|  |
| --- |
| **Karan Arora**  **R.L. Institute M: 9416974837**  **Class : XII**  **Chapter : 3**  **“ELECTROCHEMISTRY”** |

**Assignment – I**

1. If specific conductivity of N/50 KCl solution at 298 K is 0.002765 ohm – 1 cm – 1 and resistance of a cell containing this solution is 100 ohms, calculate the cell constant.
2. 0.5 normal solution of a salt placed between two platinum electrodes 2 cm apart and area of cross section 4 sq. cm. has a resistance of 25 ohms. Calculate the equivalent conductivity of solution.
3. The electrical resistance of a column of 0.05 M NaOH solution of diameter 1 cm and length 50 cm is 5.55 x 103 ohm . Calculate its resistivity, conductivity and molar conductivity.
4. Resistance of a conductivity cell filled with 0.1 mol/L KCl solution is 100 Ω. If the resistance of the same cell when filled with 0.02 M KCl solution is 520 ohm. Calculate the conductivity and molar conductivity of 0.02 M KCl solution. The conductivity of 0.1 M KCl solution is 1.29 S/m.
5. The conductivity of a solution containing 1 gram of anhydrous BaCl2 in 200 cm3 of water has been found to be 0.0058 S/cm. What are the molar conductivity and equivalent conductivity of the solution. (At masses ; Ba = 137 , Cl = 35.5).
6. The specific conductivity of N/50 solution of KCl at 298 K is 0.002765 S/cm. If the resistance of the same solution placed in the cell is 2000 ohms, what is cell constant ?
7. Specific conductivity of a 0.12 normal solution of an electrolyte is 0.024 ohm – 1 cm – 1 . Determine its equivalent conductivity.
8. The resistance of a decinormal solution of an electrolyte in a conductivity cell was found to be 245 ohms. Calculate the equivalent conductivity of the solution if the electrodes in the cell were 2 cm apart and each has an area of 3.5 sq.cm.
9. A cell with N/50 KCl solution showed a resistance of 550 ohm at 25˚C. The specific conductivity of N/50 KCl at 25˚C is 0.002768 ohm – 1 cm – 1 . The cell filled with N/10 ZnSO4 solution at 25˚C shows a resistance of 72.18 ohms. Find the cell constant and molar conductivity of ZnSO4 solution.
10. Molar conductance of a 1.5 M solution of an electrolyte is found to be 138.9 S cm2. What would be the specific conductance of this solution?
11. A potential difference of 20 volts applied to the ends of a column of M/10 AgNO3 solution, 4 cm in diameter and 12 cm in length gave a current of 0.2 A. Calculate the specific and molar conductivities of the solution.

ELECTROCHEMISTRY Page No. 1

1. Calculate the equivalent conductivity of 1 M H2SO4 solution, if its conductivity is 26 x 10 – 2 ohm – 1 cm – 1 .
2. The conductivity of 0.2 M solution of KCl at 298 K is 0.0248 S/cm. Calculate its molar conductivity.
3. The measured resistance of a conductance cell containing 7.5 x 10 – 3 M solution of KCl at 25˚C was 1005 ohms. Calculate : (a) Specific conductance (b) Molar conductance of the solution. Cell constant = 1.25 cm – 1 .

**Answers**

1. 0.2765 cm – 1  2. 40 S cm2 eq – 1  3. 87.135 Ω cm , 0.01148 S/cm , 229.6 S cm2 mol – 1

4. 0.248 S/m , 1.24 x 10 – 2 S m2 mol – 1  5. 241.67 S cm2 mol – 1  , 120.83 S cm2 eq – 1  6. 5.53 cm – 1

7. 200 S cm2 eq – 1  8. 23.32 S cm2 eq – 1  9. 1.5224 cm – 1 , 421.8 S cm2 mol – 1  10. 0.208 S/cm

11. 9.55 x 10 – 3 S/cm , 95.5 S cm2 mol – 1  12. 130 S cm2 eq – 1  13. 124 S cm2 mol – 1

14. (a) 0.001244 ohm – 1 cm – 1 , (b) 165.87 S cm2 mol – 1

ELECTROCHEMISTRY Page No. 2

**Karan Arora** **M: 9416974837**

**Assignment – II**

1. If the molar conductivities at infinite dilution of NaCl, HCl and CH3COONa (NaAc) are 126.4 , 425.9 and 91 S cm2 mol – 1  respectively, what will be that of acetic acid (HAc) ?
2. Calculate for CaCl2 and MgSO4 form the following data :

(S cm2 mol – 1 ) : Ca2+ = 119 , Mg2+ = 106 , Cl –  = 76.3 , = 160.

