EMBU UNIVERSITY COLLEGE

(A CONSTITUENT COLLEGE OF THE UNIVERSITY OF NAIROBI)

SECOND SEMESTER EXAMINATIONS 2013/2014

SECOND SEMESTER EXAMINATION FOR THE DEGREE OF BACHELOR OF SCIENCE

SCH 204: CHEMICAL KINETICS AND ELECTROCHEMISTRY

DATE: APRIL 9, 2014 **TIME: 8.30 – 10.30AM**

INSTRUCTIONS:

ANSWER QUESTION ONE AND ANY OTHER TWO

QUESTION ONE

a) Define the following terms by giving relevant examples in each case (5marks)

i.) Molecularity

ii.) Transference numbers

iii.) Pseudo order reaction

iv.) Conductance

b) Differentiate between the following concepts (5marks)

i.) Asymmetric and electrophoretic effect

ii.) Electrolysis and kinetics of reaction

Consider the general equation below and use it to answer question c

$$A \rightarrow \text{products}$$

c) If the reaction is first order, then (5marks)

i.) Give an integrated rate law expression

ii.) Give a sketch of a graph showing how one would determine the rate constant

d) The specific conductivity of a saturated solution of silver chloride at 20 ^{0}C is 1.33×10^{-6} $ohm^{-1}cm^{-1}$. If the ionic conductivities of Ag^+ and Cl^- at this temperature is 56.9 and 68.4 $ohm^{-1}cm^{-1}$ $equiv^{-1}$ respectively, calculate the solubility of the silver chloride (5marks)

e) State the following concepts and give specific examples (5marks)

i.) Faradays first law

ii.) The law of independent migration of ions

f) Explain the moving boundary method as a means of determining the transference numbers of ions. Use diagram(s) where necessary (5marks)

QUESTION TWO

a) Sketch the Hittorf apparatus and label accordingly (5 marks)

b) Describe how one can be able to derive the transference number using the Hittorf apparatus (10 marks)

c) In a transport experiment in 0.02M NaCl at 25^{0}C by the moving boundary method, it was found out that the boundary between NaCl and $CdCl_2$ solutions had moved 6.0 cm in 2070 seconds with a current of 0.0016 amp. Calculate transference numbers of Na^+ and Cl^- (5 marks)

QUESTION THREE

a) The following are the conductivities of chloroacetic acid, $CH_2ClCOOH$, in aqueous solution at 25^{0}C

[$CH_2ClCOOH$]	16	32	64	128	256	512	1024
λ	53.1	72.4	96.8	127.7	164	205.8	249.2

If the λ_0^0 is 362, graphically show that the data obeys the Ostwalds Dilution Law (10 marks)

b) The reaction

$$2H_2O_2 \rightarrow 2H_2O + O_2$$

is catalysed by iodide ions. Since the iodide ions are not consumed, we can assume the order with respect to H_2O_2 in the same way as for a reaction with a single reactant. The following data were obtained for the decomposition of hydrogen peroxide in 0.02M KI at 25 ^{0}C

Time(Minutes)	$[O_2]$
0	0
5	7.5
10	14
25	28.8
45	41.2
65	48.3
∞	57.9

c) Graphically show that the order of the reaction with respect to H_2O_2 is one (8 marks)

d) Determine the rate constant of the reaction at 25^{0}C (2 marks)

QUESTION FOUR

a) Consider the reaction

$$H_2 + Br_2 \rightarrow 2HBr$$

The rate law is found out to be

$$-\frac{d[H_2]}{dt} = \frac{k_2[H_2][Br_2]^{1/2}}{1 + k_b[HBr]/[Br_2]}$$

i.) Give a plausible mechanism for the reaction and identify the various steps of a chain reaction (7 marks)

ii.) Give rate law expressions for all the identified intermediates (5 marks)

iii.) Show that the reaction obeys the above rate law expression (8 marks)

QUESTION FIVE

a) Most reactions have their rates change when temperature of a reaction is changed

i.) Explain the above observation based on Collision Theory of reactions (5 marks)

ii.) Give the Arrhenius equation and explain each symbol accordingly (5 marks)

b) For the gas phase reaction $H_2 + I_2 \rightarrow 2HI$ at 373 K, it was found that k =8.74 x 10^{-15} $Lmol^{-1}s^{-1}$. At 473 K, it was found that k = 9.53 x 10^{-1015} $Lmol^{-1}s^{-1}$. Calculate

i) The activation energy of the reaction (5 marks)

ii) Pre-exponential factor (5 marks)

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