CHEMISTRY

BOOKS - MTG CHEMISTRY (ENGLISH)

ELECTROCHEMISTRY

Mcqs

1. In a Daniel cell,

A. the chemical energy liberted during the redox reaction is converted to electrical energy

B. the electrical energy of the cell is converted to chemical energy

C. the energy of the cell is utilised in conduction of the redox reaction

D. the potential energy of the cell is converted into electrical energy.

Answer: A

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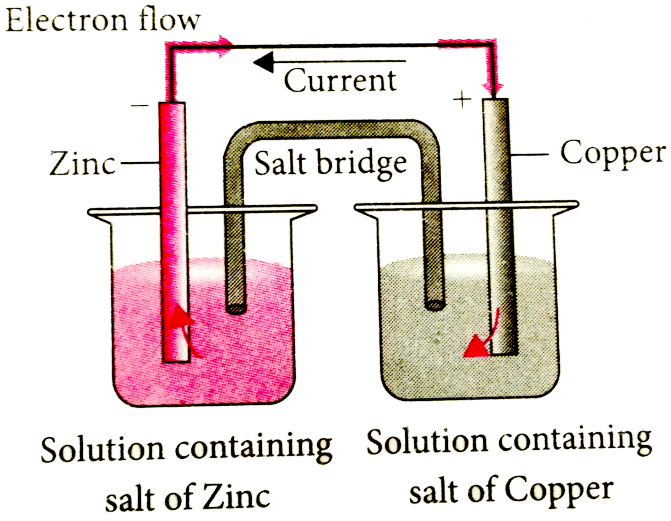
2. Which of the following statement is correct about the given Daniell cell?



A. This cell converts the electrical energy liberted during the redox reaction to chemical energy.

B. This cell has an electricel potential greater that 1.1 v when concertation of Zn^{2+} and Cu^{2+} ions is unity (1 mol dm^{-3})

C. In this cell, copper is acting as cathode and zinc is acting as anode.

D. Redox reaction occurring in this cell is

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

Answer: C

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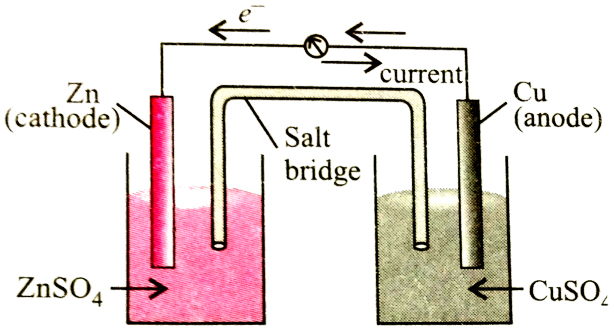
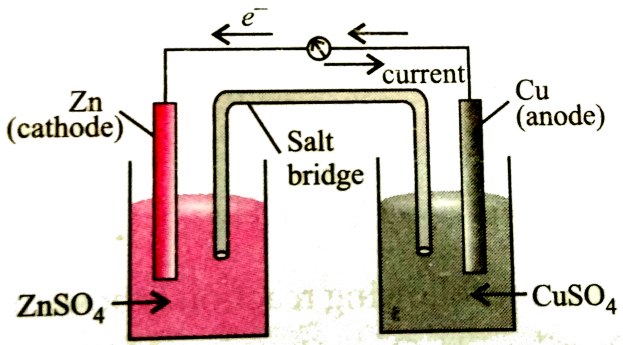
3. Given below are two figures of Daniell cell (X) and (y). Study the figures and mark the incorrect statement from the following.



$E_{ext} > 1.1$ V

(Y)



$E_{ext} > 1.1$ V

(Y)

A. In fig (X), electrons flow from Zn rod to Cu rod hence current flows from Cu to Zn $(E_{ext} < 1.1V)$

B. In fig (Y), electrons flow from Cu to Zn and current flows from Zn to Cu $(E_{ext} > 1.1V)$

C. In fig (X), Zn dissolves at anode and Cu deposits at cathode.

D. In fig (Y), Zn is deposited at Cu and Cu is deposited at Zn.

Answer: D

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4. A galvanic cell has electrical potential of 1.1 V . If an opposing potential of 1.1 V is applied to this cell, what will happen to the cell reaction and current flowing through the cell ?

A. The reaction stops and no current flows through the cell.

B. The reaction continuous but current flows in opposite direction.

C. The concentration of reactants becomes unity and current flows from cathode to anode.

D. The cell does not function as a galvanic cell and zinc is deposited on zinc plate.

Answer: A

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5. Following reactions are taking place in a Galvanic cell , $Zn \rightarrow Zn^{2+} + 2e^{-}, Ag^{+} + e^{-} \rightarrow Ag$

Which of the given representations is the correct method of depicting the cell ?

A. $Zn_{(s)} \mid Zn^{2+}_{(aq)} || Ag^{+}_{(aq)} \left| Ag_{(s)} \right.$

B. $Zn^{2+} | Zn || Ag | Ag^{+}$

C. $Zn_{(aq)} \mid Zn^{2+}_{(s)} || Ag^{+}_{(s)} \left| Ag_{(aq)} \right.$

D. $Zn_{(s)} \left| Ag^{+}_{(aq)} \right. || Zn^{2+}_{(aq)} \left| Ag_{(s)} \right.$

Answer: A

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6. Which of the following is the correct cell representation for the given cell reaction ?

$Zn + H_2SO_4 \rightarrow ZnSO_4 + H_2$

A. $Zn|Zn^{2+}||H^{+}|H_2$

B. $Zn|Zn^{2+}||H^{+}, H_2|Pt$

C. $Zn|ZnSO_4||H_2SO_4|Zn$

D. $Zn|H_2SO_4||ZnSO_4|H_2$

Answer: B

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7. The cell reaction of the galvanic cell : $Cu_{(s)}\left|Cu^{2+}_{(aq)}\right| \mid Hg^{2+}_{(aq)}\left|Hg_{(l)}\right.$ is

A. $Hg + Cu^{2+} \rightarrow Hg^{2+} + Cu$

B. $Hg + Cu^{2+} \rightarrow Cu^{+} + Hg^{+}$

C. $Cu + Hg \rightarrow CuHg$

D. $Cu + Hg^{2+} \rightarrow Cu^{2+} + Hg$

Answer: D

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8. Which of the following reaction is possible at anode ?

A. $2Cr^{3+} + 7H_2O \rightarrow Cr_2O_7^{2-} + 14H^+$

B. $F_2 \rightarrow 2F^-$

C. $(1/2)O_2 + 2H^+ \rightarrow H_2O$

D. None of these

Answer: A

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9. In the cell $Zn|Zn^{2+}||Cu^{2+}|Cu$, the negaitve terminal is

A. Cu

B. Cu^{2+}

C. Zn

D. Zn^{2+}

Answer: C

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10. For the galvanic cell, $Cu \mid Cu^{2+} || Ag^{+} \mid Ag$. Which of the following observations is not correct ?

A. Cu acts as anode and Ag acts as cathode.

B. Ag electrode loses mass and Cu electrode gains mass.

C. Reaction at anode, $Cu \rightarrow Cu^{2+} + 2e^{-}$

D. Copper is more reactive than silver .

Answer: B

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11. Which of the following is the cell reaction that occurs when the following half-cells are combined?

$I_2 + 2e^- \rightarrow 2I^-(1M), E^\circ = +0.54V$

$Br_2 + 2e^- \rightarrow 2Br(1M), E^\circ = +1.09V$

A. $2Br^- + I_2 \rightarrow Br_2 + 2I^-$

B. $I_2 + Br_2 \rightarrow 2I^- + 2Br^-$

C. $2I^- + Br_2 \rightarrow I_2 + 2Br^-$

D. $2I^- + 2Br^- \rightarrow I_2 + Br_2$

Answer: C

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12. Calculate the standard cell potential of galvanic cell in which the following reaction takes place

$2Cr_s + 3Cd_{aq}^{+2} \rightarrow 2cr_{aq}^{+3} + 3Cd_s$

Given $E_{Cr^{+3}/Cr} = -0.74(V) E^\circ\_\left(Cd^{+2}/Cd\right) = -0.04(V)$

A. 0.74 V

B. 1.14 V

C. 0.34 V

D. $-0.34V$

Answer: C

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13. The standard reduction potential for the half-cell reaction, $Cl_2 + 2e^- \rightarrow 2Cl^-$ will be $(Pt^{2+} + 2Cl^- \rightarrow Pt + Cl_2, E^\circ_{\text{cell}} = -0.15V, Pt^{2+} + 2e^- \rightarrow Pt, E^\circ = 1$

A. $-1.35V$

B. $+1.35V$

C. $1.05V$

D. $+1.05V$

Answer: B

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14. In a cell reaction, $Cu_{(s)} + 2Ag^{+}_{(aq)} \rightarrow Cu^{2+}_{(aq)} + 2Ag_{(s)}$ E°_{cell}=+0.46 V . If the concentration of Cu^{2+} ions is doubled then E°_{cell} will be

A. doubled

B. halved

C. increased by four times

D. unchanged.

Answer: D

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15. A standard hydrogen electrode has zero electrode potential because :

A. hydrogen can be most easily oxidised

B. hydrogen has only one electron

C. the electrode potential is assumed to be zero

D. hydrogen is the lightest element.

Answer: C

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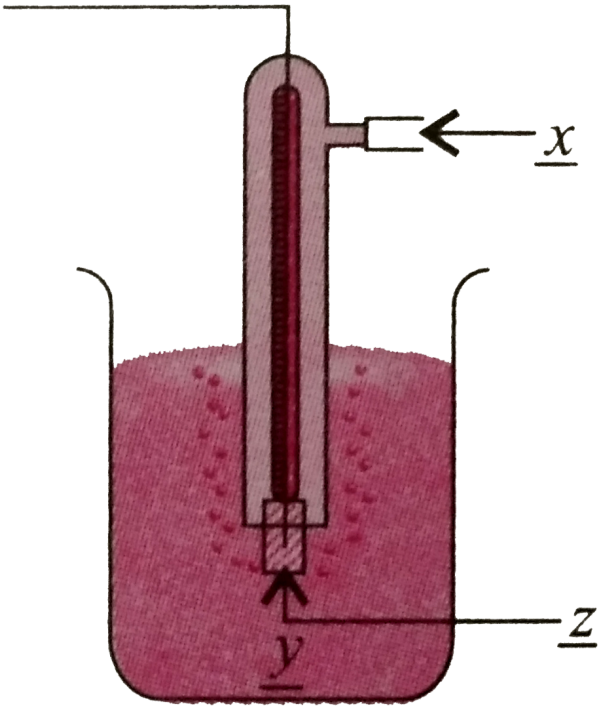
16. Observe the given diagram and fill in the blanks by choosing the correct option.



A. x $H_{2(g)}$ at 1 atm; y $10^{-2} MH^+$; z Finely divided Pt

B. x $H_{2(g)}$ at 1 bar; y $1.00 MH^+$; z Finely divided Pt

C. x $1.00 MH^+$; y $H_{2(g)}$ at 1 bar; z Finely divided Ni

D. x $H_{2(g)}$ at 1 bar; y $1.00 MH^+$; z Pt granules

Answer: B

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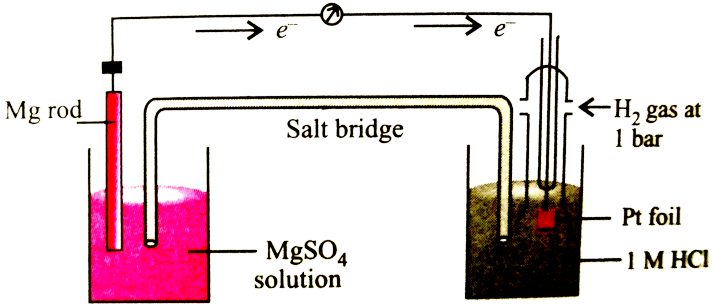
17. A cell is set up as shown in the figure. It is observed that EMF of the cell comes out to be 2.36 V. Which of the given statements is not correct about the cell?



A. Reduction takes place at magnesium electrode and oxidation at SHE.

B. Oxidation takes place at magnesium electrode and reduction at SHE.

C. Standard electrode potential for Mg^{2+}/Mg will be-2.36 V.

D. Electrons flow from magnesium electrode to hydrogen electrode.

Answer: A

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18. Which of the following is thecorrect order in which metals displace each other from the salt solution of their salts?

A. Zn,Al,Mg,Fe,Cu

B. Cu,Fe,Mg,Al,Zn

C. Mg,Al,Zn,Fe,Cu

D. Al,Mg,Fe,Cu,Zn

Answer: C

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19. Given below are the standard electrode potentials of few half-cells. The correct order of these metals in increasing reducing power will be K^+/K=-2.93 V , Ag^+ /Ag=0.80 V, Mg^{2+}/Mg=-2.37 V, Cr^{3+}/Cr =-0.74 V

A. K lt Mg lt Cr lt Ag

B. Ag lt Cr lt Mg lt K

C. Mg lt K lt Cr lt Ag

D. Cr lt Ag lt Mg lt K

Answer: B

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20. Based on the data given below, the correcy order of reducing power is:

$Fe^{3+}_{(aq.)} + e \rightarrow Fe^{2+}_{(aq.)}, E^{\circ} = +0.77V$

$Al^{3+}_{(aq.)} + 3e \rightarrow Al_{(s)}, E^{\circ} = -1.66V$

$Br_{2(aq.)} + 2e \rightarrow 2Br^{-}_{(aq.)}, E^{\circ} = +1.08V$

A. $Br^{-} < Fe^{2+} < Al$

B. $Fe^{2+} < Al < Br^{-}$

C. $Al < Br^{-} < Fe^{2+}$

D. $Al < Fe^{2+} < Br^{-}$

Answer: A

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21. Zn gives H_2 gas with H_2SO_4 and HCl but not with HNO_3 because

A. Zn Acts as oxidising agent when reacts with HNO_3

B. HNO_3 is weaker acid than H_2SO_4 and HCl

C. Zn is above the hydrogen in electrochemical series .

D. NO_3^- is reduced in preference to H^+ ion.

Answer: D

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22. Fluorine is the best oxidising agent because it has

A. highest electron afffinity

B. highest reduction potential

C. highest oxidation potential

D. lowest electron affinity.

Answer: B

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23. Which of the following is not an application of electrochemical series?

A. To compare the relative oxidising and reducing power of substances.

B. To predict evolution of hydrogen gas on reaction of metal with acid.

C. To predict spontaneity of a redox reaction.

D. To calculate the amount of metal deposited on cathode.

Answer: D

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24. E° values of three metals are listed below.

$$Zn^{2+}_{(aq)} + 2e^- \rightarrow Zn_{(s)} \qquad E^\circ = -0.76V$$

$$Fe^{2+}_{(aq)} + 2e^- \rightarrow 2Fe(s) \qquad E^\circ = -0.44V$$

$$Sn^{2+}_{(aq)} + 2e^- \rightarrow Sn_{(s)} \qquad E^\circ = -0.14V$$

Which of the following statements are correct on the basis of the above information ?

(i)Zinc will be corroded in preference to iron if zinc coating is broken on the surface.

(ii)If iron is coated with tin and the coating is broken on the surface then iron will be corroded .

(iii)Zinc is more reactive than iron but tin is less reactive then iron.