1. Calculate the molar conductance at infinite dilution for acetic acid, given

(HCl) = 425 S cm2 mol – 1 , (NaCl) = 188 S cm2 mol – 1 , (CH3COONa) = 96 S cm2 mol – 1

1. The molar conductivity of NH4Cl­ at infinite dilution is 149.7 S cm2 and the ionic conductivities of OH – and Cl –  ions re 198 and 76.3 S cm2 respectively. Calculate the molar conductivity of NH4OH at this dilution.
2. The molar conductances of NaOH , NaCl and BaCl2 at infinite dilution are 2.481 x 10 – 2 , 1.265 x 10 – 2 , 2.8 x 10 – 2 S cm2 mol – 1 respectively. Calculate Ba(OH)2.
3. Calculate the molar ionic conductance of Al3+ ions at infinite dilution, given that the molar conductance of Al2(SO4)3 and molar ionic conductance of ions at infinite dilution are 858 S cm2 mol – 1 and 160 S cm2 mol – 1 respectively.
4. Given molar conductivities at infinite dilution : for Ba(OH)2 = 457.6 S cm2 mol – 1 , for BaCl2 = 240.6 S cm2 mol – 1 , for NH4Cl = 129.8 S cm2 mol – 1 . Calculate for NH4OH.
5. Find out the molar conductivity of an aqueous solution of BaCl2 at infinite dilution when ionic conductances of Ba2+ and Cl –  ion are 127.3 S cm2 mol – 1 , 76.34 S cm2 mol – 1 respectively.
6. The values for NaCl and KCl are 126.5 and 149.9 S cm2 mol – 1 respectively. The ionic conductances of Na+ at infinite dilution is 50.1 S cm2 mol – 1 . Calculate the ionic conductance at infinite dilution for K+ ion.

**Answers**

1. 390.5 S cm2 mol – 1  2. 271.6 S cm2 mol – 1 , 266 S cm2 mol – 1  3. 333 S cm2 mol – 1

4. 271.4 S cm2 mol – 1  5. 5.232 x 10 – 2 S cm2 mol – 1  6. 189 S cm2 mol – 1

7. 238.3 S cm2 mol – 1  8. 279.99 S cm2 mol – 1  9. 73.5 S cm2 mol – 1

ELECTROCHEMISTRY Page No. 3

**Karan Arora** **M: 9416974837**

**Assignment – III**

1. At 291 K, the molar conductivities at infinite dilution for NH4Cl, NaOH and NaCl are 129.8 , 217.4 and 108.9 S cm2 mol – 1 respectively. If the molar conductivity of a centinormal solution of NH4OH is 9.33 S cm2 mol – 1, what is the percentage dissociation of NH4OH at this dilution? Also calculate the dissociation constant of NH­4OH.
2. The conductivity of 0.001028 M acetic acid is 4.95 x 10 – 5 S/cm. Calculate its dissociation constant if for acetic acid is 390.5 S cm2 mol – 1.
3. If the molar conductivities at infinite dilution at 293 K for aqueous hydrochloric acid, sodium acetate and sodium chloride solution are 383.5 , 78.4 and 102 S cm2 mol – 1 respectively, calculate the molar conductivity of acetic acid at this temperature and dilution. If the molar conductivity of acetic acid at some other dilution is 100 S cm2 mol – 1 at 293 K, calculate the degree of ionization of acetic acid at the dilution.
4. The molar conductivities at infinite dilution of potassium chloride , hydrochloric acid and potassium acetate are 130.1 , 379.4 and 95.6 S cm2 mol – 1 respectively. Calculate the value of molar conductivity at infinite dilution for acetic acid. If the molar conductivity of given acetic acid solution is 48.5 S cm2 mol – 1 at 25˚C, calculate the degree of dissociation of acetic acid at this temperature.
5. The molar conductivity of acetic acid at infinite dilution is 387 S cm2 mol – 1. At the same temperature, but at a concentration of 1 mole in 1000 litres, it is 55 S cm2 mol – 1. What is the % age dissociation of 0.001 M acetic acid?
6. Conductivity of 0.00241 M acetic acid solution is 7.896 x 10 – 5 S cm – 1. Calculate its molar conductivity in this solution. If for acetic acid be 390.5 S cm2 mol – 1, what would be its dissociation constant ?
7. The conductivity of a saturated solution of AgCl at 288 K is found to be 1.382 x 10 – 6 S cm – 1. Find its solubility. Given ionic conductance of Ag+ and Cl – at infinite dilution are 61.9 S cm2 mol – 1 and 76.3 S cm2 mol – 1 respectively.
8. At 291 K, saturated solution of BaSO4 was found to have a specific conductivity of 3.648 x 10– 6 S cm– 1 , that of water used being 1.25 x 10– 6 S cm– 1. Ionic conductances of Ba2+ and ions are 110 and 136.6 S cm2 mol – 1 respectively. Calculate the solubility of BaSO4 at 291 K. (At mass of Ba = 137).

