

Electrochemistry

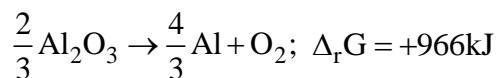
1. Cell Notation & Cell Reaction

- Q 1. In Galvanic cell
 (A) Chemical reaction produces electrical energy
 (B) Electrical energy produces chemical reaction
 (C) Reduction occurs at anode
 (D) Oxidation occurs at cathode
- Q 2. In Galvanic cell, which half cell is kept left conventionally
 (A) Oxidation half cell (B) Reduction half cell
 (C) Redox half cell (D) Cathodic half cell
- Q 3. In Galvanic cell, electron flow occur spontaneously from
 (A) Anode (+ve) to cathode (-ve electrode)
 (B) Anode (-ve) to cathode (+ve electrode)
 (C) Cathode (-ve) to Anode (+ve electrode)
 (D) Cathode (+ve) to Anode (-ve electrode)
- Q 4. Choose the incorrect statement(s)
 (A) Salt bridge prevents voltage drop
 (B) KCl can't be used in salt bridge
 (C) Salt bridge minimizes liquid - liquid junction potential
 (D) Salt bridge is employed to maintain the electrical neutrality of the solution
- Q 5. NaCl is not used in salt bridge. it may be due to
 (A) It is a strong electrolyte
 (B) It does not dissolve in agar - agar gel
 (C) cation and anion mobilities are not equal
 (D) It has high covalent character
- Q 6. Which electrolyte can't be used in salt bridge
 (A) KCl (B) NaF
 (C) CaO (D) MgO
- Q 7. Calomel electrode ($\text{Hg}/\text{Hg}_2\text{Cl}_2, \text{Cl}^-$) is an example of
 (A) Metal - Metal insoluble electrode
 (B) Metal - Metal insoluble salt - common anion electrode
 (C) Redox electrode
 (D) None of these
- Q 8. Br_2/Br^- is an example of
 (A) Redox electrode (B) gas electrode
 (C) non - metal electrode (D) None of these
- Q 9. The reaction :
 $\frac{1}{2} \text{Hg}_2(\text{g}) + \text{AgCl}(\text{s}) = \text{H}^+(\text{aq}) + \text{Cl}^-(\text{aq}) + \text{Ag}(\text{s})$
 Occurs in the galvanic cell
 (A) $\text{Ag} | \text{AgCl}(\text{s}) | \text{KCl}(\text{soln}) | \text{AgNO}_3(\text{soln}) | \text{Ag}$
 (B) $\text{Pt} | \text{H}_2(\text{g}) | \text{HCl}(\text{soln}) | \text{AgNO}_3(\text{soln}) | \text{Ag}$
 (C) $\text{Pt} | \text{H}_2(\text{g}) | \text{HCl}(\text{soln}) | \text{AgCl}(\text{s}) | \text{Ag}$
 (D) $\text{Ag} | \text{AgCl}(\text{s}) | \text{KCl}(\text{soln}) | \text{AgCl}(\text{s}) | \text{Ag}$
- Q 10. For the cell reaction
 $2\text{Cr} + 3\text{OCl}^- + 3\text{H}_2\text{O} \rightarrow 2\text{Cr}^{3+} + 3\text{Cl}^- + 6\text{OH}^-$
 cell notation is
 (A) $\text{Pt} | \text{Cr}, \text{Cr}^{3+} || \text{OCl}^-, \text{Cl}^- | \text{Pt}$
 (B) $\text{Cr} | \text{Cr}^{3+} || \text{OCl}^-, \text{Cl}^- | \text{Pt}$
 (C) $\text{Pt} | \text{Cr}, \text{Cr}^{3+} || \text{OCl}^-, \text{Cl}^- | \text{H}_2\text{O}$
 (D) $\text{Cr} | \text{Cr}^{3+} || \text{OCl}^-, \text{Cl}^- | \text{H}_2\text{O}$
- Q 11. Write cell reaction of the following cells
 (A) $\text{Ag} | \text{Ag}^+(\text{aq}) || \text{Cu}^{2+}(\text{aq}) | \text{Cu}$
 (B) $\text{Pt} | \text{Fe}^{2+}, \text{Fe}^{3+} || \text{MnO}_4^-, \text{Mn}^{2+}, \text{H}^+ | \text{Pt}$
 (C) $\text{Pt} | \text{Cl}_2 | \text{Cl}^-(\text{aq}) | \text{Ag}^+(\text{aq}) | \text{Ag}$
 (D) $\text{Pt} | \text{H}_2 | \text{H}^+(\text{aq}) | \text{Cd}^{2+}(\text{aq}) | \text{Cd}$
- Q 12. Write cell representation for following cells
 (A) $\text{Cd}^{2+}(\text{aq}) + \text{Zn}(\text{s}) \rightarrow \text{Zn}^{2+}(\text{aq}) + \text{Cd}(\text{s})$
 (B) $2\text{Ag}^+(\text{aq}) + \text{H}_2(\text{g}) \rightarrow 2\text{H}^+(\text{aq}) + 2\text{Ag}(\text{s})$
 (C) $\text{Cr}_2\text{O}_7^{2-}(\text{aq}) + 14\text{H}^+(\text{aq}) + 6\text{Fe}^{2+}(\text{aq}) \rightarrow 6\text{Fe}^{3+}(\text{aq}) + 2\text{Cr}^{3+}(\text{aq}) + 7\text{H}_2\text{O}(\text{l})$
- Q 13. Which of the following statement is true for electrochemical Daniell Cell? [AIIMS 2004]
 $\text{Zn} | \text{Zn}^{2+}(\text{aq}) || \text{Cu}^{2+}(\text{aq}) | \text{Cu}$
 (A) Electrons flow from Cu to Zn Electrode
 (B) Current flow from Zn to Cu electrode
 (C) Cations move towards Cu electrode
 (D) Anion move towards Zn electrode

2. Emf of Cell, Electrode Potential

- Q 1. Emf of cell is defined as
 (A) electromotive force exerted by cell
 (B) Force exerted by cell on electron
 (C) Work done by cell per unit charge transferred
 (D) None of these
- Q 2. The difference between the electrode potentials of two electrodes when no current is drawn through the cell is called [NCERT Exemplar]
 (A) cell potential (B) cell emf
 (C) potential difference (D) both A & B
- Q 3. For the reaction $\text{Ag} \rightarrow \text{Ag}^+ + \text{e}^-$; $\varepsilon^\circ = 0.80\text{V}$
 then for $2\text{Ag} \rightarrow 2\text{Ag} + 2\text{e}^-$; ε° is
 (A) 1.60 V (B) 0.80 V
 (C) 0.40 V (D) None of these
- Q 4. Reduction potential tell about
 (A) relative ability to reduce others
 (B) relative ability to reduce itself
 (C) relative ability to oxidize itself
 (D) None of these
- Q 5. Given that E° for Fe^{3+}/Fe & E° Fe^{2+}/Fe are -0.36V and -0.439V , respectively. The value of E° $\text{Fe}^{3+}, \text{Fe}^{2+}/\text{Pt}$ would be
 (A) $(-0.36 - 0.439)\text{V}$
 (B) $[3(-0.36) + 2(-0.439)]\text{V}$
 (C) $(-0.36 + 0.439)\text{V}$
 (D) $[3(-0.36) - 2(-0.439)]\text{V}$
- Q 6. The standard reduction potentials of $\text{Cu}^{2+}|\text{Cu}$ and $\text{Cu}^{2+}|\text{Cu}^+$ are 0.337V and 0.153V respectively. The standard electrode potential of $\text{Cu}^+|\text{Cu}$ half cell is [IIT-1997]
 (A) 0.184 V (B) 0.827 V
 (C) 0.521 V (D) 0.490 V
- Q 7. Given that $E^\circ_{\text{MnO}_4^-, \text{Mn}^{2+}} = 1.51\text{V}$ & $E^\circ_{\text{MnO}_2, \text{Mn}^{2+}} = 1.23\text{V}$, Calculate $E^\circ_{\text{MnO}_4^-, \text{MnO}_2}$
 (A) 1.69 V (B) 0.28 V
 (C) -1.69 V (D) 2.74 V
- Q 8. Calculate E°_{cell} for the cell reaction $2\text{Ce}^{4+} + \text{Co} \rightarrow 2\text{Ce}^{3+} + \text{Co}^{2+}$. If $E^\circ_{\text{Co}^{2+}|\text{Co}}$ is -0.28V and $E^\circ_{\text{Ce}^{4+}|\text{Ce}^{3+}} = 1.61\text{V}$
 (A) 1.89V (B) -1.89 V
 (C) 1.33V (D) -1.33 V
- Q 9. What is E°_{Cell} if
 $2\text{Cr} + 3\text{H}_2\text{O} + 3\text{OCl}^- \rightarrow 2\text{Cr}^{3+} + 3\text{Cl}^- + 6\text{OH}^-$
 $\text{Cr}^{3+} + 3\text{e}^- \rightarrow \text{Cr}, E^\circ = -0.74\text{V}$
 $\text{OCl}^- + \text{H}_2\text{O} + 2\text{e}^- \rightarrow \text{Cl}^- + 2\text{OH}^-, E^\circ = 0.94\text{V}$
 (A) 0.20 V (B) 1.68 V
 (C) 4.30 V (D) 1.34 V
- Q 10. Two electro chemical cells are assembled in which the following reactions occur,
 $\text{V}^{2+} + \text{VO}^{2+} + 2\text{H}^+ \rightarrow 2\text{V}^{3+} + \text{H}_2\text{O};$
 $E^\circ_{\text{Cell}} = 0.616\text{V}$
 $\text{V}^{3+} + \text{Ag}^+ + \text{H}_2\text{O} \rightarrow \text{VO}^{2+} + \text{VO}^{2+} + 2\text{H}^+ + \text{Ag};$
 $E^\circ_{\text{Cell}} = 0.439\text{V}$
 Then E° for the half reaction, $\text{V}^{3+} + \text{e}^- \rightarrow \text{V}^{2+}$, is; [Given: $E^\circ_{\text{Ag}^+|\text{Ag}} = 0.799\text{V}$]
 (A) -0.256V (B) $+0.256\text{V}$
 (C) -1.05V (D) $+1.05\text{V}$
- Q 11. Consider a voltaic cell based on these half -cells
 $\text{Ag}^+(\text{aq}) + \text{e}^- \rightarrow \text{Ag}(\text{s}); E^\circ = +0.80\text{V}$
 $\text{Cd}^{2+}(\text{aq}) + 2\text{e}^- \rightarrow \text{Cd}(\text{s}); E^\circ = -0.40\text{V}$
 Identify the anode and give the voltage of this cell under standard conditions
 (A) Ag; $E^\circ_{\text{Cell}} = 0.40\text{V}$ (B) Ag; $E^\circ_{\text{Cell}} = 2.00\text{V}$
 (C) Cd; $E^\circ_{\text{Cell}} = 1.20\text{V}$ (D) Cd; $E^\circ_{\text{Cell}} = 2.00\text{V}$
- Q 12. Given below are the half - cell reactions:
 [JEE Main 2014]
 $\text{Mn}^{2+} + 2\text{e}^- \rightarrow \text{Mn}; E^\circ = -1.18\text{V}$
 $2(\text{Mn}^{3+} + \text{e}^- \rightarrow \text{Mn}^{2+}); E^\circ = +1.51\text{V}$
 The E° for $3\text{Mn}^{2+} \rightarrow \text{Mn} + 2\text{Mn}^{3+}$ will be
 (A) -2.69V ; the reaction will not occur
 (B) -2.69V ; the reaction will occur
 (C) -0.33V ; the reaction will not occur
 (D) -0.33V ; the reaction will occur

