CHEMISTRY

BOOKS - BRILLIANT PUBLICATION

ELECTROCHEMISTRY

Question

1. What is the weight of nickel deposited on an iron article of 20cm2 by passing a current of 5 A for 500 seconds?

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2. How many litres of chlorine at STP will be evolved by 10 ampere current flowing for 3 hours through molten NaCl?

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3. Calculate the time required to coat a metal surface of 50 cm2 with $0.01mm$ thick layer of chromium (density = 7.19 g cm-3) by the passage of 5 A current.

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4. The same quantity of electricity is passed through solutions of silver nitrate and cupric sulphate connected in series. If the weight of silver deposited is 0.54 g, calculate the weight of copper deposited. (Equivalent mass of Ag = 108, equivalent mass of Cu = 31.75)

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5. A current of 5 A is passed through 3.1 litres of a solution of $CuSO_4$ for 10 minutes. What is the pH of the solution?

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6. Calculate the electrode potential of copper electrode in a 0.1 M copper sulphate solution at 25° C.

$\left(E^\circ\left(Cu^{2+} \mid Cu\right) = 0.34V\right)$.

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7. The measured EMF at 298 K for the cell reaction, $Zn(s) + Cu^{2+}(1.0M) \rightarrow Cu(s) + Zn^{2+}(0.1M)$ is 1.13 V. Calculate E° for the cell reaction.

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8. Calculate the e.m.f of the following concentration cell at 298K, $Zn(s)\left|Zn^{2+}(0.1)\right|\left|Zn^{2+}(1.0)\right|Zn(s)$

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9. For the cell reaction, $A(s) + 2B^{-}(aq) \rightarrow A^{2+}(aq) + 2B(s)$, the value of Kc is 3.98×10^{15} .Calculate E°_{cell} at 298 K.

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10. The resistance of a 0.5 N solution of salt is 20 Ω .Calculate the equivalent conductance of the solution if the platinum electrodes are 1.5 cm apart and each having an area of $3.0cm^2$.

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11. Which of the following have maximum molar conductivity.

(i) 0.1 M solution and its specific conductivity is $2 \times 10^{-2}\Omega^{-1}cm^{-1}$

(ii) 0.1M solution and its resistivity is 50 Ω cm.

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12. The eqv Ivalent conductivity of H_2SO_4 at infinite dilution is 384 $\Omega^{-1}cm^2eq^{-1}$. If 49 g H_2SO_4 per litre is present in solution and specific resistance is 18.4 Ω calculate the degree of dissociation.

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13. Calculate the molar conductivity at infinite dilution for $MgS0_4$ from the following data: $Mg^{2+} = 106Scm^2mol^1$, $SO_4^{2-} = 160Scm^2mol^{-1}$

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14. The specific conductivity of 0.1 M solution of a weak acid at 298 K is 0.00159 $ohm^{-1}cm^{-1}$. Calculate the degree of dissociation of the acid if its molar conductance at infinite dilution is 350.5 $\text{ohm}^{-1}cm^2mol^{-1}$.

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15. The specific conductivity of the saturated aqueous solution of AgCl is $1.82 \times 10^{-6} ohm^{-1} cm^{-1}$ at 298K. Calculate me solubility of AgCl. $\left[\wedge_m^{\circ} \left(Ag^{+} \right) = 61.83 ohm^{-1} cm^2 mol^{-1} \right]$ and $\wedge_m^{\circ} (CI)^{-} = 76.41 ohm^{-1} cm^2 mol^{-1}$

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Level I

1. The calomel electrode and Quinhydrone electrode are reversible with respect to which ions respectively:

A. CI^{-}, H^{+}

B. H^{+}, CI^{-}

C. $Hg_2^{2+} OH^{-}$

D. Hg_2^{2+}, OH^{+}

Answer: A

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2. A standard hydrogen electrode has zero electrode potential because

A. hydrogen is easiest to oxidise

B. this electrode potential is assumed to be zero

C. hydrogen atom has only one electron

D. hydrogen is the lightest element

Answer: B

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3. The electric charge for electrode deposition of one gram equivalent of any substance is:

A. one ampere for one hour

B. 96.500 colombs per second

C. one ampere for one hour

D. charge on one mole of electrons

Answer: D

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4. KNO_3 is used to make salt bridge because:

A. velocity of k^+ and NO_3^-

B. velocity of NO_3^- is greater than that ofk k^+

C. velocity of both k^+ and NO_3^- are nearly the same

D. KNO_3 is highly soluble in water

Answer: C

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5. In a galvanic cell, the salt bridge:

A. does not participate chemically in the cell reaction

B. stops the diffusion of ions from one electrode to antoher

C. is necessary for the occurrence of the cell reaction

D. ensures mixing of the two electrolytic solution

Answer: A

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6. Plot the graph showing variation of of resistance with increase in cell constant

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7. Which factor is responsible for decrease in electrolytic conduction?

A. Dilution

B. Increase in temperature

C. Interionic attraction in higher concentriation range

D. None of the above

Answer: C

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8. $2Ag^+(aq) + Cu(s) \rightarrow Cu^{2+}(aq) + 2Ag(s)$

The standard potential for this reaction is 0.46 V. Which change will increase the standard potential the most

A. Doiubling the $\left[Ag^+\right]$

B. Doubling the size of the Cu(s) electrode

C. Halving the $\left[Cu^{2+}\right]$

D. `Standart potential is considered only for 1M solution

Answer: D

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9. A cell in which reactants are not contained within the cell but are continuously supplied from external source?

A. Lithium battery

B. fuel cell

C. dry cell

D. lead storage battery

Answer: B

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10. The metal that cannot be obtained by electrolysis of the aqueous solution of its salts is:

A. Ag

B. Cr

C. Cu

D. Al

Answer: D

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11. The correct order of chemical reactivity with water according to electrochemical series is

A. $K < Mg > Zn > Cu$

B. $Mg > Zn > Cu > K$

C. $K > Zn > Mg > Cu$

D. $Cu > Zn > Mg > K$

Answer: A

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12. A substance that will reduce Ag to Ag but will not reduce Ni^{2+} to Ni is : $\left(E^0_{Ag^+/Ag}\right) = 0.80V, E^0_{Ni^{2+}/Ni}$

A. Zn

B. Pb

C. Mg

D. Al

Answer: B

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13. Lithium is generally used as an electrode in high energy density batteries. This is because:

A. Lithium is the lightest element

B. Lithium has quite negative reduction potential

C. Lithium is quite reactive

D. Li th i um does not corrode easily

Answer: B

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14. In electrolysis of a fused salt, the weight of the deposit on an electrode will not depend on

A. Temperature of the bath

B. Current intensity

C. Electrochemical equivalent of ions

D. Time for electrolysis

Answer: A

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15. Conductivity of a strong electrolyte

A. Increases on addition

B. Does not change considerably on dilution

C. Decreases on dilution

D. Depends on density

Answer: B

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16. Based on the following information, arrange four metals A, B, C and D in the order of decreasing ability to act as reducing agents:

(I) only A,B and C react with 1 M HCI to give $H_2(g)$

(II) When C is addd to solution of the other metal ions, metallic B and D are formed

(III) Metal C does not reduce A^{n+} $C > A > B > D, C > A > D > B,$

$A > C > D > B, A > C > B > D$

A. $C > A > B > D$

B. $C > A > D > B$

C. $A > C > D > B$

D. $A > C > B > D$

Answer: A

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17. The E at 25° C for the following reaction is 0.22 V. The equilibrium constant at 25° C is very $H_2(g) + 2AgCl(s) \rightarrow -2Ag(s) + 2HCl(aq)$

A. 2.8×10^7

B. 5.2×10^8

C. 5.2×10^6

D. 5.2×10^3

Answer: C

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18. Using the following E° values for electrode potentials, calculate $\triangle G^\circ$ in kJ for the indicated reaction:

$5Ce^{4+}(aq) + Mn^{2+}(aq) + 4H_2O(l) \rightarrow 5Ce^{3+}(aq) + MnO_4^-(aq) + 8H^+$

$MnO_4^-(aq) + 8H^+(aq) + 5e^- \rightarrow Mn^{2+}(aq) + 4H_2O(l), E^\circ = +1.51V$

$Ce^{4+}(aq) + e^- \rightarrow Ce^{3+}(aq), E^\circ = +1.61V$

A. -9.65

B. -24.3

C. -48.25

D. -35.2

Answer: B

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19. When $I_2, (s) \mid I^-$ (0.IM) half cell is connected to a $H^+(aq) \mid H_2$, (1 bar) Pt half cell, e.m.f.is found to be $0.7714V$. $If E^\circ_{I_2} = 0.535$ V, find the pH of $H^+ \mid H_2$ half-cell.

A. 1

B. 3

C. 5

D. 7

Answer: B

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20. The standard free energy change for the following reaction is-210 kJ. What is the standard cell potential? $2H_2O_2$ (aq) $\rightarrow\rightarrow$ $2H_2O$ (1) + O_2 (8)

A. $+0.752$

B. $+1.09$

C. $+0.420$

D. $+6.40$

Answer: A

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21. Resistance of 0.1 MKCI solution in a conductivity cell is 300 ohm and conductivity is 0.013 S cm^{-1} . The value of cell constant is:

A. 3.9 cm^{-1}

B. 39 m^{-1}

C. 03.9 m^{-1}

D. 39 cm^{-1}

Answer: C

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22. Which of the following statements is correct?

A. Cathode is negative terminal both in galvanic and electrolytic cells

B. Anode is positive terminal both in galvanic and electrolytic cells

C. Cathode is negative terminal in an electrolytic cell whereas anode is negative terminal in a galvanic cell

D. Anode is negative terminal in an electrolytic cell whereas cathode is positive terminal in a galvanic cell

Answer: B

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23. Two half cells have potentials-0.76 Vand-0.13 V respectively. A galvanic cell is made from these two half cells. Which of the following statements is correct?

A. Electrode of half-cell potential -0.76 V serves as cathode

B. Electrode of half-cell potential -0.76 V serves as anode

C. Electrode of half-cell potential -0.13 V serves as anode

D. Electrode of half-cell potential -0.76 V serves as positive electrode and -0.13 V as negative electrode

Answer: B

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24. Given that E values of $Ag^+|Ag, K^+|K, Mg^{2+}|Mg$ and $Cr^{3+}|Cr$ áre 0.80 V,-2.93 V,-2.37 V, and -0.74 V, respectively. Which of the following orders regarding the reducing power of metals is correct?

A. $Ag > Cr > Mg > K$

B. $Ag < Cr < Mg < K$

C. $Ag > Cr > K > Mg$

D. $Cr > Ag > Mg > K$

Answer: B

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25. Given:

$E^{\circ}\left(Sn^{2+}Sn^{4+} \mid Pt\right) = -0.15V, E^{\circ}\left(Hg_2^{2+}\middle|Hg^{2+}\right) = -0.92V$ and E°

Based on this data, which of the following statements is correct?

A. Sn^{4+} is a stronger oxidizing agent than Pb^{4+}

B. Sn^{2+} is a stronger reducing agent than Hg_2^{2+}

C. Hg^{2+} is a stronger oxidizing agent than Pb^{4+}

D. Pb^{2+} is a stronger reducing agent than Sn^{2+}

Answer: B

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26. The pressure of H_2 required to make the potential of the hydrogen electrode in water equal to zero at 298 K is

A. 10^{-7} atm

B. 10^{-14} atm

C. 10^{-5} atm

D. 10^{-10} atm

Answer: C

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27. When a lead storage battery is charged:

A. PbO_2 dissolves

B. the lead electrode becomes coated with lead sulphate

C. sulphuric acid is degenerated

D. the amount of acid decreases

Answer: B

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28. An example of a simple fuel cell is:

A. lead storage battery

B. $H_2 - O_2$ cell

C. Daniel cell

D. Lechlanche cell

Answer: B

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29. The equilibrium constant of acetic acid in an aqueous solution of concentration c is given by

A. $K = \frac{c \wedge_c^2}{\wedge^\infty + \wedge_c}$

B. $K = \frac{c \wedge_c^2}{\wedge^\infty (\wedge^\infty - \wedge_c)}$

C. $K = \frac{c \wedge_c^2}{\wedge^\infty + \wedge_c}$

D. $K = \frac{c \wedge_c^2}{\wedge^\infty (\wedge^\infty + \wedge_c)}$

Answer: C

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30. For a dilute solution of a strong electrolyte, which of the following facts is correct?