**Answers**

1. 3.92 % , 1.599 x 10 – 5  mol/L 2. 1.78 x 10 – 5  mol/L

3. = 359.9 S cm2 mol – 1, 0.278 4. = 344.9 S cm2 mol – 1 , 0.141 5. 14.21 %

6. 32.76 S cm2 mol – 1 , 1.85 x 10 – 5  mol/L 7. 1.435 x 10 – 3 g/L 8. 2.26 x 10 – 3 g/L

ELECTROCHEMISTRY Page No. 4

**Karan Arora** **M: 9416974837**

**Assignment – IV**

1. A cell is prepared by dipping a copper rod in 1 M CuSO4 solution and a nickel rod in 1 M NiSO4 solution. The standard reduction potentials of copper electrode and nickel electrode are 0.34 volt and – 0.25 volt respectively. (a) What will be the cell reaction? (b) What will be the standard EMF of the cell?

(c) Which electrode will be positive? (d) How will the cell be represented?

1. Calculate the standard EMF of a cell which involves the following cell reaction :

Zn + 2 Ag+ Zn2+ + 2 Ag

Given that = 0.76 volt and = 0.80 volt

1. For the cell : Zn (s) | ZnSO4 (aq) || CuSO4 (aq) | Cu (s), calculate standard cell potential if standard state reduction electrode potentials for Cu2+/Cu and Zn2+/Zn are +0.34 V and – 0.76 V respectively.
2. A cell is setup between copper and silver electrodes as : Cu | Cu2+ (aq) || Ag+ (aq) | Ag.

If its two half cells work under standard conditions, calculate the e. m. f. of the cell.

[Given : () = + 0.34 volt , () = + 0.80 volt ].

1. The standard e. m. f. of the cell : Ni | Ni2+ || Cu2+ | Cu, is 0.59 volt. The standard electrode potential (reduction potential) of copper electrode is 0.34 volt. Calculate the standard electrode potential of nickel electrode.
2. The EMF of the following cells are : Ag | Ag+ (1 M) || Cu2+ (1 M) | Cu : = 0.46 V

Zn | Zn2+ (1 M) || Cu2+ (1 M) | Cu : = + 1.1 V

Calculate the e. m. f. of the cell : Zn | Zn2+ (1 M) || Ag+ (1 M) | Ag

1. The half cell reaction with their oxidation potentials are : (a) Pb (s) 2 Pb2+ (aq) , = 0.13 V (b) Ag (s) Ag+ (aq) , = 0.8 V ; Write the cell reaction and calculate its emf.
2. Calculate the emf of the cell containing chromium and cadmium electrodes .

[Given : = 0.74 volt , = 0.40 volt ].

1. Two half cells are : Al3+ (aq)/Al and Mg2+ (aq)/Mg. The reduction potentials of these half cells are 1.66 V and 2.36 V respectively. Calculate the cell potential. Write the cell reaction also.

