CHEMISTRY

NCERT - NCERT CHEMISTRY(TELUGU)

ELECTROCHEMISTRY

Example

1. Represent the cell in which the following reaction takes place

$$Mg(s) + 2Ag^{+}(0.0001M) \rightarrow Mg^{2+}(0.130M) + 2Ag(s)$$

Calculates its E_{cell} if $E_{\text{cell}}^{\Theta} = 3.17V$

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2. Calculate the equilibrium constant of the reaction :

$$Cu_{(s)} + 2Ag^{+}_{(aq)} \rightarrow Cu^{2+}_{(aq)} + 2Ag_{(a)}$$

$E^{\Theta}_{(cell)} = 0.46V$

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3. The standard emf of Deniell cell is 1.1 V. Calculate the standard Gibbs energy for the cell reactions:

$Zn_{(s)} + Cu^{2+}_{(aq)} \rightarrow Zn^{2+}_{(aq)} + Cu_{(s)}$

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4. Resistance of a conductivity cell filled with $0.1 molL^{-1}$ KCl solution is 100Ω . If the resistacne of the same cell when filled with 0.02 $molL^{-1}$ KCl solution is 520Ω , calculate the conductivity and molar conductivity of 0.02 mol L^{-1} KCl solution . The conductivity of $0.1 molL^{-1}$ KCl solution is 1.29 S/m.

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5. The electrical resistance of a column $0.05 mol L^{-1}$ NaOH solution of diameter 1 cm and length 50 cm is 5.55×10^3 ohm. Calculate its resistivity, conductivity and molar conductivity.

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6. The molar conductivity of KCl soluitons at difference concentrations at 298 K are given below :

$c/\text{mol} L^{-1}$	$\wedge_m / Scm^2 \text{ mol}^{-1}$
0.000198	148.61
0.000309	148.29
0.000521	147.81
0.000989	147.09

Show that a plot between E_m and $c^{1/2}$ is a straight line . Determie the values of E_m° and A for KCl.

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7. Calculate $\wedge_m^0$ for $CaCl_2$ and $MgSO_4$ from the data given in Table 3.4.

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8. $\wedge_m^0$ for NaCl, HCl and NaAc are $126.4, 425.0$ and $91.0 Scm^2 mol^{-1}$ respectively. Calculate $\wedge(0)$ for Hac.

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9. The conductivity of $0.001028 molL^{-1}$ acetic acid is $4.95 \times 10^{-5} Scm^{-1}$. Calculate its dissociation constant if $\wedge(m)^0$ for acetic acid id $390.5 Scm^2 mol^{-1}$.

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10. A solution of $CuSO_4$ is electrolysed for 10 minutes with a current of 1.5 amperes. What is the mass of copper deposited at the cathode ?

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Intext Questions

1. How would you determine the standard electrode potential of the system Mg^{2+}/Mg?

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2. Can you store copper sulphate soolutions in a zinc pot ?

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3. Consult the table on standard electrode potentials and suggest three substance that can oxidise ferrous ions under suitable conditions.

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4. Calculate the potential of hydrogten electrode placed in a solution of pH 10.

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5. Calculate the emf of the cell with the cell reaction

$Ni_{(s)} + 2Ag^{+}(0.002M) \rightarrow Ni^{2+}(0.160M) + 2Ag_{(s)}$

$E^{0}_{cell} = 1.05V.$

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6. The cell in which the following cell reaction occurs,

$2Fe^{3+}_{(aq)} + 2I^{-}_{(aq)} \rightarrow 2Fe^{2+}_{(aq)} + I_{2(s)}$

has $E^{0}_{cell} = 0.236V$ at 298 K. Calculate the standard Gibbs energy and the equilibrium costant of the cell reaction.

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7. Why does the conductivity of a solution decrease with dilution ?

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8. Suggest a way to determine the $\wedge_m^0$ value of water.

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9. The molar conductivity of $0.025 mol L^{-1}$ methanoic acid is $46.1 Scm^2 mol^{-1}$. Calculate its degree of dissociation and dissociation constant.

Given, $\lambda^0(H^+) = 349.6 Scm^2 mol^{-1}$

and $\lambda^0(HCOO^-) = 54.6 Scm^2 mol^{-1}$

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10. If a current of 0.5 ampere flows through a metallic wire for 2h, then how many electrons would flow through the wire ?

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11. Suggest a list to metals that are extracted electrolytically.

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12. Consider the reaction,

$$Cr_2O_7^{2-} + 14H^+ + 6e^- \rightarrow 2Ce^{3+} + 7H_2O$$

What is the quantity of electricity in coulombs needed to reduce 1 mole $Cr_2O_7^{2-}$?