A. The graph between $\wedge_m$ and c is linear

B. The graph between log $\wedge_m$ and c is linear

C. The graph between $\wedge_m$ and $\sqrt{c}$ is linear

D. The graph between log $\wedge_m$ and log c is linear

Answer: D

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31. 1 L of 1 $MCuSO_4$ solution is electrolysed. After passing 2 F of electricity, molarity of $CuSO_4$ solution will be

A. M/2

B. M/4

C. M

D. zero

Answer: B

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32. If equivalent conductance of $1M$ benzoic acid is $12.8\Omega^{-1}\text{-}cm^2$ and if the conductance of benzoate ion and $H^{\cdot}$ ion are 42 and $288.42\Omega^{-1}\text{-}cm^2$ respectively, its degree of dissociation is

A. 0.39

B. 0.039

C. 0.0035

D. 0.0035

Answer: B

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33. E° for the electrochemical cell $Zn(s)\left|Zn^{2+}1M(aq)\right|\left|Cu^{2+}1M(aq)\right|Cu(s)$ is 1.10 V at 25°C. The equilibrium constant for the cell reaction, $Zn(s)+Cu^{2+}(aq.)\rightarrow Zn^{2+}(aq.)+Cu(s)$ will be:

A. 1.68×10^{-37}

B. 1.68×10^{37}

C. 1.68×10^{-39}

D. 1.68×10^{39}

Answer: D

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34. The reduction potential of hydrogen electrode will be negative if :

A. $pH_2 = 2atm$ and $\left[H^+\right] = 2.0M$

B. $pH_2 = 1atm$ and $\left[H^+\right] = 2.0M$

C. $pH_2 = 1atm$ and $\left[H^+\right] = 1.0M$

D. $pH_2 = 2atm$ and $\left[H^+\right] = 1.0M$

Answer: B

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35. Electrolysis of dilute aqueous NaCl solution was carried out by passing 10 milli ampere current. The time required to liberate 0.01 mole of H_2 gas at the cathode is:

A. 9.65×10^4 sec

B. 19.3×10^4 sec

C. 28.95×10^4 sec

D. 38.6×10^4 sec

Answer: A

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Level Ii

1. Equivalent conductivity of 1MCH_3COOH is $10\Omega^{-1}cm^2eq^{-1}$ and at infinite dilution $200\Omega^{-1}cm^2eq^{-1}$. Hence, percentage ionisation of CH_3 COOH is

A. 0.05

B. 0.02

C. 0.04

D. 0.01

Answer: D

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2. 1 L of 1 $MCuSO_4$ solution is electrolysed. After passing 2 F of electricity, molarity of $CuSO_4$ solution will be

A. $\frac{M}{2}$

B. $\frac{M}{4}$

C. M

D. 0

Answer: B

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3. The resistance of 0.1 N solution of salt is found to be $2.5 \times 10^3 \Omega$. The equivalent conductance of solution (cell constant = 1.15 cm^{-1}) in $\Omega^{-1} cm^2 eq^{-1}$ is

A. 3.8

B. 4.6

C. 6.4

D. 7.6

Answer: D

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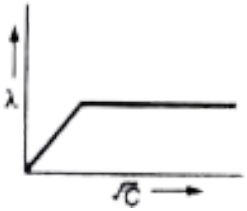
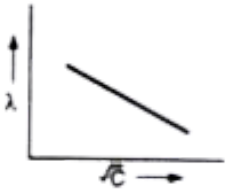
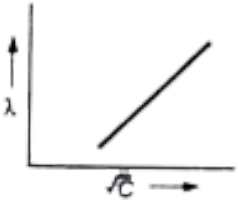
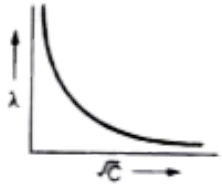
4. The variation of equivalent conductance of weak electrolyte with concentration is correctly shown in figure:

A. 

B. 

C. 

D. 

Answer: A

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5. A solution of sodium sulphate in water is electrolyzed using inert electrodes. The products at thee catahode and anode are respectively

A. H_2, O_2

B. O_2, H_2

C. O_2,Na

D. O_2, SO_2

Answer: A

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6. Which of the following condition will increase the voltage of the cell, represented by the equation?

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

A. Increase in the concentration of Ag^+ ion

B. Increase in the concentration of Cu^+ ion

C. Increase in the dimension of silver electrode

D. Increase in the dimension of copper electrode

Answer: B

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7. What is wrongly stated about electrochemical series?

A. It is the representation of elements in order of increasing or decreasing standard electrode reduction potential

B. It does not compare the relative reactivity of metals

C. It compares relative strength of oxidising agents

D. H is centrally placed element

Answer: A

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8. Which of the following statements is true for the Daniel cell?

A. Electron flow from copper electrode to zinc electrode

B. Current flows from zinc electrode to copper electrode

C. Cations move toward copper electrode which is cathode

D. Cations move toward zinc electrode

Answer: D

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9. Which of the following does not evolve oxygen at anode when electrolysis is carried out of

A. dilute H_2SO_4 with Pt electrodes

B. fused sodium hydroxide with Pt electrodes

C. acidic water with Pt electrodes

D. dilute sulphuric acid using Cu electrodes

Answer: C

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10. A current of 4 A is passed through a solution of silver nitrate to coat a metal surface of 80 cm^2 with 0.005 mm thick layers of silver. If the density of silver (molar mass: 108 g mol^{-1})is 10.8 g cm^{-3} , the time for which the current is passed is about

A. 84.5 s

B. 90.5 s

C. 96.5 s

D. 100.5 s

Answer: C

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11. In the electrolysis of copper (II) chloride solution, the mass of cathode increased by 3.15 g At copper anode, we will have

A. the liberation of 1120 mL of Cl_2 at STP

B. the liberation of 560 mL of O_2 at STP

C. the loss of 3.15g of Cu

D. the gain of 3.15 g of Cu

Answer: A

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12. Which of the following expressions is correct?

A.

$$\wedge_m^\infty (NH_4OH) = \wedge_m^\infty (NH_4Cl) + \wedge_m^\infty (NaOH) - \wedge_m^\infty (NaCl)$$

B.

$$\wedge_m^\infty (NH_4OH) = \wedge_m^\infty (NH_4Cl) - \wedge_m^\infty (NaOH) + \wedge_m^\infty (NaCl)$$

C.

$$\wedge_m^\infty (NH_4OH) = \wedge_m^\infty (NH_4Cl) - \wedge_m^\infty (NaOH) - \wedge_m^\infty (NaCl)$$

D.

$$\wedge_m^\infty (NH_4OH) = \wedge_m^\infty (NH_4Cl) + \wedge_m^\infty (NaOH) + \wedge_m^\infty (NaCl)$$

Answer: B

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13. A conductivity cell whose cell constant is 3.0 cm^{-1} is filled with 0.1 M solution of a weak acid. Its resistance is found to be 3000 Ω. If $\wedge_m^\infty = 400\Omega^{-1}cm^2mol^{-1}$, the degree of dissociation of the weak acid is about

A. 0.015

B. 0.025

C. 0.035

D. 0.055

Answer: C

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14. The conductivity of a saturated solution of a sparingly soluble salt, MX, is found to be $4.0 \times 10^{-5} Ohm^{-1} cm^{-1}$ If $\lambda_m^{\infty}\left(\frac{1}{2}M^{2+}\right) = 50.0\Omega^{-1} cm^2 mol^{-1}$ and $\lambda_m^{2+}\left(X^- = 50\Omega^{-1} cm^2 mol^{-1}\right)$ the solubility product of the salt is about

A. 2×10^{-10}

B. 2×10^{-12}

C. 32×10^{-12}

D. 16×10^{-8}

Answer: B

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15. Which of the following statements regarding the movement of ions in a cell is/are correct? (1) Cations move towards cathode and anions towards anode in both galvanic and electroytic cells. (2) Cations move towards cathode and anions towards anode in an electroytic cell and the reverse is true for a galavanic cell (3) Cations move towards cathode and anions towards anode in a galvanic cell and the reverse-is true for an electrolytic cell (4) Cations move towards anode and anions towards cathode in a galvanic cell and the reverse is true 'for an electrolytic cell

A. Cations move towards cathode and anions towards anode in both galvanic and electroytic cells.

B. Cations move towards^cajhode'and anions towards anode in an electroytic cell and the reverse is true for a galavanic cell

C. Cations move towards cathode and anions towards anode in a galvanic celland the reverse-is true for an electrolytic cell

D. Cations'move towards anode and anions towards cathode in a galvanic cell and the reverse is true 'for an electrolytic cell

Answer: A

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16. Efficiency of a fuel cell is 80% and the standard heat of reaction is -300 kJ. The reaction involves two electrons in redox change. The E° for the cell is:

A. 1.24 V

B. 2.48 V

C. 0 V

D. 0.62 V

Answer: B

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17. A current of 965 ampere is passed for 1 sec through 1 litre solution of 0.02 N $NiSO_4$ using Ni electrodes. What is the new concentration of $NiSO_4$?

A. 0.01 N

B. 0.01M

C. 0.002 M

D. 0.02M

Answer: B

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18. Given that K_{sp} of CuS= 10^{-35} and $E^{\circ}_{Cu2+/Cu} = 0.34V$ The standard oxidation potential of $Cu|Cus|S^{2-}$ half cell is .....

A. 1.0V

B. 0.693 V

C. -0.690 V

D. -1.0V

Answer: A

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19. Cost of electricity for the production of xL H_2 at NTP at cathode is x, then cost of production of x L O_2 at NTP at anode will be: (assume 1 mole of electrons as one unit of electricity)

A. 2x

B. 4x

C. 16x

D. 32x

Answer: C

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20. The equilibrium constant of the following redox reaction at 298 K is $1 \times 10^8 2Fe^{3+}(aq.) + 2I^-(aq.) \rightarrow 2Fe^{2+}(aq) + I_2(s)$ If the standard reduction potential of iodine becoming iodide is +0.54 V. What is the standard reduction potential of $\frac{Fe^{3+}}{Fe^{2+}}$?

A. + 1.006 V

B. -1.006 V

C. +0.77 V

D. -0.77 V

Answer: B

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21. At $25^\circ C$ the molar conductances at infinite dillution for the strong electrolytes NaOh, NaCl and $BaCl_2$ are $248 \times 10^{-4}, 126 \times 10^{-4}$ and $280 \times 10^{-4} Sm^2 mol^{-1}$ respectively λ° of $Ba(OH)_2$ is $Sm^2 mol^{-1}$ is

A. 52.4×10^{-4}

B. 524×10^{-4}

C. 402×10^{-4}

D. 262×10^{-4}

Answer: A

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22. Given: $E^{\circ}\left(Ag^{+}|Ag\right) = 0.80V$ and $E^{\circ}\left(I^{-} \mid AglAg\right) - 0.15V$. The value of standard solubility product Agl would be about

A. 8.4×10^{-17}

B. 8.9×10^{-15}

C. 8.9×10^{-13}

D. $8.9 \times 10E^{-11}$

Answer: B

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23. The ionic product of water at 298 K is $10^{-14}M^2$. The standard emf of the cell producing the reaction $H^+(aq) + OH^-(aq) \rightarrow H_2O(l)$ will be

A. $0.723V$

B. $-0.723V$

C. $0.82V$

D. $-0.82V$

Answer: D

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24. For the cell reaction, $Mg(s) + 2Ag^+(aq.) \rightarrow Mg^{2+}(aq) + 2Ag(s) E^\circ_{cell}$: +3.17 V at 298 K. The value of $E^\circ_{cell} \triangle G^\circ$ and at Ag^+ and Mg^{2+} concentrations of 0.001 M and 0.02 M respectively are:

A. $3.04V - 605.8kjmol^{-1}20000$

B. $3.04V - 611.8kjmol^{-1}20000$

C. $3.13V - 605.8kjmol^{-1}20000$

D. $3.04V - 611.8kjmol^{-1}20000$

Answer: B

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25. The half-cell reaction for the corrosion.

$2H^+ + \frac{1}{2}O_2 \to H_2Ol, E^\circ = 1.23V$

$Fe^{2+} + 2e^- \to Fe(s); E^\circ$ =-0.44V Find the $\triangle G^\circ$ (in kJ) for the overall reaction:

A. $-76KJ$

B. $-322kJ$

C. $-161kJ$

D. $-152kJ$

Answer: B

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26. Given $E_{\frac{Cr^{3+}}{Cr}} = -0.72V \, . E^{\circ}_{Fe^{2+}/Fe} = -0.42V$ The potential for the cell, $Cr \mid Cr^{3+}(0.1M) \mid \mid Fe^{2+}(0.01M) \mid Fe$ is:

A. -0.26 v

B. $0.26v$

C. $0.339v$

D. $-0.339v$

Answer: C

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27. A fuel cell involves combustion of butane at 1 atm and 298 K $C_4H_{10}(g)\frac{13}{2}O_2(8) \rightarrow 4CO_2(g) + 5H_20(l), \triangle G^{\circ}$ = -2746 kJ/mol. What

is E° of a cell?