A. (i) and (ii) only

B. (ii)and (iii) only

C. (i),(ii) and (iii)

D. (i) and (iii) only

Answer: C

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25. For a cell reaction : $M^{n+}(aq) + ne^- \rightarrow M(s)$, the Nernst equation for electrode potential at any concertation measured with respect to standard hydrogen electrode is represented as

A. $E_{(M^{n+}/M)} = E^{\circ}_{(M^{n+}/M)} - \frac{RT}{nF}\ln\left(\frac{1}{[M^{n+}]}\right)$

B. $E_{(M/M^{n+})} = E^{\circ}_{(M/M^{n+})} - \frac{RT}{nF}\ln\left(\frac{[M^{n+}]}{[M]}\right)$

C. $E_{(M^{n+}/M)} = E^{\circ}_{(M^{n+}/M)} - \frac{RT}{nF}\log\frac{1}{[M]}$

D. $E_{(M^{n+}/M)} = E^{\circ}_{(M^{n+}/M^{n+})} - \frac{RT}{nF}\ln[M^{n+}]$

Answer: A

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26. At $25^{\circ}C$, Nernst equation is

A. $E_{cell} = E^{\circ}_{cell} - \frac{0.0591}{n}\log\frac{[ion]_{RHS}}{[ion]_{LHS}}$

B. $E_{\text{cell}} = E^{\circ}_{\text{cell}} - \frac{0.0591}{n}\log\frac{[\text{M}]_{\text{RHS}}}{[\text{M}]_{\text{LHS}}}$

C. $E_{\text{cell}} = E^{\circ}_{\text{cell}} + \frac{0.0591}{n}\log\frac{[\text{ion}]_{\text{RHS}}}{[\text{ion}]_{\text{LHS}}}$

D. $E_{\text{cell}} = E^{\circ}_{\text{cell}} - \frac{0.0591}{n}\log\frac{[\text{ion}]_{\text{LHS}}}{[\text{ion}]_{\text{RHS}}}$

Answer: A

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27. Mark the correct Nernst equation for the given cell. $F_{(s)}\left|Fe^{2+}(0.001M)\right|\left|H^{+}(1M)\right|H_{2(g)}(1^{-})\mid Pt_{(s)}$ is

A. $E_{\text{cell}} = E^{\circ}_{\text{cell}} - \frac{0.591}{2}\log\frac{[Fe^{2+}][H^{+}]^{2}}{[Fe][H_2]}$

B. $E_{\text{cell}} = E^{\circ}_{\text{cell}} - \frac{0.591}{2}\log\frac{[Fe][H^{+}]^{2}}{[Fe^{2+}][H_2]}$

C. $E_{\text{cell}} = E^{\circ}_{\text{cell}} - \frac{0.0591}{2}\log\frac{[Fe^{2+}][H_2]}{[Fe][H^{+}]^{2}}$

D. $E_{\text{cell}} = E^{\circ}_{\text{cell}} - \frac{0.0591}{2}\log\frac{[Fe][H_2]}{[Fe^{2+}][H^{+}]^{2}}$

Answer: C

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28. The correct Nernst equation for the given cell $Pt_{(s)}\left|Br_{2(l)}\right|Br^{-}(M)||H^{+}(M)|H_{2(g)}(1^{-})|Pt_{(s)}$ is

A. $E_{\text{cell}}=E^{\circ}_{\text{cell}}-\frac{0.0591}{2}\log\frac{[Br_{2(l)}][H_2]}{[H^+]^2[Br^-]^2}$

B. $E_{\text{cell}}=E^{\circ}_{\text{cell}}-\frac{0.0591}{2}\log\frac{[H^+]^2[Br^-]^2}{[Br_{2(l)}][H_2]}$

C. $E_{\text{cell}}=E^{\circ}_{\text{cell}}-\frac{0.0591}{2}\log\frac{[H^+]^2[H_2]}{[Br_{2(l)}][Br^-]^2}$

D. $E_{\text{cell}}=E^{\circ}_{\text{cell}}-\frac{0.0591}{2}\log\frac{[Br_{2(l)}][Br^-]^2}{[H^+]^2[H_2]}$

Answer: A

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29. Given below are few reactions with some expressions. Mark the expressions which is not correctly matched.

A. For concentration cell, $Ag|Ag^{+}(C_1)||Ag^{+}(C_2)|Ag$, $E_{\text{cell}}=-\frac{0.0591}{1}\log\frac{C_1}{C_2}$

B. For the cell ,

$$2Ag^+ + H_2(1\,\text{atm}) \rightarrow 2Ag + 2H^+(1M),\ E_{\text{cell}} = E^\circ_{\text{cell}} - \frac{0.0591}{2}\log$$

C. For an electrochemical reaction, at equilibrium

$$aA + bB \overset{\text{ne}^-}{\Longleftrightarrow} cC + dD,\ E^\circ_{\text{cell}} = \frac{0.0591}{n}\log\frac{[C]^c[D]^d}{[A]^a[B]^b}$$

D. For the cell ,

$$M^{n+}_{(aq)} + \text{ne}^- \rightarrow M_{(s)},\ E = E^\circ - \frac{0.0591}{n}\log\frac{1}{[M^{n+}]}$$

Answer: B

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30. Calculate the emf of the following concentration cell at $25^\circ C$:

$Ag(s)|AgNO_3(0.01M)||AgNO_3(0.05M)|Ag(s)$

A. 0.828V

B. 0.0413V

C. -0.0413 V

D. -0.828 V

Answer: B

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31. The standard reduction potential for Cu^{2+}/Cu is $+0.34V$. Calculate the reduction potential at pH=14 for the above couple. K_{SP} of $Cu(OH)_2$ is 1.0×10^{-19}

A. 2.2 V

B. 3.4 V

C. -0.22 V

D. -2.2 V

Answer: C

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32. Calculate the reduction potential for the following half cell reaction at 298 K.

$Ag^+(aq) + e^- \rightarrow Ag(s)$

Given that $\left[Ag^+\right] = 0.1M$ and $E^\circ = +0.80V$

A. 0.741 V

B. 0.80 V

C. -0.80V

D. -0.741V

Answer: A

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33. Mark the incorrect relationship from the following:

A. Equilibrium constant is related to emf as $\log K = \frac{\mathrm{nFE}}{2.303\mathrm{RT}}$

B. EMF of a cell $Zn\left|Zn^{2+}_{(a_1)}\right||Cu^{2+}_{(a_2)}\left|Cu\right.$ is

$$E = E^{\circ} - \frac{0.591}{n}\log\ \frac{[a_2]}{[a_1]}$$

C. Nernst equations is $E_{\text{cell}} = E^{\circ}_{\text{cell}} - \frac{0.0591}{n}\log\frac{[\text{Products}]}{[\text{Reactants}]}$

D. For the electrode M^{n+}/M at 273 K $E = E^{\circ} + \frac{0.591}{n}\log\left[M^{n+}\right]$

Answer: C

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34. The standard emf for the cell reaction,

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

is $0.36V$ at $298K$. The equilibrium constant of the reaction is

A. 1.2×10^{6}

B. 7.4×10^{12}

C. 2.4×10^{6}

D. 5.5×10^{8}

Answer: A

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35. E_{cell}° for the reaction , $2H_2O \rightarrow H_3O^+ + OH^-$ at $25^{\circ}C$ is -0.8277 V.

The equilibrium constant for the reaction is

A. 10^{-14}

B. 10^{-23}

C. 10^{-7}

D. 10^{-21}

Answer: A

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36. Cell reactiomn is spontaneous when

A. E°_{red} is negative

B. ΔG° is negative

C. E°_{oxide} is positive

D. ΔG° is positive

Answer: B

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37. $\Delta_r G^{\circ}$ for the cell with the cell reaction :

$$Zn_{(s)} + Ag_2O_{(s)} + H_2O_{(l)} \rightarrow Zn^{2+}_{(aq)} + 2Ag_{(s)} + 2OH^{-}_{(aq)}$$

$$\left[E^{\circ}_{Ag_2O/Ag} = 0.344V, E^{\circ}_{Zn^{2+}/Zn} = -0.76V\right]$$

A. $2.13 \times 10^5 \text{J mol}^{-1}$

B. $-2.13 \times 10^5 \text{J mol}^{-1}$

C. $1.06 \times 10^5 \text{J mol}^{-1}$

D. $-1.06 \times 10^5 \text{J mol}^{-1}$

Answer: B

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38. E° value of Ni^{2+}/Ni is -0.25 V and Ag^+/Ag is +0.80 V . If a cell is made by taking the two electrodes what is the feasibility of the reaction?

A. Since E° value for the cell will be positive, redox reaction is feasible.

B. Since E° value for the cell will be negative, redox reaction is not feasible.

C. Ni cannot reduce Ag^+ to Ag hence reaction is not feasible.

D. Ag can reduce Ni^{2+} to Ni hence reaction is feasible.

Answer: A,B

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39. The Gibbs energy for the decomposition of Al_2O_3 at $500^\circ C$ is as follows:

$$\frac{2}{3}Al_2O_3 \rightarrow \frac{4}{3}Al + O_2, \Delta_r G = +966 kJ mol^{-1}$$

The potential difference needed for electrolytic reeduction of Al_2O_3 at $500^\circ C$ is at least:

A. 5.0 V

B. 4.5 V

C. 3.0 V

D. 2.5 V

Answer: D

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40. E° values for the half cell reactions are given below :

$Cu^{2+} + e^- \rightarrow Cu^+, E^\circ$=0.15 V

$Cu^{2+} + 2e^- \rightarrow Cu, E^\circ$=0.34 V

What will be the E° of the half-cell : $Cu^+ + e^- \rightarrow Cu$?

A. $+0.49V$

B. $+0.19V$

C. $+0.53V$

D. $+0.30V$

Answer: C

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41. Calculate ΔG° for the reaction : $Cu^{2+}(aq) + Fe(s) \Leftrightarrow Fe^{2+}(aq) + Cu(s)$. Given that $E^{\circ} Cu^{2+}/Cu = 0.34V$,

$E^{\circ}_{Fe^{+2}/Fe} = -0.44V$

A. 11.44 kJ

B. 180.8 kJ

C. 150.5 kJ

D. 28.5 kJ

Answer: C

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42. The specific conductivity of N/10 KCl solution at $20^{\circ}C$ is $0.0212 ohm^{-1} cm^{-1}$ and the resistance of the cell containing this solution at $20^{\circ}C$ is 55 ohm. The cell constant is :

A. (a) $3.324\ \text{cm}^{-1}$

B. (b) $1.166\ \text{cm}^{-1}$

C. (c) $2.372\ \text{cm}^{-1}$

D. (d) $3.682\ \text{cm}^{-1}$

Answer: B

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43. Electrical conductance through metals is called metallic or electronic conuctance and is due to the movement of electrons. The electronic conductance depends on

A. (a) the nature and structure of the metal

B. (b) the number of valence electrons per atom

C. (c) change in temperture

D. (d) all of these.

Answer: D

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44. Fill in the blanks with appropriate words.

The electrolytic solution is always neutral because the total charge on __(i)___ is equal to __(ii)__ on ___(iii)___ .Unlike the metallic conductor, the electrolyte conducts the electric current by virtue of movement of its ___(iv)___ . The property due to which a metal tends to go into solution in

term of positive ions is known as ___(v)__.

(i),(ii),(iii),(iv) and (v) respectively are

A. cations, partial charge , anions, electrons , reduction

B. cations , total charge , anions , ions , oxidation

C. cations , ionic charge , anions , atoms , dissolution

D. cations , partial charge , anions , molecules, electrolysis .

Answer: B

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45. What would be the equivalent conductivity of a cell in which 0.5 salt solution offers a resistance of 40 ohm whose electrodes are 2 cm apart and 5 cm^2 in area?

A. $10\text{ohm}^{-1}\text{cm}^2\text{eq}^{-1}$

B. $20\text{ohm}^{-1}\text{cm}^2\text{eq}^{-1}$

C. $30\text{ohm}^{-1}\text{cm}^2\text{eq}^{-1}$

D. $25 \text{ohm}^{-1}\text{cm}^2\text{eq}^{-1}$

Answer: B

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46. Units of the properties measured are given below. Which of the properties has not been matched correctly?

A. molar conductance $= Sm^2mol^{-1}$

B. Cell constant $=m^{-1}$

C. Specific conductance = S m^2

D. Equivalent conductance =S $m^2(geq)^{-1}$

Answer: C

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47. Molar conductivity of 0.15 M solution of KCI at 298 K, if its conductivity is 0.0152 S cm^{-1} will be

A. $124\Omega^{-1}\text{cm}^2\text{mol}^{-1}$

B. $204\Omega^{-1}\text{cm}^2\text{mol}^{-1}$

C. $101\Omega^{-1}\text{cm}^2\text{mol}^{-1}$

D. $300\Omega^{-1}\text{cm}^2\text{mol}^{-1}$

Answer: C

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48. The molar conductivity is maximum for the solution of concentration _____.

A. 0.004 M

B. 0.002 M

C. 0.005 M

D. 0.001 M

Answer: D

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49. The specific conductance of a saturated solution of AgCl at $25^{\circ}C$ is 1.821×10^{-5} mho cm^{-1}. What is the solubility of AgCl in water (in g L^{-1}) , if limiting molar conductivity of AgCl is 130.26 mho $cm^2 mol^{-1}$?

A. $1.89 \times 10^{-3} gL^{-1}$

B. $2.78 \times 10^{-2} gL^{-1}$

C. $2.004 \times 10^{-2} gL^{-1}$

D. $1.43 \times 10^{-3} gL^{-1}$

Answer: C

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50. Specific conductance of 0.1 M NaCl solution is $1.01 \times 10^{-2} ohm^{-1} cm^{-1}$. Its molar conductance in $ohm^{-1} cm^2 mol^{-1}$ is

A. 1.01×10^2

B. 1.01×10^3

C. 1.01×10^4

D. 1.01

Answer: A

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51. The variation in Λ_m with concentration for a strong electrolyte can be represented by the equation, $\Lambda_m = \Lambda_m^\circ - AC^{1/2}$ The value of constant A for a given solvent and temperature depends upon the type of electrolyte i.e., cations and anions produced on dissociation of electrolyte in the solution .

NaCl, $MgCl_2$ and $CaSO_4$ are known as

A. 1-1,2-1, and 2-2 type electrolytes respectively

B. strong, weak and strong electrolytes respectively

C. electrolytes with different value of A

D. electrolytes with same molar conductivity .

Answer: A

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52. The variation in Λ_m with concentration for a strong electrolyte can be represented by the equation, $\Lambda_m = \Lambda_m^\circ - AC^{1/2}$ The value of constant A for a given solvent and temperature depends upon the type of electrolyte i.e., cations and anions produced on dissociation of electrolyte in the solution .

Which of the following statements is correct regarding variations of molar conductivity with concentration.

A. Molar conductivity decrease with decrease in concentration

B. Variation in molar conductivity of weak and strong electrolytes is same.

C. Molar conductivity increases with decrease in concentration.

D. When concentration of the solution approaches zero, the molar conductivity is known as conductance.

Answer: C

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53. Two solutions of X and Y electrolytes are taken in two beakers and diluted by adding 500mL of water. Λ_m of X increases by 1.5 times while that of Y increases by 20 times, what could be the eletrolytes X and Y?

A. X $\rightarrow$ NaCl , Y $\rightarrow$ KCl

B. X $\rightarrow$ NaCl , Y $\rightarrow CH_3COOH$

C. X $\rightarrow$ KOH, Y $\rightarrow$ NaOH

D. X $\rightarrow CH_3COOH$, Y $\rightarrow$ NaCl

Answer: B

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54. When water is added to an aqueous solution of an electrolyte, what is the change in specific conductivity of the electrolyte?

A. Conductivity decreases

B. Conductivity increases

C. Conductivity remains same

D. Conductivity does not depend on number of ions.

Answer: A

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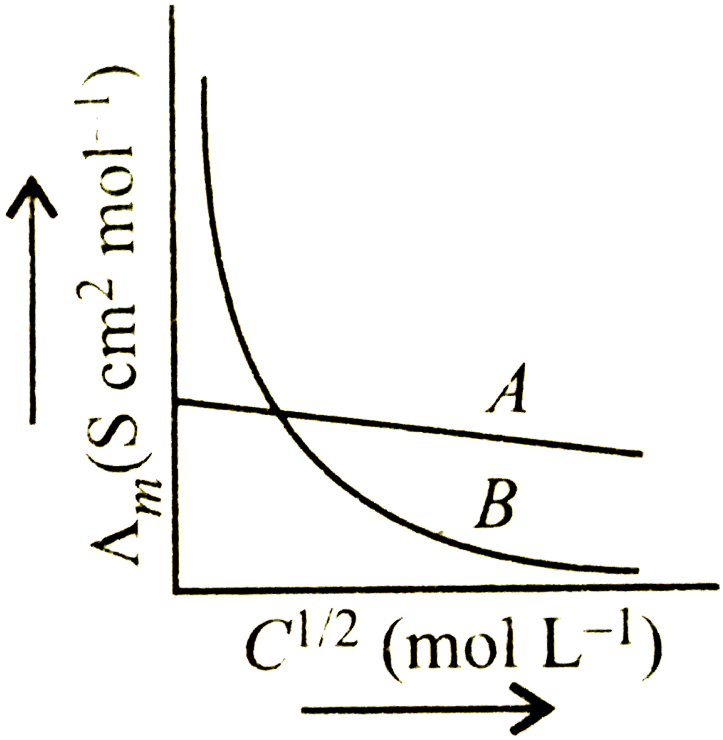
55. Mark the correct choice of electrolytes represented in the graph.



A. A $\rightarrow NH_4OH, B \rightarrow NaCl$

B. $A \rightarrow NH_4OH, B \rightarrow NH_4Cl$

C. $A \rightarrow CH_3COOH, B \rightarrow CH_3COONa$

D. $A \rightarrow KCl, B \rightarrow NH_4OH$

Answer: D

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56. Molar conductivity of NH_4OH can be calculated by the equation.

