



Chemistry Department

Examination of Electrochemistry for 2nd Level Students

Answer the following questions:

I-Choose the right answer of the following: (80 marks)

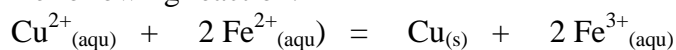
- 1- In electrolytic cells:
 - a- The chemical energy is converted to electrical energy.
 - b- The electrical energy is converted to chemical energy.
 - c- The electrical energy is converted to heat energy.
- 2-For the electrochemical reaction: $\text{Sn}^{2+}_{\text{aq}} + 2\text{Ag}^{+}_{\text{aq}} = \text{Sn}^{4+}_{\text{aq}} + \text{Ag}_s$
 $E^{\circ}_{\text{Sn}^{4+}/\text{Sn}^{2+}} = 0.15\text{V}$ and $E^{\circ}_{\text{Ag}^{+}/\text{Ag}} = 0.8\text{V}$. The equilibrium constant is:
 - a- 9.6×10^{21}
 - b- 8.4×10^{25}
 - c- 6.4×10^{18}
- 3-In amalgam concentration cell:
 - a- The anode is the electrode of low concentration.
 - b- The cathode is the electrode of low concentration.
 - c- The cathode is the electrode of high concentration.
- 4-In allotropic cells:
 - a- The electrode which made of metastable modification is the anode.
 - b- The electrode which made of metastable modification is the cathode.
 - c- None of them.
- 5-The standard potential for the Daniel cell: $\text{Cu}^{2+}_{\text{aq}} + \text{Zn}_s = \text{Cu}_s + \text{Zn}^{2+}_{\text{aq}}$
at 25 °C is 1.1V. The standard free energy of the cell is:
 - a- -300.5 kJ/mol
 - b- -212.3 kJ/mol
 - c- 212.3 kJ/mol
- 6- In the reduction electromotive series:
 - a- The metal above acts as cathode to that in below.
 - b- The metal below acts as cathode to that in above .
 - c- The metal below acts as anode to that in above .
- 7- The type of $\text{Hg}_2\text{Cl}_2(s)$, Hg / Cl^- is:
 - a- Electrode of the second kind.
 - b- Concentration cell of the second kind,
 - c- Both (a), (b).
- 8- Consider a galvanic cell with the following reaction:
$$\text{Cd}^{2+}_{\text{aq}} + \text{Zn}_s = \text{Cd}_s + \text{Zn}^{2+}_{\text{aq}}$$

The potential of the cell is 0.36 V. If the E° of the zinc electrode is -0.76 V, the E° of the cadmium electrode is:
 - a- - 1.12 V
 - b- - 0.4 V
 - c- 0.4 V
- 9- In the Leclanche cell, the cathodic reaction is:
 - a- $2\text{MnO}_2(s) + 2\text{NH}_4(\text{aqu}) = \text{Mn}_2\text{O}_3(s) + 2\text{NH}_3(\text{aqu}) + \text{H}_2\text{O}(l) + 2e$
 - b- $2\text{MnO}_2(s) + 2\text{NH}_4(\text{aqu}) + \text{H}_2\text{O} + 2e = \text{Mn}_2\text{O}_3(s) + 2\text{NH}_3(\text{aqu}) + \text{H}_2\text{O}(l)$
 - c- $2\text{MnO}_2(s) + 2\text{NH}_4(\text{aqu}) + 2e = \text{Mn}_2\text{O}_3(s) + 2\text{NH}_3(\text{aqu}) + \text{H}_2\text{O}$

