

Electrochemistry

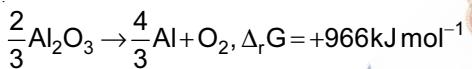
1. Given $E_{\text{Fe}^{3+}/\text{Fe}}^{\circ} = -0.036 \text{ V}$, $E_{\text{Fe}^{2+}/\text{Fe}}^{\circ} = -0.439 \text{ V}$

The value of standard electrode potential for the change, $\text{Fe}_{(\text{aq})}^{3+} + \text{e}^- \rightarrow \text{Fe}^{2+} (\text{aq})$ will be

[AIEEE-2009]

- (1) 0.385 V (2) 0.770 V
 (3) -0.270 V (4) -0.072 V

2. The Gibbs energy for the decomposition Al_2O_3 at 500°C is as follows



The potential difference needed for electrolytic reduction of Al_2O_3 at 500°C is at least

[AIEEE-2010]

- (1) 5.0 V (2) 4.5 V
 (3) 3.0 V (4) 2.5 V

3. Resistance of 0.2 M solution of an electrolyte is 50 Ω. The specific conductance of the solution is 1.3 S m⁻¹. If resistance of the 0.4 M solution of the same electrolyte is 260 Ω, its molar conductivity is

[AIEEE-2011]

- (1) 62.5 S m² mol⁻¹
 (2) 6250 S m² mol⁻¹
 (3) 6.25×10^{-4} S m² mol⁻¹
 (4) 625×10^{-4} S m² mol⁻¹

4. The standard reduction potentials for Zn^{2+}/Zn , Ni^{2+}/Ni , and Fe^{2+}/Fe are -0.76, -0.23 and -0.44 V respectively. The reaction $X + \text{Y}^{2+} \rightarrow x^{2+} + \text{Y}$ will be spontaneous when

[AIEEE-2012]

- (1) X = Ni, Y = Zn (2) X = Fe, Y = Zn
 (3) X = Zn, Y = Ni (4) X = Ni, Y = Fe

5. Given

$$E_{\text{Cr}^{3+}/\text{Cr}}^{\circ} = -0.74 \text{ V}; E_{\text{MnO}_4^{\circ}/\text{Mn}^{2+}}^{\circ} = 1.51 \text{ V}$$

$$E_{\text{Cr}_2\text{O}_7^{2-}/\text{Cr}^{3+}}^{\circ} = 1.33 \text{ V}; E_{\text{Cl}/\text{Cl}^-}^{\circ} = 1.36 \text{ V}$$

Based on the data given above, strongest oxidising agent will be

[JEE (Main)-2013]

- (1) Cl^- (2) Cr^{3+}
 (3) Mn^{2+} (4) MnO_4^-

6. Resistance of 0.2 M solution of an electrolyte is 50 Ω. The specific conductance of the solution is 1.4 S m⁻¹. The resistance of 0.5 M solution of the same electrolyte is 280 Ω. The molar conductivity of 0.5 M solution of the electrolyte in S m² mol⁻¹ is

[JEE (Main)-2014]

- (1) 5×10^{-4} (2) 5×10^{-3}
 (3) 5×10^3 (4) 5×10^2

7. The equivalent conductance of NaCl at concentration C and at infinite dilution are λ_C and λ_{∞} , respectively. The correct relationship between λ_C and λ_{∞} is given as (where the constant B is positive)

[JEE (Main)-2014]

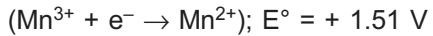
- (1) $\lambda_C = \lambda_{\infty} + (B)C$ (2) $\lambda_C = \lambda_{\infty} - (B)C$
 (3) $\lambda_C = \lambda_{\infty} - (B)\sqrt{C}$ (4) $\lambda_C = \lambda_{\infty} + (B)\sqrt{C}$

8. The metal that cannot be obtained by electrolysis of an aqueous solution of its salts is

[JEE (Main)-2014]

- (1) Ag (2) Ca
 (3) Cu (4) Cr

9. Given below are the half-cell reactions



The E° for $3\text{Mn}^{2+} \rightarrow \text{Mn} + 2\text{Mn}^{3+}$ will be

[JEE (Main)-2014]

- (1) -2.69 V; the reaction will not occur
 (2) -2.69 V; the reaction will occur
 (3) -0.33 V; the reaction will not occur
 (4) -0.33 V; the reaction will occur

29. The equation that is incorrect is

[JEE (Main)-2020]

