

FEDERAL UNIVERSITY OF TECHNOLOGY OWERRI
SCHOOL OF PHYSICAL SCIENCES
DEPARTMENT OF CHEMISTRY
2017/2018 RAIN SEMESTER EXAMINATIONS: CHM 306: ELECTROCHEMISTRY

INSTRUCTIONS: ANSWER FOUR (4) QUESTIONS IN ALL - ANSWER AT LEAST ONE QUESTION FROM EACH SECTION
TIME 2 HOURS

SECTION A

QUESTION ONE

- (a) Describe the significance of interfacial transport in Electrode processes.
(b) For the electrochemical process; $Ox + ne = Red$ ($E^{\circ} = -234$ mV vs. SCE)
Describe the current profile at the interphase when the potential is (i) -276 mV and (ii) -209 mV.
(c) Compare and contrast: (i) Interface & interphase (ii) cathodic current density & anodic current density.

QUESTION TWO

- (a) (i) All interphases are electrical double layers!
(ii) All electrical double layers are interphases!
With suitable reasons, suggest if either, both or none of the above assertions is valid.
(b) Is it in any way feasible to make an electrode surface more positive? Describe how this could be achieved.
(c) ".....however, under any condition of the electrode, there is always some element of electron release and acceptance by the electrode..." Elaborate on this statement.

SECTION B

QUESTION THREE

- (a) With the aid of well labeled diagram distinguish between a galvanic and electrolytic cell.
(b) (i) Enumerate the various factors responsible for corrosion of metallic structure deployed in service.
(ii) Discuss in detail the various ways by which oil pipelines may be protected from corrosion damage.
(c) What do you understand by the terms (i) pitting and (ii) hydrogen embrittlement?

QUESTION FOUR

- (a) (i) The main challenges in manufacturing a fuel cell lie in maintaining a high cell potential at the necessary current output. What strategies can be pursued to improve the performance of the proton exchange membrane fuel cells.
(ii) What are the advantages of fuel cells over batteries?
(b) List the different methods used to monitor corrosion, explaining the principle behind its use for corrosion monitoring.
(c) (i) With the aid of equations describe the Ni-cad battery indicating the direction of charging and discharging?
(ii) What do you understand by the process called intercalation?
(iii) What advantages does lithium ion batteries have over other types of batteries?

SECTION C

QUESTION FIVE

- (a) Describe the term "electrical double layer". What is the importance of the double layer at the interface?
(b) Differentiate between polarizable and non polarizable electrodes.
(c) What is the voltage of the Standard Hydrogen Electrode (SHE), account for the assigned value.

QUESTION SIX

- (a) The standard potential of the Ag^+ / Ag electrode is $+0.80$ V, while the standard potential of the cell; $Pt / I_2(s) / I^-(aq) // Ag^+(aq) / Ag(s)$ is 0.26 V, at the same temperature. Calculate (i) the standard potential of the iodine electrode; what is the significance of the obtained value.
(b) Account for the use of salt bridges or porous barriers in electrochemical cells.
(c) Describe a galvanic cell and give two examples.