****

**18/6/2107
Time: 2 hrs
chem : 234**

**Benha University
Faculty of Science
Chemistry Department**

|  |  |
| --- | --- |
|  | **Examination of Electrochemistry, 2nd level**  |

**Answer the following questions:**

1. **Choose the right answer of the following: (80 marks)**
2. What happens to the oxidizing agent in an oxidation- reduction reaction:
3. It is oxidized as it gains electrons.
4. It is oxidized as it loses electrons.
5. It is reduced as it gains electrons.
6. For the electrochemical reaction:

Sn2+ (aq)  + 2Ag+(aq) = Sn4+(aq) + Ag (s)

Eo Sn4+/ Sn2+= 0.15V and Eo Ag+/ Ag  = 0.8V. The equilibrium constant is:

1. 9.6x1021  b- 8.4x1025  c- 6.4x1018
2. Which of the following, concentration cell of the first kind:
3. H2 (P`H2), Pt│HCl│Pt, H2 (PH2).
4. H2, Pt│HCl (a1)│HCl (a2)│Pt, H2.
5. Both a, b.
6. Corrosion reactions are
7. Spontaneous redox reactions.
8. Non- Spontaneous redox reactions.
9. Spontaneous acid- base reactions.
10. Fuel cells are the means by which chemical energy may be converted into
11. Heat energy.
12. Electrical energy.
13. Mechanical energy.
14. Steel pipe underground can be protected by
15. Cathodic protection.
16. Sacrificial anode. c- Both a, b.
17. In galvanic cell, electrons flow from
18. Anode to cathode.
19. Cathode to anode. c- None of these.
20. Consider the following,

 Cu s  + 2 Fe3+aq  = Cu2+ aq + 2 Fe2+aq

 [Fe3+ ] = 1x10-4 M, [Cu2+ ] = 0.25 M, [Fe2+ ] = 0.2 M

Where, EoCu2+/ Cu = 0.34 V, EoFe3+/ Fe2+= 0.77 V.

The cell potential at 25oC is:

1. 0.5 V b- 0.25 V c- 25 V.
2. While charging the lead acid battery:
3. PbSO4  cathode is oxidized to PbO2.

b- PbSO4  cathode is reduced to Pb.

1. PbSO4  anode is oxidized to Pb.
2. The fraction of the total current carried by a particular ionic species is defined by:
3. Transport number.
4. Total electric current in the reaction.
5. Both a, b.
6. Total potential of galvanic cell contains junction potential in
7. Complex chemical cell.
8. Concentration cell of second kind.
9. Both a, b.
10. For the following reactions: Ag+(aq) + e **→** Ag (s) Eo= 0.80 V

 AgCN (s) + e → Ag (s) + CN- (aq) Eo= -0.01V

The solubility product for AgCN at 298 K is:

1. 2.0 x 10-14.
2. 1.0 x 10-7.
3. 5.0 x1024.
4. In hydrogen- oxygen cell, the emf depends on:
5. Concentration of H+ and OH-.
6. Partial pressures of hydrogen and oxygen.
7. Both a, b.
8. Standard Weston cell is:
9. Secondary battery which the energy of chemical reactions can be used only once.
10. Primary battery which the energy of chemical reactions can be used several times.
11. None of these.
12. In nickel – cadmium battery:
13. The anode is cadmium and the cathode is NiO(OH) on nickel metal.
14. The anode is NiO(OH) on nickel metal and the cathode is cadmium.
15. None of these.
16. In allotropic cells:
17. The electrode which made of metastable modification is the anode.

b- The electrode which made of metastable modification is the cathode.

 c- The electrode which made of stable modification is the anode.

1. The standard potential for the Daniel cell:

**Cu2+ aq + Zns = Cus  + Zn2+ aq**

at 25k is 1.1V. The standard free energy of the cell is:

1. -300.5 kJ/mol b- -212.3 kJ/mol c- 212.3 kJ/mol
2. If Eo Ag+ / Ag  = 0.8V and Eo AgI / Ag  = - 0.15 V, the solubility product of AgI is:
3. 8.51x10-17  b- 8.51x1017  c- 8.51x10-20
4. In the reduction electromotive series the tendency of metal ions to electro- deposition
5. Increases as going from the top to the bottom of the series.
6. Decreases as going from the top to the bottom of the series.
7. Increases as going from the bottom to the top of the series.
8. Potentiometry is an analytical method based on measurements of:

 a-The current of electrochemical cell under condition of constant potential.

b-The potential of electrochemical cell at different current densities.

 c-The potential of electrochemical cell under conditions of zero current.

1. Consider a galvanic cell with the following reaction:

 **Cd2+ (aq)  + Zn (s)  = Cd (s )  + Zn2+ (aq)**

The potential of the cell is 0.36 V. If the Eo  of the zinc electrode is 0.76 the Eo  of the cadmium electrode is: .