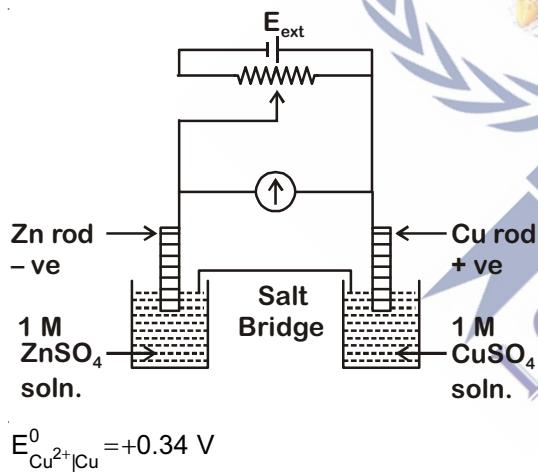
- (1) $(\Lambda_m^\circ)_{\text{NaBr}} - (\Lambda_m^\circ)_{\text{NaCl}} = (\Lambda_m^\circ)_{\text{KBr}} - (\Lambda_m^\circ)_{\text{KCl}}$
- (2) $(\Lambda_m^\circ)_{\text{H}_2\text{O}} = (\Lambda_m^\circ)_{\text{HCl}} + (\Lambda_m^\circ)_{\text{NaOH}} - (\Lambda_m^\circ)_{\text{NaCl}}$
- (3) $(\Lambda_m^\circ)_{\text{NaBr}} - (\Lambda_m^\circ)_{\text{NaI}} = (\Lambda_m^\circ)_{\text{KBr}} - (\Lambda_m^\circ)_{\text{NaBr}}$
- (4) $(\Lambda_m^\circ)_{\text{KCl}} - (\Lambda_m^\circ)_{\text{NaCl}} = (\Lambda_m^\circ)_{\text{KBr}} - (\Lambda_m^\circ)_{\text{NaBr}}$

30. Let C_{NaCl} and C_{BaSO_4} be the conductances (in S) measured for saturated aqueous solutions of NaCl and BaSO₄, respectively, at a temperature T.

Which of the following is false? [JEE (Main)-2020]

- (1) $C_{\text{BaSO}_4}(T_2) > C_{\text{BaSO}_4}(T_1)$ for $T_2 > T_1$
- (2) $C_{\text{NaCl}}(T_2) > C_{\text{NaCl}}(T_1)$ for $T_2 > T_1$
- (3) $C_{\text{NaCl}} \gg C_{\text{BaSO}_4}$ at a given T
- (4) Ionic mobilities of ions from both salts increase with T.

31.



Identify the incorrect statement from the option below for the above cell [JEE (Main)-2020]

- (1) If $E_{\text{ext}} < 1.1 \text{ V}$, Zn dissolves at anode and Cu deposits at cathode
- (2) If $E_{\text{ext}} = 1.1 \text{ V}$, no flow of e^- or current occurs
- (3) If $E_{\text{ext}} > 1.1 \text{ V}$, e^- flows from Cu to Zn
- (4) If $E_{\text{ext}} > 1.1 \text{ V}$, Zn dissolves at Zn electrode and Cu deposits at Cu electrode

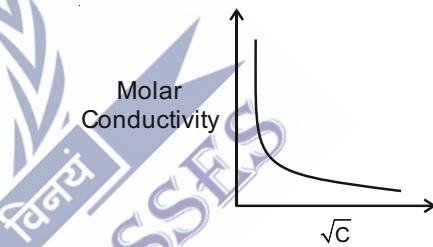
32. 250 mL of a waste solution obtained from the workshop of a goldsmith contains 0.1 M AgNO₃ and 0.1 M AuCl. The solution was electrolyzed at 2V by passing a current of 1A for 15 minutes. The metal/metals electrodeposited will be

$$\left[E^0_{\text{Ag}^+/\text{Ag}} = 0.80 \text{ V}, E^0_{\text{Au}^+/\text{Au}} = 1.69 \text{ V} \right]$$

[JEE (Main)-2020]

- (1) Silver and gold in equal mass proportion
- (2) Silver and gold in proportion to their atomic weights
- (3) Only gold
- (4) Only silver

33. The variation of molar conductivity with concentration of an electrolyte (X) in aqueous solution is shown in the given figure.