- Q 13. The Gibbs energy for the for the following reaction at 500°C is as follows Find the least potential difference needed for electrolytic reduction of Al_2O_3 at 500°C [JEE Adv. 2010]

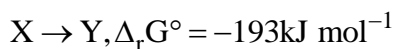


- (A) 1.0 V (B) 1.5 V
(C) 2.0 V (D) 2.5 V
- Q 14. The minimum voltage required to electrolyse alumina in the Hall-Heroult process $2\text{Al}_2\text{O}_3 + 3\text{C} \rightarrow 4\text{Al} + 3\text{CO}_2$; [AIIMS 2009]

$$\text{Given: } \Delta G_f^0(\text{Al}_2\text{O}_3) = -1520\text{kJ/mol}$$

$$\Delta G_f^0(\text{CO}_2) = -394\text{kJ/mol}$$

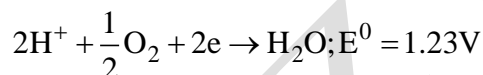
- (A) 1.575 V (B) -1.60 V
(C) 1.312 V (D) -2.62 V
- Q 15. All the energy released from the reaction



is used for oxidizing M^+ as $\text{M}^+ \rightarrow \text{M}^{3+} + 2\text{e}^-$, $E^0 = -0.25\text{V}$. Under

standard conditions, the number of moles of M^+ oxidized when one mole of X is converted to Y is [F = 96500 C/mol] [JEE Adv. 2015]

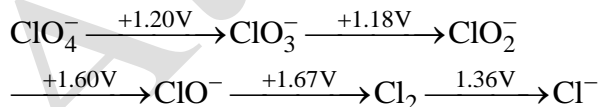
- (A) 2 (B) 4 (C) 1 (D) 8
- Q 16. The half cell reactions in the corrosion are



[JEE Main 2005]

The ΔG^0 of the overall reaction in kJ is

- (A) -152 (B) -322 (C) -76 (D) -16
- Q 17. Standard reduction potential (volts) in acid solution is



Which of the following can not disproportionate in acid solution under standard conditions

- (A) ClO_3^- (B) ClO_2^-
(C) Cl_2 (D) None of these

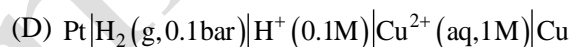
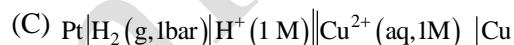
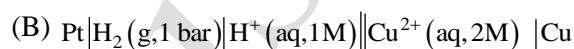
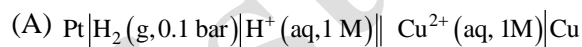
3. Electrochemical Series

- Q 1. A standard hydrogen electrode has zero electrode potential because [IIT-1997C]

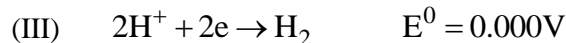
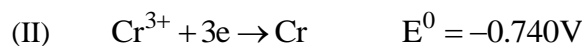
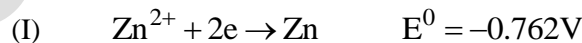
(A) Hydrogen is easiest to oxidise
(B) This electrode potential is assumed to be zero
(C) Hydrogen atom has only one electron
(D) Hydrogen is the lightest element

- Q 2. Which cell will measure standard electrode potential of copper electrode?

[NCERT Exemplar]



- Q 3. The reduction potential at 25°C for the following half cell reaction are given against each



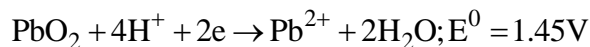
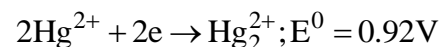
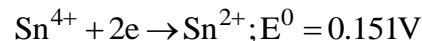
Which is the stronger reducing agent

- (A) Zn (B) Cr
(C) H_2 (D) $\text{Fe}^{3+}(\text{aq})$

- Q 4. Standard reduction electrode potentials of three metals A, B and C are +0.5 V, -3.0V and -1.2 V respectively. The reducing power of these metals are

- (A) $\text{B} > \text{C} > \text{A}$ (B) $\text{A} > \text{B} > \text{C}$
(C) $\text{C} > \text{B} > \text{A}$ (D) $\text{A} > \text{C} > \text{B}$

- Q 5. E^0 for some half cell reactions are given below

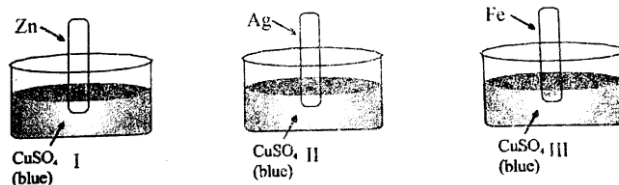


Based on the given data which statement is correct

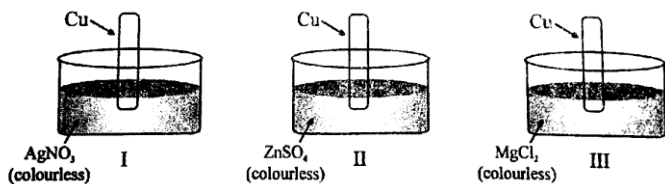
- (A) Sn^{+4} is stronger oxidizing agent than Pb^{+4}
 (B) Sn^{+2} is stronger reducing agent than Hg_2^{2+}
 (C) Hg_2^{2+} is stronger oxidizing agent than Pb^{+4}
 (D) Pb^{2+} is stronger reducing agent than Sn^{+2}
- Q 6. The standard reduction potential of some half cell reactions are given below
 $\text{PbO}_2 + 4\text{H}^+ + 2\text{e}^- \rightarrow \text{Pb}^{2+} + 2\text{H}_2\text{O}; E^0 = 1.455\text{V}$
 $\text{MnO}_4^- + 8\text{H}^+ + 5\text{e}^- \rightarrow \text{Mn}^{2+} + 4\text{H}_2\text{O}; E^0 = 1.51\text{V}$
 $\text{Ce}^{4+} + \text{e}^- \rightarrow \text{Ce}^{3+} \quad E^0 = 1.61\text{V}$
 $\text{H}_2\text{O}_2 + 2\text{H}^+ + 2\text{e}^- \rightarrow 2\text{H}_2\text{O} \quad E^0 = 1.71\text{V}$
 Pick out the incorrect statement
 (A) Ce^{+4} will oxidizes Pb^{2+} to PbO_2
 (B) MnO_4^- will oxidizes Pb^{2+} to PbO_2
 (C) H_2O_2 will oxidizes Mn^{2+} to MnO_4^-
 (D) PbO_2 will Oxidises Mn^{2+} to MnO_4^-
- Q 7. Using the data given below find out the strongest reducing agent. [NCERT Exemplar]
 $E^0\text{Cr}_2\text{O}_7^{2-}/\text{Cr}^{3+} = 1.33\text{V}; E^0\text{Cl}_2/\text{Cl}^- = 1.36\text{V}$
 $E^0\text{MnO}_4^-/\text{Mn}^{2+} = 1.51\text{V}; E^0\text{Cr}^{3+}/\text{Cr} = -0.74\text{V}$
 (A) Cl^- (B) Cr
 (C) Cr^{3+} (D) Mn^{2+}
- Q 8. Use the data of Q.7 and find out the most stable oxidised species. [NCERT Exemplar]
 (A) Cr^{3+} (B) MnO_4^-
 (C) $\text{Cr}_2\text{O}_7^{2-}$ (D) Mn^{2+}
- Q 9. $\text{I}_2 + 2\text{e}^- \rightarrow 2\text{I}^- \quad E^0_{\text{I}_2/\text{I}^-} = +0.54\text{V}$
 $2\text{Br}^- \rightarrow \text{Br}_2 + 2\text{e}^- \quad E^0_{\text{Br}^-/\text{Br}_2} = -1.09\text{V}$
 $\text{Fe} \rightarrow \text{Fe}^{2+} + 2\text{e}^- \quad E^0_{\text{Fe}/\text{Fe}^{2+}} = +0.44\text{V}$
 Which of the following reaction is non – spontaneous
 (A) $\text{Br}_2 + 2\text{I}^- \rightarrow 2\text{Br}^- + \text{I}_2$
 (B) $\text{Fe} + \text{Br}_2 \rightarrow \text{Fe}^{2+} + 2\text{Br}^-$
 (C) $\text{Fe} + \text{I}_2 \rightarrow \text{Fe}^{2+} + 2\text{I}^-$



- Q 10. The position of some metals in the electrochemical series in decreasing electropositive character is given as $\text{Mg} > \text{Al} > \text{Zn} > \text{Cu} > \text{Ag}$. What will happen if a copper spoon is used to stir a solution of aluminium nitrate?
 (A) The spoon will get coated with aluminium
 (B) An alloy of aluminium and copper is formed
 (C) The solution becomes blue
 (D) There is no reaction
- Q 11. $\text{Zn}^{2+}/\text{Zn}, E^0 = -0.76\text{V}$ & $\text{Ag}^+/\text{Ag}, E^0 = 0.799\text{V}$
 The correct statement is
 (A) The reaction Zn getting reduced and Ag getting oxidized is spontaneous
 (B) Zn^{2+} undergoes reduction & Ag is oxidized
 (C) Zn undergoes oxidation Ag^+ gets reduced
 (D) No suitable answer
- Q 12. $E^0_{\text{Zn}^{2+}/\text{Zn}} = -0.76\text{V}$ $E^0_{\text{Cu}^{2+}/\text{Cu}} = +0.34\text{V}$,
 $E^0_{\text{Ag}^+/\text{Ag}} = +0.80\text{V}$ $E^0_{\text{Fe}^{2+}/\text{Fe}} = -0.41\text{V}$
 Consider following sets
 Blue colour solutions changes to colourless (or fades) in



