



UNIVERSITY OF EMBU

2016/2017 ACADEMIC YEAR

SECOND SEMESTER EXAMINATION

FOURTH YEAR EXAMINATION FOR THE DEGREE OF BACHELOR OF SCIENCE

SCH 405: FURTHER CHEMICAL KINETICS AND ELECTROCHEMISTRY

DATE: APRIL 7, 2017

TIME: 11:00AM-1:00PM

INSTRUCTIONS:

Answer Question ONE and ANY other two Questions

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

$$Ag = 108; Cl = 35.5; Ni = 58.7; C = 12; O = 16$$

QUESTION ONE (30 MARKS)

- a) Define or explain the following (10 marks)
- i) Enzyme
 - ii) Reaction intermediate
 - iii) Galvanic cell
 - iv) Reaction rate
- b) Explain the two principles of the collision theory of reaction rates (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) Calculate the solubility of $NiCO_3$ in grams per litre given that the value of K_{sp} for $NiCO_3$ is 1.4×10^{-7} (3 marks)
- e) With examples, differentiate between parallel and opposing unimolecular reaction (4 marks)

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



g) Explain why it is important to use an inert electrode in the SHE

(2 marks)

QUESTION TWO (20 MARKS)

- a) Derive the integrated Arrhenius equation of activation energy. (6 marks)
- b) Explain how the energy of activation determined from a plot. (3 marks)
- c) The value of rate constant for the decomposition of nitrogen pentoxide ($\text{N}_2\text{O}_5 \rightarrow \text{N}_2\text{O}_4 + \frac{1}{2}\text{O}_2$) is 4.346×10^{-5} at 25°C and 4.87×10^{-3} at 65°C . Calculate the energy of activation for the reaction. ($R = 8.314 \text{ JK}^{-1} \text{ mol}^{-1}$) (4 marks)
- d) Explain the transition state theory of reaction rates (7 marks)

QUESTION THREE (20 MARKS)

- a) In determination of the strength of electrolytes, reference electrodes are used. With the aid of a diagram, briefly describe the following electrodes.
- i) Silver- silver Electrode (10 marks)
- ii) Calomel electrode (10 marks)

QUESTION FOUR (20 MARKS)

- a) Based on the Debye-Huckel theory, explain the increase in equivalent conductance with dilution in case of strong electrolyte. (10 marks)
- b) The specific conductance of saturated solution of silver chloride at 18°C is 1.24×10^{-6} 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)
- c) State two applications of electrochemistry (2 marks)

QUESTION FIVE (20 MARKS)

a) Ozone reacts with nitrogen dioxide to produce oxygen and dinitrogen pentoxide.



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) Describe the potential-energy curve to clearly show the difference between enzyme catalyzed reaction and uncatalyzed. (10 marks)

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