text{M})//\text{Cu}^{2+}(0.2\text{M})/\text{Cu}$
- $(E_{\text{Zn}/\text{Zn}^{2+}}^{\circ} = -0.76\text{V} \text{ and } E_{\text{Cu}/\text{Cu}^{2+}}^{\circ} = +0.34\text{V})$
- d) Calculate the pre-exponential factor and the activation energy given that the rate constant for $\text{N}_2\text{O}_5 \rightarrow \text{N}_2\text{O}_4 + \frac{1}{2}\text{O}_2$ is 3.46×10^{-5} at 298K and 4.87×10^{-3} at 335 K. (5 marks)

e) Explain why H^+ and OH^- have very high ionic mobilities compared to other ions. Use appropriate diagrams. (5 marks)

f) Derive the equation for half-life of a first order reaction:



QUESTION TWO

a) Draw suitable sketches and explain how one would be able determine the end-point of titrimetric analysis of the following

- i) Strong acid against a strong base (4 marks)
- ii) Weak acid against a strong base (4 marks)
- iii) Weak acid against a weak acid (6 marks)

b) Given the following information

Salt	\wedge
NaCl	126.4
KNO ₃	144.9
KCl	149.8

and t^+ for Na^+ in NaCl = 0.39

Calculate \wedge for NaNO₃ solution (Neglect the change in mobility of these ions with concentration). (5 marks)

QUESTION THREE

a) Given the following electrochemical cell reaction :



- i) Calculate the standard cell potential (3 marks)
- ii) Under standard conditions, will this reaction occur spontaneously as written? Justify your answer (4 marks)
- iii) Calculate the equilibrium constant, K_{eq} . (3 marks)

(Standard reduction potentials are: $E_{\text{Fe}^{2+}/\text{Fe}}^{\circ} = -0.44\text{V}$ and $E_{\text{Sn}^{4+}/\text{Sn}^{2+}}^{\circ} = +0.15\text{V}$)

b) A Hittorf cell is used mostly for determination of transference numbers of ions of interest in an electrolyte

- i) Give a labelled schematic representation of Hittorf cell. (3 marks)
- ii) Explain the steps, with relevant chemical and mathematical equations, used to determine transference numbers of Ag^+ and Cl^- using the Hittorf apparatus (7 marks)

QUESTION FOUR

Identify the various steps in the following chain reaction and derive the rate law equation the reaction mechanism given below for the reaction



The mechanism is:



(20 marks)

QUESTION FIVE

- a) Using Nernst equation, derive the equation for
 - i) Determining the solubility product of an insoluble salt using Ag/Cl^- , Ag^+/AgCl . (7 marks)
 - ii) Determining the equilibrium of an opposing reaction of your choice. (6 marks)
 - iii) Obtaining pH of a solution using a suitable half cell(s) (7 marks)

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