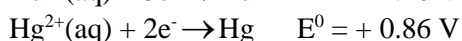
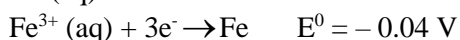
- (A) I, II, III (B) I, II
 (C) II, III (D) I, III
- Q 13. $E^0_{\text{Zn}^{2+}/\text{Zn}} = -0.76\text{V}$ $E^0_{\text{Cu}^{2+}/\text{Cu}} = +0.34\text{V}$,
 $E^0_{\text{Ag}^+/\text{Ag}} = +0.80\text{V}$ $E^0_{\text{Fe}^{2+}/\text{Fe}} = -0.41\text{V}$,
 $E^0_{\text{Mg}^{2+}/\text{Mg}} = -2.37\text{V}$
 Consider following sets



Colourless solution changes to blue coloured solution in

- (A) I (B) II
(C) III (D) I, III

Q 14. For the reduction of NO_3^- ion in an aqueous solution, E^0 is +0.96 V. Values of E^0 for some metal ions are given below [IIT 2009]



The pair(s) of metals that is (are) can't be oxidized by NO_3^- in aqueous solution is(are)

- (A) V and Hg (B) Hg and Fe
(C) Fe and Au (D) Fe and V

Q 15. Standard electrode potential data are useful for understanding the stability of an oxidant in a redox titration. Some half cell reactions and their standard potentials are given below: [IIT-2002S]



Identify the only incorrect statement regarding the quantitative estimation of aqueous $\text{Fe}(\text{NO}_3)_2$

- (A) MnO_4^- can be used in aqueous HCl
(B) $\text{Cr}_2\text{O}_7^{2-}$ can be used in aqueous HCl
(C) MnO_4^- can be used in aqueous H_2SO_4
(D) $\text{Cr}_2\text{O}_7^{2-}$ can be used in aqueous H_2SO_4

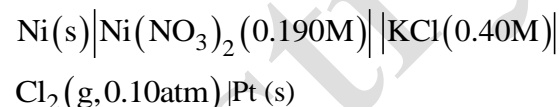
4. The Nernst Equation

Q 1. The value of reaction quotient in the reaction
 $\text{Zn} + 2\text{HCl}(0.01\text{M}) \rightarrow \text{ZnCl}_2(0.1\text{M}) + \text{H}_2(2\text{atm})$

is

- (A) 2 (B) 0.2
(C) 2×10^3 (D) None of these

Q 2. What is the value of the reaction quotient Q per mole of Ni(s) for the reaction occurring in the cell



- (A) 3×10^{-1} (B) 1.3×10^{-1}
(C) 8.0×10^{-2} (D) 3.0×10^{-2}

Q 3. Find; $E_{\text{Zn}^{2+}(0.01)/\text{Zn}}$ if $E_{\text{Zn}^{2+}/\text{Zn}}^0 = -0.76\text{V}$

- (A) -0.66V (B) -0.822V
(C) -0.86 V (D) None of these

Q 4. Find E for $\text{Co}^{2+}(0.2\text{M}) \rightarrow \text{Co}^{3+}(0.01\text{M}) + \text{e}^-$
if $E_{\text{Co}^{3+}, \text{Co}^{2+}}^0 = +1.82\text{V}$

- (A) $1.82 - \frac{0.0591}{1} \log 5 \times 10^{-2}$
(B) $-1.82 - \frac{0.05911}{1} \log 5 \times 10^{-2}$
(C) $-1.82 + \frac{0.0591}{1} \log 5 \times 10^{-2}$
(D) None of these

Q 5. A hydrogen gas electrode is made by dipping platinum wire in a solution of HCl of pH = 10 and by passing hydrogen gas around the platinum wire at 1 atm pressure. The oxidation potential of electrode would be [NEET 2013]

- (A) 0.059 V (B) 0.59 V
(C) 0.118 V (D) 1.18 V

Q 6. The pressure of H_2 required to make the potential of H_2 electrode zero in pure water at 298 K is

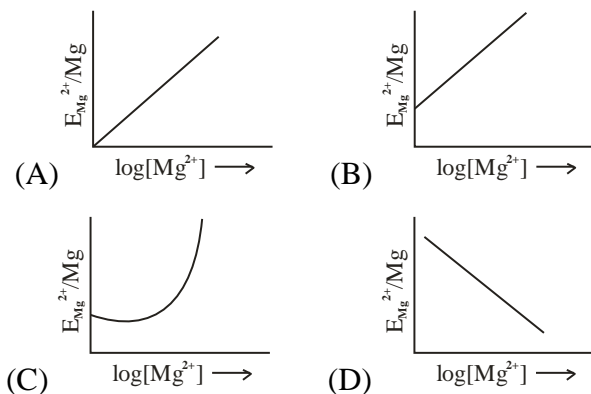
[CBSE PMT 2016 I]

- (A) 10^{-12} atm (B) 10^{-10} atm
(C) 10^{-4} atm (D) 10^{-14} atm

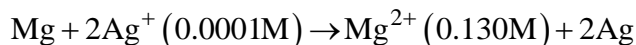
Q 7. Electrode potential for Mg electrode varies according to the equation [NCERT Exemplar]

$$E_{\text{Mg}^{2+}/\text{Mg}} = E_{\text{Mg}^{2+}/\text{Mg}}^{\ominus} - \frac{0.059}{2} \log \frac{1}{[\text{Mg}^{2+}]}$$

The graph of $E_{\text{Mg}^{2+}/\text{Mg}}$ vs $\log [\text{Mg}^{2+}]$ is



- Q 8. Represent the cell in which the following reaction takes place



Calculate its $E_{(\text{cell})}$ if $E_{(\text{cell})}^{\ominus} = 3.17\text{V}$

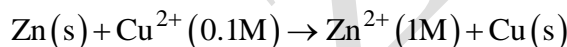
[NCERT Solved]

- Q 9. Calculate the potential of the cell
Pt / H_2 (0.50 atm) / H^+ (0.10 M) // MnO_4^- (0.10 M), Mn^{2+} (1.0 M), H^+ (0.10 M) / Pt

Given: $E^{\ominus} (\text{MnO}_4^-/\text{Mn}^{2+}, \text{H}^+) = 1.51\text{V}$

- (A) 1.45 V (B) 1.55 V
(C) 1.21 V (D) None of these

- Q 10. For the redox reaction



Taking place in a cell, $E_{\text{Cell}}^{\ominus}$ is 1.10 volt

E_{cell} for the cell will be [JEE Main 2003]

($2.303RT/F = 0.0591$)

- (A) 2.14V (B) 1.80 V
(C) 1.07 V (D) 0.80 V

- Q 11. Cell potential for electro-chemical cell

$\text{Cu} / \text{Cu}^{2+}(x_1) // \text{Ag}^+(x_2) / \text{Ag}$ is given by

- (A) $\Delta E^{\ominus} - 0.0592 / \log x_1/x_2$
(B) $\Delta E^{\ominus} - 0.0592/2 \log x_1/x_2$
(C) $\Delta E^{\ominus} - 0.0592/2 \log x_1/x_2^2$
(D) $\Delta E^{\ominus} - 0.0592/2 \log x_1^2/x_2$

- Q 12. Calculate the potential corresponding to the following cell:

Pt / Co^{2+} (2.0 M), Co^{3+} (0.010 M) // Cr^{3+} (0.50 M), $\text{Cr}_2\text{O}_7^{2-}$ (4.0 M), H^+ (1.5 M) / Pt

Given: $E^{\ominus} (\text{Co}^{2+}/\text{Co}^{3+}) = -1.82\text{V}$;

$E^{\ominus} (\text{Cr}_2\text{O}_7^{2-}/\text{Cr}^{3+}) = 1.33\text{V}$

- (A) 0.32 V (B) -0.32 V
(C) -0.16 V (D) -0.64 V

- Q 13. $\text{Zn} + \text{Cu}^{2+}(\text{aq}) \rightleftharpoons \text{Cu} + \text{Zn}^{2+}(\text{aq})$;

[Temperature = 298 K]

Reaction quotient is $Q = \frac{[\text{Zn}^{2+}]}{[\text{Cu}^{2+}]}$. Variation of

E_{cell} will $\log Q$ is of the type

$E_{\text{cell}} = E_{\text{cell}}^{\ominus} - \frac{2.303RT}{nF} \log_{10} Q$ with

$E_{\text{cell}}^{\ominus} = 1.10\text{V}$. E_{cell} will be 1.159 V when

- (A) $\frac{[\text{Cu}^{2+}]}{[\text{Zn}^{2+}]} = 0.01$ (B) $\frac{[\text{Zn}^{2+}]}{[\text{Cu}^{2+}]} = 0.01$
(C) $\frac{[\text{Zn}^{2+}]}{[\text{Cu}^{2+}]} = 0.1$ (D) $\frac{[\text{Zn}^{2+}]}{[\text{Cu}^{2+}]} = 1$

- Q 14. Given that (at $T = 298\text{K}$)

$\text{Cu}(\text{s}) | \text{Cu}^{2+} (1.0\text{M}) || \text{Ag}^+ (1.0\text{M}) | \text{Ag}(\text{s})$

$E_{\text{cell}}^{\ominus} = 0.46\text{V}$

$\text{Zn}(\text{s}) | \text{Zn}^{2+} (1.0\text{M}) || \text{Cu}^{2+} (1.0\text{M}) | \text{Cu}(\text{s})$

$E_{\text{cell}}^{\ominus} = 1.10\text{V}$

Then E_{cell} for

$\text{Zn} | \text{Zn}^{2+} (0.1\text{M}) || \text{Ag}^+ (1.0\text{M}) | \text{Ag}$; at 298 K

will be

- (A) 1.59 V (B) 1.53 V
(C) 2.53 V (D) Can't be calculated due to insufficient data

- Q 15. pH of the solution in the anode compartment of the following cell at 25°C is x when

$E_{\text{cell}} - E_{\text{cell}}^{\ominus} = 0.0591\text{V}$,

- Pt(H₂)(1atm)|PH = x| Ni²⁺(1M)| Ni. The value of x is
 (A) 4 (B) 3 (C) 2 (D) 1
- Q 16. Consider the cell $\text{H}_2(\text{Pt}) \left| \text{H}_3\text{O}^+(\text{aq}) \right| \left| \text{Ag}^+ \right| \text{xM}$
 1 atm | pH = 5.5 | xM
 Ag. The measured EMF of the cell is 1.023 V. What is the value of x? $E^\ominus_{(\text{Ag}^+/\text{Ag})} = +0.799$ volt. [T = 25°C]
- Q 17. At equimolar concentrations of Fe²⁺ and Fe³⁺, what must [Ag⁺] be so that the voltage of the galvanic cell made from the (Ag⁺/Ag) and (Fe³⁺/Fe²⁺) electrodes equals zero
 $\text{Fe}^{2+} + \text{Ag}^+ \rightleftharpoons \text{Fe}^{3+} + \text{Ag}$
 $E^\ominus_{\text{Ag}^+/\text{Ag}} = 0.7991\text{V}$, $E^\ominus_{\text{Fe}^{3+}/\text{Fe}^{2+}} = 0.711\text{V}$
 (A) 0.61 M (B) 0.44 M
 (C) 0.47M (D) 0.032 m
- Q 18. $\text{Cu}^{2+} + 2\text{e}^- \rightarrow \text{Cu}$. For this graph between log [Cu²⁺] versus E_{red} is a straight line of intercept $-\frac{0.34 \times 2}{0.0591}$ then electrode potential of the half – cell Cu/Cu²⁺ (0.1M) will be
 (A) $0.34 + \frac{0.0591}{2}$ (B) $-0.34 - \frac{0.0591}{2}$
 (C) 0.34 (D) $-0.34 + \frac{0.0591}{2}$
- Q 19. A hydrogen electrode placed in a buffer solution of CH₃COONa and acetic acid in the ratio's x:y and y:x has electrode potential values E₁ volts and E₂ volts respectively at 25 °C. The pKa values of acetic acid is (E₁ and E₂ are oxidation potential).
 (A) $(E_1 + E_2)/0.118$ (B) $(E_2 - E_1)/0.118$
 (C) $-(E_1 + E_2)/0.118$ (D) $(E_1 - E_2)/0.118$

