Benha Univerity

Faculty of Science

Chemistry Department

Time: 2 hrs
Date: 29/5/ 2019
Code: Chem. 234

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: $Sn^{2+}_{aq} + 2Ag^{+}_{aq} = Sn^{4+}_{aq} + Ag_s$
   $E^o_{Sn^{4+}/Sn^{2+}} = 0.15V$ and $E^o_{Ag+/Ag} = 0.8V$. The equilibrium constant is:
   a- $9.6x10^{21}$ b- $8.4x10^{25}$ c- $6.4x10^{18}$

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: $Cu^{2+}_{aq} + Zn_s = Cu_s + Zn^{2+}_{aq}$
   at 25 ^oC 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 $Hg_2Cl_{2\,(s)}$, 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:
   $Cd^{2+}_{aq} + Zn_s = Cd_s + Zn^{2+}_{aq}$
   The potential of the cell is 0.36 V. If the E^o of the zinc electrode is – 0.76 V, the E^o 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- $2MnO_{2(s)} + 2NH_{4\,(aqu)} = Mn_2O_{3\,(s)} + 2NH_{3\,(aqu)} + H_2O_{(l)} + 2\,e$
   b- $2MnO_{2(s)} + 2NH_{4\,(aqu)} + H_2O + 2\,e = Mn_2O_{3\,(s)} + 2NH_{3\,(aqu)} + H_2O_{(l)}$
   c- $2MnO_{2(s)} + 2NH_{4\,(aqu)} + 2\,e = Mn_2O_{3\,(s)} + 2NH_{3\,(aqu)} + H_2O$

.

10- When a rode of zinc metal is immersed in 1.0 M $CuSO_4$:

a- The $[Cu^{2+}]$ increases. b- The $[Cu^{2+}]$ decreases.

b- No change occurs. $E^o_{Zn/Zn^{2+}} = -0.76$ V, $E^o_{Cu/Cu^{2+}} = 0.34$ 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- $E = E^o + RT/ZF \ln a_R / a_P$

b- $E = E^o - RT/ZF \ln a_R / a_P$

c- $E = E^o - ZF/RT \ln a_P / a_R$ (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^o is given by:

a) $\Delta G = \Delta G^o + RT \ln K_{eq}$ b) $\Delta G = \Delta G^o - RT \ln K_{eq}$

c) $\Delta G = \Delta G^o + RT \ln Q$

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:

$AgI_{(s)} + e = Ag + I^-$ $e^o = -0.15$ V

$Ag_{(s)} = Ag^+_{(aqu)} + e$ $e^o = -0.8$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:

$Cu_s + 2\,Fe^{3+}_{aq} = Cu^{2+}_{aq} + 2\,Fe^{2+}_{aq}$

$[Fe^{3+}] = 1 \times 10^{-4}$ M, $[Cu^{2+}] = 0.25$ M, $[Fe^{2+}] = 0.2$ M

$E^o_{Cu/Cu^{2+}} = 0.34$ V, $E^o_{Fe^{3+}/Fe^{2+}} = 0.77$ 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-Increases as going from the top to the bottom of the series.
b-Decreases as going from the top to the bottom of the series.
c-Increases as going from the bottom to the top of the series.

20- For the following redox reaction, the oxidation of Mn changes from:

$MnO_4^- + 8\,H^+ + x\,e = Mn^{2+} + 4H_2O$

a- 7 to 4 b- 6 to 2 c- 7 to 2

21- For an electrochemical reaction at equilibrium:

a- $\Delta G = \Delta G^o$ b) $-\Delta G^o = RT \ln Q$ c) $-\Delta G^o = RT \ln K$

22- The oxidation process is defined as:

a- The process which involves a loss of protons.
b- The process which involves a loss of electrons.
c- The process which involves a gain of electrons.

23- In iron corrosion, the cathodic reaction is:

. a- $4\,OH^- = O_{2\,(g)} + 2\,H_2O_{(L)} + 4\,e$
b- $O_{2\,(g)} + 4\,H^+_{(aqu)} + 4\,e = 2\,H_2O_{(L)}$
c- $Fe^{2+}_{(aqu)} + 2\,e = Fe_{(s}$

24- For the following reaction:

$Cd^{2+}_{aqu} + 2\,I^-_{aqu} = Cd_s + I_{2\,(s)}$

where $E^o_{Cd^{2+}/Cd} = -0.4$ V, $E^o_{I/I^-} = 0.54$V

The standard EMF of the cell is:

. a- 0.94 V b- - 0.94 V c- 0.14 V

25- In mercury battery, the cathode is manufactured from:

a-Zinc in contact with HgO in an alkaline medium.
b- Steel in contact with HgO in an alkaline medium.
c- Steel in contact with HgO in an acidic medium.

26- The cathodic reaction in acid accumulation cells (lead storage battery) is:

. a- $Pb_{(s)} + SO_4^{2-}{}_{(aqu)} = PbSO_{4(s)} + 2\,e$
. b- $PbO_{2(s)} + 4\,H^+_{(aqu)} + SO_4^{2-}{}_{(aqu)} + 2\,e = 2\,PbSO_{4(s)} + 2\,H_2O_{(l)}$
. c- $PbO_{(s)} + 2\,H^+_{(aqu)} + SO_4^{2-}{}_{(aqu)} + 2\,e = PbSO_{4(s)} + H_2O_{(l)}$

27- For H_2, Pt / $HCl_{(a1)}$ // $HCl_{(a2),}$ / $H_{2,}$ Pt, whwre $a_1 > a_{2,}$ the emf of the cell is:

a-$(RT / ZF) \ln (a_1 / a_2)$ b- $(RT / ZF) \ln (a_1 / a_2) + E_j$
c-$(RT / ZF) \ln (P_{H2}{}^- / P_{H2})$

28- The electrode of the first kind consists of:

a- The metal covered by one of its sparingly soluble compound.
b-The metal immersed in its own salt.
c-Two electrodes of the same material but different in activities.

29- Both Al and Fe react with oxygen forming metal oxide, which oxide has higher protection to the metal:

a- $Fe_2O_3.\,H_2O$. b- Al_2O_3.
c- Both a and b have similar protection

30- Nickel-cadmium battery considered as:

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

31- The following reaction:

$Cu^{2+}_{(aqu)} + 2\,Fe^{2+}_{(aqu)} = Cu_{(s)} + 2\,Fe^{3+}_{(aqu)}$

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

The reaction is considered to be:

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

32- The following cell: $Zn / NH_4Cl, ZnCl / MnO_2, C$

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^{o}) of following reaction:

$Fe^{2+}_{(aqu)} + Zn_{(s)} = Zn_{(aqu)} + Fe_{(s)}$

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 carriers:

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**