A. $+4.74v$

B. $+0.54v$

C. $+109v$

D. $+4.37v$

Answer: C

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28. In the concentration cell,

$Pt(H_2)|HA(0.1M)||HA(IM)NaA(IM)||NaA(IM)|(H_2)Pt$, $(pK_a of HA$

The cell potential will be:

A. $0.03v$

B. $0.06v$

C. $-0.06v$

D. $-0.03v$

Answer: A

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29. At 298 K, the standard reduction potentials are 1.51 V for $MnO_4^-, Mn^{2+}, 1.36Vf$ or $C\frac{l_2}{C}I^-, 1.07VBr_2 \mid .Br^-$, and 0.54 V for $l_2 \mid l^-$ At pH=3, permaganate is expected to oxidize (2.303RT/F -0.059 V)

A. $CI^- -, Br^-$ and I^-

B. CI^- and Br^-

C. Br^- and I^-

D. l^- only

Answer: D

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30. Consider the half reactions of a galvanic cell given below:

$MnO_2 + H^+ \rightarrow Mn^{2+} + 2H_2O, EM^{\circ}_{MnO_2} = 1.23V, PbCl_2 \rightarrow Pb + 2CI^-$

The correct statement about the cell is

A. standart cell potential is 0.95 v

B. during withdrawal of eelctricity from cell lead is reduced

C. during withdrawal of electrical from cell manganese is oxidized

D. during withdrawal electrical from cell two electron are transferred from lead to managese

Answer: C

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31. For the redox reaction: $Zn(s) + Cu^{2+}(0.1M) \rightarrow Zn^{2+}(1M) + Cu(s)$ taking place in a cell, E°_{cell} is 1.10V. E°_{cell} for the cell will be [2.303(RT/F)=0.0591]

A. 2.14 v

B. 1.80 v

C. 1.07 v

D. 0.82 v

Answer: C

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32. The reaction of tin metal with acid can be written as

$Sn(s) + 2H^+(aq) \rightarrow Sn^{2+}(aq) + H_2(g), E^{\circ}_{Sn^{2+}/Sn} = -0.14V$

Assume that $\left[Sn^{2+}\right]$=1 M and the partial pressure of hydrogen gas is 1 atm, then the

A. cell reaction is spontaneous at pH = 5

B. cell reaction is non-spontaneous at standard conditions

C. cell reaction is spontaneous at pH = 2

D. cell reaction is spontaneous for all pH values

Answer: C

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33. An electric current is passed through two electrolytic cells connected in series. One cell contains Cu^{2+} and the other contains Fe^{2+} . Which of the following is the correct statement?

A. Equal masses of iron and copper are deposited on the electrode.

B. More moles of copper are deposited on the electrode.

C. Equal moles of iron and copper are deposited on the electrodes.

D. One ampere current for a day would be required to deposit one mole of each metal.

Answer: D

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34. The highest electrical conductivity of the following aqueous solutions is of

A. 0.1 M acetic acid

B. 0.1 M chloroacetic acid

C. 0.1 Mfluoroacetic acid

D. 0.1 M difluoroacetic acid

Answer: C

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35. Consider a typical lead storage battery and select the correct statement mentioned below.

A. Lead oxide is dissolved into electrolyte without any change on withdrawing current.

B. The density of electrolyte is increased on discharging

C. Sulphuric acid concentration decreases on discharging.

D. The potential difference observed is approximately 12 V.

Answer: B

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36. The dissociation constant of n-butyric acid is 1.6×10^{-5} and the molar conductivity at infinite dilution is $380 \times 10^{-4} Sm^2 mol^{-1}$. The specific conductance of the 0.01 M acid solution is

A. $1.52 \times x10^{-5} m^{-1}$

B. $1.52 \times 10^{-2} sm^{-1}$

C. $1.52 \times 10^{-3} sm^{-1}$

D. $1.52 \times 10^{-8} sm^{-1}$

Answer: D

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37. Consider the cell $Ag|AgBrBr^{-}||CI|AgClAgat25^{\circ}$ C the solubility product of AgCl and AgBr are $1 \times 10^{\circ}$ and 5×10^{-13} respectively. At which ratio of concentration of Br and Clions would the emf of cell be zero?

A. $100:1$

B. $1:100$

C. $200:1$

D. $1:200$

Answer: C

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38. The resistance of solution A is 50 ohm and that of B is 100 ohm. Both are taken in same cell. If equal volume of A and B are mixed and the mixture is taken in same cell then the resistance is

A. 150 ohm

B. 75 ohm

C. 66.67 ohm

D. 33.3 ohm

Answer: B

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39. Calculate the quantity of electricity that would be required to reduce 12.3 gm of nitrobenzene to aniline if current efficiency is 50%

A. 347400 coulomb

B. 115800 coulomb

C. 23160 coulomb

D. 694800 coulomb

Answer: C

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40. Calculate the electrode potential of copper, if the concentration of $CuSO_4$ is 0.206 M at 23.1° C. Given that $E^\circ_{cu^{2+}/Cu} = +0.34V$.

A. 0.50 V

B. 0.41V

C. 0.32 V

D. 0.28 V

Answer: B

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41. The conductivity of a saturated AgCl solution is found to be $1.86 \times 10^{-6} Scm^{-1}$ and that for water is $6.0 \times 10^{-8} Scm^{-1}$. The solubility of AgCl is (molar conductivity =137.2)

A. $1.7 \times 10^{-3} molL^{-1}$

B. $1.3 \times 10^{-5} molL^{-1}$

C. $1.3 \times 10^{-4} molL^{-1}$

D. $1.3X10^{-4}$ mol L^{-1}

Answer: C

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42. Conductivity of 0.01 M KCI solution is x S cm^{-1} . When conductivity cell is filled with 0.01 M KCl the conductance observed is y S. When the same cell is filled with 0.01M H_2SO_4 the observed conductance is z S cm^{-1} . Hence conductivity of 0.01 M H_2SO_4 is

A. xz

B. z/xy

C. xz/y

D. xy/z

Answer: B

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43. A current of 9.65 A is drawn from a Daniell cell for exactly one hour. If molar masses of Cu and Zn are 63.5 g mol^{-1} and 65.4 g mol^{-1}, respectively, the loss in mass at anode and gain in mass at cathode respectively are

A. 11.43g,11.77g

B. 11.77 g, 11.43 g

C. 22.86 g, 23.54 g

D. 23.54 g, 22.86 g

Answer: C

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44. The reaction $\frac{1}{2}H_2(g) + AgCl(s) = H^+(aq) + CI^-(aq) + Ag(s)$ occurs in the galvanic cell

A. $Ag|AgCl(s)|KCl(aq)|AgN0_3(aq)|Ag$

B. $Pt|H_2(g)|HCl(aq)\ ||\ |AgN0_3(aq)|Ag$

C. $Pt|H_2(g)|HCl(aq)\ ||\ |AgCl(s)|Ag$

D. $Pt|H_2(g)|KCl(aq)\ ||\ |AgCl(s)|Ag$

Answer: D

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45. Given $E^{\circ}_{Fe^{3+}/Fe} = -0.036V$ and $E^{\circ}_{fe^{2+}/Fe} = -0.44V$. What is the value of $E^{\circ}_{Fe^{3+}/Fe^{2+}}$

A. (- 0.036 - 0.439) V

B. (- 0.036 + 0.439) V

C. [3 (- 0.036 +2 (- 0.439)] V

D. [3 (- 0.036 - 2 (- 0.439)] V

Answer: D

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46. 4.5 g of aluminimum (At. mass-27-amu) is deposited at cathode from AP solution by a certain quantity of electric charge. The volume of hydrogen produced at STP from H^+ ions in solution by the same quantity of electric charge will be.

A. 44.8 L

B. 22.4 L

C. 11.2 L

D. 5.6 L

Answer: D

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47. The same quantity of electricity that liberates 4.316 g of silver from $AgNO_3$ solution was passed through a solution of gold salt. If the atomic weight of gold be 197 and its valency in the above-mentioned salt be 3, calculate the weight of gold deposited at the cathode and the quantity of electricity passed.

A. 3.28g, 4021.5 C

B. 3.28g, 5023.3 C

C. 2.63g, 6213.5 C

D. 2.63g, 3864.7 C

Answer: D

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48. The specific conductance of a saturated solution of silver bromide is $kScm^{-1}$. The limiting ionic conductivity of Ag^+ and Brions are x and y,

respectively. The solubility of silver bromide in g L^{-1}

is: (molar mass of AgBr=188)

A. $\frac{k \times 1000}{x - y}$

B. $\frac{k}{x + y} \times 188$

C. $\frac{k \times 1000 \times 188}{x + y}$

D. $\frac{x + y}{k} \times \frac{1000}{188}$

Answer: C

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49. The Gibbs energy for the decomposition of Al_2, O_3 , at 500° C is as follows:

$\frac{2}{3}AI_2O_3 \rightarrow \frac{4}{3}AI + O_2, \ \triangle_r G = \ | \ 966kjmol^{-1}$ The potential difference needed for the electrolytic reduction of AI_2O_3 at 500° C is at least:

A. -2.5 V

B. +5.0 V

C. 4.5 V

D. 3.0 V

Answer: A

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50. The standard reduction potentials for Zn^{2+}/Zn, $N\frac{i^{2+}}{N}i$ and $F\frac{e^{2+}}{F}eare$-0.76,-0.23 and-0.44 V respectively. The reaction: $X+Y^{2+}\rightarrow X^{2+}+y$

will be spontaneous when :

A. X= Ni,Y=Fe

B. X=Ni,Y=Zn

C. X = Fe,Y = Zn

D. X = Zn,Y=Ni

Answer: D

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51. Assertion : 1 Faraday of electricity deposits 1 g equivalent of Ag,Cu or Al. Reason : 1 mole of electrons are required to reduce 1 mole of Ag^+ or $\frac{1}{2}$ mole of Cu^{2+} or $\frac{1}{3}$ mole of Al^{3+} ions.

A. If both (A) and (R) are correct and (R) is the correct explanation of (A).

B. If both (A) and (R) are correct, but (R) is not the correct explanation of (A).

C. If both (A) and (R) are correct, but (R) is not the correct explanation of (A).

D. If both (A) and (R) are incorrect.

Answer: B

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52. Assertion : Equivalent conductance increase with dilution for an electrolyte solution. Reason: The number of ions per litre of electrolyte increases with dilution.

A. If both (A) and (R) are correct and (R) is the correct explanation of (A).

B. If both (A) and (R) are correct, but (R) is not the correct explanation of (A).

C. If both (A) and (R) are correct, but (R) is not the correct explanation of (A).

D. If both (A) and (R) are incorrect.

Answer: A

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53. Assertion : At the end of electrolysis using Pt electrodes, an aqueous solution of $CuSO_4$ turns colorless.

Reason: $CuSO_4$ changes to $Cu(OH)_2$ during electrolysis.

A. If both (A) and (R) are correct and (R) is the correct explanation of (A).

B. If both (A) and (R) are correct, but (R) is not the correct explanation of (A).

C. If (A) is correct, but (R) is incorrect

D. If both (A) and (R) are incorrect.

Answer: C

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54. Assertion : $\wedge_{eq}^{\circ}(CH_3COOH)$ cannot be determined experimentally.

Reason: CH_3COOH is a weak acid and Debye-Huckel Onsager equation

cannot be used. Extrapolation method cannot be employed.

A. If both (A) and (R) are correct and (R) is the correct explanation of (A).

B. If both (A) and (R) are correct, but (R) is not the correct explanation of (A).

C. If both (A) and (R) are correct, but (R) is not the correct explanation of (A).

D. If both (A) and (R) are incorrect.

Answer: A

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55. Assertion: Specific conductance decreases with dilution whereas equivalent conductance increases.

Reason: On dilution, number of ions per millilitre decreases but total number of ions increases considerably.

A. If both (A) and (R) are correct and (R) is the correct explanation of (A).

B. If both (A) and (R) are correct, but (R) is not the correct explanation of (A).

C. If both (A) and (R) are correct, but (R) is not the correct explanation of (A).

D. If both (A) and (R) are incorrect.

Answer: C

Watch Video Solution

56. Resistance of 0.1 MKCI solution in a conductivity cell is 300 ohm and conductivity is 0.013 S cm^{-1} . The value of cell constant is:

A. If both (A) and (R) are correct and (R) is the correct explanation of (A).

B. If both (A) and (R) are correct, but (R) is not the correct explanation of (A).

C. If both (A) and (R) are correct, but (R) is not the correct explanation of (A).

D. If both (A) and (R) are incorrect.

Answer: B

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57. Assertion : Sodium ions are discharged in preference to hydrogen ions at a mercury cathode: Reason: Na^+ is a strong reducing agent in comparison to H^+ ion.

A. If both (A) and (R) are correct and (R) is the correct explanation of (A).

B. If both (A) and (R) are correct, but (R) is not the correct explanation of (A).

C. If both (A) and (R) are correct, but (R) is not the correct explanation of (A).

D. If both (A) and (R) are incorrect.

Answer: B

Watch Video Solution

58. Assertion: An electrochemical cell can be set up only if the redox reaction is spontaneous. Reason: A reaction is spontaneous if free energy change is negative.