5. Equilibrium Condition, Concentration Cell

- Q 1. If the E^\ominus_{cell} for a given reaction has negative value, which of the following gives correct relationships for the values of ΔG^\ominus & K_{eqb} [CBSE PMT 2016 - II]
 (A) 1×10^{-10} (B) 29.5×10^{-2}
 (C) 10 (D) 1×10^{10}
- Q 2. For a cell reaction involving a two electron change, the standard emf of the cell is found to be 0.295V at 25° C. The equilibrium constant of the reaction at 25°C will be [AIIEE 2003]
 (A) 1×10^{-10} (B) 29.5×10^{-2}
 (C) 10 (D) 1×10^{10}
- Q 3. $\text{Zn} + \text{Cu}^{+2} \rightleftharpoons \text{Zn}^{+2} + \text{Cu}$; $E^\ominus_{\text{cell}} = 1.1\text{V}$
 Value of equilibrium constant for the above reaction
 (A) 1.67×10^{37} (B) 4.4×10^{18}
 (C) 2×10^{35} (D) 4.4×10^{20}
- Q 4. Calculate the equilibrium constant of the reaction
 $\text{Cu}(\text{s}) + 2\text{Ag}^+(\text{aq}) \rightarrow \text{Cu}^{2+}(\text{aq}) + 2\text{Ag}(\text{s})$
 $E^\ominus_{(\text{cell})} = 0.46\text{V}$ [NCERT Solved]
- Q 5. The equilibrium constant for the reaction
 $\text{Sr}(\text{s}) + \text{Mg}^{+2}(\text{aq}) \rightleftharpoons \text{Sr}^{+2}(\text{aq}) + \text{Mg}(\text{s})$ is
 2.69×10^{12} at 25°C
 The E^\ominus for a cell made up of the Sr/ Sr⁺² and Mg⁺²/Mg half cells
 (A) 0.367 V (B) 0.7346 V
 (C) 0.1836 V (D) 0.1349 V
- Q 6. Calculate the equilibrium constant for the reaction, $2\text{Fe}^{3+} + 3\text{I}^- \rightleftharpoons 2\text{Fe}^{2+} + \text{I}_3^-$. The standard reduction potentials in acidic conditions are 0.77 and 0.54 V respectively for Fe³⁺/Fe²⁺ and I₃⁻/I⁻ couples. [IIT JEE 1998]
 (A) 3.13×10^7 (B) 6.26×10^7
 (C) 6.26×10^6 (D) None of these

- Q 7. Cell reaction: $A + 2B^+ \rightleftharpoons A^{2+} + 2B$
 $A^{2+} + 2e^- \rightarrow A$; $E^0 = +0.34$ V
 & $\log K = 15.6$ at 298 K for the cell reactions.
 Find E^0 for $B^+ + e^- \rightarrow B$ [AIIMS 2018]
 (A) 0.80 V (B) 1.26 V
 (C) -0.54 V (D) 0.94 V
- Q 8. Calculate the equilibrium constant for the reaction:
 $3Sn(s) + 2Cr_2O_7^{2-} + 28H^+ \rightarrow 3Sn^{4+} + 4Cr^{3+} + 14H_2O$
 E^0 for $Sn/Sn^{2+} = 0.136$ V E^0 for $Sn^{2+}/Sn^{4+} = -0.154$ V
 E^0 for $Cr_2O_7^{2-}/Cr^{3+} = 1.33$ V
 (A) 10^{268} (B) 268
 (C) 10^{-268} (D) None of these
- Q 9. Find the equilibrium constant at 298 K for the reaction,
 $Cu^{2+}(aq) + In^{2+}(aq) \rightleftharpoons Cu^+(aq) + In^{3+}(aq)$
 Given that $E^0_{Cu^{2+}/Cu^+} = 0.15$ V, [JEE 2004]
 $E^0_{In^{3+}/In^{2+}} = -0.42$ V, $E^0_{In^{2+}/In^+} = -0.40$ V
 (A) 10^{-10} (B) 10^2
 (C) 10^{10} (D) 10^5
- Q 10. $Pt | H_2(p_1) | H^+(1M) || H^+(1M) | H_2(p_2) | Pt$
 (where p_1 and p_2 are pressures). Cell reaction will be spontaneous is
 (A) $p_1 = p_2$ (B) $p_1 > p_2$
 (C) $p_2 > p_1$ (D) $p_1 = 1$ atm
- Q 11. Calculate the EMf of the following cell
 $Zn | Zn^{2+}(0.01M) || Zn^{2+}(0.1M) | Zn$ at 298 K
 (A) 0.0295 V (B) 0.0395 V
 (C) 0.0495 V (D) 0.0595 V
- Q 12. Calculate pH of anodic solution using the following cell
 $Pt(H_2, 1 \text{ atm}) | H^+(xM) || H^+(1M), (H_2, 1 \text{ atm}) / Pt$
 if $E_{cell} = 0.2364$ V
 (A) 1 (B) 2
 (C) 3 (D) 4
- Q 13. $Zn + Cu^{2+} \rightleftharpoons Zn^{2+} + Cu$; $E^0_{cell} = 1.1$ V
 Value of equilibrium constant for the above reaction
 (A) 1.67×10^{37} (B) 4.4×10^{18}
 (C) 2×10^{35} (D) 4.4×10^{20}
- Q 14. Calculate the EMF of the cell.
 $Zn - Hg(c_1M) | Zn^{2+}(aq) | Hg - Zn$ at 25°C, if the concentrations of the zinc amalgam are :
 $c_1 = 10$ g per 100 g of mercury and $c_2 = 1$ g per 100 g of mercury
 (A) 0.0295 V (B) 0.0395 V
 (C) 0.0495 V (D) 0.0595 V
- Q 15. In two vessels each containing 500ml water, 0.5 millimol of aniline ($K_b = 10^{-9}$) and 25 millimol of HCl are added separately. Two hydrogen electrodes are constructed using these solutions. Calculate the emf of cell made by connecting them appropriately
 (A) 0.395 V (B) 0.495 V
 (C) 0.295 V (D) 0.195 V
- Q 16. Calculate the emf of the cell (Take $P_{H_2} = 1$ atm)
 $Pt, H_2 | CH_3COOH(0.1M) || NH_3(0.1M) | H_2, Pt$
 $K_a(CH_3COOH) = 1.8 \times 10^{-5} = K_b(NH_4OH)$;
 (A) -0.458 V (B) 0.458 V
 (C) -0.358 V (D) 0.358 V
- Q 17. An Galvanic cell is given below ($P_{H_2} = 1$ atm)
 $Pt, H_2 | HCl(0.1M) || CH_3COOH(0.1M) | H_2, Pt$
 The emf of cell will not be zero, because [CBSE PMT 1994]
 (A) emf depends on molarities of acid used
 (B) pH of 0.1 M HCl & 0.1 M CH_3COOH is not same
 (C) the temperature is constant
 (D) acid used in two compartment is different

6. Emf of Metal Insoluble Salt Electrode

- Q 1. The reduction potential at pH = 14 for the Cu^{2+}/Cu couple is [AIIMS 2009, 2012]
Given : $E_{\text{Cu}^{2+}/\text{Cu}}^0 = 0.34\text{V}$,
For $\text{Cu}(\text{OH})_2$, $K_{\text{SP}} = 1.0 \times 10^{-19}$
(A) 0.34 V (B) -0.34 V
(C) 0.22 V (D) -0.22 V
- Q 2. A silver wire dipped in 0.1 M HCl solution saturated with AgCl develops oxidation potential of -0.25V. If $E_{\text{Ag}/\text{Ag}^+}^0 = -0.799\text{V}$, the K_{sp} of AgCl in pure water will be
(A) 2.95×10^{-11} (B) 5.1×10^{-11}
(C) 3.95×10^{-11} (D) 1.95×10^{-11}
- Q 3. The dissociation constant for $[\text{Ag}(\text{NH}_3)_2]^+$ into Ag^+ and NH_3 is 10^{-13} at 298 K. If $E_{\text{Ag}^+/\text{Ag}}^0 = 0.8\text{V}$, then E^0 for the half cell $[\text{Ag}(\text{NH}_3)_2] + e^- \rightarrow \text{Ag} + 2\text{NH}_3$ will be
(A) 0.33V (B) -0.33 V
(C) -0.033V (D) 0.033V
- Q 4. The solubility product of silver iodide is 8.3×10^{-17} and the standard potential (reduction) of Ag , Ag^+ electrode is +0.800 volts at 25°C .
The standard potential of Ag , AgI/I^- electrode (reduction) from these data is
(A) -0.30 V (B) +0.15 V
(C) +0.10 V (D) -0.15 V
- Q 5. The emf of the cell $\text{Ag}|\text{AgI}|\text{KI}(0.05\text{M})||\text{AgNO}_3(0.05\text{M})|\text{Ag}$ is 0.788V. Calculate the solubility product of AgI.
(A) 1.16×10^{-16} (B) 1.16×10^{-15}
(C) 1.16×10^{-17} (D) 1.16×10^{-16}
- Q 6. Consider the cell $\text{Ag}|\text{AgBr}(\text{s})|\text{Br}^-||\text{AgCl}(\text{s})|\text{Ag}|\text{Cl}^-$ at 25°C . The solubility product constants of AgBr & AgCl are respectively 5×10^{-13} & 1×10^{-10} . For what ratio of the concentrations of Br^- & Cl^- ions would the emf of the cell be zero?
(A) 1:2 (B) 1:200
(C) 1:100 (D) 200:1
- Q 7. For the following cell - reaction,
 $\text{Cu}(\text{s}) + 2\text{Ag}^+(\text{aq}) \rightarrow 2\text{Ag}(\text{s}) + \text{Cu}^{2+}(\text{aq})$.
 E_{cell} is 0.46 V at 300K and 0.48V at 310 K. Hence, netropy change is
(A) 193JK^{-1} (B) 386JK^{-1}
(C) 386JK^{-1} (D) -193JK^{-1}
- Q 8. The temperature coefficient of the e.m.f. of the cell in above question is
(A) 0.02VK^{-1} (B) 0.2VK^{-1}
(C) 0.002VK^{-1} (D) 2VK^{-1}
- Q 9. $\Delta G = \Delta H - T\Delta S$ and $\Delta G = \Delta H + T \left[\frac{d(\Delta G)}{dT} \right]_p$ then $\left(\frac{dE_{\text{cell}}}{dT} \right)$ is
(A) $\frac{\Delta S}{nF}$ (B) $\frac{nE}{\Delta S}$
(C) $-nFE_{\text{cell}}$ (D) $+nFE_{\text{cell}}$
- Q 10. The potential of the Daniell cell, $\text{Zn}|\text{ZnSO}_4(1\text{M})||\text{CuSO}_4(1\text{M})|\text{Cu}$ was reported by Ritesh, Mohan & Afroz as $E^0 = (1.1028 - 0.641 \times 10^{-3}T + 0.72 \times 10^{-5}T^2)$ Volt where T is the Celsius temperature. Calculate ΔS° for the cell reaction at 25°C
(A) -45.32 J/k (B) -34.52 J/k
(C) -25.43 Jk (D) -54.23 J/k
- Q 11. The standard emf of the cell, $\text{Cd}(\text{s})|\text{CdCl}_2(\text{aq})(0.1\text{M})||\text{AgCl}(\text{s})|\text{Ag}(\text{s})$ in which the cell reaction,
 $\text{Cd}(\text{s}) + 2\text{AgCl}(\text{s}) \rightarrow 2\text{Ag}(\text{s}) + \text{Cd}^{2+}(\text{aq}) + 2\text{Cl}^-(\text{aq})$ is occurring is 0.6915 V at 0°C and 0.6753 V at 25°C . The ΔH of the reaction at 25°C is
(A) -176kJ (B) -234.7 kJ
(C) +123.5 kJ (D) -167.5 kJ