- 10- When a rod of zinc metal is immersed in 1.0 M CuSO₄:
- a- The [Cu²⁺] increases. b- The [Cu²⁺] decreases.
b- No change occurs. $E^{\circ}_{Zn/Zn^{2+}} = -0.76 \text{ V}$, $E^{\circ}_{Cu/Cu^{2+}} = 0.34 \text{ V}$
- 11- In an electrochemical cell, electrons travel from:
- a- The anode to the cathode through the external circuit.
b- The anode to the cathode through the salt bridge.
c- The cathode to the anode through the external circuit.
- 12- The concentration cells of the first kind is defined as:
- a- Those which consist of two electrodes of the same material but differ in activities, immersed in the same electrolyte.
b- Those which consist of two electrodes of the same material but differ in activities, immersed in two different electrolytes.
c- Those which consist of two electrodes of different materials immersed in the same electrolyte.
- 13- The mathematical expression of Nernst equation for non-metal is given by:
- a- $E = E^{\circ} + \frac{RT}{ZF} \ln \frac{a_R}{a_P}$
b- $E = E^{\circ} - \frac{RT}{ZF} \ln \frac{a_R}{a_P}$
c- $E = E^{\circ} - \frac{ZF}{RT} \ln \frac{a_P}{a_R}$ (R = Reactants, P = Products)
- 14- In gravitational cells:
- a- The electrode of greater height has higher free energy acts as anode.
b- The electrode of greater height has lower free energy acts as anode.
c- The electrode of lower height has higher free energy acts as cathode.
- 15- The relation between ΔG and ΔG° is given by:
- a) $\Delta G = \Delta G^{\circ} + RT \ln K_{eq}$ b) $\Delta G = \Delta G^{\circ} - RT \ln K_{eq}$
c) $\Delta G = \Delta G^{\circ} + RT \ln Q$
- 16- The dissolution of metals will occur spontaneously if:
- a- ΔG has +ve value. b- ΔG has -ve value.
c- ΔG equals to zero.
- 17- Using the following equations:
- $AgI_{(s)} + e = Ag + I$ $e^{\circ} = -0.15 \text{ V}$
 $Ag_{(s)} = Ag^+_{(aq)} + e$ $e^{\circ} = -0.8 \text{ V}$
The solubility product AgI is
a- 8.51×10^{-17} b- 8.51×10^{17} c- 8.51×10^{-20}
- 18- Consider a galvanic cell with the following reaction:
- $Cu_s + 2 Fe^{3+}_{aq} = Cu^{2+}_{aq} + 2 Fe^{2+}_{aq}$
 $[Fe^{3+}] = 1 \times 10^{-4} \text{ M}$, $[Cu^{2+}] = 0.25 \text{ M}$, $[Fe^{2+}] = 0.2 \text{ M}$
 $E^{\circ}_{Cu/Cu^{2+}} = 0.34 \text{ V}$, $E^{\circ}_{Fe^{3+}/Fe^{2+}} = 0.77 \text{ V}$
The potential of the cell is:
a- 0.25V b- -0.25 V c- 0.61 V
- 19- In the reduction electromotive series the tendency of metal ions to electro-deposition:

- a- Primary cell. b- Secondary cell c- None of (a), (b)

31- The following reaction:



in which, $e^{\circ}_{\text{Cu}/\text{al Cu}^{2+}} = 0.34 \text{ V}$, $e^{\circ}_{\text{Fe}^{3+}/\text{Fe}^{2+}} = 0.77 \text{ V}$

The reaction is considered to be:

- a- Spontaneous. b- Non-spontaneous. c- At equilibrium.

32- The following cell: $\text{Zn} / \text{NH}_4\text{Cl}, \text{ZnCl} / \text{MnO}_2, \text{C}$

is considered to be a type of:

- a- Complex chemical cell. b) Simple chemical cell.

c- Physical cell.

33- In lithium ion-ion battery, the manufactured cathode contains

a- Mixed transition metals beside cobalt to obtain greater charge capacity.

b- LiC_6

c- Both a, b

34- In lithium battery, the liquid electrolyte acts as a conductive pathway for the movement is:

a- Anions from the anode to the cathode during discharge.

b- Cations from the anode to the cathode during discharge.

c- Cations from the anode to the cathode during charge.

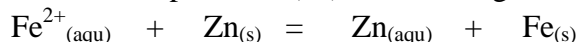
35- The main difference between Leclanche cell and alkaline dry cell is:

a- The anode composition.

b- The cathode composition.

c- The electrolyte.

36- The standard cell potential (E°) of following reaction:



is 0.32 V , if a piece of zinc is placed in a 1M Fe^{2+} solution:

a- The concentration of Fe^{2+} increases in the solution.

b- The concentration of Fe^{2+} decreases in the solution.

c- The concentration of Fe^{2+} not altered in the solution.

37- The emf of the hydrogen - oxygen cell depends on:

a-Concentration of the conducting electrolyte.

b-The concentration of Fe^{2+} decreases in the solution.

c- The concentration of Fe^{2+} increases in the solution.

38- In Weston cell, the crystals of cadmium sulphate are put in the cell:

a-To make the electrolyte saturated, hence the emf of the cell remains constant.

b-To make the electrolyte concentrated, hence acts as polarizer.

c-None of a, b.

39- The cathode of galvanic cell carries:

a-Negative charge.

b- Positive charge.

c- Neutral charge.

40- The rusting of iron occurs in the media of:

a-Oxygen – free water.

b- Dry air

c- Oxygen – water.

(1) b	(2) a	(3) b	(4) a	(5) b
(6) b	(7) a	(8) b	(9) c	(10) b
(11) a	(12) a	(13) b	(14) a	(15) c
(16) b	(17) a	(18) a	(19) a	(20) c
(21) c	(22) b	(23) b	(24) b	(25) b
(26) b	(27) b	(28) b	(29) b	(30) b
(31) a	(32) a	(33) a	(34) b	(35) c
(36) b	(37) b	(38) b	(39) b	(40) c