1. - 1.12 V b- - 0.4 Vc- 0.4 V
2. Liquid junction potentials are the result of:
3. Movement of the electric current in the external circuit.
4. The difference between cations and anions mobilities under the influence of an electric field.
5. None of these.
6. In gravitational galvanic cells:
7. The electrode of high level acts as cathode.
8. The electrode of high level acts as anode.
9. The electrode of low level acts as cathode.
10. The metallic indicator electrode of first kind used for detection:
11. Cations.
12. Anions.
13. Both cations and anions.
14. In a galvanic cell consists of Cd immersed in its ions (EoCd= -0.4V ) and Pb immersed in its ions (EoPb= -0.126V ) the following process occur:
15. Pb dissolved and Cd deposited.
16. Cd dissolved and Pb deposited.
17. The eo of the cell equal to (-0.274).

 26- Consider the following equation:

Co + SO4 2-­+ 4H+-------- Co2+ + H2SO3 + H2O

1. Hydrogen is reduced and oxygen is oxidized.
2. Cobalt is oxidized and sulphur is reduced.
3. sulphur is oxidized and cobalt is reduced.
4. For the following equation:

 MnO4- ↔ MnO4 2-

The oxidation state of Mn changes as follows:

1. +7 to +4
2. +7 to +6 c- +7 to +2
3. Which statement is true for an electrochemical cell:
4. Oxidation occurs at the anode only.
5. Reduction occurs at both cathode and anode.
6. Reduction occurs at anode only.
7. What is Eo for an electrochemical cell with the following reaction:

2 Au3+ + 3Co → 3 Co2+ +2Au

Eo Au3+/ Au = 1.498 V Eo Co2+/ Co= -0.277 V

1. -1.22 V.
2. 1.78 V
3. 1.22 V
4. Given the equation: 2Cr (s) + 3Pb2+ (aq) → 2Cr3+ (aq) + 3 Pb(s).
5. Cr (s) + 3 e → Cr3+ (aq) .`
6. Pb2+ (aq) → Pb(s) + 2 e.
7. Pb2+ (aq) +2 e → Pb(s).
8. When a rode of zinc metal is immersed in 1.0 M CuSO4 :
9. The [Cu2+] increases.
10. The [Cu2+] decreases.
11. No change occurs.

where Eo Zn2+/ Zn = - 0.76 V, Eo Cu 2+ / Cu= 0.34 V.

1. The concentration cell of the first type is defined as:
2. Those which consist of two electrodes of the same material but differ in activities, immersed in the same electrolyte.
3. Those which consist of two electrodes of the same material but differ in activities, immersed in two different electrolytes.
4. Those which consist of two electrodes of different materials immersed in the same electrolyte.
5. The potential of calomel electrode depends on:
6. The concentration of mercurous ions.
7. The concentration of chloride ions.
8. The concentration of potassium ions.
9. The Leclanche cell is represented by:
10. Zn│NH4Cl, KOH│Mn2O3, C
11. Zn│NH4Cl, ZnCl2│MnO2, C.
12. None of these.

35- In the standard notation for a voltaic cell, the double vertical line "||" represents:

1. A phase boundary.
2. A wire (metal) connection.
3. A salt bridge.

36- The mathematical expression of Nernst equation is given by:

1. E = Eo + RT/ZF ln aOx / aRed
2. E = Eo - RT/ZF ln aOx / aRed
3. E = Eo + ZF/RT ln aOx / aRed

 37- The relation between ∆G and ∆Go  is given by:

 a) ∆G = ∆Go + RT ln Keq

 b) ∆G = ∆Go - RT ln Keq

 c) ∆G = ∆Go + RT ln Q

 38- Mercury-mercury oxide electrode can be used as a reference electrode:

 a) Only in acidic solution.

 b) Only in alkaline solutions

 c) In both acidic and alkaline solutions.

 39- A certain galvanic cell has for its spontaneous cell reaction:

 Zn + HgO → ZnO + Hg

 Which is the half- reaction occurring at the anode,

 a) HgO +2e → HgO + O2-.

 b) Zn2+ + 2e → Zn.

 c) Zn → Zn2+ +2e.

 40- Consider the following cell: Als / Al3+ (0.18 M) // Fe2+ (0.85 M) / Fes

 Eo Al3+ /Al = -1.68 V and Eo Fe2+ / Fe  = -0.44 V. The cell potential is:

 a) 1.24 V b) 2.12 V c) -2.12 V

**Model Answer**

 **The right answer:**

 (1) **C**  (2) **A** (3) **A**  (4) **A**

 (5)  **B**  (6) **C** (7)  **A** (8)  **B**

 (9)  **B** (10) **A** (11) **B** (12) **A**

 (13) **B** (14) **C** (15) **A**  (16) **A**

(17) **B** (18) **A** (19) **A** (20) **C**

(21) **B** (22) **B** (23) **B**  (24) **A**

 (25) **B** (26) **B** (27) **B** (28) **A**

(29) **B** (30) **C** (31) **B** (32) **A**

 (33) **B** (34) **B** (35) **C**  (36) **A**

(37) **C** (38) **B** (39) **C** (40) **A**