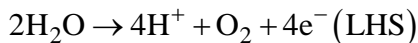
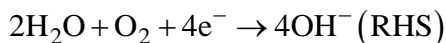
7. Battery & Corrosion

- Q 1. Select the incorrect statement. In the dry cell:
 (A) Zn container acts as anode
 (B) Graphite is used as cathode
 (C) $[\text{Zn}(\text{NH}_3)_4]^{2+}$ complex is formed during discharging
 (D) Manganese is reduced for the +4 oxidation state to the +2 oxidation state
- Q 2. Which battery has constant voltage throughout its life time ?
 (A) Alkaline dry cell battery
 (B) Mercury cell
 (C) Nickel cadmium battery
 (D) Fuel cell
- Q 3. Assertion (A): Mercury cell does not give steady potential
 Reason (R): In the cell reaction, ions are not involved in solution. **[NCERT Exemplar]**
 (A) Both assertion and reason are true and the reason is the correct explanation of assertion
 (B) Both assertion and reason are true and reason is not the correct explanation of assertion
 (C) Assertion is true but the reason is false
 (D) Both assertion and reason are false
 (E) Assertion is false but reason is true
- Q 4. In lead storage battery, during discharging of battery, constant of electrolytes
 (A) decreases (B) increases
 (C) constant (D) unpredictable
- Q 5. While charging the lead storage battery
[NCERT Exemplar]
 (A) PbSO_4 anode is reduced to Pb
 (B) PbSO_4 cathode is reduced to Pb
 (C) PbSO_4 cathode is oxidised to Pb
 (D) PbSO_4 anode is oxidised to PbO_2
- Q 6. Which of the reaction is used to make a fuel cell?
[AIIMS 2003]
 (A) $\text{Cd} + 2\text{Ni}(\text{OH})_3 \rightarrow \text{CdO} + 2\text{Ni}(\text{OH})_2 + \text{H}_2\text{O}$
 (B) $\text{Pb} + \text{PbO}_2 + 2\text{H}_2\text{SO}_4 \rightarrow 2\text{PbSO}_4 + 2\text{H}_2\text{O}$
 (C) $2\text{H}_2(\text{g}) + \text{O}_2(\text{g}) \rightarrow 2\text{H}_2\text{O}(\text{g})$
 (D) $2\text{Fe} + \text{O}_2(\text{g}) + 4\text{H}^+ \rightarrow 2\text{Fe}^{2+} + 2\text{H}_2\text{O}$
- Q 7. The incorrect statement about fuel cell is
 (A) Efficiency is very high
 (B) It is pollution free
 (C) It converts electrical energy into chemical energy
 (D) In $\text{H}_2 - \text{O}_2$ fuel cell the overall reaction is $2\text{H}_2(\text{g}) + \text{O}_2(\text{g}) \rightarrow 2\text{H}_2\text{O}(\text{g})$
- Q 8. Standard free energies of formation (KJ/mol) at 298 K are -237.2, -394.4 and -8.2 for $\text{H}_2\text{O}(\text{l})$, $\text{CO}_2(\text{g})$ and pentane (g) respectively. The value of E_{cell}^0 for the pentane-oxygen fuel cell is
[CBSE PMT 2008]
 (A) 1.968 V (B) 2.0968 V
 (C) 1.0968 V (D) 0.0968 V
- Q 9. In the fuel cell, with cell reaction
 $2\text{H}_2 + \text{O}_2 \rightarrow 2\text{H}_2\text{O}$: $\Delta H = -285 \text{ kJ/mol}$ & $\Delta G = -237 \text{ kJ/mol}$
 (A) 80% (B) 83%
 (C) 25% (D) None of these
- Q 10. The cathodic protection from rusting is done by
 (A) attaching a more electropositive metal
 (B) attaching a less electropositive metal
 (C) passing constant current on metal surface
 (D) Both A & C
- Q 11. **Assertion (A):** Iron is protected from corrosion by connecting Mg metal with it
Reason (R): Iron acts as cathode & Mg as anode which gradually disappears. **[AIIMS 2014]**
 (A) Both assertion and reason are true and the reason is the correct explanation of assertion
 (B) Both assertion and reason are true and reason is not the correct explanation of assertion
 (C) Assertion is true but the reason is false
 (D) Both assertion and reason are false

8. Electrolysis – Faraday Law

- Q 1. An electrochemical cell can behave like an electrolytic cell when [NCERT Exemplar]
 (A) $E_{\text{cell}} = 0$ (B) $E_{\text{cell}} > E_{\text{ext}}$
 (C) $E_{\text{ext}} > E_{\text{cell}}$ (D) $E_{\text{cell}} = E_{\text{ext}}$
- Q 2. Aluminium oxide may be electrolysed at 1000°C to furnish aluminium metal (at. Mass = 27 amu; 1 Faraday = 96,500 Coulombs). The cathode reaction is $\text{Al}^{3+} + 3\text{e}^- \rightarrow \text{Al}$
 To prepare 5.12 kg of aluminium metal by this method would require
 (A) $5.49 \times 10^7 \text{C}$ (B) $1.83 \times 10^7 \text{C}$
 (C) $5.49 \times 10^4 \text{C}$ (D) $5.49 \times 10^1 \text{C}$
- Q 3. Number of electrons lost during electrolysis of 0.355g of Cl^- is
 (A) 0.01 (B) $0.01N_A$
 (C) $0.02N_A$ (D) $\frac{0.01}{2N_A}$
- Q 4. 1 mol of electrons passes through each of the solution of AgNO_3 , CuSO_4 , AlCl_3 and TiCl_4 when Ag, Cu, Al and Ti are deposited. Their molar ratio will be
 (A) 1:1:1:1 (B) 12:6:4:3
 (C) 6:3:4:2 (D) 1:3:6:2
- Q 5. Salts of metals X, Y & Z are electrolysed under identical conditions using same quantity of electricity. It was observed that 4.2 g of X, 5.4 g of Y and 19.2 g of Z were deposited at respective cathode. If the atomic weight of X, Y Z are 7, 27 and 64 respectively, then their ratio of valencies is [AIIMS 2015]
 (A) 1:2:3 (B) 1:3:2
 (C) 2:3:1 (D) 3:2:2
- Q 6. The density of Cu is 8.94g cm^{-3} . The quantity of electricity needed to plate an area $10 \text{cm} \times 10 \text{cm}$ to a thickness of 10^{-2}cm using CuSO_4 solution would be
 (A) 13586 C (B) 27172 C
 (C) 40758 C (D) 20348 C
- Q 7. A quantity of electrical charge that brings about the deposition of 4.5 g Al from Al^{3+} at the cathode will also produce the following volume (STP) of $\text{H}_2(\text{g})$ from H^+ at the cathode
 (A) 44.8 L (B) 22.4 L
 (C) 11.2 L (D) 5.6 L
- Q 8. In the electrolysis of an aqueous SnCl_2 solution, 4.48 L of chlorine at NTP were liberated at the anode. The mass of tin deposited at the cathode was (M of Sn = 118.5)
 (A) 119 g (B) 79.3 g
 (C) 47.4 g (D) 23.7 g
- Q 9. Three electrolytic cells A, B, C containing solutions of ZnSO_4 , AgNO_3 & 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? [NCERT]
- Q 10. The passage of a constant current through a solution of dilute H_2SO_4 with 'Pt' electrodes liberated 336cm^3 of a mixture of H_2 and O_2 at N.T.P. The quantity of electricity that was passed is
 (A) 96500 C (B) 965 C
 (C) 1930 C (D) $\frac{1}{100}$ faraday
- Q 11. If 0.224 L of H_2 gas is formed at the cathode, the volume of O_2 gas formed at the anode under identical conditions, is
 (A) 0.224 L (B) 0.448 L
 (C) 0.112 L (D) 1.12 L
- Q 12. In the electrolysis of aqueous NaCl under appropriate conditions, along with Cl_2 gas H_2 and O_2 are obtained as by products. If 2.24 litres of H_2 gas and 0.56 litres of O_2 gas is obtained at 1 atm and 273 K, then volume of $\text{Cl}_2(\text{g})$ obtained at same condition will be
 (A) 1.12 litre (B) 0.56 litre
 (C) 1.68 litre (D) 2.24 litre
- Q 13. 100 mL of a buffer of 1M $\text{NH}_3(\text{aq})$ and 1M $\text{NH}_4^+(\text{aq})$ are placed in two voltmeter

separately. A current of 1.5 A is passed through both cells for 20 minutes. If electrolysis of water only takes place



The pH of the

- (A) LHS half cell will increase
 (B) RHS half – cell will increase
 (C) both half – cells will increase
 (D) both half – cells will decrease

