R.H.M. Public Sr. Sec. School
Social Reforms By Education With Edutainment
(Affiliated to CBSE, New Delhi, Affliation No : 40972, School Code : 20605)

Class XII Assignment

Electrochemistry Assignment

1. Differentiate between Galvanic cell and electrolytic cell
2. How would you determine the standard electrode potential of the system $Mg^{2+}|Mg$
3. Depict the galvanic cell in which the reaction takes place. Further show:

$$Zn(s)+2Ag^{+}(aq) \rightarrow Zn^{2+}(aq)+2Ag(s)$$

   (i) Which of the electrode is negatively charged? (ii) The carriers of the current in the cell. (iii) Individual reaction at each electrode.
4. How is electrode potential different from cell potential
5. Describe the construction and working of standard hydrogen electrode.
6. What is the purpose of salt bridge placed between two half cells of a galvanic cell?
7. Give the representation of the Daniel cell.
8. Define resistivity and conductivity.
9. What is cell constant? How is it determined?
10. What are the problems faced in measuring R of ionic solutions and how are they overcome
11. Differentiate between metallic and electrolytic conduction.
12. Define the terms conductivity and molar conductivity for solution of an electrolyte. Discuss their variation with concentration.
13. What is the unit of molar conductivity?
14. What is limiting molar conductivity?
15. Describe the characteristics of variation of molar conductivity with dilution for a) strong electrolyte b) weak electrolyte. (or) With the help of a graph explain why it is not possible to determine the limiting molar conductivity for a weak electrolyte by extrapolating the concentration-molar conductance curve as for strong electrolytes. (or) Express the relationship between degree of dissociation of an electrolyte and its molar conductivities.
16. How is molar conductivity of a weak electrolyte at infinite dilution determined? (or) State Kohlrausch's Law. Write two applications.
17. How will you determine Λ_m^0 for water
18. State Faraday's Laws of Electrolysis.
19. What is the difference between primary cell and secondary cell?
20. Describe the Lechlanche cell with reference to electrodes used and reactions occurring at electrodes.
21. Describe the composition of anode and cathode in mercury cell. Write the electrode reactions
22. Write the cell reactions which occur in lead storage battery when battery is in use and when it is on charging
23. What is the reaction taking place in Nickel cadmium cell?
24. What are fuel cells? Suggest two materials other than hydrogen that can be used as fuels in fuel cell.
25. Describe the hydrogen fuel cell.
26. Rusting is an electrochemical process. Explain.
27. How can corrosion be prevented?

28. Account for the following
a) Rusting of iron is quicker in saline water than in ordinary water. b) Alkaline medium inhibits the rusting of iron. c) Iron does not rust even if zinc coating is broken in a galvanized iron pipe.
29. Predict the products of electrolysis in each of the following:
(i) An aqueous solution of $AgNO_3$ with silver electrodes. (ii) An aqueous solution of $AgNO_3$ with platinum electrodes. (iii) A dilute solution of H_2SO_4 with platinum electrodes. (iv) An aqueous solution of $CuCl_2$ with platinum electrodes.
30. Standard reduction potentials are given below
F_2/F^- = +2.9V, Ag^+/Ag = - 0.8V, Cu^+/Cu = +0.5V Fe^{2+}/Fe = -0.4V, Na^+/Na= -2.7V , K^+/K= -2.9V
a) Arrange oxidizing agents in order of increasing strength b) Which will oxidize Cu to Cu^+ under standard conditions
31. Can you store copper sulphate solutions in a zinc pot?
32. Given the standard electrode potentials,
K^+/K = –2.93V, Ag^+/Ag = 0.80V,
Hg^{2+}/Hg = 0.79V
Mg^{2+}/Mg = –2.37 V, Cr^{3+}/Cr = – 0.74V
Arrange these metals in their increasing order of reducing power.
33. Arrange the following metals in the order in which they displace each other from the solution of their salts. Al, Cu, Fe, Mg and Zn.
34. Why is it necessary to platinize the electrodes of a conductivity cell before it is used for conductance measurement?
35. Suggest a list of metals that are extracted electrolytically.