A. $\Lambda^{\circ}_{NH_4OH} = \Lambda^{\circ}_{Ba(OH)_2} + \Lambda^{\circ}_{NH_4Cl} - \Lambda^{\circ}_{BaCl_2}$

B. $\Lambda^{\circ}_{NH_4OH} = \Lambda^{\circ}_{BaCl_2} + \Lambda^{\circ}_{NH_4Cl} - \Lambda^{\circ}_{Ba(OH)_2}$

C. $\Lambda^{\circ}_{NH_4OH} = \dfrac{\Lambda^{\circ}_{Ba(OH)_2} + 2\Lambda^{\circ}_{NH_4Cl} - \Lambda^{\circ}_{BaCl_2}}{2}$

D. $\Lambda^{\circ}_{NH^4OH} = \dfrac{\Lambda^{\circ}_{NH_4Cl} + \Lambda^{\circ}_{Ba(OH)_2}}{2}$

Answer: C

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57. Limiting molar conductivity of NaBr is

A. $\Lambda^{\circ}_m NaBr = \Lambda^{\circ}_m NaCl + \Lambda^{\circ}_m KBr$

B. $\Lambda^{\circ}_m NaBr = \Lambda^{\circ}_m NaCl + \Lambda^{\circ}_m KBr - \Lambda^{\circ}_m KCl$

C. $\Lambda^{\circ}_m NaBr = \Lambda^{\circ}_m NaOH + \Lambda^{\circ}_m NaBr - \Lambda^{\circ}_m NaCl$

D. $\Lambda_m^\circ NaBr = \Lambda_m^\circ NaCl - \Lambda_m^\circ NaBr$

Answer: B

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58. What will be the molar conductivity of Al 3+ ions at infinite dilution if molar conductivity of $Al^2(SO_4)_3$ is 858 S cm^2 mol^{-1} and ionic conductance of SO_4^{2-} is 160 S $cm^2\text{mol}^{-1}$ at infinite dilution ?

A. 189 S $\text{cm}^2\text{mol}^{-1}$

B. 698 S $\text{cm}^2\text{mol}^{-1}$

C. 1018 S $\text{cm}^2\text{mol}^{-1}$

D. 429 S $\text{cm}^2\text{mol}^{-1}$

Answer: A

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59. Limiting molar conductivity for some ions is given below (in S cm^2mol^{-1}) :

$Na^+ - 50.1, Cl^- - 76.3, H^+ - 349.6, CH_3COO^- - 40.9, Ca^{2+} - 119.0$

What will be the limiting molar conductivities (Λ_m°) of $CaCl_2, CH_3COONa$ and NaCl respectively ?

A. 97.65 , 111.0 and 242.8 S cm^2mol^{-1}

B. 195.3, 182.0 and 26.2 S cm^2mol^{-1}

C. 271.6, 91.0 and 126.4 S cm^2mol^{-1}

D. 119.0, 1024.5 and 9.2 S cm^2mol^{-1}

Answer: C

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60. The equivalent conductivity of N/10 solution of acitic acid at $25^\circ C$ is $14.3ohm^{-1}cm^2eq^{-1}$. Calculate the degree of dissociation of CH_3COOH if $\Lambda_{\infty CH_3COOH}$ is 390.71.

A. $3.66\ \%$

B. $3.9\ \%$

C. $2.12\ \%$

D. $0.008\ \%$

Answer: A

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61. The molar conducatance of Ba^{2+} and Cl^{-} are 127 and $76 ohm^{-1} cm^{-1} mol^{-1}$ respectively at infinite dilution. The equivalent conductance of $BaCl_2$ at infinte dilution will be

A. $139.5 \text{ohm}^{-1} \text{cm}^2 \text{eq}^{-1}$

B. $203 \text{ohm}^{-1} \text{cm}^2 \text{eq}^{-1}$

C. $279 \text{ohm}^{-1} \text{cm}^2 \text{eq}^{-1}$

D. $101.5 \text{ohm}^{-1} \text{cm}^2 \text{eq}^{-1}$

Answer: A

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62. The molar conductivity of $0.025 mol L^{-1}$ methanoic acid is $46.1 Scm^2 mol^{-1}$. Its degree of dissociation (α) and dissociation constant. Given $\lambda^\circ\left(H^+\right) = 349.6 Scm^{-1}$ and $\lambda^\circ\left(HCOO^-\right) = 54.6 Scm^2 mol^{-1}$.

A. 11.4%, $3.67 \times 10^{-4} \text{mol L}^{-1}$

B. 22.8%, $1.83 \times 10^{-4} \text{mol L}^{-1}$

C. 52.2%, $4.25 \times 10^{-4} \text{mol L}^{-1}$

D. 1.14%, $3.67 \times 10^{-6} \text{mol L}^{-1}$

Answer: A

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63. A weak monobasic acid is 5% dissociated in 0.01 mol dm^{-3} solution. The limiting molar conductivity at infinite dilution is $4.00 \times 10^{-2} ohm^{-1} m^2 mol^{-1}$. Calculate the conductivity of a 0.05 mol dm^{-3} solution of the acid.

A. $8.94 \times 10^{-6} \text{ohm}^{-1} cm^2 mol^{-1}$

B. $8.92 \times 10^{-4} \text{ohm}^{-1} cm^2 mol^{-1}$

C. $4.46 \times 10^{-6} \text{ohm}^{-1} cm^2 mol^{-1}$

D. $2.23 \times 10^{-5} \text{ohm}^{-1} cm^2 mol^{-1}$

Answer: B

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64. In the electrolytic cell, flow of electrons is from:

A. from cathode to anode in the solution

B. from cathode to anode through external supply

C. from cathode to anode through internal supply

D. from anode to cathode through internal supply

Answer: C

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65. Match the column I with column II and mark the appropriate choice.

	Column I		Column II
(A)	Electrochemical equivalent	(i)	Potential difference × Quantity of charge
(B)	Faraday	(ii)	Mass of substance deposited by one coulomb of charge
(C)	Ampere	(iii)	Charge carried by one mole of electrons
(D)	Electrical energy	(iv)	One coulomb of electric charge passed through one second

A. A-(i),B-(ii),C-(iii),D-(iv)

B. A-(ii),B-(iii),C-(iv),D-(i)

C. A-(iii),B-(iv),C-(i),D-(ii)

D. A-(iv),B-(i),C-(ii),D-(iii)

Answer: B

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66. How long does it take to deposit 100 g of Al from an electrolytic cell containing Al_2O_3 using a current of 125 ampere ?

A. 1.54 h

B. 1.42 h

C. 1.32 h

D. 2.15 h

Answer: B

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67. The charge required for reducing 1 mole of MnO_4^- to Mn^{2+} is

A. 1.93×10^5 C

B. 2.895×10^5 C

C. 4.28×10^5 C

D. 4.825×10^5 C

Answer: D

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68. How much electricity in terms of Faraday is required to produce 100 g of Ca from molten $CaCl_2$?

A. 1 F

B. 2 F

C. 3 F

D. 5 F

Answer: D

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69. If a current of 1.5 ampere flows through a metallic wire for 3 hours, then how many electrons would flow through the wire?

A. 2.25×10^{22} electrons

B. 1.13×10^{23} electrons

C. 1.01×10^{23} electrons

D. 4.5×10^{23} electrons

Answer: C

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70. How many coulombs of electricity is required to reduce 1 mole of $Cr_2O_7^{2-}$ in acidic medium?

A. 4 x 96500 C

B. 6 x 96500 C

C. 2 x 96500 C

D. 1 x 96500 C

Answer: B

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71. An electric charge of 5 Faradays is passed through three electrolytes $AgNO_3$, $CuSO_4$ and $FeCl_3$ solution. The grams of each metal liberted at cathode will be

A. Ag = 10.8 g, Cu = 12.7g, Fe = 1.11g

B. Ag = 540 g, Cu = 367.5 g, Fe = 325 g

C. Ag=108 g , Cu=63.5 g , Fe=56 g

D. Ag=540 g , Cu=158.8 g , Fe = 93.3 g

Answer: D

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72. A current of 1.40 ampere is passed through 500 mL of 0.180 M solution of zinc sulphate for 200 seconds. What will be the molarity of Zn^{2+} ions after deposition of zinc?

A. 0.154 M

B. 0.177 M

C. 2 M

D. 0.180 M

Answer: B

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73. How much time is required to deposit 1×10^{-3} cm thick layer of silver (density is 1.05 g cm^{-3}) on a surface of area 100 cm^2 by passing a current of 5 A through $AgNO_3$ solution?

A. 125 s

B. 115 s

C. 18.7 s

D. 27.25 s

Answer: C

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74. How much metal will be deposited when a current of 12 ampere with 75% efficiency is passed through the cell for 3 h? (Given: Z= 4×10^{-4})

A. 32.4 g

B. 38.8 g

C. 36.0 g

D. 22.4 g

Answer: B

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75. Same amount of electric current is passed through the solutions of $AgNO_3$ and HCI. If 1.08 g of silver is obtained from $AgNO_3$ solution. The amount of hydrogen liberted at STP will be

A. 1.008 g

B. 11.2 g

C. 0.01 g

D. 1.1 g

Answer: C

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76. When during electrolusis of a solution of $AgNO_3$, 9650 coulmbs of charge pass through the electroplationg bath, the mass of silver deposited on the cathode will be:

A. 108 g

B. 10.8 g

C. 1.08 g

D. 216 g

Answer: B

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77. The amount of chlorine evolved by passing 2 A of current in an aqueous solution of NaCI for 30 minutes is

A. 2.64 g

B. 1.32 g

C. 3.62 g

D. 4.22 g

Answer: B

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78. How many moles of Pt may be deposited on the cathode when 0.80F of electricity is passed through 1.0M solution of Pt^{4+}?

A. 0.1 mol

B. 0.2 mol

C. 0.4 mol

D. 0.6 mol

Answer: B

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79. An electric current is passed through silver nitrate solution using silver electrodes. 15.28 g of silver was found to be deposited on catode. What will be the weight of copper deposited on cathode if same amount of electricity is passed through copper sulphate solution using copper electrodes?

A. 4.49 g

B. 6.4 g

C. 12.8 g

D. 3.2 g

Answer: A

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80. If 54 g of silver is deposited during an electrolysis reaction, how much aluminium will be deposited by the same amount of electric current?

A. (a) 2.7 g

B. (b) 4.5 g

C. (c) 27 g

D. (d) 5.4 g

Answer: B

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81. An acidic solution of Cu^{2+} ions containing 0.4 g of Cu^{2+} ions is electrolysed until all the copper is deposited. Calculate the volume of oxygen evolved at N.T.P.

A. 141 cc

B. 31.75 cc

C. 64 cc

D. 32 cc

Answer: A

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82. Choose the option with correct words to fill in the blanks.

According to preferential discharge theory, out of number of ions the one which requires ___ energy will be liberted ___ at a given electrode.

A. least, first

B. least, last

C. highest, first

D. highest, last

Answer: A

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83. Which of the following statement is true?

A. When an aqueous solution of NaCI is electrolysed, sodium metal is deposited at cathode.

B. There is no difference between specific conductivity and molar conductivity.

C. Silver nitrate solution can be stored in a copper container.

D. The addition of liquid bromine acid, the following process is possible at anode.

Answer: D

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84. During the electrolysis of dilute sulphuric acid, the following process is possible at anode.

A. $2H_2O_{(l)} \rightarrow O_{2(g)} + 4H^+_{(aq)} + 4e^-$

B. $2SO^{2-}_{4(aq)} \rightarrow S_2O_{8(aq)} + 2e^-$

C. $H_2O_{(l)} \rightarrow H^+_{(aq)} + OH^-_{(aq)}$

D. $H_2O_{(l)} + e^- \rightarrow \frac{1}{2}H_{2(g)} + OH^-_{(aq)}$

Answer: A

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85. In electrolysis of dilute H_2SO_4 what is liberated at anode?

A. H_2

B. SO_4^{2-}

C. SO_2

D. O_2

Answer: D

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86. When an aqueous solution of $AgNO_3$ is electroysed between platinum electrodes, the substances liberted at anode and cathode are

A. silver is deposited at cathode and O_2 is liberated at anode

B. silver is deposited at cathode and H_2 is liberated at anode

C. hydrogen is liberted at cathode and O_2 is liberated at anode.

D. silver is deposited at cathode and Pt is dissolved in electrolyte.

Answer: A

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87. Electrolysis of an aqueous solution of $AgNO_3$ with silver electrodes produce __(i)___ at cathode while ___(ii)___ ions are dissolved from anode. When Pt electrodes are used ____(iii)___ is produced at anode ___(iv)___ at cathode.

A.

(i)	(ii)	(iii)	(iv)
H_2	NO_3^-	OH^-	H_2

B. (i) Ag (ii) H^+ (iii) O_2 (iv) H_2

C. (i) Ag (ii) H^+ (iii) O_2 (iv) Ag

D. (i) Ag (ii) H^+ (iii) Ag^+ (iv) O_2

Answer: C

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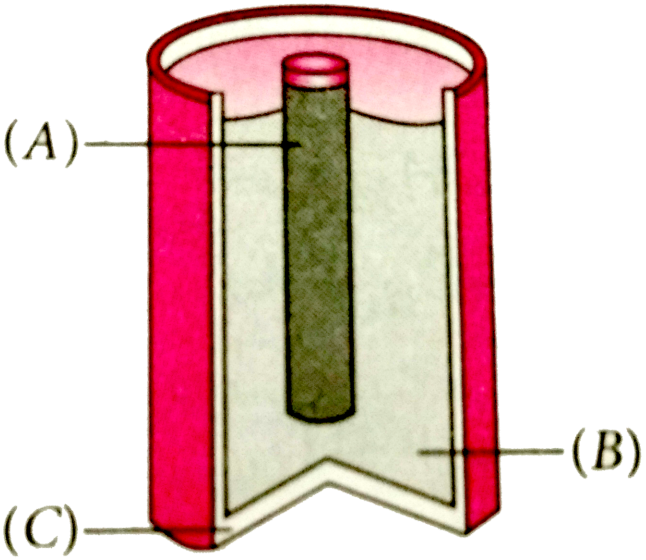
88. Label the parts represented by (A), (B) and C



A. A-Zinc rod , B-$NH_4Cl + MgCl_2$, C-Graphite rod

B. A-Carbon rod , B-NH_4OH + carbon , C-Zinc rod

C. A-Carbon rod , B-$MnO_2 + C + NH_4Cl$,C-Zinc can

D. A-Zinc rod , B-$MnO_2 + NH_4Cl$, C-Carbon rod

Answer: C

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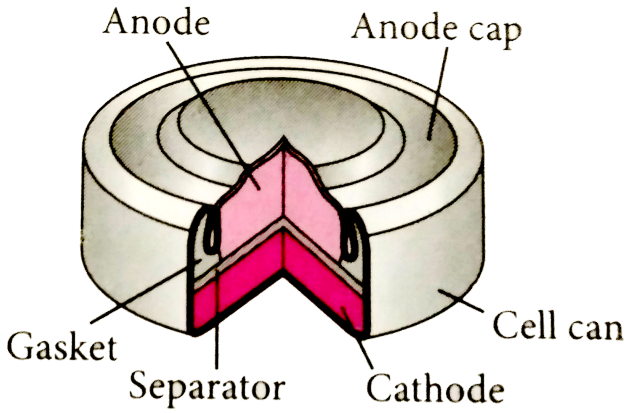
89. Which of the given statements for mercury cell are incorrect?



(i)Mercury cell is suitable for low current devices like hearing aids, watches, etc.

(ii)It consists of zinc-mercury amalgam as anode and a paste of HgO and carbon as the cathode.

(iii)The electrolyte is a paste of $Zn(OH)_2$ and KO_2.

(iv)The electrolyte reactions for the cell are At anode : $Zn(Hg) + H_2O \rightarrow ZnO_{(s)} + 2OH^- + 2e^-$

At cathode : $HgO + H_2O + 2e^- \rightarrow Hg_{(l)} + 2OH^-$

A. (ii) and (iii) only

B. (i) and (ii) only

C. (i),(iii) and (iv) only

D. (iii) and (iv) only

Answer: D

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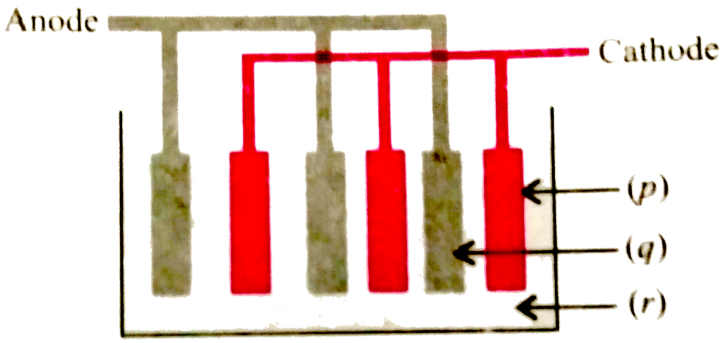
90. Label the given diagram showing lead storage battery :



A. $p - Pb, q - PbO_2, r - 5MH_2SO_4$

B. $p - PbO_2, q - Pb, r - conc.\ H_2SO_4$

C. $p - Pb_3O_4, q - PbO_2, 50\ \%\ H_2SO_4$

D. $p - PbO_2, q - Pb, r - dil.\ 38\ \%\ H_2SO_4$

Answer: D

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91. When a lead storage battery is discharged

A. lead sulphate is consumed

B. oxygen gas is evolved.

C. lead sulphate is formed

D. lead sulphide is formed.

Answer: C

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92. The reaction which is taking place in nickel cadmium battery can be represented by which of the following equations?