- Q 14. For the electrolytic production of NaClO_4 from NaClO_3 as per the equation, $\text{NaClO}_3 + \text{H}_2\text{O} \rightarrow \text{NaClO}_4 + \text{H}_2$ how many faradays of electricity will be required to produce 0.5 mole of NaClO_4 , assuming 60% efficiency ?
- (A) 0.835 F (B) 1.67 F
 (C) 3.34 F (D) 1.6 F
- Q 15. Electrolytic reduction of 6.15 g of nitrobenzene using a current efficiency of 40% will require which of the following quantity of electricity. [C = 12, H = 1, N = 14, O = 16]
- (A) 0.75 F (B) 0.15 F
 (C) 0.75 C (D) 0.125 C

9. Faraday Law & Relative Oxidation & Reduction at Electrode

- Q 1. A conducting wire carries a current of 0.965 ampere. Rate of flow of electrons per second at a given point is
- (A) $1 \times 10^{-5} N_A$ (B) N_A
 (C) $0.965 N_A$ (D) $\frac{N_A}{0.965}$
- Q 2. Which of the following statement is not correct about an inert electrode in a cell?
- [NCERT Exemplar]**
- (A) It does not participate in the cell reaction
 (B) It provides surface either for oxidation or for reduction reaction

(C) It provides surface for conduction of electrons

(D) It provides surface for redox reaction

- Q 3. The gas evolved at the anode when K_2SO_4 (aq.) is electrolysed using inert electrode is
- (A) O_2 (B) H_2
 (C) SO_2 (D) SO_3
- Q 4. When a dilute aqueous Li_2SO_4 solution is electrolysed, the products formed at the anode and cathode, respectively, are
- (A) S and LI (B) O_2 and Li
 (C) SO_2 and H_2
 (D) O_2 and H_2
- Q 5. A solution of sodium sulphate in water is electrolysed using inert electrodes. The products at the cathode and anode are respectively
- (A) H_2, O_2 (B) O_2, H_2
 (C) O_2, Na (D) None
- Q 6. In electrolysis of very dilute NaOH using Pt electrodes
- (A) H_2 is evolved at cathode and O_2 at anode
 (B) H_2 is evolved at anode and O_2 at cathode
 (C) Na_2O_2 is produced
 (D) H_2O_2 is produced
- Q 7. In the electrolysis of an aqueous nickel (II) sulphate solution, the process $2\text{H}_2\text{O} = \text{O}_2 + 4\text{H}^+ + 4\text{e}^-$ occurs at the anode. The material of construction of the anode is
- (A) Nickel (B) gold
 (C) Iron (D) None of these
- Q 8. In the electrolysis of an aqueous solution of salt, the pH in the space near one of the electrodes increased. A solution of which salt is being electrolyzed ?
- (A) None of the following
 (B) CuCl_2
 (C) $\text{Cu}(\text{NO}_3)_2$
 (D) KCl

- Q 9. In the electrolysis of aqueous sodium chloride solution which of the half cell reaction will occur at anode? [NCERT Exemplar]
 (A) $\text{Na}^+(\text{aq}) + \text{e}^- \rightarrow \text{Na}(\text{s}); E_{\text{cell}}^{\ominus} = -2.71\text{V}$
 (B) $2\text{H}_2\text{O} \rightarrow \text{O}_2 + 4\text{H}^+ + 4\text{e}^-; E_{\text{cell}}^{\ominus} = -1.23\text{V}$
 (C) $\text{H}^+(\text{aq}) + \text{e}^- \rightarrow \frac{1}{2}\text{H}_2(\text{g}); E_{\text{cell}}^- = 0.00\text{V}$
 (D) $\text{Cl}^-(\text{aq}) \rightarrow \frac{1}{2}\text{Cl}_2(\text{g})\text{e}^-; E_{\text{cell}}^{\ominus} = 1.36\text{V}$
- Q 10. When NaCl (aq) is electrolysed using Pt electrodes
 (A) $\text{H}_2(\text{g})$ is formed at cathode
 (B) $\text{O}_2(\text{g})$ is formed at cathode
 (C) $\text{Cl}_2(\text{g})$ is formed at anode
 (D) Both (A) and (C)
- Q 11. When NaCl (aq, very dilute, 10^{-6}M) is electrolysed using Pt electrodes
 (A) $\text{H}_2(\text{g})$ is formed at cathode
 (B) $\text{O}_2(\text{g})$ is formed at cathode
 (C) $\text{O}_2(\text{g})$ is formed at anode
 (D) Both (A) and (C)
- Q 12. When NaCl(aq) is electrolysed using Pt anode & Hg cathode [CBSE PMT 2002]
 (A) Na-Hg amalgam is formed at cathode
 (B) Cl_2 gas is formed at anode
 (C) Both (A) and (B)
 (D) Neither (A) nor (B)
- Q 13. The products formed when an aqueous solution of NaBr is electrolysed in a cell having inert electrodes are [AIIMS 2006]
 (A) Na & Br_2 (B) Na & O_2
 (C) H_2 , Br_2 & NaOH (D) H_2 & O_2
- Q 14. **Assertion (A):** A small amount of Acid or Alkali is added before electrolysis of water.
Reason (R): Pure water is a weak electrolyte. [AIIMS 2002]
 (A) Both assertion and reason are true and the reason is the correct explanation of assertion
 (B) Both assertion and reason are true and reason is not the correct explanation of assertion
 (C) Assertion is true but the reason is false
 (D) Both assertion and reason are false
- Q 15. A current of 3.7A is passed for 6hrs between Ni electrodes in 0.5L of 2M solution of $\text{Ni}(\text{NO}_3)_2$. What will be the molarity of solution at the end of electrolysis ?
- Q 16. A certain metal fails to liberate H_2 gas from a moderately conc. HCl solution. However it displaces Ag from AgNO_3 solution. Which among the following may it be
 (A) Hg (B) Fe
 (C) Cu (D) Cd
- Q 17. Of the following metals that can not be obtained by electrolysis of the aqueous of their salts are
 (A) Ag and Mg (B) Ag and Al
 (C) Mg and Al (D) Cu and Cr
- Q 18. The pH of 0.5 lit of 1.0 M NaCl after the electrolysis for 965 sec using 5.0 A current is [AIIMS 2010]
 (A) 1.0 (B) 12.7
 (C) 13.0 (D) 1.30

10. Resistance & Conductance of Cell

- Q 1. Find the resistance of the mixture of solution A ($V_A = 100\text{ml}$) & $R_A = 50\Omega$ & solution B ($V_B = 200\text{ml}$) & $R_B = 60\Omega$
 (A) 27.27Ω (B) 56.25Ω
 (C) 55Ω (D) None of these
- Q 2. The cell constant of a given cell is 0.5cm^{-1} . The resistance of a solution placed in this cell is measured to be 25 ohm. The conductivity of the solution (in 0.5cm^{-1}) is
 (A) 0.15 (B) 1.5
 (C) 0.02 (D) 150
- Q 3. 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 $0.146 \times 10^{-3}\text{S cm}^{-1}$ [NCERT]
- Q 4. The specific conductances of a 0.1 N KCl solution at 23°C is $0.0112\text{ohm}^{-1}\text{cm}^{-1}$. The

- resistance of the cell containing solution at the same temperature was found to be 55 ohm. The cell constant will be
 (A) 0.142cm^{-1} (B) 0.918cm^{-1}
 (C) 1.12cm^{-1} (D) 0.616cm^{-1}
- Q 5. Which of the statements about solutions of electrolytes is not correct? [NCERT Exemplar]
 (A) Conductivity of solution depends upon size of ions
 (B) Conductivity depends upon viscosity of solution
 (C) Conductivity does not depend upon solvation of ions present in solution
 (D) Conductivity of solution increases with temperature
- Q 6. Aqueous solution of which of the following compounds is the best conductor of electricity [CBSE PMT 2015]
 (A) Acetic acid (B) HCl
 (C) NH_3 (D) Fructose
- Q 7. Which has maximum conductivity
 (A) $[\text{Cr}(\text{NH}_3)_3\text{Cl}_3]$ (B) $[\text{Cr}(\text{NH}_3)_4\text{Cl}_2]\text{Cl}$
 (C) $[\text{Cr}(\text{NH}_3)_5\text{Cl}]\text{Cl}_2$ (D) $[\text{Cr}(\text{NH}_3)_6]\text{Cl}_3$
- Q 8. What is the reason that the molar conductivity of $\text{HCl}(\text{aq})$ is greater than that of $\text{NaCl}(\text{aq})$?
 (A) Molecular mass of HCl is less than that is NaCl
 (B) Mobility of H^+ ions is more than that of Na^+ ions
 (C) HCl gives strong acidic solution whereas NaCl gives a neutral solution
 (D) HCl is ionized to a greater extent than NaCl
- Q 9. Assertion (A): Conductivity of all electrolytes decreases on dilution
 Reason (R): On dilution number of ions per unit volume decreases [NCERT Exemplar]
 (A) Both assertion and reason are true and the reason is the correct explanation of assertion
 (B) Both assertion and reason are true and reason is not the correct explanation of assertion
 (C) Assertion is true but the reason is false
 (D) Both assertion and reason are false
 (E) Assertion is false but reason is true
- Q 10. The electrical resistance of a column of 0.05 M NaOH solution of diameter 1 cm and length 50 cm is 5.55×10^3 ohm. Calculate its resistivity, conductivity and molar conductivity. [NCERT Solved]
- Q 11. 0.1 M solution present in conductivity cell where electrodes of 100cm^2 area placed at 1 cm and resistance observed is 5000 ohm, what is the molar conductivity of solution? [AIIMS 2018]
 (A) $5.0 \times 10^2 \text{Scm}^2\text{mol}^{-1}$ (B) $10^4 \text{Scm}^2\text{mol}^{-1}$
 (C) $200 \text{Scm}^2\text{mol}^{-1}$ (D) $0.02 \text{Scm}^2\text{mol}^{-1}$
- Q 12. The specific conductance of a salt of 0.01M concentration is $1.061 \times 10^{-4} \text{Scm}^{-1}$. Molar conductance of the same solution will be
 (A) $1.061 \times 10^{-4} \text{Scm}^2\text{mol}^{-1}$
 (B) $1.061 \text{Scm}^2\text{mol}^{-1}$
 (C) $10.61 \text{Scm}^2\text{mol}^{-1}$
 (D) $106.1 \text{Scm}^2\text{mol}^{-1}$
- Q 13. The specific conductance of 0.01M solution of KCl is $0.0014 \text{ohm}^{-1} \text{cm}^{-1}$ at 25°C . Its equivalent conductivity is
 (A) $14 \text{Scm}^2\text{eq}^{-1}$ (B) $140 \text{Scm}^2\text{eq}^{-1}$
 (C) $1.4 \text{Scm}^2\text{eq}^{-1}$ (D) $0.14 \text{Scm}^2\text{eq}^{-1}$