A. If both (A) and (R) are correct and (R) is the correct explanation of (A).

B. If both (A) and (R) are correct, but (R) is not the correct explanation of (A).

C. A is correct but R is wrong

D. If both (A) and (R) are incorrect.

Answer: A

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59. Assertion : If $\lambda_{Na}A^{\circ} + \lambda^{\circ}_{CI^-}$ are molar limiting conductivity of the sodium and chloride ions respectively, then the limiting molar conducting for sodium chloride is given by the equation: $\lambda^{\circ}_{NaCI} = \lambda^{\circ}_{Na} + \lambda^{\circ}_{Cl^-}$

Reason : This is according to Kohlrausch's law of independent migration of ions.

A. If both (A) and (R) are correct and (R) is the correct explanation of (A).

B. If both (A) and (R) are correct, but (R) is not the correct explanation of (A).

C. If both (A) and (R) are correct, but (R) is not the correct explanation of (A).

D. If both (A) and (R) are incorrect.

Answer: C

Watch Video Solution

60. Assertion : One coulomb of electric charge deposits weight equal to the electrochemical equivalent of the substance.

Reason : One Faraday deposits one mole of the substance.

A. If both (A) and (R) are correct and (R) is the correct explanation of (A).

B. If both (A) and (R) are correct, but (R) is not the correct explanation of (A).

C. If (A) is correct, but (R) is incorrect

D. If both (A) and (R) are incorrect.

Answer: A

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61. Assertion : $(Ni)\left|\left(Ni^{2+}\right)(1.0M)\right|\left|Au^{3+}(l.0M)\right|Au$ for this cell emf is 1.75 V, if $E^{\circ}_{Au^{3+}/Au} = 1.50$ and $E_{Ni^{2+}}/Ni^{\circ} = 0.25V$

Reason: Emf of the cell $=E^{\circ}_{cathode} - E^{\circ}_{anode}$

A. If both (A) and (R) are correct and (R) is the correct explanation of (A).

B. If both (A) and (R) are correct, but (R) is not the correct explanation of (A).

C. If both (A) and (R) are correct, but (R) is not the correct explanation of (A).

D. If both (A) and (R) are incorrect.

Answer: C

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62. Assertion : Emf andpotential difference are not same for cell. Reason: Both gives the difference in electrode potential under any condition.

A. If both (A) and (R) are correct and (R) is the correct explanation of (A).

B. If both (A) and (R) are correct, but (R) is not the correct explanation of (A).

C. If both (A) and (R) are correct, but (R) is not the correct explanation of (A).

D. If both (A) and (R) are incorrect.

Answer: B

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63. Assertion : Kohlrausch's law helps to find the molar conductivity of a weak electrolyte at infinite dilution. Reason: The cell potential of mercury

cell is 1.35 V, which remains constant.

A. If both (A) and (R) are correct and (R) is the correct explanation of (A).

B. If both (A) and (R) are correct, but (R) is not the correct explanation of (A).

C. (A) is correct but (R) is wrong

D. If both (A) and (R) are incorrect.

Answer: B

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64. Assertion :In mercury cell, the electrolyte is a paste of KOH and ZnO.

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

A. If both (A) and (R) are correct and (R) is the correct explanation of (A).

B. If both (A) and (R) are correct, but (R) is not the correct explanation of (A).

C. If both (A) and (R) are correct, but (R) is not the correct explanation of (A).

D. If both (A) and (R) are incorrect.

Answer: A

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65. Assertion : Molar conductivity increases with decrease in concentration. Reason:Conductivity always decreases with decrease in concentration.

A. If both (A) and (R) are correct and (R) is the correct explanation of (A).

B. If both (A) and (R) are correct, but (R) is not the correct explanation of (A).

C. A is correct but R is wrong

D. If both (A) and (R) are incorrect.

Answer: B

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66. 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 (A) and (R) are correct and (R) is the correct explanation of (A).

B. If both (A) and (R) are correct, but (R) is not the correct explanation of (A).

C. A is correct but R is incorrect

D. If both (A) and (R) are incorrect.

Answer: A

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

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

A. If both (A) and (R) are correct and (R) is the correct explanation of (A).

B. If both (A) and (R) are correct, but (R) is not the correct explanation of (A).

C. If (A) is correct, but (R) is incorrect

D. If both (A) and (R) are incorrect.

Answer: B

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68. Assertion : If an aqueous solution of NaCl is electrolysed, the product obtained at the cathode is hydrogen gas and not Na. Reason: Gases are liberated faster than the metals.

A. If both (A) and (R) are correct and (R) is the correct explanation of (A).

B. If both (A) and (R) are correct, but (R) is not the correct explanation of (A).

C. (A) is correct but (R) is wrong

D. If both (A) and (R) are incorrect.

Answer: C

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69. Assertion: The ratio of specific conductivity to the observed conductance does not depend upon the concentration of the solution taken in the conductivity cell. Reason: Specific conductivity decreases with dilution whereas observed conductance-increases with dilution.

A. If both (A) and (R) are correct and (R) is the correct explanation of (A).

B. If both (A) and (R) are correct, but (R) is not the correct explanation of (A).

C. A is correct but R is wrong

D. If both (A) and (R) are incorrect.

Answer: B

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70. Assertion: According to Kohlrausch's law, the molar conductance of a strong electrolyte at infinite dilution is sum ofmolar conductivities of its ions. Reason: The current carried by cation and anion is always equal.

A. If both (A) and (R) are correct and (R) is the correct explanation of (A).

B. If both (A) and (R) are correct, but (R) is not the correct explanation of (A).

C. if (A) is correct (B) is wrong

D. If both (A) and (R) are incorrect.

Answer: C

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Questions

1. What is the weight of nickel deposited on an iron article of 20cm2 by passing a current of 5 A for 500 seconds?

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2. How many litres of chlorine at STP will be evolved by 10 ampere current flowing for 3 hours through molten NaCl?

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3. Calculate the time required to coat a metal surface of 50 cm2 with $0.01mm$ thick layer of chromium (density = 7.19 g cm-3) by the passage of 5 A current.

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4. The same quantity of electricity is passed through solutions of silver nitrate and cupric sulphate connected in series. If the weight of silver deposited is 0.54 g, calculate the weight of copper deposited. (Equivalent mass of Ag = 108, equivalent mass of Cu = 31.75)

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5. When HCl gas is passed through a saturated aqueous solution of NaCl

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6. Calculate the electrode potential of copper electrode in a 0.1 M copper sulphate solution at 25° C.

$\left(E^\circ\left(Cu^{2+} \mid Cu\right) = 0.34V\right)$.

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7. The measured EMF at 298 K for the cell reaction, $Zn(s) + Cu^{2+}(1.0M) \rightarrow Cu(s) + Zn^{2+}(0.1M)$ is 1.13 V. Calculate E° for the cell reaction.

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8. Calculate the e.m.f of the following concentration cell at 298K, $Zn(s)\left|Zn^{2+}(0.1)\right|\left|Zn^{2+}(1.0)\right|Zn(s)$

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9. For the cell reaction, $A(s) + 2B^{-}(aq) \rightarrow A^{2+}(aq) + 2B(s)$, the value of Kc is 3.98×10^{15} .Calculate E°_{cell} at 298 K.

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10. Calculate the standard free energy change for the reaction, $Zn + Cu^{2+} \rightarrow Cu + Zn^{2+}$

Given that standard free energy (G^{o}) for $Zn2 + (aq), Cu2 + (aq), are - 147.2kJmol - 1$ and $65.0kJmol - 1$ respectively.

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11. The resistance of a 0.5 N solution of salt is 20 Ω .Calculate the equivalent conductance of the solution if the platinum electrodes are 1.5 cm apart and each having an area of $3.0cm^{2}$.

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12. Which of the following have maximum molar conductivity.

(i) 0.1 M solution and its specific conductivity is $2 \times 10^{-2}\Omega^{-1}cm^{-1}$

(ii) 0.1M solution and its resistivity is 50 Ω cm.

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13. Which of the following have maximum molar conductivity.

(i) 0.1 M solution and its specific conductivity is $2 \times 10^{-2} \Omega^{-1} cm^{-1}$

(ii) 0.1M solution and its resistivity is 50 Ω cm.

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14. The eqv Ivalent conductivity of H_2SO_4 at infinite dilution is 384 $\Omega^{-1} cm^2 eq^{-1}$. If 49 g H_2SO_4 per litre is present in solution and specific resistance is 18.4 Ω calculate the degree of dissociation.

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15. Calculate the molar conductivity at infinite dilution for $MgS0_4$ from the following data: $Mg^{2+} = 106 Scm^2 mol^1$, $SO_4^{2-} = 160 Scm^2 mol^{-1}$

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16. The specific conductivity of 0.1 M solution of a weak acid at 298 K is 0.00159 $ohm^{-1}cm^{-1}$. Calculate the degree of dissociation of the acid if its molar conductance at infinite dilution is 350.5 $\text{ohm}^{-1}cm^2mol^{-1}$.

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17. The specific conductivity of the saturated aqueous solution of AgCl is $1.82 \times 10^{-6} ohm^{-1}cm^{-1}$ at 298K. Calculate me solubility of AgCl. $\left[\wedge_m^\circ \left(Ag^+\right) = 61.83 ohm^{-1}cm^2mol^{-1}\right]$ and $\wedge_m^\circ (CI)^- = 76.41 ohm^{-1}cm^2mol^{-1}$

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Level I

1. The calomel electrode and Quinhydrone electrode are reversible with respect to which ions respectively:

A. Cl, H^+

B. H^+, Cl^-

C. Hg_2^{2+}, OH^-

D. Hg_2^{2+}, OH^-

Answer: A

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2. A standard hydrogen electrode has zero electrode potential because

A. hydrogen is easiest to oxidise

B. this electrode potential is assumed to be zero

C. hydrogen atom has only one electron

D. hydrogen is the lightest element

Answer: B

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3. The electric charge for electrode deposition of one gram equivalent of any substance is:

A. one ampere per second

B. 96.500 coloumbs per second

C. one ampere for one hour

D. charge on one mole of electrons

Answer: D

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4. KNO_3 is used to make salt bridge because:

A. velocity of K^+ is greater than that of NO_3^-

B. velociyt of NO_3^- is greater than that of k

C. velocity of both K^+ and NO_3^- are nearly the same

D. KNO_3 is highly souble in water

Answer: C

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5. In a galvanic cell, the salt bridge:

A. does not participate chemically in the cell reaction

B. stops the diffusion of ions from one electrode to another

C. is necessary for the occurrence of the cell reaction

D. ensures mixing of two electrolytic solution

Answer: A

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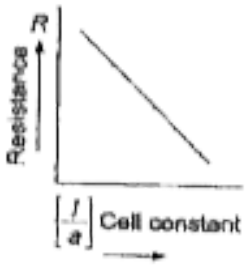
6. Variationof resistance with increase in cell constant gives graph of the type

A.



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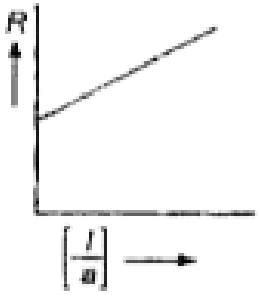
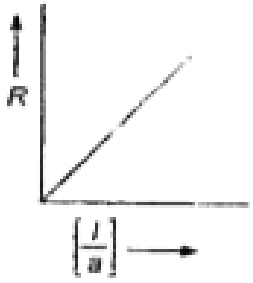
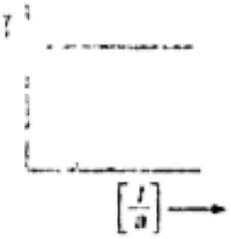


C.



D. 

Answer: C

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7. Which factor is responsible for decrease in electrolytic conduction?

A. Dilution

B. Increase in temperature

C. Interionic attraction in higher concentration range

D. None of the above

Answer: C

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8. $2Ag^{+}(aq) + Cu(s) \rightarrow Cu^{2+}(aq) + 2Ag(s)$

The standard potential for this reaction is 0.46 V. Which change will increase the standard potential the most

A. Doubling the $\left[Ag^{+}\right]$

B. Doubling the size of the Cu(s) electrode

C. Halving the $\left[Cu^{2+}\right]$

D. Standard potential is considered only for 1M solution

Answer: D

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9. A cell in which reactants are not contained within the cell but are continuously supplied from external source?

