



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). Attempt any **FOUR** questions.

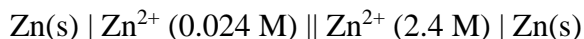
Do not write on the question paper.

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) |



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 $15 \text{ M}^{-1}\text{s}^{-1}$, rate constant is $12 \text{ M}^{-1}\text{s}^{-1}$ 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

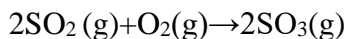
- a) Use the Debye-Hückel equation to calculate the activity coefficient for Hg^{2+} in a solution that has an ionic strength of 0.085. Use 0.5 nm for the effective diameter of the ion. (5 marks)
- b) What is the ionic strength of a solution that is 0.05 M in KNO_3 and 0.1 M in Na_2SO_4 ? (4 marks)
- 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 $\text{Sn(s)} \mid \text{Sn}^{2+} \parallel \text{Ag}^+ \mid \text{Ag(s)}$ 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 .



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 $\text{Ni} + 2\text{Ag}^+ = \text{Ni}^{2+} + 2\text{Ag}$.
- 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: $E^{\circ}(\text{Ni}^{2+}/\text{Ni}) = -0.28\text{V}$, $E^{\circ}(\text{Ag}^{+}/\text{Ag}) = +0.80\text{V}$
(6 marks)