A. $Cd + NiO_2 + 2H_2O \rightarrow Cd(OH)_2 + Ni(OH)_2$

B. $Cd + NiO_2 + 2OH^- \rightarrow Ni + Cd(OH)_2$

C. $Ni + Cd(OH)_2 \rightarrow Cd \rightarrow Ni(OH)_2$

D. $Ni(OH)_2 + Cd(OH)_2 \rightarrow Ni + Cd + 2H_2O$

Answer: A

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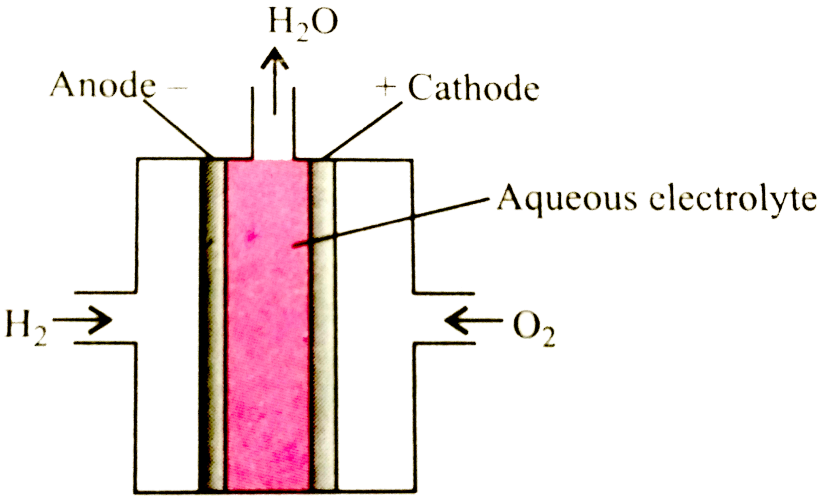
93. Study the given cell carefully and fill in the blanks by choosing an appropriate option.

In the given cell, hydrogen and oxygen are bubbled through porous ___(i)___ electrodes into concontrated aqueous ____(ii)___ solution. Catalysts like finely dividend __(iii)__ or ___(iv)___ metal are incorporated into the electrodes for increasing the rate of electrode reactions.



A. i-hydrogen , ii-potassium hydroxide , iii-palladium , iv - platinum

B. i-oxygen , ii-hydrogen chloride , iii-manganese , iv-iron

C. i-carbon , ii-sodium hydroxide , iii-platinum , iv-palladium

D. i-graphite , ii-sodium chloride , iii-nickel , iv - platinum

Answer: C

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94. The overall reactions of a hydrogen -oxygen fuel cell is

A. $2H_{2(g)} + O_{2(g)} \rightarrow 2H_2O_{(l)}$

B. $2H_{2(g)} + 4OH_{(aq)} \rightarrow 4H_2O_{(l)} + 4e^-$

C. $O_{2(g)} + 2H_2O_{(l)} + 4e^- \rightarrow 4OH^-_{(aq)}$

D. $4OH^-_{(aq)} + 4e^- \rightarrow 2H_2O_{(l)}$

Answer: A

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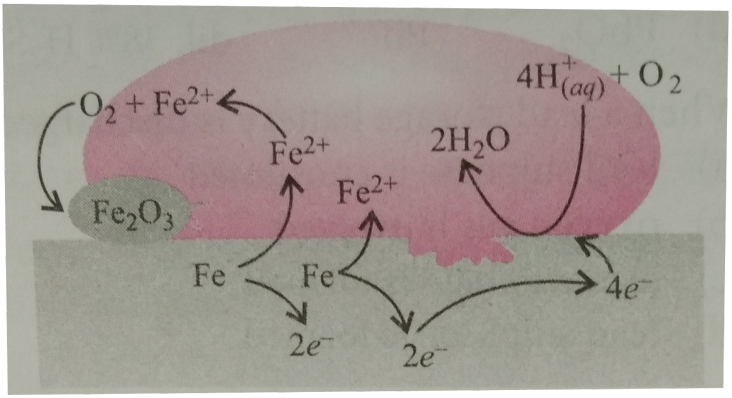
95. The given figure shows the corrosion of iron in atmosphere.



Fill in the blanks by choosing an appropriate option.

At a particular spot of an object made of iron, ___(i)___ of iron to ferrous ion takes place and that spot behaves as ___(ii)___. Electrons released at anodic spot move through the metal and go to another spot on the metal and reduce oxygen in presence of H^+ . This spot behaves as ___(iii)___. The ferrous ions are further oxidised by atmospheric oxygen to ferric ions which come out as rust, __(iv)____ and with further production of ____(v)__ ions.

A. i-oxidation , ii-anode , iii-cathode , iv-$Fe_2O_3.\ xH_2O$, v-hydrogen

B. i-reduction, ii-cathode, iii-anode , Fe_3O_4 , v-hydroxide

C. i-oxidation, ii-cathode, iii-anode , iv-$Fe_2O_3.\ xH_2O$, v-hydrogen

D. i-oxidation , ii-anode, iii-cathode , iv-$Fe_2O_3.\ H_2O$, v-ferrous

Answer: A

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96. Which of the following reactions does not take place during rusting?

A. $H_2CO_3 \Leftrightarrow 2H^+ + CO_3^{2-}$

B. $4Fe^{2+} + O_{2\,(dry)} \rightarrow Fe_2O_3$

C. $4Fe^{2+} + O_2 + 4H_2O \rightarrow 2Fe_2O_3 + 8H^+$

D. $Fe_2O_3 + xH_2O \rightarrow Fe_2O_3.\ xH_2O$

Answer: B

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97. Match the column I with column II and mark the appropriate choice.

	Column I		Column II
(A)	$Pb_{(s)} + SO^{2-}_{4(aq)} \rightarrow PbSO_{4(s)} + 2e^-$	(i)	Rusting of iron
(B)	$2SO^{2-}_{4(aq)} \rightarrow S_2O^{2-}_{8(aq)} + 2e^-$	(ii)	Reaction at anode in lead storage battery
(C)	$2H_{2(g)} + 4OH^-_{(aq)} \rightarrow 4H_2O_{(l)} + 4e^-$	(iii)	Electrolysis of concentrated H_2SO_4
(D)	$2Fe_{(s)} + O_{2(g)} + 4H^+_{(aq)} \rightarrow 2Fe^{2+}_{(aq)} + 2H_2O_{(l)}$	(iv)	Reaction at anode in fuel cell

A. A-(i),B-(ii),C-(iii),D-(iv)

B. A-(ii),B-(iii),C-(iv),D-(i)

C. A-(iii),B-(iv),C-(i),D-(ii)

D. A-(iv),B-(i),C-(ii),D-(iii)

Answer: B

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Hots

1. Which of the following reactions canot be a base for electrochemical cell?

A. $H_2 + O_2 \rightarrow H_2O$

B. $AgNO_3 + Zn \rightarrow Zn(NO_3)_2 + Ag$

C. $AgNO_3 + NaCl \rightarrow AgCl \downarrow + NaNO_3$

D.

$$KMnO_4 + FeSO_4 + H_2SO_4 \rightarrow K_2SO_4 + Fe_2(SO_4)_3 + MnSO_4 +$$

Answer: D

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2. In a galvanic cell, the salt bridge

(i) does not participate chemically in the cell reaction

(ii) stops the diffusion of ions from one electrolytes to another

(ii) is necessary for the occurrence of the cell reaction

(iv) ensures mixing of the two elecrolytic solutions

A. (i) and (iii) only

B. (i) and (ii) only

C. (iii) and (iv) only

D. all of these.

Answer: B

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3. The position of some metals in the electrochemical series in dectreasing electropositeve character is given as $Mg > Al > Zn > Cu > Ag$. What will happen if a copper spoon is used to stir a solution of aluminimum nitrate ?

A. The spoon will get coated will aluminium.

B. An alloy of copper and aluminium is formed.

C. The solution becomes blue.

D. There is no reaction.

Answer: D

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4. A gas X at 1 atm is bubbled through a solution containing a mixture of 1M Y^- and 1M Z^- at $25^\circ C$. If the reduction potential of $Z > Y > X$, then

A. Y will oxidise X and not Z

B. Y will oxidise Z and not X

C. Y will oxidise both X and Z.

D. Y will reduce both X and Z.

Answer: A

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5. For the cell prepared from electrodes A and B,

Electrode A :$Cr_2O_7^{2-}/Cr^{3+}, E^{\circ}_{red} = 1.33V$ and Electrode B: $Fe^{3+}/Fe^{2+}, E^{\circ}_{red} = 0.77V$

Which of the following statements is correct?

A. The electrons will flow from B to A when connections are made.

B. The standard EMF of the cell will be 0.56 V.

C. A will be a positive electrode.

D. All of these.

Answer: D

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6. The formal potential of Fe^{3+}/Fe^{2+} in a sulphuric acid and phosphoric acid mixture $(E^{\circ} = +0.61V)$ is much lower than the standard potential (E° =+0.77 V). This is due to

(i) formation of the species $[FeHPO_4]^+$

(ii) lowering of potential upon complexation

(iii) formation of the species $[FeSO_4]^+$

(iv) high acidity of the medium.

A. (i) and (ii) only

B. (i), (ii) and (iv) only

C. (iii) only

D. all of these.

Answer: A

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7. Calculate the euilibrium constant for the reaction,

$2Fe^{3+} + 3I^- \Leftrightarrow 2Fe^{2+} + I_3^-$.

The standard reduction potential in acidic conditions are $0.77V$ and $0.54V$ respectivelu for Fe^{3+}/Fe^{2+} and I_3^-/I^- couples.

A. 4.25×10^7

B. 7.05×10^5

C. 6.25×10^5

D. 6.25×10^7

Answer: D

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8. The emf of a cell corresponding to the reaction

$Zn + 2H^+(aq) \rightarrow Zn^{2+}(0.1M) + H_2(g)1$ atm is 0.28 volt at $25^\circ C$.

Calculate the pH of the solution at the hydrogen electrode.

$E^\circ_{Zn^{2+}/Zn} = -0.76$ volt and $E^\circ_{H^+/H_2} = 0$

A. 7.05

B. 8.62

C. 8.75

D. 9.57

Answer: B

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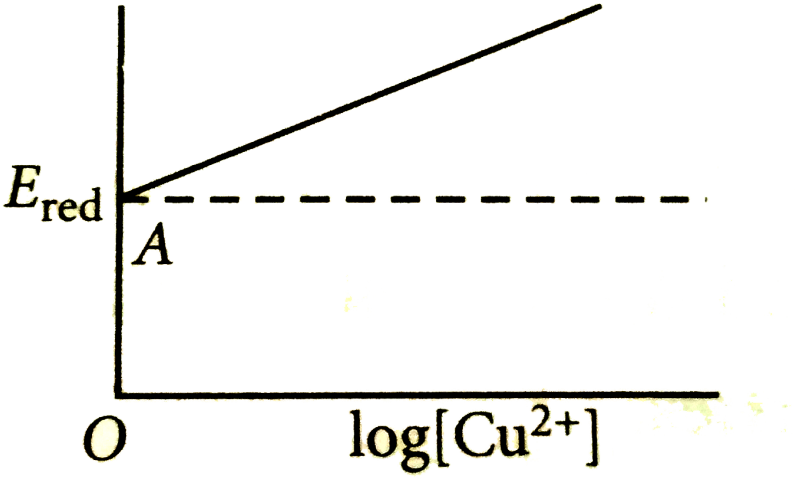
9. For the reaction, $Cu^{2+} + 2e^- \rightarrow Cu$, $\log[Cu^{2+}]$ vs E graph is of type as shown in figure where OA = 0.34 V,the electrode potential of the half-cell of $Cu \mid Cu^{2+}(0.1M)$ will be



A. $-0.34 + \frac{0.0591}{2} V$

B. 0.34+0.0591 V

C. 0.34 V

D. None of these

Answer: A

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10. How long will it take for a uniform current of 6.0 ampere to deposit 78.0 g gold from a solution of $AuCl_4^-$? What mass of chlorine gas will be formed simultaneously at the anode in the electrolytic cell ?

A. t = 3010 sec, w = 35.50 g

B. t = 20306 sec, w = 45.54 g

C. t = 19500 sec, w = 54.5 g

D. t = 19139 sec, w = 42.24 g

Answer: D

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Exemplar Problems

1. Which cell will measure standard electrode potential of copper electrode?

A. $Pt_{(s)}|H_2(g, 0.1\text{bar})|H^+(aq, 1M) \parallel |Cu^{2+}(aq, 1M)|Cu$

B. $Pt_{(s)}|H_2(g, 1\text{bar})|H^+(aq, 1M) \parallel |Cu^{2+}(aq, 2M)|Cu$

C. $Pt_{(s)}|H_2(g, 1\text{bar})|H^+(aq, 1M) \parallel |Cu^{2+}(aq, 1M)|Cu$

D. $Pt_{(s)}|H_2(g, 1\text{bar})|H^+(aq, 0.1M) \parallel |Cu^{2+}(aq, 1M)|Cu$

Answer: C

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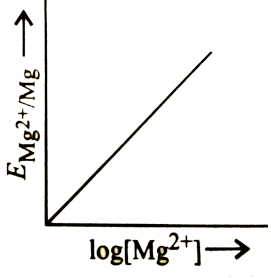
2. Electrode potential for Mg electrode varies according to the equation

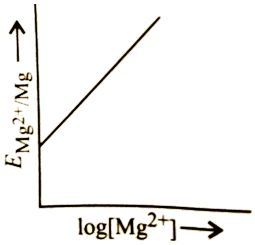
$$E_{Mg^{2+}|Mg} = E^{\Theta}_{Mg^{2+}|Mg} - \frac{0.059}{2}\log\frac{1}{[Mg^{2+}]}$$

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

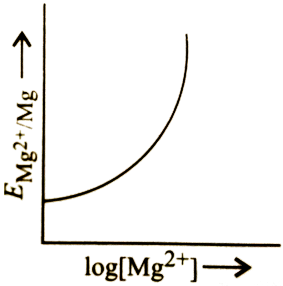
A.



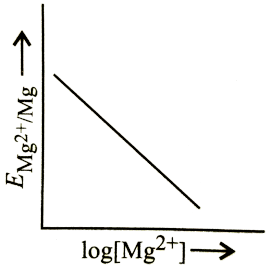
B.



C.



D.



Answer: B

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3. Which of the following statement is correct?

A. E_{cell} and $\Delta_r G$ of cell reaction both are extensive properties.

B. E_{cell} and $\Delta_r G$ of cell reaction both are intensive properties.

C. E_{cell} is an intensive property while $\Delta_r G$ of cell reaction is an extensive property.

D. E_{cell} is an intensive property while $\Delta_r G$ of cell reaction is an intensive property.

Answer: C

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4. The difference between the electrode potentials of two electrons when no current is drawn through the cell is called:

A. cell potential

B. cell emf

C. potential difference

D. cell voltage

Answer: B

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5. Which of the following statement is not correct about an inert electrode in a cell?

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 provide surface for redox reaction

Answer: D

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6. An electrochemical cell an behave like an electrolytic cell when

A. $E_{\text{cell}} = 0$

B. $E_{\text{cell}} > E_{\text{ext}}$

C. $E_{\text{ext}} > E_{\text{cell}}$

D. $E_{\text{cell}} = E_{\text{ext}}$

Answer: C

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7. Which of the statements about solution of electrolytes is not correct?

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 temperture.

Answer: C

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8. Using the data given below:

$E^{\circ}_{Cr_2O_7^{2-}|Cr^{3+}} = 1.33V\, E^{\circ}_{Cl_2|Cl^-} = 1.36V$

$E^{\circ}_{MnO_4^-|Mn^{2+}} = 1.51V\, E_{Cr^{3+}|Cr} = -0.74V$

Mark the strongest reducing agent.

A. Cl^-

B. Cr

C. Cr^{3+}

D. Mn^{2+}

Answer: B

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9. Using tha data given below is reducing potenial.

$E^{\circ}_{Cr_2O_7^{2-}/Cr^{3+}}$ =1.33 V , $E^{\circ}_{Cl_2/Cl^-}$ =1.36 V

$E^{\circ}_{MnO_4^-/Mn^{2+}}$ =1.51 V , $E^{\circ}_{Cr^{3+}/Cr}$ =- 0.74 V

find out which of the following is the strongest oxidising agent.

A. Cl^-

B. Mn^{2+}

C. MnO_4^-

D. Cr^{3+}

Answer: C

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10. Using the data given below:

$E^{\circ}_{Cr_2O_7^{2-}|Cr^{3+}} = 1.33V\, E^{\circ}_{Cl_2|Cl^-} = 1.36V$

$E^{\circ}_{MnO_4^-|Mn^{2+}} = 1.51V\, E_{Cr^{3+}|Cr} = -0.74V$

In which option the order of reducing power is correct?