A. Lithium battery

B. Fuel cell

C. Dry cell

D. Lead -storage battery

Answer: B

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10. The metal that cannot be obtained by electrolysis of the aqueous solution of its salts is:

A. Ag

B. Cr

C. Cu

D. Al

Answer: D

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11. The correct order of chemical reactivity with water according to electrochemical series is

A. $K > Mg > Zn > Cu$

B. $Mg > Zn > Cu > K$

C. $K > Zn > Mg > Cu$

D. $Cu > Zn > Mg > K$

Answer: A

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12. A substance that will reduce Ag to Ag but will not reduce Ni^{2+} to Ni is : $\left(E^0_{Ag^+/Ag}\right) = 0.80V, E^0_{Ni^{2+}/Ni}$

A. Zn

B. Pb

C. Mg

D. Al

Answer: B

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13. Lithium is generally used as an electrode in high energy density batteries. This is because:

A. Lithium is the lightest element

B. Lithium has quite negative reduction potential

C. Lithium is quite reactive

D. Lithium does not corrode easily

Answer: B

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14. In electrolysis of a fused salt, the weight of the deposit on an electrode will not depend on

A. Temperature of the bath

B. Current intensity

C. Electrochemical equivalent of ions

D. Time for electrolysis

Answer: A

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15. Conductivity of a strong electrolyte

A. Increases on addition

B. Does not change considerably on dilution

C. Decrease on dilution

D. Depends on density

Answer: B

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16. The unit ohm^{-1} is used for

A. Molar conductivity

B. Equivalent conductivity

C. Specific conductivity

D. Conductivity

Answer: D

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17. Which of the following reactions occurs at the cathode of a common dry cell?

A. $Mn \rightarrow Mn^{2+} + 2e^-$

B. $MnO_2 + NH_4^+, + e^- \rightarrow MnO(OH) + NH_3$

C. $2ZnO_2 + Mn^{2+} + 2e^- \rightarrow MnZn_2O_4$

D. Cu-Zn cell

Answer: B

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18. In a hydrogen -oxygen fuel cell, combustion of hydrogen occurs to

A. Produce high purity water

B. Create potential difference between the two electrodes

C. Generate heat

D. Remove adsorbed oxygen from electrode surfaces

Answer: B

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19. Which of the following statements is correct ? Galvanic cell converts

A. chemical energy into electrical energy

B. electrical energy into chemical energy

C. metal from its elemental state to the combined state

D. electrolyte into individual ions

Answer: A

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20. If the molar conductivity values of Ca^{2+} and Cl^{-} at infinite dilution are, respectively, 118.88×10^{-4} and $77.33 \times 10^{-4} Sm^2 mol^{-1}$, then that of $CaCl_2$ is $(Sm^2 mol^{-1})$

A. 118.88×10^{-4}

B. 154.66×10^{-4}

C. 273×10^{-4}

D. 196.21×10^{-4}

Answer: C

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21. Conductivity is directly proportional to the area of the vessel and the concentration of the solution in it and is inversely proportional to the length of the vessel, then the unit of constant of proportionality is

A. $Smmol^{-1}$

B. Sm^2mol^{-1}

C. $S^{-2}m^2mol$

D. $S^2m^2mol^{-2}$

Answer: B

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22. How many faradays are required to reduce 1 mol BrO_3^- to Br^- in basic medium?

A. 3

B. 5

C. 6

D. 4

Answer: C

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23. The equilibrium constant for the following reaction at 298K is expressed as $x \times 10^y$.

$2Fe^{3+} + 2I^- \rightarrow 2Fe^{2+} + I_2, E^\circ_{\text{cell}} = 0.236V$. The value of y is .....

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24. Emf of the cell $Ni\left|Ni^{2+}(0.1M)\right|\left|Au^{3+}(1.0M)\right|Au$ will be (Given $E^{\circ}_{Ni^{2+}/Ni} = 0.25V, E^{\circ}_{Au^{2+}/Au} = 1.5V$)

A. $+1.75V$

B. $+1.7795V$

C. $+0.7795V$

D. $-1.7795V$

Answer: B

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25. Molar conductivities of $BaCl_2, H_2SO_4$ and HCl at infinite dilution are x_1 and x_2, and x_3 respectively. Molar conductivity of $BaSO_4$ at infinite dilution will be

A. $(x_1 + x_2 - x_3)/2$

B. $x_1 + x_2 - 2x_3$

C. $(x_1 - x_2 - x_3)/2$

D. $(x_1 + x_2 - 2x_3)/2$

Answer: B

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26. Electrolysis can be used to determine atomic masses. A current of 0.550A deposits 0.55g of a certain metal in 100 minutes. Calculate the atomic mass of the metal if eq. wt = mole.wt./3

A. 100

B. 45.0

C. 48.25

D. 144.75

Answer: C

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27. One gram of metal M^{3+} was discharged by the passage of 1.81×10^{23} electrons. What is the atomic weight of the metal?

A. 33.35

B. 133.4

C. 66.7

D. 9.98

Answer: D

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28. An aqueous solution containing 1M each of $Au^{3+}, Cu^{2+}, Ag^{+}, Li^{+}$ is being electrolysed by using inert electrodes. The value of standard potentials are

$E^{\circ}_{Ag^{+}/Ag} = 0.80V, E^{\circ}_{Cu^{2+}/Cu} = 0.34V,$ and $E^{\circ}_{Au^{3+}/Au} = 1.50V,$

$E^{\circ}_{Li^+/Li} = -3.03V$, With increasing voltage, the sequence of deposition of metals on the cathode will be

A. Li, Cu, Ag, Au

B. Cu, Ag, Au

C. Au, Ag, Cu

D. Au, Ag, Cu, Li

Answer: C

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29. Electrolysis of an oxytungsten complex ion using 1.10A for 40 min produces 0.838g of tungsten. What is the charge on tungsten in the material ? (Atomic weight W= 184)

A. 6

B. 2

C. 4

D. 1

Answer: A

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30. Sodium metal is produced by the electrolysis of molten sodium chloride and chlorine is produced as a by product. How many litres of chlorine at 1.8 atm and $27^{\circ}C$ will be produced if a current of 1.0×10^{3}A is passed through NaCl (l) for 9.65 h?

A. 2463

B. 460

C. 1800

D. 1231.6

Answer: A

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31. Based on the following information, arrange four metals A, B, C and D in the order of decreasing ability to act as reducing agents:

(I) only A,B and C react with 1 M HCI to give $H_2(g)$

(II) When C is addd to solution of the other metal ions, metallic B and D are formed

(III) Metal C does not reduce A^{n+} $C > A > B > D$, $C > A > D > B$, $A > C > D > B$, $A > C > B > D$

A. $C > A > B > D$

B. $C > A > D > B$

C. $A > C > D > B$

D. $A > C > B > D$

Answer: D

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32. The E at 25° C for the following reaction is 0.22 V. The equilibrium constant at 25° C is very $H_2(g) + 2AgCl(s) \rightarrow -2Ag(s) + 2HCl(aq)$

A. 2.8×10^7

B. 5.2×10^8

C. 5.2×10^6

D. 5.2×10^3

Answer: A

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33. Using the following E° values for electrode potentials, calculate $\triangle G^\circ$ in kJ for the indicated reaction:

$5Ce^{4+}(aq) + Mn^{2+}(aq) + 4H_2O(l) \rightarrow 5Ce^{3+}(aq) + MnO_4^-(aq) + 8H^+$

$MnO_4^-(aq) + 8H^+(aq) + 5e^- \rightarrow Mn^{2+}(aq) + 4H_2O(l), E^\circ = +1.51V$

$Ce^{4+}(aq) + e^- \rightarrow Ce^{3+}(aq), E^\circ = +1.61V$

A. -9.65

B. -24.3

C. -48.25

D. -35.2

Answer: C

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34. When $I_2, (s) \mid I^-$ (0.IM) half cell is connected to a $H^+(aq) \mid H_2$, (1 bar) Pt half cell, e.m.f.is found to be $0.7714V$. $IfE^\circ_{I_2} = 0.535$ V, find the pH of $H^+ \mid H_2$ half-cell.

A. 1

B. 3

C. 5

D. 7

Answer: B

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35. The standard free energy change for the following reaction is-210 kJ. What is the standard cell potential? $2H2O_2$ (aq) $\rightarrow\rightarrow$ $2H_20$ (1) + 0_2 (8)

A. $+0.752$

B. $+1.09$

C. $+0.420$

D. $+0.640$

Answer: B

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36. Resistance of 0.1 MKCI solution in a conductivity cell is 300 ohm and conductivity is 0.013 S cm^{-1} . The value of cell constant is:

A. $3.9cm^{-1}$

B. $39m^{-1}$

C. $3.9m^{-1}$

D. $39cm^{-1}$

Answer: A

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37. Which of the following statements is correct?

A. Cathode is negative terminal both in galvanic and electrolytic cells

B. Anode is positive terminal both is galvanic and electrolytic cells

C. Cathode is negative terminal in an electrolytic cell whereas anode is negative terminal in a galvanic cell

D. Anode is negative terminal in an electrolytic cell whereas cathode is positive terminal in a galvanic cell

Answer: C

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38. Two half cells have potentials $-0.76V$ and $-0.13V$ respectively. A galvanic cell is made from these two half-cells. Which of the following statements is correct ?

A. Electrode of half-cell potential $-0.76V$ serves as cathode

B. Electrode of half-cell potential $-0.76V$ serves as anode

C. Electrode of half-cell potential $-0.13V$ serves as anode

D. Electrode of half-cell potential $-0.76V$ serves as positive electrode and $-0.13V$ as negative electrode

Answer: B

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39. Given that E values of $Ag^+|Ag, K^+|K, Mg^{2+}|Mg$ and $Cr^{3+}|Cr$ áre 0.80 V,-2.93 V,-2.37 V, and -0.74 V, respectively. Which of the following orders regarding the reducing power of metals is correct?

A. $Ag > Cr > Mg > K$

B. $Ag > Cr > Mg > K$

C. $Ag > Cr > K > Mg$

D. $Cr > Ag > Mg > K$

Answer: B

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40. Given:

$E^\circ\left(Sn^{2+}Sn^{4+} \mid Pt\right) = -0.15V, E^\circ\left(Hg_2^{2+}|Hg^{2+}\right) = -0.92V$ and E°

Based on this data, which of the following statements is correct?

A. Sn^{4+} is a stronger oxidizing agent than Pb^{4+}

B. Sn^{2+} is a stronger reducing agent than Hg_2^{2+}

C. Hg^{2+} is a stronger oxidizing agent than Pb^{4+}

D. Pb^{2+} is a stronger reducing agent than Sn^{2+}

Answer: B

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41. The pressure of H_2 required to make the potential of the hydrogen electrode in water equal to zero at 298 K is

A. 10^{-7} atm

B. 10^{-14} atm

C. 10^{-5} atm

D. 10^{-10} atm

Answer: B

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42. When a lead storage battery is charged:

A. PbO_2 dissolves

B. the lead electrode becomes coated with lead sulphate

C. sulphuric acid is regenerated

D. the amount of acid decreases

Answer: C

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43. An example of a simple fuel cell is:

A. lead storage battery

B. $H_2 - O_2$ cell

C. Daniel cell

D. Lechlanche cell

Answer: B

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44. The equilibrium constant of acetic acid in an aqueous solution of concentration c is given by

A. $K = \frac{c\Lambda_e^2}{\Lambda^\propto - \Lambda_c}$

B. $K = \frac{c\Lambda_c^2}{\Lambda^\propto(\Lambda^\propto - \Lambda_c)}$

C. $K = \frac{c\Lambda_c^2}{\Lambda^\propto + \Lambda_c}$

D. $K = \frac{c\Lambda_c^2}{\Lambda^\propto(\Lambda - \Lambda_c)}$

Answer: B

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45. For a dilute solution of a strong electrolyte, which of the following facts is correct?