**Answers**

1. (a) Ni + Cu2+ Ni2+ + Cu (b) 0.59 V (c) copper electrode (d) Ni | NiSO4 (1 M) || CuSO4 (1 M) | Cu

2. 1.56 V 3. 1.1 V 4. 0.46 V 5. 0.25 V 6. 1.56 V

7. Pb (s) + 2 Ag+ (aq) Pb2+ (aq) + 2 Ag (s) ; EMF = 0.93 V 8. 0.34 V

9. 0.7 V ; 3 Mg + 2 Al3+ 3 Mg2+ + 2 Al

ELECTROCHEMISTRY Page No. 5

**Karan Arora** **M: 9416974837**

**Assignment – V**

1. Predict whether zinc and silver react with 1 M sulphuric acid to give out hydrogen gas or not. Given that the standard reduction potentials of zinc and silver are – 0.76 V and 0.80 V respectively.
2. Can a nickel spatula be used to stir a solution of copper sulphate? Support your answer with a reason.

= 0.25 volt , = 0.34 volt

1. Iodine (I2) and bromine (Br2) are added to a solution containing Iodide (I – ) and bromide (Br –) ions. What reaction would occur if the concentration of each species is 1 M? The electrode potentials for the reaction are : = 0.54 volt , = 1.08 volt.
2. Predict reaction of 1 N sulphuric acid with : (i) Copper (ii) Lead (iii) iron.

= 0.34 volt , = 0.13 volt , = 0.44 volt

1. Can we store : (a) Copper sulphate solution in zinc vessel? (b) Copper sulphate solution in silver vessel?

(c) Copper sulphate solution in iron vessel?

= 0.34 V , = 0.76 V , = 0.80 V , = 0.44 V

1. Why blue colour of copper sulphate solution gets discharged when zinc rod is dipped in it ? Given :

= 0.34 volt , = 0.76 volt

1. A copper wire is dipped in AgNO3 solution kept in beaker A and a silver wire is dipped in a solution of copper sulphate kept in beaker B. If standard electrode potential for : Cu2+ + 2 Cu is 0.34 V and Ag+ + Ag is 0.80 V ; Predict in which beaker the ions present will get reduced?
2. Can chlorine gas be stored in copper cylinder ? Given : = 0.34 volt , = 1.36 volt
3. Predict whether the following reaction would occur spontaneously at 298 K :

Co (s) + Fe2+ (aq) Co2+ (aq) + Fe (s)

Given [Co2+] = 1 M and [Fe2+] = 1 M = 0.28 V , = 0.44 V

1. Can a nickel spoon be used to stir a solution of silver nitrate? Support your answer with reason.

= 0.25 V , = 0.80 V

1. Using standard electrode potentials, predict the reaction, if any, that occurs between Fe3+(aq) and I– (aq)

= 0.77 V , = 0.54 V

**Answers**

1. Zn = yes , Ag = No 2. EMF comes out to be positive. Hence, CuSO4 cannot be stored in nickel vessel.

3. Br2 + 2 I –  2 Br –  + I2 4. (i) No (ii) Yes (iii) Yes 5. (i) No (ii) Yes (iii) No

6. = 1.1 V, i.e. positive. Reaction takes place changing blue colour CuSO4 to colourless ZnSO4.

7. In beaker A, Ag+ ions will be reduced 8. No 9. No 10. No

11. 2 Fe3+ + 2 I –  2 Fe2+  + I2

ELECTROCHEMISTRY Page No. 6

**Karan Arora** **M: 9416974837**

**Assignment – VI**

1. Calculate the electrode potential of a copper wire dipped in 0.1 M CuSO4 solution at 25˚C. The standard electrode potential of copper is 0.34 volt.
2. A zinc rod is dipped in 0.1 M solution of ZnSO4. The salt is 95 % dissociated at this dilution at 298 K. Calculate the electrode potential ( = 0.76 V ).
3. Represent the cell in which the following reaction takes place:

Mg (s) + 2 Ag+ (0.0001 M) Mg2+ (0.130 M) + 2 Ag (s) ; Calculate its .