A. $Cr^{3+} < Cl^- < Mn^{2+} < Cr$

B. $Mn^{2+} < Cl^- < Cr^{3+} < Cr$

C. $Cr^{3+} < Cl^- < Cr_2O_7^{2-} < MnO_4^-$

D. $Mn^{2+} < Cr^{3+} < Cl^- < Cr$

Answer: B

Watch Video Solution

11. Using the data given below:

$E^\circ_{Cr_2O_7^{2-}|Cr^{3+}} = 1.33V\, E^\circ_{Cl_2|Cl^-} = 1.36V$

$E^\circ_{MnO_4^-|Mn^{2+}} = 1.51V\, E_{Cr^{3+}|Cr} = -0.74V$

Find the most stable ion in its reduced forms

A. Cl^-

B. Cr^{3+}

C. Cr

D. Mn^{2+}

Answer: D

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12. Using the data given below:

$E^{\circ}_{Cr_2O_7^{2-}|Cr^{3+}} = 1.33V\, E^{\circ}_{Cl_2|Cl^-} = 1.36V$

$E^{\circ}_{MnO_4^-|Mn^{2+}} = 1.51V\, E_{Cr^{3+}|Cr} = -0.74V$

Find the most stable oxidised species.

A. Cr^{3+}

B. MnO_4^-

C. $Cr_2O_7^{2-}$

D. Mn^{2+}

Answer: A

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13. The quantity of charge required to obtain one mole of aluminium from Al_2O_3 is

A. 1 F

B. 6 F

C. 3 F

D. 2 F

Answer: C

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14. The cell constant of a conductivity cell

A. change with change of electrolyte

B. changes with change of concentration of electrolyte

C. changes with temperture of electrolyte

D. remains constant for a cell

Answer: D

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15. While charging the lead storage battery:

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

Answer: A

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16. $\Lambda^{\circ}_{(m)\,(NH_4OH)}$ is equal to

A. $\Lambda^{\circ}_{m(NH_4OH)} + \Lambda^{\circ}_{m(NH_4Cl)} - \Lambda^{\circ}_{m(HCl)}$

B. $\Lambda^{\circ}_{m(NH_4Cl)} + \Lambda^{\circ}_{m(NaOH)} - \Lambda^{\circ}_{m(NaCl)}$

C. $\Lambda^{\circ}_{m(NH_4Cl)} + \Lambda^{\circ}_{m(NaCl)} - \Lambda^{\circ}_{m(NaOH)}$

D. $\Lambda^{\circ}_{m(NaOH)} + \Lambda^{\circ}_{m(NaCl)} - \Lambda^{\circ}_{m(NH_4Cl)}$

Answer: B

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17. In the electrolysis of aqueous sodium chloride solution which of the hall cell reaction will occur at anode?

A. $Na^{+}_{(aq)} + e^{-} \rightarrow Na_{(s)}$, E°_{cell}=-2.71 V

B. $2H_2O_{(l)} \rightarrow O_{2(g)} + 4H^{+}_{(aq)} + 4e^{-}$, E°_{cell}=1.23 V

C. $H^{+}_{(aq)} + e^{-} \rightarrow \frac{1}{2}H_{2(g)}$, E°_{cell} =0.00 V

D. $Cl^{-}_{(aq)} \rightarrow \frac{1}{2}Cl_{2(g)} + e^{-}$, E°_{cell} =1.36 V

Answer: D

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Assertion Reason

1. Assertion:Electrolytic cell uses electrical energy to carry non-spontaneous chemical reactions.

Reason : Chemical energy of a spontaneous redox reaction can be converted into electrical energy.

A. If both assertion and reason are true and reason is the correct explanation of assertion .

B. If both assertion and reason are true but reason is not the correct explanation of assertion .

C. If assertion is true but reason is false .

D. If both assertion and reason are false .

Answer: B

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2. Assertion :EMF of the cell is the potential difference between the electrode potentials of the cathode and anode when no current is drawn through the cell.

Reason: Anode is kept on the right side and cathode on the left side while representing the galvanic cell.

A. If both assertion and reason are true and reason is the correct explanation of assertion .

B. If both assertion and reason are true but reason is not the correct explanation of assertion .

C. If assertion is true but reason is false .

D. If both assertion and reason are false .

Answer: C

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3. Assertion:A standard hydrogen electrode is also called reversible electrode.

Reason : Standard hydrogen electrode can act both as anode as well as cathode in an electrochemical cell.

A. If both assertion and reason are true and reason is the correct explanation of assertion .

B. If both assertion and reason are true but reason is not the correct explanation of assertion .

C. If assertion is true but reason is false .

D. If both assertion and reason are false .

Answer: A

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4. Assertion:Cu^{2+} ions get reduced more easily than H^{+} ions.

Reason: Standard electrode potential of copper is 0.34 V.

A. If both assertion and reason are true and reason is the correct explanation of assertion .

B. If both assertion and reason are true but reason is not the correct explanation of assertion .

C. If assertion is true but reason is false .

D. If both assertion and reason are false .

Answer: A

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5. Assertion:Lithium has the lowest electrode potential.

Reason: Lithium ion is the strongest oxidising agent.

A. If both assertion and reason are true and reason is the correct explanation of assertion .

B. If both assertion and reason are true but reason is not the correct explanation of assertion .

C. If assertion is true but reason is false .

D. If both assertion and reason are false .

Answer: C

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6. Assertion : Current stops flowing when $E_{cell} = 0$.

Reason : Equilibrium of the cell reaction is attained.

A. If both assertion and reason are true and reason is the correct explanation of assertion .

B. If both assertion and reason are true but reason is not the correct explanation of assertion .

C. If assertion is true but reason is false .

D. If both assertion and reason are false .

Answer: A

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7. Assertion : To obtain maximum work from a galvanic cell charge has to be passed reversibly.

Reason: The reversible work done by a galvanic cell is equal to decrease in its Gibbs energy.

A. If both assertion and reason are true and reason is the correct explanation of assertion .

B. If both assertion and reason are true but reason is not the correct explanation of assertion .

C. If assertion is true but reason is false .

D. If both assertion and reason are false .

Answer: A

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8. Assertion:The electrical resistance of any object decrease with increase in its length.

Reason: Electrical resistance of any object increases with increase in its area of cross-section.

A. If both assertion and reason are true and reason is the correct explanation of assertion .

B. If both assertion and reason are true but reason is not the correct explanation of assertion .

C. If assertion is true but reason is false .

D. If both assertion and reason are false .

Answer: D

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9. Assertion: The conductivity of electrolytic soutions increase with increase of temperture.

Reason: Electronic conductance decrease with increase of temperture.

A. If both assertion and reason are true and reason is the correct explanation of assertion .

B. If both assertion and reason are true but reason is not the correct explanation of assertion .

C. If assertion is true but reason is false .

D. If both assertion and reason are false .

Answer: B

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10. Assertion:Molar conductivity increases with decrease in concentration.

Reason:Conductivity always decrease with decrease in concentration.

A. If both assertion and reason are true and reason is the correct explanation of assertion .

B. If both assertion and reason are true but reason is not the correct explanation of assertion .

C. If assertion is true but reason is false .

D. If both assertion and reason are false .

Answer: B

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11. Assertion:Kohlrausch law helps to find the molar conductivity of weak electrolyte at infinite dilution.

Reason:Molar conductivity of a weak electrolyte at infinite dilution cannot be determined experimentally.

A. If both assertion and reason are true and reason is the correct explanation of assertion .

B. If both assertion and reason are true but reason is not the correct explanation of assertion .

C. If assertion is true but reason is false .

D. If both assertion and reason are false .

Answer: A

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12. Assertion:When a copper wire is dipped in silver nitrate solution, there is no change in the colour of the solution.

Reason : Copper cannot displace silver from its salt solution.

A. If both assertion and reason are true and reason is the correct explanation of assertion .

B. If both assertion and reason are true but reason is not the correct explanation of assertion .

C. If assertion is true but reason is false .

D. If both assertion and reason are false .

Answer: D

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13. Assertion : In electrolysis, the quantity of electricity needed for depositing 1 mole silver is different from that required for 1 mole of copper.

Reason : The molecular weights of silver and copper are different.

A. If both assertion and reason are true and reason is the correct explanation of assertion .

B. If both assertion and reason are true but reason is not the correct explanation of assertion .

C. If assertion is true but reason is false .

D. If both assertion and reason are false .

Answer: B

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14. Assertion:In electrolysis of aqueous NaCl the product obtained is H_2 gas.

Reason:Gases are liberted faster than the metals.

A. If both assertion and reason are true and reason is the correct explanation of assertion .

B. If both assertion and reason are true but reason is not the correct explanation of assertion .

C. If assertion is true but reason is false .

D. If both assertion and reason are false .

Answer: C

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15. Assertion:In mercury cell, the cell potential is approximately 1.35 V Which cell will measure standard electrode and remains constant during its life.

Reason : The overall reaction in mercury cell is represented as $Zn(Hg) + HgO_{(s)} \rightarrow ZnO_{(s)} + Hg_{(l)}$

A. If both assertion and reason are true and reason is the correct explanation of assertion .

B. If both assertion and reason are true but reason is not the correct explanation of assertion .

C. If assertion is true but reason is false .

D. If both assertion and reason are false .

Answer: A

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Electrochemical Cell

1. In a Daniel cell,

A. the chemical energy liberted during the redox reaction is converted to electrical energy

B. the electrical energy of the cell is converted to chemical energy

C. the energy of the cell is utilised in conduction of the redox reaction

D. the potential energy of the cell is converted into electrical energy.

Answer: A

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Galvanic Cell

1. A galvanic cell has electrical potential of 1.1 V . If an opposing potential of 1.1 V is applied to this cell, what will happen to the cell reaction and current flowing through the cell ?

A. The reaction stops and no current flows through the cell.

B. The reaction continuous but current flows in opposite direction.

C. The concentration of reactants becomes unity and current flows from cathode to anode.

D. The cell does not function as a galvanic cell and zinc is deposited on zinc plate.

Answer: A

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2. Following reactions are taking place in a Galvanic cell , $Zn \rightarrow Zn^{2+} + 2e^{-}, Ag^{+} + e^{-} \rightarrow Ag$

Which of the given representations is the correct method of depicting the cell ?

A. $Zn_{(s)} \mid Zn^{2+}_{(aq)} || Ag^{+}_{(aq)} \left| Ag_{(s)} \right.$

B. $Zn^{2+} | Zn || Ag | Ag^{+}$

C. $Zn_{(aq)} \mid Zn^{2+}_{(s)} || Ag^{+}_{(s)} \left| Ag_{(aq)} \right.$

D. $Zn_{(s)} \left| Ag^{+}_{(aq)} \right. || Zn^{2+}_{(aq)} \left| Ag_{(s)} \right.$

Answer: A

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3. Which of the following is the correct cell representation for the given cell reaction ?

$Zn + H_2SO_4 \rightarrow ZnSO_4 + H_2$

A. $Zn|Zn^{2+}||H^{+}|H_2$

B. $Zn|Zn^{2+}||H^{+}, H_2|Pt$

C. $Zn|ZnSO_4||H_2SO_4|Zn$

D. $Zn|H_2SO_4||ZnSO_4|H_2$

Answer: B

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4. The cell reaction of the galvanic cell : $Cu_{(s)}\left|Cu^{2+}_{(aq)}\right| \mid Hg^{2+}_{(aq)}\left|Hg_{(l)}\right.$ is

A. $Hg + Cu^{2+} \rightarrow Hg^{2+} + Cu$

B. $Hg + Cu^{2+} \rightarrow Cu^{+} + Hg^{+}$

C. $Cu + Hg \rightarrow CuHg$

D. $Cu + Hg^{2+} \rightarrow Cu^{2+} + Hg$

Answer: D

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5. Which of the following reaction is possible at anode ?

A. $2Cr^{3+} + 7H_2O \rightarrow Cr_2O_7^{2-} + 14H^+$

B. $F_2 \rightarrow 2F^-$

C. $(1/2)O_2 + 2H^+ \rightarrow H_2O$

D. None of these

Answer: A

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6. In the cell $Zn|Zn^{2+}||Cu^{2+}|Cu$, the negaitve terminal is

A. Cu

B. Cu^{2+}

C. Zn

D. Zn^{2+}

Answer: C

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7. For the galvanic cell, $Cu \mid Cu^{2+} || Ag^{+} \mid Ag$. Which of the following observations is not correct ?

A. Cu acts as anode and Ag acts as cathode.

B. Ag electrode loses mass and Cu electrode gains mass.

C. Reaction at anode, $Cu \rightarrow Cu^{2+} + 2e^{-}$

D. Copper is more reactive than silver .

Answer: B

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8. Which of the following is the cell reaction that occurs when the following half-cells are combined?

$I_2 + 2e^- \rightarrow 2I^-(1M), E^\circ = +0.54V$

$Br_2 + 2e^- \rightarrow 2Br(1M), E^\circ = +1.09V$

A. $2Br^- + I_2 \rightarrow Br_2 + 2I^-$

B. $I_2 + Br_2 \rightarrow 2I^- + 2Br^-$

C. $2I^- + Br_2 \rightarrow I_2 + 2Br^-$

D. $2I^- + 2Br^- \rightarrow I_2 + Br_2$

Answer: C

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9. Calculate the standard cell potential of galvanic cell in which the following reaction takes place

$2Cr_s + 3Cd_{aq}^{+2} \rightarrow 2cr_{aq}^{+3} + 3Cd_s$

Given $E_{Cr^{+3}/Cr} = -0.74(V) E^\circ\_\left(Cd^{+2}/Cd\right) = -0.04(V)$

A. 0.74 V

B. 1.14 V

C. 0.34 V

D. $-0.34V$

Answer: C

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10. The standard reduction potential for the half-cell reaction, $Cl_2 + 2e^- \rightarrow 2Cl^-$ will be $(Pt^{2+} + 2Cl^- \rightarrow Pt + Cl_2, E^\circ_{\text{cell}} = -0.15V, Pt^{2+} + 2e^- \rightarrow Pt, E^\circ = 1$

A. $-1.35V$

B. $+1.35V$

C. $1.05V$

D. $+1.05V$

Answer: B

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11. In a cell reaction, $Cu_{(s)} + 2Ag^{+}_{(aq)} \rightarrow Cu^{2+}_{(aq)} + 2Ag_{(s)}$ E°_{cell}=+0.46 V . If the concentration of Cu^{2+} ions is doubled then E°_{cell} will be

A. doubled

B. halved

C. increased by four times

D. unchanged.

Answer: D

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12. A standard hydrogen electrode has zero electrode potential because :

A. hydrogen can be most easily oxidised

B. hydrogen has only one electron

C. the electrode potential is assumed to be zero

D. hydrogen is the lightest element.

Answer: C

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13. Which of the following is thecorrect order in which metals displace each other from the salt solution of their salts?

A. Zn,Al,Mg,Fe,Cu

B. Cu,Fe,Mg,Al,Zn

C. Mg,Al,Zn,Fe,Cu

D. Al,Mg,Fe,Cu,Zn

Answer: C

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14. Given below are the standard electrode potentials of few half-cells. The correct order of these metals in increasing reducing power will be

K^+/K=-2.93 V , Ag^+ /Ag=0.80 V, Mg^{2+}/Mg=-2.37 V, Cr^{3+}/Cr =-0.74 V

A. K lt Mg lt Cr lt Ag

B. Ag lt Cr lt Mg lt K

C. Mg lt K lt Cr lt Ag

D. Cr lt Ag lt Mg lt K

Answer: B

View Text Solution

15. Based on the data given below, the correcy order of reducing power is:

$Fe^{3+}_{(aq.)} + e \rightarrow Fe^{2+}_{(aq.)}, E^\circ = +0.77V$

$Al^{3+}_{(aq.)} + 3e \rightarrow Al_{(s)}, E^{\circ} = -1.66V$

$Br_{2(aq.)} + 2e \rightarrow 2Br^{-}_{(aq.)}, E^{\circ} = +1.08V$

A. $Br^{-} < Fe^{2+} < Al$

B. $Fe^{2+} < Al < Br^{-}$

C. $Al < Br^{-} < Fe^{2+}$

D. $Al < Fe^{2+} < Br^{-}$

Answer: A

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16. Zn gives H_2 gas with H_2SO_4 and HCl but not with HNO_3 because

A. Zn Acts as oxidising agent when reacts with HNO_3

B. HNO_3 is weaker acid than H_2SO_4 and HCl

C. Zn is above the hydrogen in electrochemical series .

D. NO_3^- is reduced in preference to H^+ ion.

Answer: D

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17. Fluorine is the best oxidising agent because it has

A. highest electron afffinity

B. highest reduction potential

C. highest oxidation potential

D. lowest electron affinity.

Answer: B

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18. Which of the following is not an application of electrochemical series?

A. To compare the relative oxidising and reducing power of substances.

B. To predict evolution of hydrogen gas on reaction of metal with acid.

C. To predict spontaneity of a redox reaction.

D. To calculate the amount of metal deposited on cathode.

Answer: D

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19. E° values of three metals are listed below.

$$Zn^{2+}_{(aq)} + 2e^- \rightarrow Zn_{(s)} \quad E^\circ = -0.76V$$

$$Fe^{2+}_{(aq)} + 2e^- \rightarrow 2Fe(s) \quad E^\circ = -0.44V$$

$$Sn^{2+}_{(aq)} + 2e^- \rightarrow Sn_{(s)} \quad E^\circ = -0.14V$$

Which of the following statements are correct on the basis of the above information ?

(i)Zinc will be corroded in preference to iron if zinc coating is broken on the surface.