EXTRA

1. Define the term – standard electrode potential?
2. What is electromotive force of a cell?
3. Can an electrochemical cell act as electrolytic cell? How?
4. Single electrode potential cannot be determined. Why?
5. What is an electrochemical series? How does it predict the feasibility of a certain redox reaction?
6. Give some uses of electrochemical cells?
7. What is meant by Faraday's constant?
8. A Leclanche cell is also called dry cell. Why?
9. Why is the voltage of a mercury cell constant during its working?
10. Name two metals than can be used for cathodic protection of iron

Numericals for Practice

1. The conductivity of an aq. Solution of NaCl in a cell is 92 x 10^{-4} $ohm^{-1}cm^{-1}$. The resistance offered by the cell is 247.8ohm. Calculate the cell constant for the cell. (2.28/cm)
2. The conductivity of a solution containing 1g of anhydrous $BaCl_2$ in 200cm3 of the solution is found to be 0.0058S/cm. Calculate the molar conductivity of the solution. (λm = 241.28Scm^2/)
3. The resistance of a 0.01M solution of KCl is 100Ω at 298 K. Calculate (1) conductance (ii) conductivity (iii) resistivity (10^{-2}, 10^{-2}, 100) G* = $1cm^{-1}$
4. 0.5 molar solution of a salt placed between platinum electrodes 2 cm apart and each of area of cross section $4cm^2$ has a resistance of 25Ω. Calculate λm. (40)
5. Calculate the molar conductivity at infinite dilution of AgCl from the following data. $\Lambda^o m$ $AgNO_3$ = 133.4, $\Lambda^o m$KCl = 149.9, $\Lambda^o m$ KNO_3 = 144.9 Scm^2/mol (138.45 Scm^2/mol)
6. The conductivity of 0.001 M acetic acid is 4.95 X 10^{-5} S/cm. Calculate the dissociation constant. $\Lambda^o m$ = 90.5 Scm^2/mol. ($1.85x10^{-5}$)
7. At 18 ºC, the conductivities at infinite dilution of NH4Cl, NaOH and NaCl are 129.8, 217.4 and 108.9 Scm^2/mol. If the equivalent conductivity of n/100 solution of NH_4OH is 9.93

Scm^2/eq, Calculate the degree of dissociation and dissociation constant at this dilution. (4.17%, $1.8x10^{-5}$)

8. Construct the cells in which the following reactions are taking place. Which of the electrodes act as anode and which as cathode?
   i) $Zn + CuSO_4 \rightarrow ZnSO_4 + Cu$ ii) $Cu + 2AgNO_3 \rightarrow Cu(NO_3)_2 + 2Ag$ iii) $Zn + H_2SO_4 \rightarrow ZnSO_4 + H_2$ iv) $Fe + SnCl_2 \rightarrow FeCl_2 + Sn$
9. Calculate the electrode potential at a copper electrode dipped in a 0.1 M solution of copper sulphate at 25ºC. The standard electrode potential of Cu^{2+}/Cu system is 0.34 V (0.31V)
10. What is a single electrode potential of a half cell for zinc electrode dipping in 0.01M zincsulphate solution at 25ºC.The standard electrode potential of Zn/Zn2+ system is 0.763 V. (0.8221V)
11. Calculate the emf of the cell. $Mg/Mg^{2+}(1M)||Ag^+$ (0.001M)|Ag $E^oAg^+/Ag = 0.8V$; $|E^oMg^{2+}/Mg = -237V$. What will be the effect on emf if concentration of Mg^{2+} is decreased to 0.1M? (3.013V; 3.022V)
12. To find the standard potential of M^{3+}/M electrode, the following cell is constituted. Pt| $M/M^{3+}(0.00018M)||Ag^+$ (0.01M)|Ag. The emf of this cell is found to be 0.42V. Calculate the standard potential of the half reaction $M^{3+} + 3e^- \rightarrow M$ $E^oAg^+/Ag = 0.8V$ (0.32V)
13. A zinc rod is dipped in 0.1M solution of $ZnSO_4$. The salt is 95% dissociated at this dilution at 298 K. Calculate the electrode potential given that $E^oZn^{2+}/Zn = -0.76V$ (-0.79V)
14. One half in a voltaic cell is constructed from a silver wire dipped in silver nitrate solution of unknown concentration. The other half cell of zinc electrode in 0.10M solution of $Zn(NO)_3$. A voltage of 1.48 is measured for this cell. Use this information to calculate the concentration of silver nitrate solution. $E^oZn^{2+}/Zn = -0.763V$; $E^oAg^+/Ag = 0.8V$ (0.0124M)
15. Calculate the pH of the half cell $Pt(H_2)1atm/H_2SO_4$, its oxidation potential is 0.4V (6.77)
16. Calculate the cell potential of the following concentration cell . $PtH_2(2atm)|H^+(0.M)||H^+$ (0.3M)| H_2(4atm) (0.019V)
17. For the reaction $Ni/Ni^{2+}||Ag^+|Ag$ $E^oNi^{2+}/Ni = -0.25V$; $E^oAg^+/Ag = 0.8V$. Calculate the equilibrium constant at 25ºC. How much maximum work can be obtained by the operation of the cell? (3.98×10^{35}, 202650J)

18. Estimate the minimum potential difference needed to reduce Al_2O_3 at 500ºC. The free energy for decomposition reaction $2/3\ Al_2O_3 \rightarrow 4/3\ Al + O_2$ is 960KJ/mol.(2.847V)
19. How many molecules of chlorine will be liberated by electrolysis of an aqueous solution of NaCl in 1 minute by a current of 600mA?
20. How many hours does it take to reduce 3 moles of Fe^{3+} to Fe^{2+} with a 2 ampere current?
21. A current of 100 ampere is passed through a molten solution of molten NaCl for 5 hours. Calculate the volume of chlorine gas liberated at the anode at NTP?