Given that : = 2.37 V , = 0.80 V

1. The EMF of the following cell is found to be 0.2 V at 298 K : Cd | Cd2+ (?) || Ni2+ (2 M) | Ni . What is the molar concentration of Cd2+ ions in this solution? = 0.40 volt , = 0.25 V
2. At what pH of HCl solution will hydrogen gas electrode show electrode potential of – 0.118 V? H2 gas is bubbled at 298 K and 1 atm pressure.
3. A galvanic cell is constructed with Ag/Ag+ as one electrode and Fe2+/Fe3+ as the second electrode. Calculate the concentration of Ag+ ions in which the EMF of the cell will be zero at equimolar concentrations of Fe2+ and Fe3+ ions. Given = 0.80 V , = 0.77 V
4. Calculate the emf of the cell : Cd | Cd2+ (0.1 M) || H+ (0.2 M) | Pt, H2 (0.5 atm) ;

Given : = 0.403 volt , R = 8.314 J K – 1 mol– 1 , F = 96500 C/mol

1. Iron and nickel are used to make an electrochemical cell by using a salt bridge to join a half-cell containing 1 M solution of Fe2+ (aq) in which a strip of iron has been immersed to a second half-cell which contains 1 M Ni2+ (aq) solution in which a strip of nickel has been immersed. A voltmeter is connected between the two metal strips.
2. In which cell does reduction occur ?
3. Write the half cell reaction involved.
4. Which metal is the anode?
5. In which direction are the electrons are passing through the voltmeter?
6. What would be effect on the voltmeter reading if Fe2+ concentration were increased?
7. What will be the voltmeter reading when the cell reaches equilibrium?

Given : = 0.44 V , = 0.25 V.

1. Calculate the electrode potential of the electrode Zn/Zn2+(0.1 M) at 25˚C. ; = 0.7618 volt.
2. A galvanic cell consists of a metallic zinc plate immersed in 0.1 M Zn(NO3)2 solution and a metallic plate of lead in 0.02 M Pb(NO3)2 solution. Calculate the emf of the cell. Write the chemical equation for the electrode reactions and represent the cell. Given : = 0.76 V , = 0.13 volt

ELECTROCHEMISTRY Page No. 7

1. Calculate the standard electrode potential of the Ni2+/Ni electrode if the cell potential of the cell

Ni | Ni2+ (0.01 M) || Cu2+ (0.1 M) | Cu is 0.59 V. Given : = 0.34 volt

1. A voltaic cell is set up at 25˚C with the half cells, Al3+ (0.001 M) and Ni2+ (0.5 M) . Write an equation for the reaction that occurs when the cell generates an electric current and determine the cell potential . Given : = 0.25 V , = 1.66 V
2. The measured emf at 25˚C for the cell reaction : Zn (s) + Cu2+ (1 M) Cu (s) + Zn2+ (0.1 M) is 1.3 V. Calculate Eo for the cell reaction
3. Calculate the potential of the following cell reaction at 298 K

Sn4+ (1.5 M) + Zn (s) Sn2+ (0.50 M) + Zn2+ (2 M)

The standard potential Eo of the cell is 0.89 V. Whether the potential of the cell will increase or decrease, if the concentration of Sn4+ is increased in the cell?

1. Calculate the potential of a zinc – zinc ion electrode in which the zinc ion activity is 0.001 M. = 0.76 V , R = 8.314 J K – 1 mol– 1 , F = 96500 C/mol
2. (a) Calculate the electrode potential of silver electrode dipped in 0.1 M solution of silver nitrate of 298 K assuming AgNO3 to be completely dissociated. The standard electrode potential of Ag+ | Ag is 0.8 V at 298 K.

(b) At what concentration of Ag+ ions will this electrode have a potential of 0 Volt?

1. Cu2+ + 2 Cu ; Eo = 0.34 V ; Ag+ + Ag ; Eo = 0.80 V
2. Construct a galvanic cell using the above data.
3. For what concentration of Ag+ ions will the emf of the cell be zero at 25˚C, if the concentration of Cu2+ is 0.01 M? (log 3.919 = 0.593)
4. Calculate the potential of half cell containing 0.1 M K2Cr2O7 (aq), 0.2 M Cr3+ (aq) and 1 X 10 – 4 M H+ (aq). The half - cell reaction is : (aq) + 14 H+ (aq) + 6 2 Cr3+ (aq) + 7 H2O (l)

and the standard electrode potential is given as Eo = 1.33 V.