(ii)If iron is coated with tin and the coating is broken on the surface then

iron will be corroded .

(iii)Zinc is more reactive than iron but tin is less reactive then iron.

A. (i) and (ii) only

B. (ii)and (iii) only

C. (i),(ii) and (iii)

D. (i) and (iii) only

Answer: C

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Nernst Equation

1. For a cell reaction : $M^{n+}(aq) + \mathrm{ne}^- \rightarrow M(s)$, the Nernst equation for electrode potential at any concertation measured with respect to standard hydrogen electrode is represented as

A. $E_{(M^{n+}/M)} = E^{\circ}_{(M^{n+}/M)} - \frac{\mathrm{RT}}{\mathrm{nF}} \ln\left(\frac{1}{[M^{n+}]}\right)$

B. $E_{(M/M^{n+})} = E^{\circ}_{(M/M^{n+})} - \frac{RT}{nF}\ln\left(\frac{[M^{n+}]}{[M]}\right)$

C. $E_{(M^{n+}/M)} = E^{\circ}_{(M^{n+}/M)} - \frac{RT}{nF}\log\frac{1}{[M]}$

D. $E_{(M^{n+}/M)} = E^{\circ}_{(M^{n+}/M^{n+})} - \frac{RT}{nF}\ln[M^{n+}]$

Answer: A

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2. At $25^{\circ}C$, Nernst equation is

A. $E_{cell} = E^{\circ}_{cell} - \frac{0.0591}{n}\log\frac{[ion]_{RHS}}{[ion]_{LHS}}$

B. $E_{cell} = E^{\circ}_{cell} - \frac{0.0591}{n}\log\frac{[M]_{RHS}}{[M]_{LHS}}$

C. $E_{cell} = E^{\circ}_{cell} + \frac{0.0591}{n}\log\frac{[ion]_{RHS}}{[ion]_{LHS}}$

D. $E_{cell} = E^{\circ}_{cell} - \frac{0.0591}{n}\log\frac{[ion]_{LHS}}{[ion]_{RHS}}$

Answer: A

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3. Mark the correct Nernst equation for the given cell.

$F_{(s)}\left|Fe^{2+}(0.001M)\right|\left|H^{+}(1M)\right|H_{2(g)}(1^{-})\mid Pt_{(s)}$ is

A. $E_{\text{cell}}=E^{\circ}_{\text{cell}}-\frac{0.591}{2}\log\frac{\left[Fe^{2+}\right]\left[H^{+}\right]^{2}}{[Fe][H_2]}$

B. $E_{\text{cell}}=E^{\circ}_{\text{cell}}-\frac{0.591}{2}\log\frac{[Fe]\left[H^{+}\right]^{2}}{\left[Fe^{2+}\right][H_2]}$

C. $E_{\text{cell}}=E^{\circ}_{\text{cell}}-\frac{0.0591}{2}\log\frac{\left[Fe^{2+}\right][H_2]}{[Fe]\left[H^{+}\right]^{2}}$

D. $E_{\text{cell}}=E^{\circ}_{\text{cell}}-\frac{0.0591}{2}\log\frac{[Fe][H_2]}{\left[Fe^{2+}\right]\left[H^{+}\right]^{2}}$

Answer: C

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4. The correct Nernst equation for the given cell

$Pt_{(s)}\left|Br_{2(l)}\right|Br^{-}(M)\left|\left|H^{+}(M)\right|H_{2(g)}(1^{-})\right|Pt_{(s)}$ is

A. $E_{\text{cell}}=E^{\circ}_{\text{cell}}-\frac{0.0591}{2}\log\frac{\left[Br_{2(l)}\right][H_2]}{\left[H^{+}\right]^{2}\left[Br^{-}\right]^{2}}$

B. $E_{\text{cell}}=E^{\circ}_{\text{cell}}-\frac{0.0591}{2}\log\frac{\left[H^{+}\right]^{2}\left[Br^{-}\right]^{2}}{\left[Br_{2(l)}\right][H_2]}$

C. $E_{\text{cell}} = E^{\circ}_{\text{cell}} - \frac{0.0591}{2}\log\frac{[H^+]^2[H_2]}{[Br_{2(l)}][Br^-]^2}$

D. $E_{\text{cell}} = E^{\circ}_{\text{cell}} - \frac{0.0591}{2}\log\frac{[Br_{2(l)}][Br^-]^2}{[H^+]^2[H_2]}$

Answer: A

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5. Given below are few reactions with some expressions. Mark the expressions which is not correctly matched.

A. For concentration cell,

$$Ag|Ag^+(C_1)||Ag^+(C_2)|Ag,\ E_{\text{cell}} = -\frac{0.0591}{1}\log\frac{C_1}{C_2}$$

B. For the cell ,

$$2Ag^+ + H_2(1\,\text{atm}) \rightarrow 2Ag + 2H^+(1M),\ E_{\text{cell}} = E^{\circ}_{\text{cell}} - \frac{0.0591}{2}\log[$$

C. For an electrochemical reaction, at equilibrium

$$aA + bB \overset{ne^-}{\Longleftrightarrow} cC + dD,\ E^{\circ}_{\text{cell}} = \frac{0.0591}{n}\log\frac{[C]^c[D]^d}{[A]^a[B]^b}$$

D. For the cell ,

$$M^{n+}_{(aq)} + ne^- \rightarrow M_{(s)}, E = E^\circ - \frac{0.0591}{n}\log\frac{1}{[M^{n+}]}$$

Answer: B

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6. Calculate the emf of the following concentration cell at $25^\circ C$:

$Ag(s)|AgNO_3(0.01M)||AgNO_3(0.05M)|Ag(s)$

A. 0.828V

B. 0.0413V

C. -0.0413 V

D. -0.828 V

Answer: B

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7. The standard reduction potential for Cu^{2+}/Cu is $+0.34V$. Calculate the reduction potential at pH=14 for the above couple. K_{SP} of $Cu(OH)_2$ is 1.0×10^{-19}

A. 2.2 V

B. 3.4 V

C. -0.22 V

D. -2.2 V

Answer: C

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8. Calculate the reduction potential for the following half cell reaction at 298 K.

$Ag^+(aq) + e^- \rightarrow Ag(s)$

Given that $[Ag^+] = 0.1M$ and $E^\circ = +0.80V$

A. 0.741 V

B. 0.80 V

C. -0.80V

D. -0.741V

Answer: A

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9. Mark the incorrect relationship from the following:

A. Equilibrium constant is related to emf as $\log K = \frac{\text{nFE}}{2.303\text{RT}}$

B. EMF of a cell $Zn\left|Zn^{2+}_{(a_1)}\right| \left|Cu^{2+}_{(a_2)}\right|Cu$ is $E = E^\circ - \frac{0.591}{n}\log \frac{[a_2]}{[a_1]}$

C. Nernst equations is $E_{\text{cell}} = E^\circ_{\text{cell}} - \frac{0.0591}{n}\log\frac{[\text{Products}]}{[\text{Reactants}]}$

D. For the electrode M^{n+}/M at 273 K $E = E^\circ + \frac{0.591}{n}\log\left[M^{n+}\right]$

Answer: C

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10. The standard emf for the cell reaction,

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

is $0.36V$ at $298K$. The equilibrium constant of the reaction is

A. 1.2×10^6

B. 7.4×10^{12}

C. 2.4×10^6

D. 5.5×10^8

Answer: A

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11. E°_{cell} for the reaction , $2H_2O \rightarrow H_3O^+ + OH^-$ at $25^\circ C$ is -0.8277 V. The equilibrium constant for the reaction is

A. 10^{-14}

B. 10^{-23}

C. 10^{-7}

D. 10^{-21}

Answer: A

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12. Cell reactiomn is spontaneous when

A. E°_{red} is negative

B. ΔG° is negative

C. E°_{oxide} is positive

D. ΔG° is positive

Answer: B

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13. $\Delta_r G^\circ$ for the cell with the cell reaction :

$$Zn_{(s)} + Ag_2O_{(s)} + H_2O_{(l)} \rightarrow Zn^{2+}_{(aq)} + 2Ag_{(s)} + 2OH^-_{(aq)}$$

$$\left[E^\circ_{Ag_2O/Ag} = 0.344V, E^\circ_{Zn^{2+}/Zn} = -0.76V\right]$$

A. $2.13 \times 10^5 \text{J mol}^{-1}$

B. $-2.13 \times 10^5 \text{J mol}^{-1}$

C. $1.06 \times 10^5 \text{J mol}^{-1}$

D. $-1.06 \times 10^5 \text{J mol}^{-1}$

Answer: B

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14. E° value of Ni^{2+}/Ni is -0.25 V and Ag^+/Ag is +0.80 V . If a cell is made by taking the two electrodes what is the feasibility of the reaction?

A. Since E° value for the cell will be positive, redox reaction is feasible.

B. Since E° value for the cell will be negative, redox reaction is not feasible.

C. Ni cannot reduce Ag^+ to Ag hence reaction is not feasible.

D. Ag can reduce Ni^{2+} to Ni hence reaction is feasible.

Answer: A,B

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15. The Gibbs energy for the decomposition of Al_2O_3 at $500^\circ C$ is as follows:

$$\frac{2}{3}Al_2O_3 \rightarrow \frac{4}{3}Al + O_2, \Delta_r G = +966kJmol^{-1}$$

The potential difference needed for electrolytic reeduction of Al_2O_3 at $500^\circ C$ is at least:

A. 5.0 V

B. 4.5 V

C. 3.0 V

D. 2.5 V

Answer: D

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16. E° values for the half cell reactions are given below :

$Cu^{2+} + e^- \rightarrow Cu^+$, E°=0.15 V

$Cu^{2+} + 2e^- \rightarrow Cu$, E°=0.34 V

What will be the E° of the half-cell : $Cu^+ + e^- \rightarrow Cu$?

A. $+0.49V$

B. $+0.19V$

C. $+0.53V$

D. $+0.30V$

Answer: C

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17. Calculate ΔG° for the reaction : $Cu^{2+}(aq) + Fe(s) \Leftrightarrow Fe^{2+}(aq) + Cu(s)$. Given that $E^{\circ} Cu^{2+}/Cu = 0.34V$,

$E^{\circ}_{Fe^{+2}/Fe} = -0.44V$

A. 11.44 kJ

B. 180.8 kJ

C. 150.5 kJ

D. 28.5 kJ

Answer: C

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Conductance Of Electrolytic Solutions

1. The specific conductivity of N/10 KCl solution at $20^{\circ}C$ is $0.0212 ohm^{-1} cm^{-1}$ and the resistance of the cell containing this

solution at $20^{\circ} C$ is 55 ohm. The cell constant is :

A. (a) $3.324 \mathrm{~cm}^{-1}$

B. (b) $1.166 \mathrm{~cm}^{-1}$

C. (c) $2.372 \mathrm{~cm}^{-1}$

D. (d) $3.682 \mathrm{~cm}^{-1}$

Answer: B

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2. Electrical conductance through metals is called metallic or electronic conuctance and is due to the movement of electrons. The electronic conductance depends on

A. (a) the nature and structure of the metal

B. (b) the number of valence electrons per atom

C. (c) change in temperture

D. (d) all of these.

Answer: D

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3. Fill in the blanks with appropriate words.

The electrolytic solution is always neutral because the total charge on __(i)___ is equal to __(ii)__ on ___(iii)___ .Unlike the metallic conductor, the electrolyte conducts the electric current by virtue of movement of its ___(iv)___ . The property due to which a metal tends to go into solution in term of positive ions is known as ___(v)__.

(i),(ii),(iii),(iv) and (v) respectively are

A. cations, partial charge , anions, electrons , reduction

B. cations , total charge , anions , ions , oxidation

C. cations , ionic charge , anions , atoms , dissolution

D. cations , partial charge , anions , molecules, electrolysis .

Answer: B

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4. What would be the equivalent conductivity of a cell in which 0.5 salt solution offers a resistance of 40 ohm whose electrodes are 2 cm apart and 5 cm^2 in area?

A. $10 \text{ohm}^{-1} \text{cm}^2 \text{eq}^{-1}$

B. $20 \text{ohm}^{-1} \text{cm}^2 \text{eq}^{-1}$

C. $30 \text{ohm}^{-1} \text{cm}^2 \text{eq}^{-1}$

D. $25 \text{ohm}^{-1} \text{cm}^2 \text{eq}^{-1}$

Answer: B

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5. Match the column I with column II and mark the appropriate choice.

	Column I		Column II
(A)	Λ_m	(i)	l/A
(B)	G^*	(ii)	$\rho l/A$
(C)	κ	(iii)	κ/C
(D)	R	(iv)	G^*/R

A. A - (i), B-(iii), C-(ii) ,D-(iv)

B. A-(iii) , B-(i), C-(iv),D-(ii)

C. A-(ii),B-(iv), C-(iii), D-(i)

D. A-(iv), B-(ii),C-(i), D-(iii)

Answer: B

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6. Units of the properties measured are given below. Which of the properties has not been matched correctly?

A. molar conductance $= Sm^2mol^{-1}$

B. Cell constant $=m^{-1}$

C. Specific conductance = S m^2

D. Equivalent conductance =S $m^2(geq)^{-1}$

Answer: C

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7. Molar conductivity of 0.15 M solution of KCI at 298 K, if its conductivity is 0.0152 S cm^{-1} will be

A. $124\Omega^{-1}\mathrm{cm}^2\mathrm{mol}^{-1}$

B. $204\Omega^{-1}\mathrm{cm}^2\mathrm{mol}^{-1}$

C. $101\Omega^{-1}\mathrm{cm}^2\mathrm{mol}^{-1}$

D. $300\Omega^{-1}\mathrm{cm}^2\mathrm{mol}^{-1}$

Answer: C

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8. The molar conductivity is maximum for the solution of concentration _____.

A. 0.004 M

B. 0.002 M

C. 0.005 M

D. 0.001 M

Answer: D

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9. The specific conductance of a saturated solution of AgCl at $25^{\circ}C$ is 1.821×10^{-5} mho cm^{-1}. What is the solubility of AgCl in water (in g L^{-1}) , if limiting molar conductivity of AgCl is 130.26 mho $cm^{2}mol^{-1}$?

A. $1.89 \times 10^{-3} gL^{-1}$

B. $2.78 \times 10^{-2} gL^{-1}$

C. $2.004 \times 10^{-2} gL^{-1}$

D. $1.43 \times 10^{-3} gL^{-1}$

Answer: C

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10. Specific conductance of 0.1 M NaCl solution is $1.01 \times 10^{-2} ohm^{-1} cm^{-1}$. Its molar conductance in $ohm^{-1} cm^2 mol^{-1}$ is

A. 1.01×10^2

B. 1.01×10^3

C. 1.01×10^4

D. 1.01

Answer: A

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11. The variation in Λ_m with concentration for a strong electrolyte can be represented by the equation, $\Lambda_m = \Lambda_m^\circ - AC^{1/2}$ The value of constant A for a given solvent and temperature depends upon the type of electrolyte i.e., cations and anions produced on dissociation of electrolyte in the solution .

NaCl, $MgCl_2$ and $CaSO_4$ are known as

A. 1-1,2-1, and 2-2 type electrolytes respectively

B. strong, weak and strong electrolytes respectively

C. electrolytes with different value of A

D. electrolytes with same molar conductivity .

Answer: A

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12. The variation in Λ_m with concentration for a strong electrolyte can be represented by the equation, $\Lambda_m = \Lambda_m^\circ - AC^{1/2}$ The value of constant A for a given solvent and temperature depends upon the type of electrolyte i.e., cations and anions produced on dissociation of electrolyte in the solution .

Which of the following statements is correct regarding variations of molar conductivity with concentration.

A. Molar conductivity decrease with decrease in concentration

B. Variation in molar conductivity of weak and strong electrolytes is same.

C. Molar conductivity increases with decrease in concentration.

D. When concentration of the solution approaches zero, the molar conductivity is known as conductance.

Answer: C

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13. Two solutions of X and Y electrolytes are taken in two beakers and diluted by adding 500mL of water. Λ_m of X increases by 1.5 times while that of Y increases by 20 times, what could be the eletrolytes X and Y?

A. X $\rightarrow$ NaCl , Y $\rightarrow$ KCl

B. X $\rightarrow$ NaCl , Y $\rightarrow$ CH_3COOH

C. X $\rightarrow$ KOH, Y $\rightarrow$ NaOH

D. X $\rightarrow$ CH_3COOH , Y $\rightarrow$ NaCl

Answer: B

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14. When water is added to an aqueous solution of an electrolyte, what is the change in specific conductivity of the electrolyte?

A. Conductivity decreases

B. Conductivity increases

C. Conductivity remains same

D. Conductivity does not depend on number of ions.

Answer: A

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15. Molar conductivity of NH_4OH can be calculated by the equation.

