NATIONAL OPEN UNVERSITY OF NIGERIA
PLOT 91, CADASTRAL ZONE, NNAMDI AZIKIWE EXPRESSWAY, JABI - ABUJA
FACULTY OF SCIENCES
DEPARTMENT OF PURE & APPLIED SCIENCES
2021_1 EXAMINATION 1234

CHM409: ELECTROCHEMISTRY
CREDIT: 2
TIME: 2 HOURS
INSTRUCTION: ANSWER QUESTION ONE & ANY OTHER THREE QUESTIONS.

Question 1

1(a) What is the significance of redox process to an electrochemical cell? (2 marks)

(b) With the aid of suitable diagrams, highlight the major features of the following electrochemical cells;

(i) Galvanic cell (8 arks)

(ii) Electrolytic cell. (9 marks)

(c) Evaluate the force between two charges of magnitude, 1.2 and 1.6 C separated by a distant of 0.8 m in a medium whose relative permittivity is 78.54 at 298 K (3 marks)

(d) What are the different processes that can bring about a difference in potential in an electrochemical system? (3 marks)

Question 2

2(a)(i) Identify the three major zone in an electrochemical system. Hence highlight the different forms of transfer that is associated with each of the identified zones. (5 marks)

(ii) What account for the differences in ionic concentration between the bulk electrolyte and electrode surface (2 marks)

(iii) What is the consequence of changes in ionic concentration highlighted in (ii) above (2 marks)

(b) Briefly describe the processes that leads to the formation of electric double layer (4 marks)

(c) Define potential at zero according to IUPAC convention (2 marks)

Question 3

3(a) Under what conditions of current flow do we use exchange current density? (4 marks)

(b) In two sentences for each, briefly describe reversible and irreversible electrode reaction (4 marks)

(c) What is the difference between polarizable and non polarizable electrodes (2 marks)

(d) State and define the two types of polarization that you know. Hence how would you calculate total polarization in a cell (5 marks)

Question 4

4.(a) (i) Consider a corrosion cell in which a piece of iron metal is immersed in an aerated water, Where would the anode, cathode and salt bridge in the cell be located: Explain this cell and give reason for your answer. (5 marks)

(b) Write the anodic, cathodic and overall cell reactions for the system. Hence, if the electrode potentials of the cathodic and anodic half reactions are 1.25 and -0.45 V respectively, calculate the cell electrode potential. Hence is the cell reaction spontaneous? (10 marks)

Question 5

5(a) The equilibrium cell reaction is written as $M^{n+} = M + ne^{-}$. Use suitable sketches to explain the changes expected for the direction of the reaction and the magnitude of the cathodic and anodic current under the following conditions

(i) Current is pumped to the system (5 marks)

(ii) Current is withdrawn from the system (5 marks)

(iii) Discuss the expected change in electrode potential (with respect to the above) and define polarization and overpotential. (5 marks)