**Answers**

1. 0.31 V 2. – 0.79 V 3. 2.96 V 4. 0.041 M 5. pH = 2 6. 0.31 M 7. 0.4 V

8. (i) Nickel half cell (ii) Ni2+ + 2 Ni (iii) Fe (iv) iron to nickel (v) decreases (vi) 0

9. – 0.7914 V 10. 0.6094 V , Zn + Pb2+ Zn2+ + Pb ; Zn |Zn2+ (0.1 M) || Pb2+ (0.02 M) | Pb

11. – 0.2205 V 12. 1.46 V 13. 1.27045 V 14. 0.895 V , increase 15. – 0.849 V

16. (a) 0.741 V (b) 2.9 x 10 – 14 M 17. 1.7 x 10 – 9 M , Cu | Cu2+ || Ag+ | Ag 18. 0.76 V

ELECTROCHEMISTRY Page No. 8

**Karan Arora** **M: 9416974837**

**Assignment – VII**

1. Calculate the emf of the following concentration cell at 298 K ;

Zn | ZnSO4 (0.05 M) || ZnSO4 (0.5 M) | Zn

1. A cell consists of 2 hydrogen electrodes. The negative electrode is in contact with a solution having 10 – 6 M H+ ion concentration. Calculate the concentration of H+ ions at the positive electrode, if the emf of the cell is found to be 0.118 V at 298 K.
2. Calculate the equilibrium constant for the reaction : Cu (s) + 2 Ag+ (aq) Cu2+ (aq) + 2 Ag (s)

Given that : = 0.34 volt , = 0.80 volt

1. Calculate the equilibrium constant for the reaction : Zn + Cd2+ ⇌ Zn2+ + Cd

Given that : = 0.403 volt , = 0.763 volt

1. Calculate the equilibrium constant for the reaction : Zn + Cu2+ ⇌ Zn2+ + Cu

Given that : = 0.763 volt , = 0.34 volt

1. Calculate the equilibrium constant for the reaction at 298 K

4 Br –  + O2 + 4 H+ 2 Br2 + 2 H2O Given that : = 0.16 V

1. Calculate the equilibrium constant for the reaction at 298 K

2 Fe3+  + 2 I –  2 Fe2+ + I2 Given that : = 0.235 V

1. Calculate the equilibrium constant for the reaction at 298 K

NiO2 + 2 Cl –  + 4 H+ Cl2 + Ni2+ + 2 H2O Given that : = 0.32 V

1. Calculate the equilibrium constant for the reaction at 298 K : Cu (s) + Cl2 (g) CuCl2 (aq)

= 0.34 volt , = 1.36 volt

**Answers**

1. 0.02955 V 2. 10 – 4 M 3. 3.6 x 1015 4. 1.52 x 1012 5. 2.121 x 1037

6. 6.747 x 1010 7. 8.966 x 107  8. 6.747 x 1010 9. 3.295 x 1034

ELECTROCHEMISTRY Page No. 9

**Karan Arora** **M: 9416974837**

**Assignment – VIII**

1. (a) Calculate the standard free energy change and maximum work obtained for the reaction :

Zn (s) + Cu2+ (aq) ⇌ Zn2+ (aq) + Cu (s) ; Given : = 0.76 volt , = 0.34 volt

(b) Also calculate the equilibrium constant for the reaction.

1. Estimate the minimum potential difference needed to reduce Al2O3 at 500˚C. The free energy change for the decomposition reaction : Al2O3 Al + O2 is G = + 960 KJ.
2. The Eo values corresponding to the following two reduction electrode processes are : (i) Cu+/Cu = + 0.52V (ii) Cu2+/Cu+ = + 0.16 V, Formulate the galvanic cell for their combination. What will be the standard cell potential for it? Calculate Go for the cell reaction.
3. For the cell, Mg (s) | Mg2+ (aq) || Ag+ (aq) | Ag (s), calculate the equilibrium constant of the cell reaction at 25˚C and maximum work that can be obtained by operating the cell.

= 2.37 volt , = 0.80 volt

1. For the reaction : N2 (g) + 3 H2 (g) ⇌ 2 NH3 (g) at 298 K, enthalpy and entropy change are – 92.4 KJ and – 198.2 J/K respectively. Calculate the equilibrium constant of the reaction
2. Determine the values of equilibrium constant and Go for the following reaction :

Ni (s) + 2 Ag+ (aq) Ni2+ (aq) + 2 Ag (s) ; EO = 1.05 V

1. For the equilibrium, 2 H2 (g) + O2 (g) ⇌ 2 H2O (l) at 25˚C, Go is – 474.78 KJ/mol. Calculate log K for it.
2. The emf of the cell reaction, 3 Sn4+ + 2 Cr 3 Sn2+ + 2 Cr3+ is 0.89 V. Calculate Go for the reaction.
3. Calculate the cell emf at 25˚C for the cell : Mg (s) | Mg2+ (0.01 M) || Sn2+ (0.1 M) | Sn (s).

