TECHNICAL UNIVERSITY OF MOMBASA

FACULTY OF APPLIED AND HEALTH SCIENCES

DEPARTMENT OF PURE & APPLIED SCIENCES

UNIVERSITY EXAMINATION FOR:

MASTERS OF SCIENCE IN CHEMISTRY

ACH 5103: ADVANCED ELECTROCHEMISTRY AND CHEMICAL KINETICS

SPECIAL/ SUPPLEMENTARY EXAMINATIONS

SERIES: SEPTEMBER 2018

TIME: 3HOURS

DATE: Sep2018

Instructions to Candidates
You should have the following for this examination
-Answer Booklet, examination pass and student ID
This paper consists of **SIX**Question(s). Attemptany FOUR questions.
Do not write on the question paper.

Question ONE

Differentiate between:	a) Stern and shear plane	**(5 marks)**
	b) Uniform and localized corrosion	**(4 marks)**
	c) Activation and Concentration Polarization	**(6 marks)**
	d) Rechargeable and Non-rechargeable cells	**(4 marks)**
	e) Diffusion and activation controlled	**(6 marks)**

Question TWO

a) Compare and contrast between faradaic and non-faradaic processes **(6 marks)**

b) List the **five** variables to be considered in faradaic processes **(10 mark)**

c) Discuss the **three** mass transport processes **(6 marks)**

d) Calculate the EMF of the cell using the Nernst equation **(3 marks)**

$$Zn(s) \mid Zn^{2+} (0.024 \text{ M}) \parallel Zn^{2+} (2.4 \text{ M}) \mid Zn(s)$$
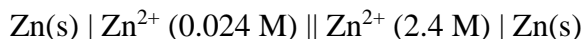
Question THREE

a) Describe the **three** basic types of reaction step in a chain polymerization   **(6 marks)**

b) Calculate the activation energy if the pre-exponential factor is 15 $M^{-1}s^{-1,}$ rate constant is $12M^{-1}s^{-1}$ and it is at 22K   **(6 marks)**

c) i) Discuss how enzymes lowers the activation energy   **(4 marks)**

ii) Describe the **three** types of enzyme inhibition with examples   **(9 marks)**

Question FOUR

a) Use the Debye-Hückel equation to calculate the activity coefficient for Hg2+ in a solution that has an ionic strength of 0.085. Use 0.5 nm for the effective diameter of the ion.   **(5 marks)**

b) What is the ionic strength of a solution that is 0.05 M in KNO_3 and 0.1 M in Na_2SO_4?   **(4 marks)**

c) Assume the half-life of the first order decay of radioactive isotope takes about 1 year (365 days). How long will it take the radioactivity of that isotope to decay by 60%?   **(6 marks)**

d) State **five** postulates of collision theory   **(10 marks)**

Question FIVE

a) Differentiate between flash photolysis and the pressure jump   **(10 marks)**

b) Discuss the **two** main theories to explain catalysis.   **(8 marks)**

b) Use the Arrhenius equation to sketch an Arrhenius graph   **(7 marks)**

Question SIX

a) Calculate the equilibrium constant, K, for the reaction $Sn_{(s)}|Sn^{2+}||Ag^+|Ag_{(s)}$ at 25°C.

        (6 marks)

b) The key step in the industrial production of sulfuric acid is the reaction of SO_2 with O_2 to produce SO_3.

$$2SO_2 (g)+O_2(g) \rightarrow 2SO_3(g)$$
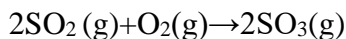
Write expressions for the reaction rate in terms of the rate of change of the concentration of each species

        (3 marks)

c) A voltaic cell is constructed that uses the following reaction $Ni + 2Ag^+ = Ni^{2+} + 2Ag$.

i) Write the half reactions & indicate the anodic or cathodic reactions.   **(4 marks)**

ii) Calculate E°_{cell} **(6 marks)**

iii) State whether the reaction is spontaneous. Given: E^o (Ni^{2+}/Ni) = -0.28V, Eo (Ag^+ /Ag) = +0.80V

(6 marks)