A. The graph between Λ_m and c is linear

B. The graph between log Λ_m and c is linear

C. The graph between Λ_m and $\sqrt{c}$ is linear

D. The graph between log Λ_m and log c is linear

Answer: C

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46. 1 L of 1 $MCuSO_4$ solution is electrolysed. After passing 2 F of electricity, molarity of $CuSO_4$ solution will be

A. M/2

B. M/4

C. M

D. zero

Answer: D

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47. If equivalent conductance of $1M$ benzoic acid is $12.8\Omega^{-1}\text{-}cm^2$ and if the conductance of benzoate ion and $H^{\cdot}$ ion are 42 and $288.42\Omega^{-1}\text{-}cm^2$ respectively, its degree of dissociation is

A. $39\ \%$

B. $3.9\ \%$

C. $0.35\ \%$

D. $0.039\ \%$

Answer: B

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48. E° for the electrochemical cell $Zn(s)\left|Zn^{2+}1M(aq)\right|\left|Cu^{2+}1M(aq)\right|Cu(s)$ is 1.10 V at 25°C. The

equilibrium constant for the cell reaction, $Zn(s) + Cu^{2+}(aq.) \rightarrow Zn^{2+}(aq.) + Cu(s)$ will be:

A. 1.68×10^{-37}

B. 1.68×10^{37}

C. 1.68×10^{-39}

D. 1.68×10^{39}

Answer: B

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49. The reduction potential of hydrogen electrode will be negative if :

A. $pH_2 = 2$ atm and $\left[H^+\right] = 2.0M$

B. $pH_2 = 1$ atm and $\left[H^+\right] = 2.0M$

C. $pH_2 = 1$ atm and $\left[H^+\right] = 1.0M$

D. $pH_2 = 2$ atm and $\left[H^+\right] = 1.0M$

Answer: D

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50. Electrolysis of dilute aqueous NaCl solution was carried out by passing 10 milli ampere current. The time required to liberate 0.01 mole of H_2 gas at the cathode is:

A. 9.65×10^4 sec

B. 19.3×10^4 sec

C. 28.95×10^4 sec

D. 38.6×10^4 sec

Answer: B

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Level Ii

1. Equivalent conductivity of 1MCH_3COOH is $10\Omega^{-1}cm^2eq^{-1}$ and at infinite dilution $200\Omega^{-1}cm^2eq^{-1}$. Hence, percentage ionisation of CH_3 COOH is

A. $5\ \%$

B. $2\ \%$

C. $4\ \%$

D. $1\ \%$

Answer: A

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2. 1 L of 1 $MCuSO_4$ solution is electrolysed. After passing 2 F of electricity, molarity of $CuSO_4$ solution will be

A. $\frac{M}{2}$

B. $\frac{M}{4}$

C. M

D. 0

Answer: D

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3. The resistance of 0.1 N solution of salt is found to be $2.5 \times 10^3 \Omega$. The equivalent conductance of solution (cell constant = 1.15 cm^{-1}) in $\Omega^{-1} cm^2 eq^{-1}$ is

A. 3.8

B. 4.6

C. 6.4

D. 7.6

Answer: B

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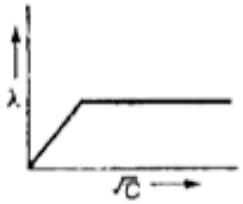
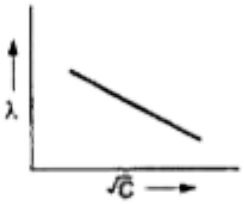
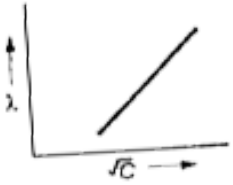
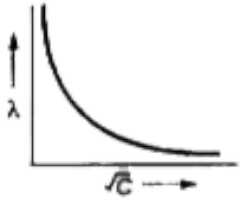
4. The variation of equivalent conductance of weak electrolyte with concentration is correctly shown in figure:

A. 

B. 

C. 

D. 

Answer: D

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5. A solution of sodium sulphate in water is electrolyzed using inert electrodes. The products at thee catahode and anode are respectively

A. H_2, O_2

B. O_2, H_2

C. O_2, Na

D. O_2, SO_2

Answer: A

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6. Which of the following condition will increase the voltage of the cell, represented by the equation?

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

A. Increase in the concentration of Ag^+ ion

B. Increase in the concentration of Cu^+ ion

C. Increase in the dimension of silver electrode

D. Increase in the dimension of copper electrode

Answer: A

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7. What is wrongly stated about electrochemical series?

A. It is the representation of elements in order of increasing or decreasing standard electrode reduction potential

B. It does not compare the relative reactivity of metals

C. It compares relative strength of oxidising agents

D. H_2 is centrally placed element

Answer: B

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8. Which of the following statements is true for the Daniel cell?

A. Electron flow from copper electrode to zinc electrode

B. Current flows from zinc electrode to copper electrode

C. Cations move towards copper electrode which is cathode

D. Cations move towards zinc electrode

Answer: A

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9. Which of the following does not evolve oxygen at anode when electrolysis is carried out of

A. dilute H_2SO_4 with Pt electrodes

B. Fused sodium hydroxide with Pt electrodes

C. acidic water with Pt electrodes

D. dilute sulphuric acid using Cu electrodes

Answer: D

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10. A current of 4 A is passed through a solution of silver nitrate to coat a metal surface of 80 cm^2 with 0.005 mm thick layers of silver. If the density of silver (molar mass: 108 g mol^{-1})is 10.8 g cm^{-3} , the time for which the current is passed is about

A. 84.5s

B. 90.5s

C. 96.5s

D. 100.5s

Answer: C

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11. In the electrolysis of copper (II) chloride solution, the mass of cathode increased by 3.15 g At copper anode, we will have

A. the liberation of 1120 mL of Cl_2 at STP

B. the liberation of 560mL of O_2 at STP

C. the loss of 3.16g of Cu

D. the gain 3.15g of Cu

Answer: C

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12. Which of the following expressions is correct?

A. $\Lambda_m)^{\infty}(NH_4OH) = \Lambda_m^{\infty}(NH_4Cl) - \Lambda_m^{\infty}(NaOH) - \Lambda_m^{\infty}(NaCl)$

B. $\Lambda_m)^{\infty}(NH_4OH) = \Lambda_m^{\infty}(NH_4Cl) - \Lambda_m^{\infty}(NaOH) + \Lambda_m^{\infty}(NaCl)$

C. $\Lambda_m)^{\infty}(NH_4OH) = \Lambda_m^{\infty}(NH_4Cl) - \Lambda_m^{\infty}(NaOH) - \Lambda_m^{\infty}(NaCl)$

D. $\Lambda_m)^{\infty}(NH_4OH) = \Lambda_m^{\infty}(NH_4Cl) + \Lambda_m^{\infty}(NaOH) + \Lambda_m^{\infty}(NaCl)$

Answer: A

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13. A conductivity cell whose cell constant is 3.0 cm^{-1} is filled with 0.1 M solution of a weak acid. Its resistance is found to be 3000 Ω. If $\wedge_m^\infty = 400\Omega^{-1}cm^2mol^{-1}$, the degree of dissociation of the weak acid is about

A. 0.015

B. 0.025

C. 0.035

D. 0.055

Answer: B

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14. The conductivity of a saturated solution of a springly soluble salt, MX_2 is found to be $4.0 \times 10^{-6}\Omega^{-1}cm^{-1}$. If $\lambda_m^{\infty}\left(\frac{1}{2}M^{2+}\right) = 50.0\Omega^{-1}cm^2mol^{-1}$ and $\lambda_m^{\infty}\left(X^{-}\right) = 50\Omega^{-1}cm^2mol^{-1}$, the solubility product of the salt is about

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15. Which of the following statements regarding the movement of ions in a cell is/are correct? (1) Cations move towards cathode and anions towards anode in both galvanic and electroytic cells. (2) Cations move towards cathode and anions towards anode in an electroytic cell and the reverse is true for a galavanic cell (3) Cations move towards cathode and anions towards anode in a galvanic cell and the reverse-is true for an electrolytic cell (4) Cations move towards anode and anions towards cathode in a galvanic cell and the reverse is true 'for an electrolytic cell

A. Cations move towards cathode and anions towards anode in both galvanic and electrolytic cells.

B. Cations move towards cathode and anions towards anode in an electroytic cell and the reverse in true for a galvanic cell

C. Cations move towards cathode and anions towards anode in a galvanic cell and the reverse is true for an electrolytic cell

D. Cations move towards anode and anions towards cathode in a galvanic cell and the reverse is true for an electrolytic cells

Answer: B

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16. Efficiency of a fuel cell is 80% and the standard heat of reaction is -300 kJ. The reaction involves two electrons in redox change. The E° for the cell is:

A. 1.24V

B. 2.48V

C. 0V

D. 0.62V

Answer: A

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17. A current of 965 ampere is passed for 1 sec through 1 litre solution of 0.02 N $NiSO_4$ using Ni electrodes. What is the new concentration of $NiSO_4$?

A. 0.01M

B. 0.01M

C. 0.002M

D. 0.02M

Answer: B

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18. Given that K_{sp} of CuS= 10^{-35} and $E^{\circ}_{Cu2+/Cu} = 0.34V$ The standard oxidation potential of $Cu|Cus|S^{2-}$ half cell is .....

A. 1.0V

B. 0.693V

C. $-0.690V$

D. $-1.0V$

Answer: B

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19. Cost of electricity for the production of xL H_2 at NTP at cathode is x, then cost of production of x L O_2 at NTP at anode will be: (assume 1 mole of electrons as one unit of electricity)

A. 2x

B. 4x

C. 16x

D. 32x

Answer: A

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20. The equilibrium constant of the following redox reaction at 298 K is $1 \times 10^8 2Fe^{3+}(aq.) + 2I^-(aq.) \rightarrow 2Fe^{2+}(aq) + I_2(s)$ If the standard reduction potential of iodine becoming iodide is +0.54 V. What is the standard reduction potential of $\frac{Fe^{3+}}{Fe^{2+}}$?

A. $+1.006V$

B. $-1.006V$

C. $+0.77V$

D. $-0.77V$

Answer: C

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21. At $25^\circ C$ the molar conductances at infinite dillution for the strong electrolytes NaOh, NaCl and $BaCl_2$ are 248×10^{-4}, 126×10^{-4} and $280 \times 10^{-4} Sm^2 mol^{-1}$ respectively λ° of $Ba(OH)_2$ is $Sm^2 mol^{-1}$ is

A. 52.4×10^{-4}

B. 524×10^{-4}

C. 402×10^{-4}

D. 262×10^{-4}

Answer: B

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22. Given: $E^\circ\left(Ag^+ | Ag\right) = 0.80V$ and $E^\circ\left(I^- \mid AglAg\right) - 0.15V$. The value of standard solubility product Agl would be about

A. 7.9×10^{-17}

B. 8.9×10^{-15}

C. 8.9×10^{-13}

D. 8.9×10^{-11}

Answer: A

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23. The ionic product of water at 298 K is $10^{-14} M^2$. The standard emf of the cell producing the reaction $H^+(aq) + OH^-(aq) \rightarrow H_2O(l)$ will be

A. 0.723V

B. $-0.723V$

C. $0.82V$

D. $-0.82V$

Answer: B

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24. For the cell reaction, $Mg(s) + 2Ag^{+}(aq.) \rightarrow Mg^{2+}(aq) + 2Ag(s) E^{\circ}_{cell}$: +3.17 V at 298 K. The value of $E^{\circ}_{cell} \triangle G^{\circ}$ and at Ag^{+} and Mg^{2+} concentrations of 0.001 M and 0.02 M respectively are:

A. $3.04V, -605.8kJmol^{-1}, 20000$

B. $3.04V, 611.8kJmol^{-1}, 20000$

C. $3.13V, -604kJmol^{-1}, 20$

D. $3.04V, -611.8kJmol^{-1}, 20000$

Answer: D

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25. The half-cell reaction for the corrosion.

$2H^{+} + \frac{1}{2}O_2 \rightarrow H_2Ol, E^{\circ} = 1.23V$

$Fe^{2+} + 2e^- \rightarrow Fe(s); E^\circ$ =-0.44V Find the $\triangle G^\circ$ (in kJ) for the overall reaction:

A. $-76kJ$

B. $-322kJ$

C. $-161kJ$

D. $-152kJ$

Answer: B

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26. Given $E_{\frac{Cr^{3+}}{Cr}} = -0.72V \, . E^\circ_{Fe^{2+}/Fe} = -0.42V$ The potential for the cell, $Cr \mid Cr^{3+}(0.1M) \mid \mid Fe^{2+}(0.01M) \mid Fe$ is:

A. $-0.26V$

B. 0.26V

C. 0.339V

D. $-0.339V$

Answer: B

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27. A fuel cell involves combustion of butane at 1 atm and 298 K $C_4H_{10}(g)\frac{13}{2}O_2(8) \rightarrow 4CO_2(g) + 5H_20(l),\ \triangle G^\circ$ = -2746 kJ/mol. What is E° of a cell?