= 2.34 volt , = 0.136 volt

Calculate the maximum work that can be accomplished by the operation of this cell.

1. Write the cell formulation and calculate the standard cell potential of the galvanic cell in operation of which the reaction taking place Is : 2 Cr (s) + 3 Cd2+ (aq) 2 Cr3+ (aq) + 3 Cd (s). Calculate Go for the reaction. Given that : = 0.74 volt , = 0.40 volt
2. + 14 H+ + 6 Cr+++ + 7 H2O , Eo = 1.33 V.

3 X [ 2 I –  I2 + 2 ] , Eo = 0.54 V. Find out the value of equilibrium constant and Gibbs free energy change in the reaction given above.

**Answers**

1. (a) – 212.3 KJ/mol (b) 1.6 x 1037 2. 2.487 V 3. – 34740 J/mol

4. Max. work = 611.81 KJ , K = 1.891 x 10107 5. 6.958 x 105 6. 3.41 x 1035 , – 2.02 x 105 J

7. 83.2 8. – 515310 J 9. 2.236 V , 425.372 KJ

10. 0.34 V , – 196.86 KJ/mol 11. 1.596 x 1080 , – 457.41 KJ/mol

ELECTROCHEMISTRY Page No. 10

**Karan Arora** **M: 9416974837**

**Assignment – IX**

1. How much charge is required for the following reduction ?

(i) 1 mol of Al3+ to Al (ii) 1 mol of Cu2+ to Cu (iii) 1 mol of to Mn2+

[Ans = (i) 289500 C (ii) = 193000 C (iii) = 482500 C]

1. Calculate the charge in coulombs required for the oxidation of :

(i) 2 moles of H2O to O2 (ii) 1 mol of FeO to Fe2O3 [Ans = (i) 386000 C (ii) 96500 C]

1. How many coulombs of electricity are required for:

(i) Complete oxidation of 90 g of H2O [Ans = 965000 C]

(ii) Complete reduction of 100 mL of 0.1 M KMnO4 solution? [Ans = 4825 C]

1. A solution of CuSO4 is electrolysed for 10 minutes with a current of 1.5 amperes. What is the mass of copper deposited at the cathode? (At. mass of Cu = 63.5 g/mol) [Ans = 0.296 g]
2. Two electrolytic cells containing silver nitrate solution and copper sulphate solution are connected in series. A steady current of 2.5 ampere was passed through them till 1.078 g of Ag were deposited. How long did the current flow? What weight of Cu will be deposited? (At. mass : Ag = 107.8, Cu = 63.5)

[Ans = 386 s, 0.3175 g]

1. Silver is electro-deposited on a metallic vessel of surface area 800 cm2 by passing a current 0.2 ampere for 3 hours. Calculate the thickness of silver deposited. Given the density of silver as 10.47 g/cc (At. mass of Ag = 107.92 amu) [Ans = 2.88 x 10-4 cm]
2. In the electrolysis of acidulated water, it is desired to obtain hydrogen at the rate of 1cc per second at NTP condition. What should be the current passed? [Ans = 8.6 ampere]
3. Find the charge in coulombs on 1 g-ion of N3-. [Ans = 2.89 x 105 C]
4. When a current of 0.75 A is passed through CuSO4 solution for 25 min, 0.369 g of copper is deposited at the cathode. Calculate the atomic mass of copper? [Ans = 63.3 g]
5. Calculate the quantity of electricity that would be required to reduce 12.3 g of nitrobenzene to aniline if the current efficiency for the process is 50%. If the potential drop across the cell is 3 volts, how much energy will be consumed? [Ans = 347400 J]
6. A current of 4 ampere was passed for 1.5 hours through a solution of copper sulphate when 3.2g of copper was deposited. Calculate the current efficiency? [Ans = 45%]
7. How many electrons flow through a metallic wire if a current of 0.5 A is passed for 2 hours? (Given : 1F = 96500 C/mol) [Ans = 2.25 x 1022]

ELECTROCHEMISTRY Page No. 11