The electrolyte X is

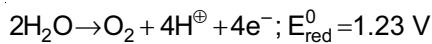
- (1) NaCl
 - (2) HCl
 - (3) CH₃COOH
 - (4) KNO₃
34. For the given cell;
 $\text{Cu(s)}|\text{Cu}^{2+}(\text{C}_1 \text{M})||\text{Cu}^{2+}(\text{C}_2 \text{M})|\text{Cu(s)}$
 change in Gibbs energy (ΔG) is negative, if

[JEE (Main)-2020]

- (1) $\text{C}_2 = \sqrt{2}\text{C}_1$
- (2) $\text{C}_2 = \frac{\text{C}_1}{\sqrt{2}}$
- (3) $\text{C}_1 = 2\text{C}_2$
- (4) $\text{C}_1 = \text{C}_2$

35. What would be the electrode potential for the given half cell reaction at pH = 5? _____

[JEE (Main)-2020]



(R = 8.314 J mol⁻¹K⁻¹; Temp = 298 K; oxygen under std. atm. pressure of 1 bar)

36. For an electrochemical cell



the ratio $\frac{[\text{Sn}^{2+}]}{[\text{Pb}^{2+}]}$ when this cell attains equilibrium is _____.

$$(\text{Given : } E_{\text{Sn}^{2+}|\text{Sn}}^0 = -0.14\text{V},$$

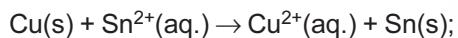
$$E_{\text{Pb}^{2+}|\text{Pb}}^0 = -0.13\text{V}, \frac{2.303\text{RT}}{\text{F}} = 0.06)$$

[JEE (Main)-2020]

37. 108 g of silver (molar mass 108 g mol⁻¹) is deposited at cathode from AgNO_3 (aq) solution by a certain quantity of electricity. The volume (in L) of oxygen gas produced at 273 K and 1 bar pressure from water by the same quantity of electricity is _____.

[JEE (Main)-2020]

38. The Gibbs energy change (in J) for the given reaction at $[\text{Cu}^{2+}] = [\text{Sn}^{2+}] = 1\text{ M}$ and 298 K is:



$$(E_{\text{Sn}^{2+}|\text{Sn}}^0 = -0.16\text{ V}, E_{\text{Cu}^{2+}|\text{Cu}}^0 = 0.34\text{ V})$$

$$\text{Take F} = 96500\text{ C mol}^{-1}$$

[JEE (Main)-2020]

39. For the disproportionation reaction $2\text{Cu}^{+}(\text{aq}) \rightleftharpoons \text{Cu(s)} + \text{Cu}^{2+}(\text{aq})$ at 298 K. In K (where K is the equilibrium constant) is _____ $\times 10^{-1}$.

Given :

$$(E_{\text{Cu}^{2+}/\text{Cu}^{+}}^0 = 0.16\text{ V})$$

$$E_{\text{Cu}^{+}/\text{Cu}}^0 = 0.52\text{ V}$$

$$\frac{\text{RT}}{\text{F}} = 0.025$$

[JEE (Main)-2020]

40. The photoelectric current from Na (work function, $w_0 = 2.3\text{ eV}$) is stopped by the output voltage of the cell

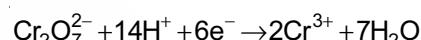


The pH of aq. HCl required to stop the photoelectric current from K($w_0 = 2.25\text{ eV}$), all other conditions remaining the same, is _____ $\times 10^{-2}$ (to the nearest integer).

$$\text{Given, } 2.303 \frac{\text{RT}}{\text{F}} = 0.06\text{ V}; E_{\text{AgCl}|\text{AgCl}^-}^0 = 0.22\text{ V}$$

[JEE (Main)-2020]

41. An acidic solution of dichromate is electrolyzed for 8 minutes using 2 A current. As per the following equation



The amount of Cr^{3+} obtained was 0.104 g. The efficiency of the process (in%) is (Take : F = 96000 C, At. mass of chromium = 52) _____.

[JEE (Main)-2020]

42. An oxidation-reduction reaction in which 3 electrons are transferred has a ΔG^0 of 17.37 kJ mol⁻¹ at 25°C. The value of E_{cell}^0 (in V) is _____ $\times 10^{-2}$.

$$(1\text{ F} = 96,500\text{ C mol}^{-1})$$

[JEE (Main)-2020]

43. Potassium chlorate is prepared by the electrolysis of KCl in basic solution



If only 60% of the current is utilized in the reaction, the time (rounded to the nearest hour) required to produce 10 g of KClO_3 using a current of 2 A is _____.

(Given : F = 96,500 C mol⁻¹; molar mass of KClO_3 = 122 g mol⁻¹)

[JEE (Main)-2020]