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13. Write the chemistry of recharging the lead stronge battery, highlighting all the materials that are involved during recharging.

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14. Suggest two materials other than hydrogen that can be used as fuels in fule cells.

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15. Explain how rusting of iron is envisaged as setting up of an electrochemical cell.

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Exercises

1. i) 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

ii) Calculate the molarity of sodium carbonate in a solution prepared by dissolving 5.3 g in enough water to form 250 ml of the solution.

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2. The standard potentials of some electrodes are as follows. Arrange the metals in an increasing order of their reductiong power.

$1)K^{+}/K = -2.93V \quad 2)Ag^{+}/Ag = 0.80V \quad 3)Cu^{2+}/Cu = 0.34V$

$4)Mg^{2+}/Mg = -2.37V \quad 5)Cr^{3+}/Cr = -0.74C \quad 6)Fe^{+}/Fe = -$

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3. Depict the galvanic cell in which the reaction $Zn(s) + 2Ag^{+}(aq) \rightarrow Zn^{2+}(aq) + 2A(s)$ 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.

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4. Calculate the standard cell potentials of galvanic cell in which the following reactions take place.

(i) $2Cr(s) + 3Cd^{2+}(aq) \rightarrow 2Cr^{3+}(aq) + 3Cd$

(ii) $Fe^{2+}(aq) + Ag^{+}(aq) \rightarrow Fe^{3+}(aq) + Ag(s)$

Calculate the ΔrG and equilibrium constant of the reactions.

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5. Write the Nernst equation and emf of the following cells at 298 K:

(i) $Mg(s)|Mg^{2+}(0.001M)|Cu^{2+}(0.0001M) \mid Cu(s)$

(ii) $Fe(s)|Fe^{2+}(0.001M)|H^{+}(1M)|H_2(g)(1^{-})|Pt(s)$

(iii) $Sn(s)|Sn^{2+}(0.050M)|H^{+}(0.020M)|H_2(g)(1\text{bar})|Pt(s)$

(iv) $Pt(s)|Br_2(l)|Br^{-}(0.010M)|H^{+}(0.030M)|H_2(g)(1\text{bar})) \mid Pt(s)$.

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6. Calculate ΔG° for the following cell reaction.

$Zn_{(s)} + Ag_2O_{(s)} + H_2O((I)) \rightarrow Zn_{aq}^{2+} + 2Ag(s) + 2OH^{-}_{(aq)}$

$E^{\circ}_{\frac{Ag^{+}}{Ag}} = +0.80V$ and $E^{\circ}_{\frac{Zn^{2+}}{Zn}} = -0.76V$

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7. Define conductivity and molar conductivity for the solution of an electrolyte. Discuss their variation with concentration.

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8. The conductivity of $0.20M$ solution of KCl at 298 K is $0.0248Scm^{-1}$. Calculate molar conductance.

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9. The resistance of a conductivity cell containing 0.001M KCl solution at 298 K is 1500Ω. What is the cell constant if conductivity of 0.001M KCl solution at 298 K is $0.146 \times 10^{-2}Scm^{-1}$.

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10. Conductivity of 0.00241 M acetic acid is 7.896×10^{-4} S cm^{-1} . Calculate its moar conductivity and if $\wedge_m^\circ$ for acetic is 390.5 S $cm^2 mo^{-1}$, what is its dissociation constant ?

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11. How much charge is required for the following reductions:

(i) 1 mol of Al^{3+} to Al.

(ii) 1 mol of Cu^{2+} to Cu.

(iii) 1 mol of MnO_4^- to Mn^{2+}.

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12. How much electricity in terms of Faraday is required to produce .

(i) 20.0 g of Ca from molten $CaCl_2$

(ii) 40.0 g of Al form molten Al_2O_3 .

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13. How much electricity is required in coulomb for the oxidation of

(i) 1 mol of H_2O to O_2.

(ii) mol of FeO to Fe_2O_3.

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14. A solution of $Ni(NO_3)_2$ is electrolysed between platinum electrodes using a current of 5 amperes for 20 minutes. What mass of Ni is deposited at the cathode?

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15. 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?

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16. Using the standard electron potentials given in the Table 8.1, predict if the reaction between the following is feasible :

(a) $Fe^{3+}(aq)$ and $I^{-}(aq)$

(b) $Ag^{+}(aq)$ and $Cu(s)$

(c) $Fe^{3+}(aq)$ and $Cu(s)$

(d) $Ag(s)$ and $Fe^{3+}(aq)$

(e) $Br_2(aq)$ and $Fe^{2+}(aq)$

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17. 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.

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