11. Molar & Equivalent Conductance

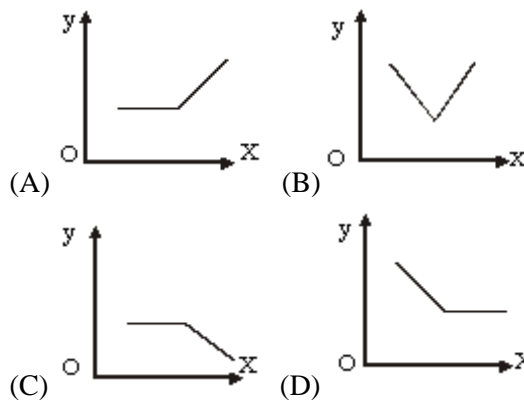
- Q 1. Resistance of 0.2 M solution of an electrolyte is 50Ω . The specific conductance of the solution is 1.4Sm^{-1} . The resistance of 0.5M solution of the same electrolyte is 280Ω . The molar conductivity of 0.5 M solution of the electrolyte in $\text{Sm}^2\text{mol}^{-1}$ is [JEE Main 2014]
 (A) 5×10^{-4} (B) 5×10^{-3}
 (C) 5×10^3 (D) 5×10^2
- Q 2. Resistance of a conductivity cell filled with a solution of an electrolyte of concentration 0.1M is 100Ω . The conductivity of this solution is 1.29Sm^{-1} . Resistance of the same cell when filled with 0.02 M of the same solution is 520Ω

- the molar conductivity of 0.02 M solution of the electrolyte will be [NCERT Solved]
- (A) $124 \times 10^{-4} \text{Sm}^2 \text{mol}^{-1}$
 (B) $62 \times 10^{-4} \text{Sm}^2 \text{mol}^{-1}$
 (C) $248 \times 10^{-4} \text{Sm}^2 \text{mol}^{-1}$
 (D) None of these
- Q 3. The equivalent conductance of NaCl at concentration C and at infinite dilution are λ_C and λ_∞ , respectively. The correct relationship between λ_C & λ_∞ is given as (the constant B is positive) [JEE Main 2014]
- (A) $\lambda_C = \lambda_\infty + (B)C$
 (B) $\lambda_C = \lambda_\infty - (B)C$
 (C) $\lambda_C = \lambda_\infty - (B)\sqrt{C}$
 (D) $\lambda_C = \lambda_\infty + (B)\sqrt{C}$
- Q 4. An increase in equivalent conductance of a strong electrolyte with dilution is mainly due to [CBSE PMT 2010]
- (A) increase in ionic mobility of ions
 (B) 100 % ionization of electrolyte at normal dilution
 (C) increase in both, no of ions and ionic mobility of ions
 (D) increase in no of ions
- Q 5. **Assertion (A):** Λ_m for weak electrolytes shows a sharp increase when the electrolytic solution is diluted. [NCERT Exemplar]
Reason (R): For weak electrolytes degree of dissociation increases with dilution of solution
- (A) Both assertion and reason are true and the reason is the correct explanation of assertion
 (B) Both assertion and reason are true and reason is not the correct explanation of assertion
 (C) Assertion is true but the reason is false
 (D) Both assertion and reason are false
 (E) Assertion is false but reason is true
- Q 6. Specific conductance of a solution is directly related to
- (A) Concentration of ions
 (B) degree of dissociation
 (C) No. of ions
 (D) Concentration of electrolytes
- Q 7. The conductivity of 0.01 mole/dm³ aqueous acetic acid at 300 K is $19.5 \times 10^{-5} \text{ohm cm}^{-1}$ the limiting molar conductivity of acetic acid at the same temperature is $390 \text{ohm}^{-1} \text{cm}^2 \text{mol}^{-1}$. The degree of dissociation of acetic acid is
- (A) 0.5 (B) 0.05
 (C) 5×10^{-5} (D) 5×10^{-7}
- Q 8. The conductivity of $0.001028 \text{mol L}^{-1}$ acetic acid is $4.95 \times 10^{-5} \text{S cm}^{-1}$. Calculate its dissociation constant if Λ_m^0 for acetic acid is $390.5 \text{S cm}^2 \text{mol}^{-1}$. [NCERT Solved]
- Q 9. Equivalent conductance of 0.1 M HA (Weak acid) solution is $10 \text{S cm}^2 \text{equivalent}^{-1}$ and that at infinite dilution is $200 \text{S cm}^2 \text{equivalent}^{-1}$ Hence pH of HA solution is
- (A) 1.3 (B) 1.7
 (C) 2.3 (D) 3.7
- Q 10. The equivalent conductivity of 0.1 N CH_3COOH at 25°C is $80 \text{S cm}^2 \text{eq}^{-1}$ and at infinite dilution $400 \text{S cm}^2 \text{eq}^{-1}$. The degree of dissociation of CH_3COOH is
- (A) 1 (B) 0.2
 (C) 0.1 (D) 0.5
- Q 11. For Ag_3PO_4 , equivalent conductance is $1.50 \times 10^{-4} \text{S m}^2 \text{eq}^{-1}$. Its molar conductivity ($\text{S m}^2 \text{mol}^{-1}$) is
- (A) 1.5×10^{-4} (B) 4.5×10^{-4}
 (C) 5×10^{-5} (D) None of these
- Q 12. For BaSO_4 , molar conductance is $2.0 \times 10^{-3} \text{S m}^2 \text{mol}^{-1}$. Its equivalent conductivity ($\text{S m}^2 \text{eq}^{-1}$) is
- (A) 1×10^{-3} (B) 4×10^{-3}
 (C) 2×10^{-3} (D) None of these

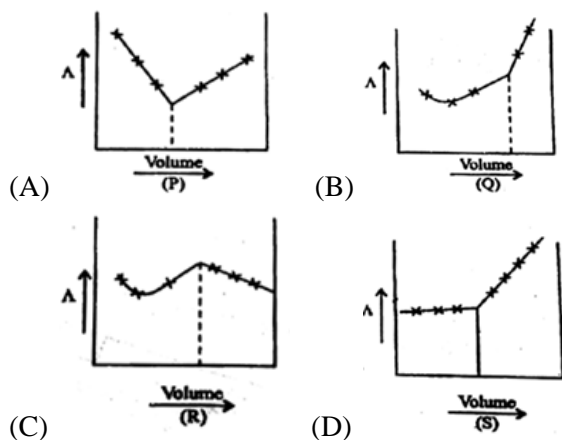
12. Kohlraush's Law

- Q 1. The molar conductance at infinite dilution of NaCl, HCl and CH_3COONa at 298K are 126.0, 426.0 and $91.0 \text{ ohm}^{-1}\text{cm}^2\text{mol}^{-1}$ respectively. The value of molar conductance of acetic acid at infinite dilution at the same temperature is
[NCERT Solved]
(A) 644.0 (B) 300.0
(C) 517.0 (D) 391.0
- Q 2. The molar conductivities $\Lambda_{\text{NaOAc}}^{\circ}$ and $\Lambda_{\text{HCl}}^{\circ}$ at infinite dilution in water at 25°C are 91.0 and $426.2\text{S cm}^2/\text{mol}$ respectively. To calculate $\Lambda_{\text{HOAc}}^{\circ}$, the additional value required is
(A) $\Lambda_{\text{NaCl}}^{\circ}$ (B) $\Lambda_{\text{H}_2\text{O}}^{\circ}$
(C) $\Lambda_{\text{KCl}}^{\circ}$ (D) $\Lambda_{\text{NaOH}}^{\circ}$
- Q 3. The limiting molar conductivities infinite dilution ($\Lambda_{m^{\circ}}$) at 298 K for KOH, KNO_3 and NH_4NO_3 are 239, 125 and $128 \text{ S cm}^2 \text{ mol}^{-1}$ respectively. If a 0.1 M solution of NH_4OH has a molar conductivity of $24 \text{ S cm}^2 \text{ mol}^{-1}$ the degree of dissociation α is
(A) 0.024 (B) 0.24
(C) 0.10 (D) 0.05
- Q 4. If molar conductance at infinite dilution of $(\text{NH}_4)_2\text{SO}_4$, NaOH and Na_2SO_4 solutions are x_1, x_2 and x_3 respectively, then molar conductance of NH_4OH solution is
(A) $\frac{x_1 + 2x_2 - x_3}{2}$ (B) $\frac{x_1 - x_2 - x_3}{2}$
(C) $2(x_1 + x_2 - 2x_3)$ (D) $\frac{x_1 + x_2 - 2x_3}{2}$
- Q 5. Molar conductivity of BaCl_2 , H_2SO_4 & HCl at infinite dilution are X_1, X_2 & X_3 respectively. Equivalent conductance of BaSO_4 at infinite dilution will be
(A) $\frac{X_1 + X_2 - X_3}{2}$ (B) $x_1 + 2x_2 - x_3$
(C) $\frac{X_1 + X_2 - X_3}{2}$ (D) $x_1 + x_2 - x_3$
- Q 6. Equivalent conductivity of BaCl_2 , H_2SO_4 & HCl at infinite dilution are X_1, X_2 & X_3 respectively. Equivalent conductance of BaSO_4 at infinite dilution will be
(A) $x_1 + x_2 - x_3$ (B) $x_1 - x_2 - x_3$
(C) $x_1 + x_2 - 2x_3$ (D) $x_1 - 2x_2 + x_3$
- Q 7. Solubility of a sparingly soluble salt, S, specific conductance, K and the equivalent conductance A_o are related as:
(A) $S = 1000A^{\circ}/K$ (B) $S = KA^{\circ}$
(C) $S = K/1000A^{\circ}$ (D) $S = 1000K/A^{\circ}$
- Q 8. The ionic conductance of Ag^+ and Cl^- ions are $\lambda_{\text{Ag}^+}^{\circ} = 56.5 \text{ ohm}^{-1} \text{ cm}^2 \text{ eq}^{-1}$ and $\lambda_{\text{Cl}^-}^{\circ} = 68.0 \text{ ohm}^{-1} \text{ cm}^2 \text{ eq}^{-1}$. The specific conductance of saturated AgCl solution in water = $1.37 \times 10^{-6} \text{ ohm}^{-1}\text{cm}^{-1}$ at 20°C . Calculate the solubility product of AgCl in water at 20°C .
(A) 1.21×10^{-10} (B) 1.6×10^{-10}
(C) 1.33×10^{-10} (D) 1.54×10^{-10}
- Q 9. The dissociation constant of n-butyric acid is 1.6×10^{-5} and the molar conductivity at infinite dilution is $380 \times 10^{-4} \text{ S m}^2 \text{ mol}^{-1}$. The specific conductance of the 0.01M acid solution is
(A) $1.52 \times 10^{-5} \text{ S m}^{-1}$ (B) $1.52 \times 10^{-2} \text{ S m}^{-1}$
(C) $1.52 \times 10^{-3} \text{ S m}^{-1}$ (D) None
- Q 10. The conductivity of a saturated solution of Ag_3PO_4 is $9 \times 10^{-6} \text{ m}^{-1}$ and its equivalent conductivity is $1.50 \times 10^{-4} \text{ S m}^2 \text{ equivalent}^{-1}$. The K_{sp} of Ag_3PO_4 is
(A) 4.32×10^{-18} (B) 1.8×10^{-9}
(C) 8.64×10^{-13} (D) None of these
- Q 11. The ionization constant of a weak acid (HA) is 25×10^{-6} while the equivalent conductance of its 0.01M solution is $19.6 \text{ S cm}^2 \text{ eq}^{-1}$. The equivalent conductance of the electrolyte at infinite dilution (in $\text{S cm}^2 \text{ eq}^{-1}$) will be
(A) 250 (B) 196
(C) 392 (D) 384