Board Questions 2011

1. What type of battery is a lead storage battery? Write the anode and cathode reactions occurring in the operation of lead storage battery.
2. Calculate the potential of the half cell containing 0.10M $K_2Cr_2O_7$(aq), 0.20M cr^{3+}(aq) and 1.0 x 10^{-4}M H^+(aq). The half reaction is $Cr_2O_7^{2-} + 14H+ \rightarrow 2Cr^{3+} + 7H_2O$ and the standard electrode potential is 1.33V.
3. How many moles of mercury will be produced by electrolysing1.0M $Hg(NO_3)_2$ solution with a current of 2 amp for 3 hours? ($Hg(NO_3)_2$ = 200.6g/mol)
4. A voltaic cell is set up at 25 ºC with the following half cells Al^{3+} (0.001M) and Ni^{2+}(0.05M). Write an equation for the reaction that occurs when the cell generates an electric current and determine the cell potential. Ag $E^ºNi^{2+}/Ni$ = -0.25V; $E^ºAl^{3+}/Al$ = -1.66V

2010

1. What is meant by limiting molar conductivity?
2. Express the relationship among the cell constant, the resistance of the solution in the cell and the conductivity of the solution. How is the conductivity of a solution related to its molar conductivity?
3. Given the standard electrode potentials, Arrange these metals in their increasing order of reducing power

   K^+/K = –2.93V, Ag^+/Ag = 0.80V,
   Hg^{2+}/Hg = 0.79V
   Mg^{2+}/Mg = –2.37 V, Cr^{3+}/Cr = – 0.74V .
4. Two half reactions of electrochemical cell are given below
   MnO^{4-} (aq) + $8H^+$(aq) + 5e- → Mn^{2+} (aq) + $4H_2O$ $E^º$ = 1.51V Sn^{2+} (aq) → Sn^{4+} + e^- $E^º$ = 0.15V .Construct redox reaction from 2 half reactions and calculate the cell potential from the standard potentials and predict if the reaction is reactant or product favoured

2009

1. What type of battery is a lead storage battery? Write the anode and cathode reactions occurring in the operation of a lead storage battery.
2. Two half reactions of electrochemical cell are given below
   MnO^{4-} (aq) + $8H^+$(aq) + 5e- → Mn^{2+} (aq) + $4H_2O$ $E^º$ = 1.51V Sn^{2+} (aq) → Sn^{4+} + e^- $E^º$ = 0.15V Construct the redox reaction from the two half reactions and calculate the cell potential from the standard potentials and predict if the reaction is reactant or product favoured
3. A voltaic cell is set up at 25 ºC with the following half cells Al/ Al^{3+} (0.001M) and Ni^{2+}/Ni(0.05M). Write an equation for the reaction that occurs when the cell generates an electric current and determine the cell potential. Ag $E^ºNi^{2+}/Ni$ = -0.25V; $E^ºAl^{3+}/Al$ = -1.66V
4. A copper silver cell is set up. The copper io concentration in it is 0.10M. The concentration of silver ion is not known. The cell potential measured is not known. Determine the concentration of silver ion in the cell. . $E^ºCu^{2+}/Cu$ = 0.34 V; $E^ºAg^+/Ag$ = 0.8V

2008

1. Depict the galvanic cell in which the reaction takes place. Further show (i) Which of the electrode is negatively charged? (ii) The carriers of the current in the cell. (iii) Individual reaction at each electrode.

   $Zn(s)+2Ag^+(aq) \rightarrow Zn^{2+}(aq)+2Ag(s)$

2. Write the Nernst equation and emf of the following at 298 K: $Mg(s)|Mg^{2+}(0.001M)||Cu^{2+}(0.0001\ M)|Cu(s)$ $E^ºCu^{2+}/Cu$ = 0.34 V; $E^ºMg^{2+}/Mg$ = - 2.375V
3. Define conductivity and molar conductivity for the solution of an electrolyte. Discuss their variation with concentration.
4. Three electrolytic cells A,B,C containing solutions of $ZnSO_4$, $AgNO_3$ and $CuSO_4$,respectively are connected in series. A steady current of 1.5 amperes was passed through them until 1.45 g of silver deposited at the cathode of cell B. How long did the current flow? What mass of copper and zinc were deposited?