A. $\Lambda^{\circ}_{NH_4OH} = \Lambda^{\circ}_{Ba(OH)_2} + \Lambda^{\circ}_{NH_4Cl} - \Lambda^{\circ}_{BaCl_2}$

B. $\Lambda^{\circ}_{NH_4OH} = \Lambda^{\circ}_{BaCl_2} + \Lambda^{\circ}_{NH_4Cl} - \Lambda^{\circ}_{Ba(OH)_2}$

C. $\Lambda^{\circ}_{NH_4OH} = \frac{\Lambda^{\circ}_{Ba(OH)_2} + 2\Lambda^{\circ}_{NH_4Cl} - \Lambda^{\circ}_{BaCl_2}}{2}$

D. $\Lambda^{\circ}_{NH^4OH} = \frac{\Lambda^{\circ}_{NH_4Cl} + \Lambda^{\circ}_{Ba(OH)_2}}{2}$

Answer: C

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16. Limiting molar conductivity of NaBr is

A. $\Lambda_m^\circ NaBr = \Lambda_m^\circ NaCl + \Lambda_m^\circ KBr$

B. $\Lambda_m^\circ NaBr = \Lambda_m^\circ NaCl + \Lambda_m^\circ KBr - \Lambda_m^\circ KCl$

C. $\Lambda_m^\circ NaBr = \Lambda_m^\circ NaOH + \Lambda_m^\circ NaBr - \Lambda_m^\circ NaCl$

D. $\Lambda_m^\circ NaBr = \Lambda_m^\circ NaCl - \Lambda_m^\circ NaBr$

Answer: B

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17. What will be the molar conductivity of Al 3+ ions at infinite dilution if molar conductivity of $Al^2(SO_4)_3$ is 858 S cm^2 mol^{-1} and ionic conductance of SO_4^{2-} is 160 S $cm^2\text{mol}^{-1}$ at infinite dilution ?

A. 189 S $\text{cm}^2\text{mol}^{-1}$

B. 698 S $\text{cm}^2\text{mol}^{-1}$

C. 1018 S $\text{cm}^2\text{mol}^{-1}$

D. 429 S cm^2mol^{-1}

Answer: A

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18. Limiting molar conductivity for some ions is given below (in S cm^2mol^{-1}) :

$Na^+ - 50.1, Cl^- - 76.3, H^+ - 349.6, CH_3COO^- - 40.9, Ca^{2+} - 119.0$

What will be the limiting molar conductivities (Λ_m°) of $CaCl_2, CH_3COONa$ and NaCl respectively ?

A. 97.65 , 111.0 and 242.8 S cm^2mol^{-1}

B. 195.3, 182.0 and 26.2 S cm^2mol^{-1}

C. 271.6, 91.0 and 126.4 S cm^2mol^{-1}

D. 119.0, 1024.5 and 9.2 S cm^2mol^{-1}

Answer: C

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19. Match the column I with column II and mark the appropriate choice.

	Column I		Column II
(A)	Kohlrausch's law	(i)	$\Lambda^{\circ}_{eq} = \Lambda^{\circ}_{c} + \Lambda^{\circ}_{a}$
(B)	Molar conductivity	(ii)	$\Lambda_m = \frac{\kappa}{C}$
(C)	Degree of dissociation	(iii)	$\alpha = \frac{\Lambda_m}{\Lambda^{\circ}_m}$
(D)	Dissociation constant	(iv)	$K_a = \frac{C\alpha^2}{1-\alpha}$

A. A-(iii),B-(iv),C-(i),D-(ii)

B. A-(i),B-(ii),C-(iii),D-(iv)

C. A-(iv), B-(i),C-(ii),D-(iii)

D. A-(iv),B-(i),C-(ii),D-(iii)

Answer: B

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20. The equivalent conductivity of N/10 solution of acitic acid at $25^{\circ}C$ is $14.3ohm^{-1}cm^{2}eq^{-1}$. Calculate the degree of dissociation of CH_3COOH if $\Lambda_{\infty CH_3COOH}$ is 390.71.

A. $3.66\ \%$

B. $3.9\ \%$

C. $2.12\ \%$

D. $0.008\ \%$

Answer: A

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21. The molar conducatance of Ba^{2+} and Cl^{-} are 127 and $76ohm^{-1}cm^{-1}mol^{-1}$ respectively at infinite dilution. The equivalent conductance of $BaCl_2$ at infinte dilution will be

A. $139.5\text{ohm}^{-1}\text{cm}^{2}\text{eq}^{-1}$

B. $203 \text{ohm}^{-1}\text{cm}^2\text{eq}^{-1}$

C. $279 \text{ohm}^{-1}\text{cm}^2\text{eq}^{-1}$

D. $101.5 \text{ohm}^{-1}\text{cm}^2\text{eq}^{-1}$

Answer: A

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22. The molar conductivity of $0.025 mol L^{-1}$ methanoic acid is $46.1 Scm^2 mol^{-1}$. Its degree of dissociation (α) and dissociation constant. Given $\lambda^\circ\left(H^+\right) = 349.6 Scm^{-1}$ and $\lambda^\circ\left(HCOO^-\right) = 54.6 Scm^2 mol^{-1}$.

A. 11.4%, $3.67 \times 10^{-4} \text{mol L}^{-1}$

B. 22.8%, $1.83 \times 10^{-4} \text{mol L}^{-1}$

C. 52.2%, $4.25 \times 10^{-4} \text{mol L}^{-1}$

D. 1.14%, $3.67 \times 10^{-6} \text{mol L}^{-1}$

Answer: A

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23. A weak monobasic acid is 5% dissociated in 0.01 mol dm^{-3} solution. The limiting molar conductivity at infinite dilution is $4.00 \times 10^{-2} ohm^{-1} m^2 mol^{-1}$. Calculate the conductivity of a 0.05 mol dm^{-3} solution of the acid.

A. $8.94 \times 10^{-6} \text{ohm}^{-1} cm^2 mol^{-1}$

B. $8.92 \times 10^{-4} \text{ohm}^{-1} cm^2 mol^{-1}$

C. $4.46 \times 10^{-6} \text{ohm}^{-1} cm^2 mol^{-1}$

D. $2.23 \times 10^{-5} \text{ohm}^{-1} cm^2 mol^{-1}$

Answer: B

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Electrolytic Cells And Electrolysis

1. In the electrolytic cell, flow of electrons is from:

A. from cathode to anode in the solution

B. from cathode to anode through external supply

C. from cathode to anode through internal supply

D. from anode to cathode through internal supply

Answer: C

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2. How long does it take to deposit 100 g of Al from an electrolytic cell containing Al_2O_3 using a current of 125 ampere ?

A. 1.54 h

B. 1.42 h

C. 1.32 h

D. 2.15 h

Answer: B

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3. The charge required for reducing 1 mole of MnO_4^- to Mn^{2+} is

A. 1.93×10^5 C

B. 2.895×10^5 C

C. 4.28×10^5 C

D. 4.825×10^5 C

Answer: D

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4. How much electricity in terms of Faraday is required to produce 100 g of Ca from molten $CaCl_2$?

A. 1 F

B. 2 F

C. 3 F

D. 5 F

Answer: D

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5. If a current of 1.5 ampere flows through a metallic wire for 3 hours, then how many electrons would flow through the wire?

A. 2.25×10^{22} electrons

B. 1.13×10^{23} electrons

C. 1.01×10^{23} electrons

D. 4.5×10^{23} electrons

Answer: C

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6. How many coulombs of electricity is required to reduce 1 mole of $Cr_2O_7^{2-}$ in acidic medium?

A. 4 x 96500 C

B. 6 x 96500 C

C. 2 x 96500 C

D. 1 x 96500 C

Answer: B

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7. An electric charge of 5 Faradays is passed through three electrolytes $AgNO_3$, $CuSO_4$ and $FeCl_3$ solution. The grams of each metal liberted at cathode will be

A. Ag = 10.8 g, Cu = 12.7g, Fe = 1.11g

B. Ag = 540 g, Cu = 367.5 g, Fe = 325 g

C. Ag=108 g , Cu=63.5 g , Fe=56 g

D. Ag=540 g , Cu=158.8 g , Fe = 93.3 g

Answer: D

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8. A current of 1.40 ampere is passed through 500 mL of 0.180 M solution of zinc sulphate for 200 seconds. What will be the molarity of Zn^{2+} ions after deposition of zinc?

A. 0.154 M

B. 0.177 M

C. 2 M

D. 0.180 M

Answer: B

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9. How much time is required to deposit 1×10^{-3} cm thick layer of silver (density is 1.05 g cm^{-3}) on a surface of area 100 cm^2 by passing a current of 5 A through $AgNO_3$ solution?

A. 125 s

B. 115 s

C. 18.7 s

D. 27.25 s

Answer: C

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10. How much metal will be deposited when a current of 12 ampere with 75% efficiency is passed through the cell for 3 h? (Given: Z= 4×10^{-4})

A. 32.4 g

B. 38.8 g

C. 36.0 g

D. 22.4 g

Answer: B

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11. Same amount of electric current is passed through the solutions of $AgNO_3$ and HCI. If 1.08 g of silver is obtained from $AgNO_3$ solution. The amount of hydrogen liberted at STP will be

A. 1.008 g

B. 11.2 g

C. 0.01 g

D. 1.1 g

Answer: C

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12. When during electrolusis of a solution of $AgNO_3$, 9650 coulmbs of charge pass through the electroplationg bath, the mass of silver deposited on the cathode will be:

A. 108 g

B. 10.8 g

C. 1.08 g

D. 216 g

Answer: B

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13. The amount of chlorine evolved by passing 2 A of current in an aqueous solution of NaCI for 30 minutes is

A. 2.64 g

B. 1.32 g

C. 3.62 g

D. 4.22 g

Answer: B

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14. How many moles of Pt may be deposited on the cathode when 0.80F of electricity is passed through 1.0M solution of Pt^{4+}?

A. 0.1 mol

B. 0.2 mol

C. 0.4 mol

D. 0.6 mol

Answer: B

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15. An electric current is passed through silver nitrate solution using silver electrodes. 15.28 g of silver was found to be deposited on catode. What will be the weight of copper deposited on cathode if same amount of electricity is passed through copper sulphate solution using copper electrodes?

A. 4.49 g

B. 6.4 g

C. 12.8 g

D. 3.2 g

Answer: A

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16. If 54 g of silver is deposited during an electrolysis reaction, how much aluminium will be deposited by the same amount of electric current?

A. (a) 2.7 g

B. (b) 4.5 g

C. (c) 27 g

D. (d) 5.4 g

Answer: B

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17. Standard electrode potentials of few half-cell reactions are given below :

$$MnO_4^- + 8H^+ + 5e^- \rightarrow Mn^{2+} + 4H_2O \qquad E^\circ = 1.51V$$

$$Cr_2O_7^{2-} + 14H^+ + 6e^- \rightarrow 2Cr^{3+} + 7H_2O \qquad E^\circ = 1.33V$$

$$Fe^{3+} + e^- \rightarrow Fe^{2+} \qquad E^\circ = 0.77V$$

$$Cl_2 + 2e^- \rightarrow 2Cl^- \qquad E^\circ = 1.36$$

Based on the above information match the column I with column II and mark the appropriate choice.

	Column I		Column II
(A)	1 mol of MnO_4^- to Mn^{2+}	(i)	579000 C
(B)	1 mol of $Cr_2O_7^{2-}$ to $2Cr^{3+}$	(ii)	193000 C
(C)	1 mol of Fe^{3+} to Fe^{2+}	(iii)	482500 C
(D)	1 mol of Cl_2 to $2Cl^-$	(iv)	96500 C

A. A-(i),B-(ii),C-(iii),D-(iv)

B. A-(ii),B-(iii),C-(i),D-(iv)

C. A-(iii),B-(i),C-(iv),D-(ii)

D. A-(iv),B-(ii),C-(iii),D-(i)

Answer: C

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18. An acidic solution of Cu^{2+} ions containing 0.4 g of Cu^{2+} ions is electrolysed until all the copper is deposited. Calculate the volume of oxygen evolved at N.T.P.

A. 141 cc

B. 31.75 cc

C. 64 cc

D. 32 cc

Answer: A

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19. Choose the option with correct words to fill in the blanks.

According to preferential discharge theory, out of number of ions the one which requires ___ energy will be liberted ___ at a given electrode.

A. least, first

B. least, last

C. highest, first

D. highest, last

Answer: A

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20. Which of the following statement is true?

A. When an aqueous solution of NaCI is electrolysed, sodium metal is deposited at cathode.

B. There is no difference between specific conductivity and molar conductivity.

C. Silver nitrate solution can be stored in a copper container.

D. The addition of liquid bromine acid, the following process is possible at anode.

Answer: D

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21. During the electrolysis of dilute sulphuric acid, the following process is possible at anode.

A. $2H_2O_{(l)} \rightarrow O_{2(g)} + 4H^+_{(aq)} + 4e^-$

B. $2SO^{2-}_{4(aq)} \rightarrow S_2O_{8(aq)} + 2e^-$

C. $H_2O_{(l)} \rightarrow H^+_{(aq)} + OH^-_{(aq)}$

D. $H_2O_{(l)} + e^- \rightarrow \frac{1}{2}H_{2(g)} + OH^-_{(aq)}$

Answer: A

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22. In electrolysis of dilute H_2SO_4 what is liberated at anode?

A. H_2

B. SO_4^{2-}

C. SO_2

D. O_2

Answer: D

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23. When an aqueous solution of $AgNO_3$ is electroysed between platinum electrodes, the substances liberted at anode and cathode are

A. silver is deposited at cathode and O_2 is liberated at anode

B. silver is deposited at cathode and H_2 is liberated at anode

C. hydrogen is liberted at cathode and O_2 is liberated at anode.

D. silver is deposited at cathode and Pt is dissolved in electrolyte.

Answer: A

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24. Electrolysis of an aqueous solution of $AgNO_3$ with silver electrodes produce __(i)___ at cathode while ___(ii)___ ions are dissolved from anode. When Pt electrodes are used ___(iii)___ is produced at anode ___(iv)___ at cathode.

A. $\begin{matrix}(\mathrm{i}) & (\mathrm{ii}) & (\mathrm{iii}) & (\mathrm{iv}) \\ H_2 & NO_3^- & OH^- & H_2\end{matrix}$

B. $\begin{matrix}(\mathrm{i}) & (\mathrm{ii}) & (\mathrm{iii}) & (\mathrm{iv}) \\ Ag & H^+ & O_2 & H_2\end{matrix}$

C. $\begin{matrix}(\mathrm{i}) & (\mathrm{ii}) & (\mathrm{iii}) & (\mathrm{iv}) \\ Ag & H^+ & O_2 & Ag\end{matrix}$

D. $\begin{matrix}(\mathrm{i}) & (\mathrm{ii}) & (\mathrm{iii}) & (\mathrm{iv}) \\ \mathrm{Ag} & \mathrm{H}^+ & \mathrm{Ag}^+ & \mathrm{O}_2\end{matrix}$

Answer: C

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Batteries

1. When a lead storage battery is discharged

A. lead sulphate is consumed

B. oxygen gas is evolved.

C. lead sulphate is formed

D. lead sulphide is formed.

Answer: C

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2. The reaction which is taking place in nickel cadmium battery can be represented by which of the following equations?

A. $Cd + NiO_2 + 2H_2O \rightarrow Cd(OH)_2 + Ni(OH)_2$

B. $Cd + NiO_2 + 2OH^- \rightarrow Ni + Cd(OH)_2$

C. $Ni + Cd(OH)_2 \rightarrow Cd \rightarrow Ni(OH)_2$

D. $Ni(OH)_2 + Cd(OH)_2 \rightarrow Ni + Cd + 2H_2O$

Answer: A

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Fuel Cells

1. The overall reactions of a hydrogen -oxygen fuel cell is

A. $2H_{2(g)} + O_{2(g)} \rightarrow 2H_2O_{(l)}$

B. $2H_{2(g)} + 4OH_{(aq)} \rightarrow 4H_2O_{(l)} + 4e^-$

C. $O_{2(g)} + 2H_2O_{(l)} + 4e^- \rightarrow 4OH^-_{(aq)}$

D. $4OH^-_{(aq)} + 4e^- \rightarrow 2H_2O_{(l)}$

Answer: A

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Corrosion

1. Which of the following reactions does not take place during rusting?

A. $H_2CO_3 \Leftrightarrow 2H^+ + CO_3^{2-}$

B. $4Fe^{2+} + O_{2\,(dry)} \rightarrow Fe_2O_3$

C. $4Fe^{2+} + O_2 + 4H_2O \rightarrow 2Fe_2O_3 + 8H^+$

D. $Fe_2O_3 + xH_2O \rightarrow Fe_2O_3.\,xH_2O$

Answer: B

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Higher Order Thinking Skills

1. Which of the following reactions canot be a base for electrochemical cell?

A. $H_2 + O_2 \rightarrow H_2O$

B. $AgNO_3 + Zn \rightarrow Zn(NO_3)_2 + Ag$

C. $AgNO_3 + NaCl \rightarrow AgCl \downarrow + NaNO_3$

D.

$$KMnO_4 + FeSO_4 + H_2SO_4 \rightarrow K_2SO_4 + Fe_2(SO_4)_3 + MnSO_4 +$$

Answer: D

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2. In a galvanic cell, the salt bridge

(i) does not participate chemically in the cell reaction

(ii) stops the diffusion of ions from one electrolytes to another

(ii) is necessary for the occurrence of the cell reaction

(iv) ensures mixing of the two elecrolytic solutions

A. (i) and (iii) only

B. (i) and (ii) only

C. (iii) and (iv) only

D. all of these.

Answer: B

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3. The position of some metals in the electrochemical series in decreasing electropositeve character is given as $Mg > Al > Zn > Cu > Ag$. What will happen if a copper spoon is used to stir a solution of aluminimum nitrate ?