A. $+4.74V$

B. $+0.547V$

C. $+1.09V$

D. $+4.37V$

Answer: C

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28. In the concentration cell,

$Pt(H_2)|HA(0.1M)||HA(IM)NaA(IM)||NaA(IM)|(H_2)Pt$, $(pK_a of HA$

The cell potential will be:

A. 0.03V

B. 0.06V

C. $-0.06V$

D. $-0.03V$

Answer: C

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29. At 298 K, the standard reduction potentials are 1.51 V for $MnO_4^-, Mn^{2+}, 1.36Vf$ or $C\frac{l_2}{C}I^-, 1.07VBr_2$ | . Br^-, and 0.54 V for l_2 | l^- At pH=3, permaganate is expected to oxidize (2.303RT/F -0.059 V)

A. Cl^-, Br^- and I^-

B. Cl^- and Br^-

C. Br^- and I^-

D. I^- only

Answer: A

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30. Consider the half reactions of a galvanic cell given below: $MnO_2 + H^+ \Leftrightarrow Mn^{2+} + 2H_2O, E^\circ_{MnO_2} = 1.23V, PbCl_2 \Leftrightarrow Pb + 2Cl^-,$. The correct statement about the cell is

A. Standard cell potential is 0.95V

B. During withdrawal of electricity from cell, lead is reduced

C. During withdrawal of electricity from cell, manganese is oxidized.

D. During withdrawal of electricity from cell, two electrons are transferred from lead to manganese.

Answer: D

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31. For the redox reaction: $Zn(s) + Cu^{2+}(0.1M) \rightarrow Zn^{2+}(1M) + Cu(s)$ taking place in a cell, E°_{cell} is 1.10V. E°_{cell} for the cell will be [2.303(RT/F)=0.0591]

A. 2.14V

B. 1.80V

C. 1.07V

D. 0.82V

Answer: C

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32. The reaction of tin metal with acid can be written as

$Sn(s) + 2H^{+}(aq) \rightarrow Sn^{2+}(aq) + H_2(g), E^{\circ}_{Sn^{2+}/Sn} = -0.14V$

Assume that $\left[Sn^{2+}\right]$=1 M and the partial pressure of hydrogen gas is 1 atm, then the

A. cell reaction is spontaneous at pH=5

B. cell reaction is non-spontaneous at standard conditions

C. cell reaction is spontaneous at pH=2

D. cell reaction is spontaneous for all pH values

Answer: C

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33. An electric current is passed through two electrolytic cells connected in series. One cell contains Cu^{2+} and the other contains Fe^{2+} . Which of the following is the correct statement?

A. Equal masses of iron and copper are deposited on the electrode

B. More moles of copper are depoosited on the electrode

C. Equal moles of iron and copper are deposited on the electrodes

D. One ampere current for a day would be required to deposit one mole of each metal.

Answer: C

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34. The highest electrical conductivity of the following aqueous solutions is of

A. 0.1M acetic acid

B. 0.1M chloroacetic acid

C. 0.1M fluoroacetic acid

D. 0.1M difluoroacetic acid

Answer: D

Watch Video Solution

35. Consider a typical lead storage battery and select the correct statement mentioned below.

A. Lead oxide is dissolved into electrolyte without any change on withdrawing current

B. The density of electrolyte is increased on discharging

C. Sulphuric acid concentration decreases on discharging

D. The potential difference observed is approximately 12V.

Answer: C

Watch Video Solution

36. The dissociation constant of n-butyric acid is 1.6×10^{-5} and the molar conductivity at infinite dilution is $380 \times 10^{-4} Sm^2 mol^{-1}$. The specific conductance of the 0.01 M acid solution is

A. $1.52 \times 10^{-5} Sm^{-1}$

B. $1.52 \times 10^{-2} Sm^{-1}$

C. $1.52 \times 10^{-3} Sm^{-1}$

D. $1.52 \times 10^{-8} Sm^{-1}$

Answer: B

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37. Consider the cell $Ag|AgBrBr^{-}||CI|AgClAgat25^{\circ}$ C the solubility product of AgCl and AgBr are $1 \times 10^{\circ}$ and 5×10^{-13} respectively. At which ratio of concentration of Br and Clions would the emf of cell be zero?

A. $100:1$

B. $1:100$

C. $200:1$

D. $1:200$

Answer: D

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38. The resistance of solution A is 50 ohm and that of B is 100 ohm. Both are taken in same cell. If equal volume of A and B are mixed and the mixture is taken in same cell then the resistance is

A. 150ohm

B. 75 ohm

C. 66.67 ohm

D. 33.3ohm

Answer: C

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39. Calculate the quantity of electricity that would be required to reduce 12.3 gm of nitrobenzene to aniline if current efficiency is 50%

A. 347400 coulomb

B. 115800 coulomb

C. 23160 coulomb

D. 694800 coulomb

Answer: B

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40. Calculate the electrode potential of copper, if the concentration of $CuSO_4$ is 0.206 M at 23.1° C. Given that $E^\circ_{cu^{2+}/Cu} = +0.34V$.

A. 0.50V

B. 0.41V

C. 0.32V

D. 0.28V

Answer: C

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41. The conductivity of a saturated AgCl solution is found to be $1.86 \times 10^{-6} Scm^{-1}$ and that for water is $6.0 \times 10^{-8} Scm^{-1}$. The solubility of AgCl is (molar conductivity =137.2)

A. $1.7 \times 10^{-3} molL^{-1}$

B. $1.3 \times 10^{-5} molL^{-1}$

C. $1.3 \times 10^{-4} molL^{-1}$

D. $1.3 \times 10^{-6} molL^{-1}$

Answer: B

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42. Conductivity of 0.01 M KCI solution is x S cm^{-1} . When conductivity cell is filled with 0.01 M KCl the conductance observed is y S. When the same cell is filled with 0.01M H_2SO_4 the observed conductance is z S cm^{-1} . Hence conductivity of 0.01 M H_2SO_4 is

A. xz

B. z/xy

C. xz/y

D. xy/z

Answer: C

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43. A current of 9.65 A is drawn from a Daniell cell for exactly one hour. If molar masses of Cu and Zn are 63.5 g mol^{-1} and 65.4 g mol^{-1}, respectively, the loss in mass at anode and gain in mass at cathode respectively are

A. 11.43g, 11.77g

B. 11.77g, 11.43g

C. 22.86g, 23.54g

D. 23.54g, 22.86g

Answer: B

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44. The reaction $\frac{1}{2}H_2(g) + AgCl(s) = H^+(aq) + CI^-(aq) + Ag(s)$ occurs in the galvanic cell

A. $Ag|AgCl(s)|KCl(aq) \mid |AgNO_3(aq)|Ag$

B. $Pt|H_2(g)|HCl(aq) \mid |AgNO_3(aq)|Ag$

C. $Pt|H_2(g)|HCl(aq) \mid |AgCl(s)|Ag$

D. $Pt|H_2(g)|KCl(aq) \mid |AgCl(s)|Ag$

Answer: C

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45. Given $E^{\circ}_{Fe^{3+}/Fe} = -0.036V$ and $E^{\circ}_{fe^{2+}/Fe} = -0.44V$. What is the value of $E^{\circ}_{Fe^{3+}/Fe^{2+}}$

A. $(-0.036-0.439)V$

B. $(-0.036+0.439)V$

C. $[3(-0.036+2(-0.439)]V$

D. $[3(-0.036-2(-0.439)]V$

Answer: D

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46. 4.5 g of aluminimum (At. mass-27-amu) is deposited at cathode from AP solution by a certain quantity of electric charge. The volume of hydrogen produced at STP from H^+ ions in solution by the same quantity of electric charge will be.

A. 44.8L

B. 22.4L

C. 11.2L

D. 5.6L

Answer: D

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47. The same quantity of electricity that liberates 4.316 g of silver from $AgNO_3$ solution was passed through a solution of gold salt. If the atomic weight of gold be 197 and its valency in the above-mentioned salt be 3, calculate the weight of gold deposited at the cathode and the quantity of electricity passed.

A. 3.2g, 4021.5C

B. 3.28g, 5023.3C

C. 2.63g, 6213.5C

D. 2.63g, 3864.7 C

Answer: D

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48. The specific conductance of a saturated solution of silver bromide is $kScm^{-1}$. The limiting ionic conductivity of Ag^{+} and Brions are x and y, respectively. The solubility of silver bromide in g L^{-1} is: (molar mass of AgBr=188)

A. $\frac{k \times 1000}{x - y}$

B. $\frac{k}{x + y} \times 188$

C. $\frac{k \times 1000 \times 188}{x + y}$

D. $\frac{x + y}{k} \times \frac{1000}{188}$

Answer: C

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49. The Gibbs energy for the decomposition of Al_2, O_3 , at 500° C is as follows:

$\frac{2}{3}AI_2O_3 \rightarrow \frac{4}{3}AI + O_2, \ \triangle_r G = \ | \ 966kjmol^{-1}$ The potential difference needed for the electrolytic reduction of AI_2O_3 at 500° C is at least:

A. $-2.5V$

B. $+5.0V$

C. $4.5V$

D. $3.0V$

Answer: A

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50. The standard reduction potentials for $Zn^{2+} / Zn, N\frac{i^{2+}}{N}i$ and $F\frac{e^{2+}}{F}eare$-0.76,-0.23 and-0.44 V respectively.

The reaction: $X + Y^{2+} \rightarrow X^{2+} + y$

will be spontaneous when :

A. $X = Ni, Y = Fe$

B. $X = Ni, Y = Zn$

C. $X = Fe, Y = Zn$

D. $X = Zn, Y = Ni$

Answer: D

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Level Iii Single Correct Answer Type

1. A solution of $Ni(NO_3)_2$ is electrolysed between platinam electrodes using a current of $5am^-$ peres for 20 minutes. What mass of Ni is de posited at the cathode?

A. $75.5:1$

B. $65.2:1$

C. $55.2:1$

D. $45.2:1$

Answer: A

Watch Video Solution

2. Resistance of a conductivity cell filled with a solution of an electrolyte of concentration 0.1M is 100ohm. The conductivity of this solution is $1.29Sm^{-1}$. Resistance of the same cell when filled with 0.2M of the same solution is 520ohm. The molar conductivity of 0.02M solution of the electrolyte will be

A. $124 \times 10^{-4} Sm^2 mol^{-1}$

B. $1240 \times 10^{-4} Sm^2 mol^{-1}$

C. $1.24 \times 10^{-4} Sm^2 mol^{-1}$

D. $12.4 \times 10^{-4} Sm^2 mol^{-1}$

Answer: A

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3. In a fuel cell, methanol is used as fuel and oxygen gas is used as an oxidizer. The reaction is $CH_3OH(l) + \frac{3}{2}O_2(g) \rightarrow CO_2(g) + 2H_2O(l)$

At 298 K, standard Gibbs energies of formation for $CH_3OH(l)$, $H_2O(l)$ and $CO_2(g)$ are -166.2, -237.2 and $-394.4 kJmol^{-1}$ respectively. If standard enthalpy of combustion of methanol is $-726 kJmol^{-1}$ efficiency of the fuel cell will be:

A. $90\ \%$

B. $97\ \%$

C. $80\ \%$

D. $87\ \%$

Answer: B

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4. Pure water is saturated with pure solid AgCl. A silver electrode is placed in the solution and the potential is measured against normal calomel electrode at $25^{\circ}C$. This experiment is then repeated with a saturated solution of AgI. If the difference in potential in the two cases is 0.177V, what is the ratio of solubilities of AgCl and AgI at the temperature of experiment ?

A. 10^3

B. 10^6

C. 10^4

D. 10^2

Answer: A

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5. The hydrogen electrode when placed in a buffer solution of CH_3COONa and CH_3COOH in the ratio x:y and y:x has oxidation electrode potetnial E_1 and E_2 volts respectively at $25^\circ C(P_{H_2} = 1 \text{ atm})$. pK_a for CH_3COOH will be

A. $E_1 + E_2$

B. $E_1 - E_2$

C. $\frac{E_1 + E_2}{0.0591 \times 2}$

D. $\frac{E_1 - E_2}{0.0591 \times 2}$

Answer: C

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6. During the discharge of lead storage battery, the density of H_2SO_4 fall from 1.3g/mL of 1.1g/mL. Sulphuric acid of density 1.3g/mL is 40% by weight and that of density 1.1g/mL is 20% by weight. The battery contains

2.0 litres of acid. The volume remains unchanged during discharge. How many faraday of current is liberated ?

A. 6.12

B. 4.92

C. 5.34

D. 3.06

Answer: A

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7. What current would be required to deposit $1.00m^2$ of chromium plate having a thickness of 0.052mm in 4.5h from a solution of H_2CrO_4 ? The current efficiency is 74% and density of chromium is $7.19gcm^{-3}$. [Atomic mass of Cr= 52u]

A. 347A

B. 185A

C. 125A

D. 0.25A

Answer: A

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8. In a zinc -manganese dioxide dry cell, the anode is made up of zinc and cathode of a carbon rod surrounded by a mixture of MnO_2, carbon, NH_4Cl and $ZnCl_2$ in aqueous base. The cathodic reaction may be represented as: $MnO_2 + NH_4^+ + e^- \rightarrow MnO(OH) + NH_3$. Let there be $8gMnO_2$ in the cathodic compartment. How many days will the dry cell continue to give a current of 4×10^{-3} ampere ?

A. 32 days

B. 25.675days

C. 48.35 days

D. 18.55 days

Answer: B

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9. A 0.05N solution of a salt occupying a volume between two platinum electrodes separated by a distance of 1.72cm and having an area of $4.5cm^2$ has a resistance of 250 ohm. Calculate the equivalent conductance of the solution

A. $48.23ohm^{-1}cm^2eq^{-1}$

B. $62.83ohm^{-1}cm^2eq^{-1}$

C. $22.36ohm^{-1}cm^2eq^{-1}$

D. $30.576ohm^{-1}cm^2eq^{-1}$

Answer: D

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10. The standard reduction potential of $Cu^{2+} \mid Cu$ and $Ag^{+} \mid Ag$ electrodes are 0.337 and 0.799 volt respectively. Construct a galvanic cell using these electrodes so that its standard emf is positive. For what concentration of Ag^{+} will the emf of the cell at $25^{\circ}C$ be zero if the concentration of Cu^{2+} is 0.01M?