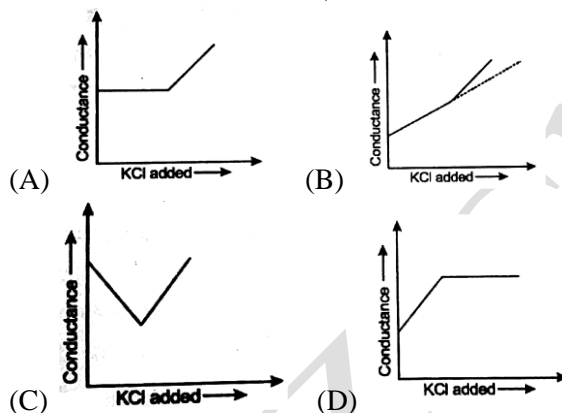
- Q 12. Equal volumes of 0.015M CH_3COOH & 0.015M NaOH are mixed together. What would be molar conductivity of mixture if conductivity of CH_3COONa is $6.3 \times 10^{-4} \text{ S cm}^{-1}$
- (A) $8.4 \text{ S cm}^2 \text{ mol}^{-1}$ (B) $74 \text{ S cm}^2 \text{ mol}^{-1}$
 (C) $4.2 \text{ S cm}^2 \text{ mol}^{-1}$ (D) $42 \text{ S cm}^2 \text{ mol}^{-1}$
- Q 13. At 25°C , $\lambda_\infty(\text{H}^+) = 3.4982 \times 10^{-2} \text{ S m}^2 \text{ mol}^{-1}$ and $\lambda_\infty(\text{OH}^-) = 1.98 \times 10^{-2} \text{ S m}^2 \text{ mol}^{-1}$
- Given: Sp. Conductance = $5.7 \times 10^{-6} \text{ S m}^{-1}$ for H_2O , determine pH and K_w
- (A) 7 (B) 6.98
 (C) 7.5 (D) None of these
- Q 14. The molar conductivity of a solution of a weak acid HX (0.01M) is 10 times smaller than the molar conductivity of a solution of a weak acid HY (0.10M). If $\lambda_{x^-}^0 \approx \lambda_{y^-}^0$, the difference in their pK_a values, $\text{pK}_a(\text{HX}) - \text{pK}_a(\text{HY})$, is (consider degree of ionization of both acids to be $\ll 1$)
- [JEE Adv. 2015]
 (A) 5 (B) 2
 (C) 3 (D) None of these
- Q 3. The equivalent conductance at infinite dilution of the salt, MX is $160.084 \text{ ohm}^{-1} \text{ eq}^{-1} \text{ cm}^2$. If the transport number of M^+ is 0.40, the ionic mobilities of X^- in $\text{cm}^2 \text{ s}^{-1} \text{ v}^{-1}$ is
- (A) 3.9×10^{-5} (B) 6.7×10^{-4}
 (C) 2.5×10^{-3} (D) 1.0×10^{-3}
- Q 4. The molar ionic conductance at infinite dilution of Ag^+ is $61.92 \times 10^{-4} \text{ S m}^2 \text{ mol}^{-1}$ at 25°C . The ionic mobility of Ag^+ will be
- (A) 6.4×10^{-8} (B) 6.192
 (C) 6.192×10^{-4} (D) 3.2×10^{-4}
- Q 5. The limiting molar conductivity $\lambda_{\text{K}^+}^0 = 64.35 \text{ ohm}^{-1} \text{ cm}^2 \text{ mole}^{-1}$ in KCl solution. What is limiting ionic mobility of K^+ ion
- (A) $6.67 \times 10^{-4} \text{ cm}^2 \text{ sec}^{-1} \text{ volt}^{-1}$
 (B) $3.33 \times 10^{-4} \text{ cm}^2 \text{ sec}^{-1} \text{ volt}^{-1}$
 (C) $2 \times 10^{-4} \text{ cm}^2 \text{ sec}^{-1} \text{ volt}^{-1}$
 (D) None of these
- Q 6. If NaOH is treated with HCl , variation of conductance (y-axis) with addition of HCl (x-axis) will be



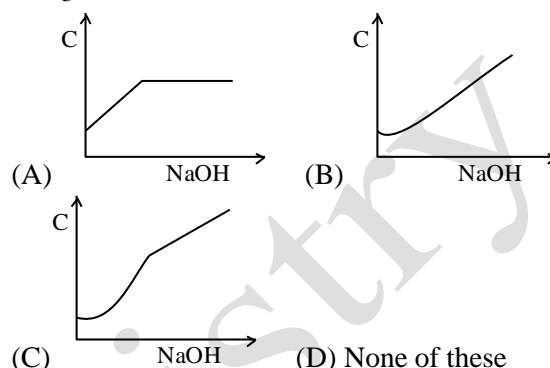
- 13. Conductometric Titration**
- Q 1. The transport number of Cl^- in 0.1 N HCl & 0.1 N NaCl aqueous solutions are 0.16 and 0.62 respectively. This is because
- (A) NaCl is neutral and HCl is strongly acidic
 (B) the mass of HCl is lower than that of NaCl for a given volume
 (C) Na^+ is more hydrated than H^+ ions
 (D) the mobility of H^+ is much higher than Na^+ ions
- Q 2. The equivalent, ionic conductance or Na and Cl^- ions in 0.1M NaCl are $45 \text{ ohm}^{-1} \text{ cm}^2$ and $65 \text{ ohm}^{-1} \text{ cm}^2$ respectively, at 298 K. The transport number of Cl^- ions in this solution is
- (A) 0.848 (B) 0.591
 (C) 0.409 (D) 0.512
- Q 7. $\text{AgNO}_3(\text{aq})$ was added to an aqueous KCl solution gradually and the conductivity of the solution was measured. The plot of conductance (Λ) versus the volume of AgNO_3 is



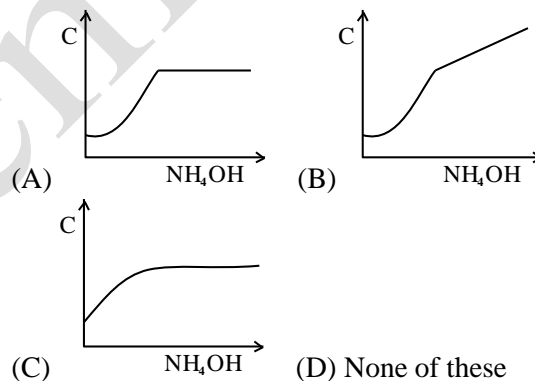
Q 8. Which of the following is the most appropriate graph for conductometric titration when AgNO_3 (aq). Solution is titrated against KCl (aq.) solution. (Assuming that these ions do not differ much in ionic conductance).



Q 9. Which of the following is correct curve for conductance vs Volume of NaOH added to CH_3COOH solution?



Q 10. Which of the following is correct curve for conductance vs volume of NH_4OH when added to HF solution?



Answer Key

1. Cell Notation & Cell Reaction

- (1). A (2). A (3). B
 (4). B (5). C (6). C
 (7). B (8). A (9). C
 (10). B
 (11). See theory Notes
 (12). See theory Notes
 (13). C

2. Emf of Cell, Electrode Potential

- (1). C (2). D (3). B
 (4). B (5). D (6). C
 (7). A (8). A (9). B
 (10). A (11). C (12). A
 (13). D (14). B (15). B
 (16). B (17). C

3. Electrochemical Series

- (1). B (2). C (3). A
 (4). A (5). B (6). D
 (7). B (8). A (9). D
 (10). D (11). C (12). D
 (13). A (14). C (15). A

4. The Nernst Equation

- (1). C (2). A (3). B
 (4). B (5). B (6). D
 (7). B (8). 2.96 V (9). A
 (10). C (11). C (12). B
 (13). B (14). A (15). D
 (16). A (17). D (18). D
 (19). A

5. Equilibrium Condition, Concentration Cell

- (1). A (2). D (3). A
 (4). 3.92×10^{15} (5). A
 (6). B (7). A (8). A
 (9). C (10). B (11). A
 (12). D (13). A (14). A
 (15). A (16). A (17). B

6. Emf of Metal Insoluble Salt Electrode

- (1). D (2). B (3). D
 (4). D (5). A (6). B
 (7). B (8). C (9). A
 (10). D (11). D

7. Battery & Corrosion

- (1). D (2). B (3). E
 (4). A (5). A (6). C
 (7). C (8). C (9). B
 (10). D (11). A

8. Electrolysis – Faraday Law

- (1). C (2). A (3). B
 (4). B (5). B (6). B
 (7). D (8). D

- (9). $t = 14.40$ min, $m_{\text{Cu}} = 0.426$ g, $m_{\text{Zn}} = 0.439$ g
 (10). C (11). C (12). A
 (13). B (14). B (15). A

9. Faraday Law & Relative Oxidation & Reduction at Electrode

- (1). A (2). D (3). A
 (4). D (5). A (6). A
 (7). B (8). D (9). B
 (10). D (11). D (12). C
 (13). C (14). A (15). B
 (16). C (17). C (18). C

10. Resistance & Conductance of Cell

- (1). B (2). C (3). 0.219 cm^{-1}
 (4). D (5). C (6). B
 (7). D (8). B (9). A
 (10). $229.6 \times 10^{-4} \text{ S cm}^2 \text{ mol}^{-1}$
 (11). D (12). C (13). B

11. Molar & Equivalent Conductance

- (1). A (2). A (3). C
 (4). A (5). A (6). A
 (7). B (8). $1.78 \times 10^{-5} \text{ M}$
 (9). C (10). B (11). B
 (12). A

12. Kohlraush's Law

- (1). D (2). A (3). D
 (4). A (5). D (6). A
 (7). D (8). A (9). B
 (10). A (11). C (12). B
 (13). B (14). C

13. Conductometric Titration

- (1). D (2). B (3). D
 (4). A (5). A (6). B
 (7). D (8). A (9). B
 (10). A