A. The spoon will get coated will aluminium.

B. An alloy of copper and aluminium is formed.

C. The solution becomes blue.

D. There is no reaction.

Answer: D

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4. A gas X at 1 atm is bubbled through a solution containing a mixture of 1M Y^- and 1M Z^- at $25^\circ C$. If the reduction potential of $Z > Y > X$, then

A. Y will oxidise X and not Z

B. Y will oxidise Z and not X

C. Y will oxidise both X and Z.

D. Y will reduce both X and Z.

Answer: A

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5. For the cell prepared from electrodes A and B,

Electrode A $:Cr_2O_7^{2-}/Cr^{3+}, E^\circ_{\text{red}} = 1.33V$ and Electrode B:

$Fe^{3+}/Fe^{2+}, E^{\circ}_{red} = 0.77V$

Which of the following statements is correct?

A. The electrons will flow from B to A when connections are made.

B. The standard EMF of the cell will be 0.56 V.

C. A will be a positive electrode.

D. All of these.

Answer: D

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6. The formal potential of Fe^{3+}/Fe^{2+} in a sulphuric acid and phosphoric acid mixture $(E^{\circ} = +0.61V)$ is much lower than the standard potential (E° =+0.77 V). This is due to

(i) formation of the species $[FeHPO_4]^+$

(ii) lowering of potential upon complexation

(iii) formation of the species $[FeSO_4]^+$

(iv) high acidity of the medium.

A. (i) and (ii) only

B. (i), (ii) and (iv) only

C. (iii) only

D. all of these.

Answer: A

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7. Calculate the euilibrium constant for the reaction,

$2Fe^{3+} + 3I^{-} \Leftrightarrow 2Fe^{2+} + I_3^{-}$.

The standard reduction potential in acidic conditions are $0.77V$ and $0.54V$ respectivelu for Fe^{3+}/Fe^{2+} and I_3^{-}/I^{-} couples.

A. 4.25×10^7

B. 7.05×10^5

C. 6.25×10^5

D. 6.25×10^7

Answer: D

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8. The emf of a cell corresponding to the reaction

$Zn + 2H^+(aq) \rightarrow Zn^{2+}(0.1M) + H_2(g)1$ atm is 0.28 volt at $25^\circ C$.

Calculate the pH of the solution at the hydrogen electrode.

$E^\circ_{Zn^{2+}/Zn} = -0.76$ volt and $E^\circ_{H^+/H_2} = 0$

A. 7.05

B. 8.62

C. 8.75

D. 9.57

Answer: B

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9. How long will it take for a uniform current of 6.0 ampere to deposit 78.0 g gold from a solution of $AuCl_4^-$? What mass of chlorine gas will be formed simultaneously at the anode in the electrolytic cell ?

A. t = 3010 sec, w = 35.50 g

B. t = 20306 sec, w = 45.54 g

C. t = 19500 sec, w = 54.5 g

D. t = 19139 sec, w = 42.24 g

Answer: D

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Ncert Exemplar

1. Which cell will measure standard electrode potential of copper electrode?

A. $Pt_{(s)}|H_2(g, 0.1\text{bar})|H^+(aq, 1M) \mid |Cu^{2+}(aq, 1M)|Cu$

B. $Pt_{(s)}|H_2(g, 1\text{bar})|H^+(aq, 1M) \mid |Cu^{2+}(aq, 2M)|Cu$

C. $Pt_{(s)}|H_2(g, 1\text{bar})|H^+(aq, 1M) \mid |Cu^{2+}(aq, 1M)|Cu$

D. $Pt_{(s)}|H_2(g, 1\text{bar})|H^+(aq, 0.1M) \mid |Cu^{2+}(aq, 1M)|Cu$

Answer: C

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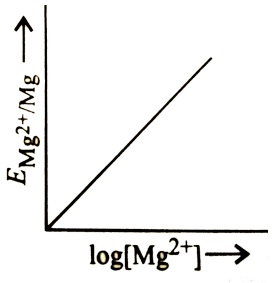
2. Electrode potential for Mg electrode varies according to the equation

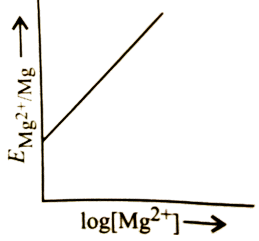
$$E_{Mg^{2+}|Mg} = E^{\ominus}_{Mg^{2+}|Mg} - \frac{0.059}{2}\log\frac{1}{[Mg^{2+}]}$$

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

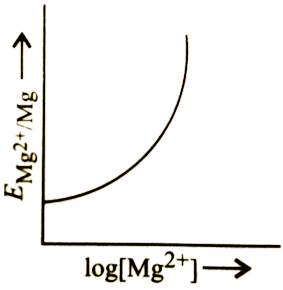
A.



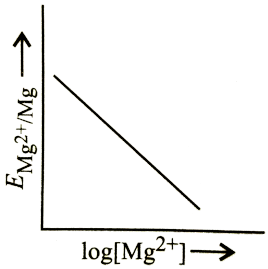
B.



C.



D.



Answer: B

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3. Which of the following statement is correct?

A. E_{cell} and $\Delta_r G$ of cell reaction both are extensive properties.

B. E_{cell} and $\Delta_r G$ of cell reaction both are intensive properties.

C. E_{cell} is an intensive property while $\Delta_r G$ of cell reaction is an extensive property.

D. E_{cell} is an intensive property while $\Delta_r G$ of cell reaction is an intensive property.

Answer: C

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4. The difference between the electrode potentials of two electrons when no current is drawn through the cell is called:

A. cell potential

B. cell emf

C. potential difference

D. cell voltage

Answer: B

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5. Which of the following statement is not correct about an inert electrode in a cell?

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 provide surface for redox reaction

Answer: D

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6. An electrochemical cell an behave like an electrolytic cell when

A. $E_{\text{cell}} = 0$

B. $E_{\text{cell}} > E_{\text{ext}}$

C. $E_{\text{ext}} > E_{\text{cell}}$

D. $E_{\text{cell}} = E_{\text{ext}}$

Answer: C

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7. Which of the statements about solution of electrolytes is not correct?

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 temperture.

Answer: C

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8. Using the data given below:

$E^{\circ}_{Cr_2O_7^{2-}|Cr^{3+}} = 1.33V\, E^{\circ}_{Cl_2|Cl^-} = 1.36V$

$E^{\circ}_{MnO_4^-|Mn^{2+}} = 1.51V\, E_{Cr^{3+}|Cr} = -0.74V$

Mark the strongest reducing agent.

A. Cl^-

B. Cr

C. Cr^{3+}

D. Mn^{2+}

Answer: B

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9. Using tha data given below is reducing potenial.

$E^{\circ}_{Cr_2O_7^{2-}/Cr^{3+}}$ =1.33 V , $E^{\circ}_{Cl_2/Cl^-}$ =1.36 V

$E^{\circ}_{MnO_4^-/Mn^{2+}}$ =1.51 V , $E^{\circ}_{Cr^{3+}/Cr}$ =- 0.74 V

find out which of the following is the strongest oxidising agent.

A. Cl^-

B. Mn^{2+}

C. MnO_4^-

D. Cr^{3+}

Answer: C

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10. Using the data given below:

$E^{\circ}_{Cr_2O_7^{2-}|Cr^{3+}} = 1.33V E^{\circ}_{Cl_2|Cl^-} = 1.36V$

$E^{\circ}_{MnO_4^-|Mn^{2+}} = 1.51V E_{Cr^{3+}|Cr} = -0.74V$

In which option the order of reducing power is correct?

A. $Cr^{3+} < Cl^- < Mn^{2+} < Cr$

B. $Mn^{2+} < Cl^- < Cr^{3+} < Cr$

C. $Cr^{3+} < Cl^- < Cr_2O_7^{2-} < MnO_4^-$

D. $Mn^{2+} < Cr^{3+} < Cl^- < Cr$

Answer: B

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11. Using the data given below:

$E^\circ_{Cr_2O_7^{2-}|Cr^{3+}} = 1.33V E^\circ_{Cl_2|Cl^-} = 1.36V$

$E^\circ_{MnO_4^-|Mn^{2+}} = 1.51V E_{Cr^{3+}|Cr} = -0.74V$

Find the most stable ion in its reduced forms

A. Cl^-

B. Cr^{3+}

C. Cr

D. Mn^{2+}

Answer: D

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12. Using the data given below:

$E^{\circ}_{Cr_2O_7^{2-}|Cr^{3+}} = 1.33V\, E^{\circ}_{Cl_2|Cl^-} = 1.36V$

$E^{\circ}_{MnO_4^-|Mn^{2+}} = 1.51V\, E_{Cr^{3+}|Cr} = -0.74V$

Find the most stable oxidised species.

A. Cr^{3+}

B. MnO_4^-

C. $Cr_2O_7^{2-}$

D. Mn^{2+}

Answer: A

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13. The quantity of charge required to obtain one mole of aluminium from Al_20_3 is

A. 1 F

B. 6 F

C. 3 F

D. 2 F

Answer: C

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14. The cell constant of a conductivity cell

A. change with change of electrolyte

B. changes with change of concentration of electrolyte

C. changes with temperture of electrolyte

D. remains constant for a cell

Answer: D

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15. While charging the lead storage battery:

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

Answer: A

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16. $\Lambda^{\circ}_{(m)\ (NH_4OH)}$ is equal to

A. $\Lambda^{\circ}_{m(NH_4OH)} + \Lambda^{\circ}_{m(NH_4Cl)} - \Lambda^{\circ}_{m(HCl)}$

B. $\Lambda^{\circ}_{m(NH_4Cl)} + \Lambda^{\circ}_{m(NaOH)} - \Lambda^{\circ}_{m(NaCl)}$

C. $\Lambda^{\circ}_{m(NH_4Cl)} + \Lambda^{\circ}_{m(NaCl)} - \Lambda^{\circ}_{m(NaOH)}$

D. $\Lambda^{\circ}_{m(NaOH)} + \Lambda^{\circ}_{m(NaCl)} - \Lambda^{\circ}_{m(NH_4Cl)}$

Answer: B

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17. In the electrolysis of aqueous sodium chloride solution which of the hall cell reaction will occur at anode?

A. $Na^{+}_{(aq)} + e^{-} \rightarrow Na_{(s)}$, E°_{cell}=-2.71 V

B. $2H_2O_{(l)} \rightarrow O_{2(g)} + 4H^{+}_{(aq)} + 4e^{-}$, E°_{cell}=1.23 V

C. $H^{+}_{(aq)} + e^{-} \rightarrow \frac{1}{2}H_{2(g)}$, E°_{cell} =0.00 V

D. $Cl^{-}_{(aq)} \rightarrow \frac{1}{2}Cl_{2(g)} + e^{-}$, E°_{cell} =1.36 V

Answer: D

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Assertion And Reason

1. Assertion:Electrolytic cell uses electrical energy to carry non-spontaneous chemical reactions.

Reason : Chemical energy of a spontaneous redox reaction can be converted into electrical energy.

A. If both assertion and reason are true and reason is the correct explanation of assertion .

B. If both assertion and reason are true but reason is not the correct explanation of assertion .

C. If assertion is true but reason is false .

D. If both assertion and reason are false .

Answer: B

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2. Assertion :EMF of the cell is the potential difference between the electrode potentials of the cathode and anode when no current is drawn through the cell.

Reason: Anode is kept on the right side and cathode on the left side while representing the galvanic cell.

A. If both assertion and reason are true and reason is the correct explanation of assertion .

B. If both assertion and reason are true but reason is not the correct explanation of assertion .

C. If assertion is true but reason is false .

D. If both assertion and reason are false .

Answer: C

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3. Assertion:A standard hydrogen electrode is also called reversible electrode.

Reason : Standard hydrogen electrode can act both as anode as well as cathode in an electrochemical cell.

A. If both assertion and reason are true and reason is the correct explanation of assertion .

B. If both assertion and reason are true but reason is not the correct explanation of assertion .

C. If assertion is true but reason is false .

D. If both assertion and reason are false .

Answer: A

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4. Assertion:Cu^{2+} ions get reduced more easily than H^{+} ions.

Reason: Standard electrode potential of copper is 0.34 V.

A. If both assertion and reason are true and reason is the correct explanation of assertion .

B. If both assertion and reason are true but reason is not the correct explanation of assertion .

C. If assertion is true but reason is false .

D. If both assertion and reason are false .

Answer: A

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5. Assertion:Lithium has the lowest electrode potential.

Reason: Lithium ion is the strongest oxidising agent.

A. If both assertion and reason are true and reason is the correct explanation of assertion .

B. If both assertion and reason are true but reason is not the correct explanation of assertion .

C. If assertion is true but reason is false .

D. If both assertion and reason are false .

Answer: C

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6. Assertion : Current stops flowing when $E_{cell} = 0$.

Reason : Equilibrium of the cell reaction is attained.

A. If both assertion and reason are true and reason is the correct explanation of assertion .

B. If both assertion and reason are true but reason is not the correct explanation of assertion .

C. If assertion is true but reason is false .

D. If both assertion and reason are false .

Answer: A

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7. Assertion : To obtain maximum work from a galvanic cell charge has to be passed reversibly.

Reason: The reversible work done by a galvanic cell is equal to decrease in its Gibbs energy.

A. If both assertion and reason are true and reason is the correct explanation of assertion .

B. If both assertion and reason are true but reason is not the correct explanation of assertion .

C. If assertion is true but reason is false .

D. If both assertion and reason are false .

Answer: A

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8. Assertion:The electrical resistance of any object decrease with increase in its length.

Reason: Electrical resistance of any object increases with increase in its area of cross-section.

A. If both assertion and reason are true and reason is the correct explanation of assertion .

B. If both assertion and reason are true but reason is not the correct explanation of assertion .

C. If assertion is true but reason is false .

D. If both assertion and reason are false .

Answer: D

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9. Assertion: The conductivity of electrolytic soutions increase with increase of temperture.

Reason: Electronic conductance decrease with increase of temperture.

A. If both assertion and reason are true and reason is the correct explanation of assertion .

B. If both assertion and reason are true but reason is not the correct explanation of assertion .

C. If assertion is true but reason is false .

D. If both assertion and reason are false .

Answer: B

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10. Assertion:Molar conductivity increases with decrease in concentration.

Reason:Conductivity always decrease with decrease in concentration.

A. If both assertion and reason are true and reason is the correct explanation of assertion .

B. If both assertion and reason are true but reason is not the correct explanation of assertion .

C. If assertion is true but reason is false .

D. If both assertion and reason are false .

Answer: B

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11. Assertion:Kohlrausch law helps to find the molar conductivity of weak electrolyte at infinite dilution.

Reason:Molar conductivity of a weak electrolyte at infinite dilution cannot be determined experimentally.

A. If both assertion and reason are true and reason is the correct explanation of assertion .

B. If both assertion and reason are true but reason is not the correct explanation of assertion .

C. If assertion is true but reason is false .

D. If both assertion and reason are false .

Answer: A

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12. Assertion:When a copper wire is dipped in silver nitrate solution, there is no change in the colour of the solution.

Reason : Copper cannot displace silver from its salt solution.

A. If both assertion and reason are true and reason is the correct explanation of assertion .

B. If both assertion and reason are true but reason is not the correct explanation of assertion .

C. If assertion is true but reason is false .

D. If both assertion and reason are false .

Answer: D

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13. Assertion : In electrolysis, the quantity of electricity needed for depositing 1 mole silver is different from that required for 1 mole of copper.

Reason : The molecular weights of silver and copper are different.

A. If both assertion and reason are true and reason is the correct explanation of assertion .

B. If both assertion and reason are true but reason is not the correct explanation of assertion .

C. If assertion is true but reason is false .

D. If both assertion and reason are false .

Answer: B

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14. Assertion:In electrolysis of aqueous NaCl the product obtained is H_2 gas.

Reason:Gases are liberted faster than the metals.

A. If both assertion and reason are true and reason is the correct explanation of assertion .

B. If both assertion and reason are true but reason is not the correct explanation of assertion .

C. If assertion is true but reason is false .

D. If both assertion and reason are false .

Answer: C

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15. Assertion:In mercury cell, the cell potential is approximately 1.35 V Which cell will measure standard electrode and remains constant during its life.

Reason : The overall reaction in mercury cell is represented as $Zn(Hg) + HgO_{(s)} \rightarrow ZnO_{(s)} + Hg_{(l)}$

A. If both assertion and reason are true and reason is the correct explanation of assertion .

B. If both assertion and reason are true but reason is not the correct explanation of assertion .

C. If assertion is true but reason is false .

D. If both assertion and reason are false .

Answer: A

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