A. $15.23 \times 10^{-9} M$

B. $1.523 \times 10^{-9} M$

C. $3.846 \times 10^{-9} M$

D. $38.46 \times 10^{-9} M$

Answer: B

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Level Iii Multiple Correct Answer Type

1. A fuel cell is

A. The voltaic cells in which continuous supply of fuels are at anode to give oxidation

B. The voltaic cell in which fuels such as, CH_4, H_2, CO are used at anode

C. It involves the reactions of $H_2 - O_2$ fuel cell such as, Anode : $2H_2 + 4OH^- \rightarrow 4H_2O_{(I)} + 4e$ Cathode

$O_2 + 2H_2O_{(I)} + 4e \rightarrow 4OH^-$

D. The efficiency of a $H_2 - O_2$ fuel cell is 23%

Answer: A::B::C

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2. Which of the following statements are applicable to electrolytic conductors ?

A. Greater will be the polarity of solvent, more will be the conductivity

B. Ions are responsible for carrying the current

C. Show a positive temperature coefficient for conductance

D. On increasing temperature conduction decreases

Answer: A::B::C

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3. Select the correct statements

A. Corrosion is an electrochemical process

B. Reversible cell is recharged by D.C., source of current

C. In electrolytic cell on increasing temperature resistance decreases

D. Electroplating is a spontaneous process

Answer: A::B::C

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4. The main factors which affect corrosion are

A. position of metal in electrochemical series

B. presence of CO_2 in water

C. presence of impurities in metal

D. presence of protective coating

Answer: A::B::C::D

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5. Which of the following statements is/are correct ?

A. One faraday is the charge carried by one mole of electrons

B. If same quantity of eletricity flows through the solutions of 0.1M $AgNO_3$ and 0.1M $CuSO_4$ solutions, same weight of silver and copper will be deposited

C. Electrochemical equivalent has the unit of grams per coulomb

D. Passage of one faraday of electricity produces one gram equivalent of the substance at the electrode

Answer: A::C::D

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6. Rusting on the surface of iron involves:

A. $Fe(s) \rightarrow Fe^{2+}(aq) + 2e^{-}$ (at anodic site)

B. $O_2(g) + 4H^{+}(aq) + 4e^{-} \rightarrow 2H_2O(I)$ (at cathodic site)

C. $4Fe^{2+}(aq) + O_2(g) + 4H_2O(I) \rightarrow 2Fe_2O_3(s) + 8H^{+}$

D. $Fe_2O_3(s) + xH_2O(I) \rightarrow Fe_2O_3xH_2O$

Answer: A::B::C::D

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7. For the reduction of NO_3^- in an aqueous solution, E° is 0.96V. Values of E° for some metal ions are given below

$V_{(aq)}^{2+} + 2e^- \rightarrow VE^\circ = -1.19V$

$Fe_{(aq)}^{3+} + 3e^- \rightarrow FeE^\circ = -0.04V$

$Au_{(aq)}^{3+} + 3e^- \rightarrow AuE^\circ = +1.40V$

$Hg_{(aq)}^{2+} + 2e^- \rightarrow HgE^\circ = +0.86V$

The pair(s) of metal that is (are) oxidised by NO_3^- in aqueous solution is (are)

A. V and Hg

B. Hg and Fe

C. Fe and Au

D. Fe and V

Answer: A::B::D

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8. Which of the following statements is (are) correct ?

A. The reactivity of metals decreases in going down the electrochemical series

B. A metal can displace any other metal placed above it in the electrochemical series from its salt solution

C. The oxidizing power of the substances decrease from the top to the bottom in the electrochemical series

D. A redox reaction is feasible when the substance having higher reduction potential gets reduced and the one having lower reduction potential gets oxidized.

Answer: B::C::D

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9. Which of the following statements is (are) incorrect ?

A. Electrolysis of sulphuric acid (dilute or concentrated) using inert electrodes give H_2 at cathode and O_2 at anode

B. Electrolysis of dilute NaOH solution gives H_2 at cathode and O_2 at anode

C. Oxidation of copper anode occurs in the electrolysis of aqueous copper sulphate solution using copper electrodes

D. Electrolysis of aqueous KF solution gives fluorine at the anode

Answer: A::D

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Level Iii Numerical Type

1. Calćulate the pH of the following half cell Pt, H_2 / H_2SO_4 The oxidation potential is +0.3 V .

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2. The electrolysis of a metal salt was carried out by passing a current of 4 amp for 45 minutes. It resulted in the deposition of 2.977g metal. If atomic mass of the metal is $106.4 gmol^{-1}$, calculate the charge of metal cation.

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3. Three litres of 0.5M $K_2Cr_2O_7$ solution have to completely reduced in the acidic medium. The number of faraday of electricity required will be ....

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4. At equimolar concentration of Fe^{2+} and Fe^{3+} what must $\left[Ag^{+}\right]$ be so that the voltage of the galvanic cell made from Ag^{+}/Ag and Fe^{3+}/Fe^{2+} electrodes equals zero? The reaction is $Fe^{2+} + Ag^{+} \Leftrightarrow Fe^{3+} + Ag$. Determine the equilibrium constant at

$25^\circ C$ for the reaction. Given

$E^\circ_{Ag^+/Ag} = 0.799V$ and $E^\circ_{Fe/Fe^{2+}} = 0.771V$

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5. If 0.3605 g of a metal is deposited on the electrode by passing 1.2A current for 15 min through its salt, what will be its valence ? (Atomic weight of the metal is 96)

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6. During the discharge of a lead storage battery, the density of 40% H_2SO_4 by weight fell from 1.225 to 0.98 (which is 20% by weight). What is the charge in molarities of H_2SO_4 ?

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7. ΔG for the reaction $\frac{4}{3}Al + O_2 \rightarrow \frac{2}{3}Al_2O_3$ is $-772kJmol^{-1}$ of O_2. Calculate the minimum EMF in volts required to carry out an electrolysis of Al_2O_3

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8. $k = 4.95 \times 10^{-5}Scm^{-1}$ for a 0.001M solution. The reciprocal of the degree of dissociation of acetic acid, if Λ_m° for acetic acid is $400Scm^{-2}mol^{-1}$ is

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Level Iii Matching Column Type

1. Match the following columns

Column I	Column II
A) Strong electrolyte	p) Degree of dissociation ≈ 1
B) Weak electrolyte	q) Kohlaraush's law is applicable
C) Weak electrolyte at infinite dilution	r) Limiting value can be calculate from graph between Λ_m and $\sqrt{C}$

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2.

Column I Name of cell/battery	Column II Electrolyte
A) Mercury cell	p) KOH solution
B) Lead storage battery	q) HgO + KOH (moist)
C) Dry cell	r) 38% H_2SO_4
D) Fuel cell (H_2-O_2)	s) MnO_2 + C (touching cathode) and paste of NH_4Cl + $ZnCl_2$ (touching anode)
E) Ni-Cd storage cell	t) Concentrated aqueous KOH solution

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3. Match the column -I with column-II

Column I	Column II
A) Specific conductance, κ	p) $\Lambda_m^\circ / \Lambda_m$
B) Molar conductance, Λ_m	q) Decreases with dilution
C) Resistance of electrolyte solution R	r) Increases with dilution
D) Degree of ionization of weak electrolyte, α	s) Increases with increase in the distance parallel plates

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4. Match the column -I with column-II

Column I	Column II
A) $E^{\circ} = 0$	p) Cell is discharged
B) $E = 0$	q) $Q = K$
C) $\Delta G = 0$	r) 96500 coulomb
D) 1 Faraday	s) 1mol electrons
	t) Concentration cell

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Level Iii Statement Type

1. Statement 1: Ionic conductivities increase with increase of temperature and pressure.

Statement 2: Viscosity of water decreases with increase of temperature and increases with the increases of pressure

A. Statement I is True, statement 2 is True, Statement 2 is correct explanation for statement 1

B. Statement I is True, statement 2 is True, Statement 2 is NOT correct explanation for statement 1

C. Statement 1 is True, Statement 2 is False

D. Statement 1 is False, Statement 2 is True

Answer: D

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2. Statement 1: The correct order of equivalent conductance at infinite dilution is $LiCl > NaCl > KCl$

Statement 2: In case of alkali metal ions, the hydration tendency follows the order $LI^+ < Na^+ < K^+$

A. Statement I is True, statement 2 is True, Statement 2 is correct explanation for statement 1

B. Statement I is True, statement 2 is True, Statement 2 is NOT correct explanation for statement 1

C. Statement 1 is True, Statement 2 is False

D. Statement 1 is False, Statement 2 is True

Answer: D

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3. Statement 1: For the Daniell cell, $Zn|Zn^{2+}||Cu^{2+}|Cu$ with $E_{\text{cell}} = 1.1$ volt, the application of opposite potential greater than 1.1V results into flow of electrons from cathode to anode.

Statement 2: Zn is deposited at anode and Cu is dissolved at cathode

A. Statement I is True, statement 2 is True, Statement 2 is correct explanation for statement 1

B. Statement I is True, statement 2 is True, Statement 2 is NOT correct explanation for statement 1

C. Statement 1 is True, Statement 2 is False

D. Statement 1 is False, Statement 2 is True

Answer: B

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4. Statement 1: When a copper wire is dipped in silver nitrate solution, there is no change in the colour of the solution.

Statement 2: Copper cannot displace silver from its salt solution

A. Statement I is True, statement 2 is True, Statement 2 is correct explanation for statement 1

B. Statement I is True, statement 2 is True, Statement 2 is NOT correct explanation for statement 1

C. Statement 1 is True, Statement 2 is False

D. Statement 1 is False, Statement 2 is True

Answer: D

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5. Statement 1: $H_2 + O_2$ fuel cell gives a constant voltage throughout its life

Statement 2: In this fuel cell H_2 reacts with OH^- ions, yet th eoverall concentration of OH^- ions does not change.

A. Statement I is True, statement 2 is True, Statement 2 is correct explanation for statement 1

B. Statement I is True, statement 2 is True, Statement 2 is NOT correct explanation for statement 1

C. Statement 1 is True, Statement 2 is False

D. Statement 1 is False, Statement 2 is True

Answer: A

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6. Statement 1: KCl and NH_4Cl cannot be used in salt bridge of a cell containing Ag^+, Hg_2^{2+} and Tl^+ ions.

Statement 2: Cell will be destroyed due to precipitation of metal chlorides.

A. Statement I is True, statement 2 is True, Statement 2 is correct explanation for statement 1

B. Statement I is True, statement 2 is True, Statement 2 is NOT correct explanation for statement 1

C. Statement 1 is True, Statement 2 is False

D. Statement 1 is False, Statement 2 is True

Answer: A

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7. Statement 1: $\Lambda^{\circ}_{eq(CH_3COOH)}$ cannot be determined experimentally Statement 2: CH_3COOH is a weak acid and Debye- Huckel Onsager equation cannot be used. Extrapolation method cannot be employed.

A. Statement I is True, statement 2 is True, Statement 2 is correct explanation for statement 1

B. Statement I is True, statement 2 is True, Statement 2 is NOT correct explanation for statement 1

C. Statement 1 is True, Statement 2 is False

D. Statement 1 is False, Statement 2 is True

Answer: A

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Level Iii Linked Comprehension Type

1. In order to reduce 1 mole of $Cr_2O_7^{2-}$ into Cr^{+3} in acidic medium, how many Faraday of electricity are required ?

A. 6F

B. 12F

C. 4F

D. 2F

Answer: B

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2. Faraday's first law of electrolysis: Amount of a substance deposited or liberated on respective electrode is directly proportional to the quantity of electricity following through the circuit.

$W \propto Q \Rightarrow W = ZQ$

W= Zit where Z= electrochemical equivalent of the substance.

(i) In order to deposit or liberate 1 mole of substance, integeral no of

Faradays are required.

(ii) In order to deposit one gram equivalent of substance, 1 Faraday electricity is required.

Current efficiency $= \frac{\text{Actual yield}}{\text{Theoritical yield}} \times 100\,\%$

For the reaction, $2CH_3COO^- \rightarrow C_2H_6(g) + 2CO_2(g) + 2e^-$. If current of 20A is passed for 965sec, volume of liberated gases measured at NTP is found to be 3.36 lit, then calculate current efficiency of the reaction

A. $60\,\%$

B. $70\,\%$

C. $50\,\%$

D. $75\,\%$

Answer: C

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3. Faraday's first law of electrolysis: Amount ofa substance deposited or liberated on respective electrode is directly proportional to the quantity of electricity following through the circuit.

$W \propto Q \Rightarrow W = ZQ$

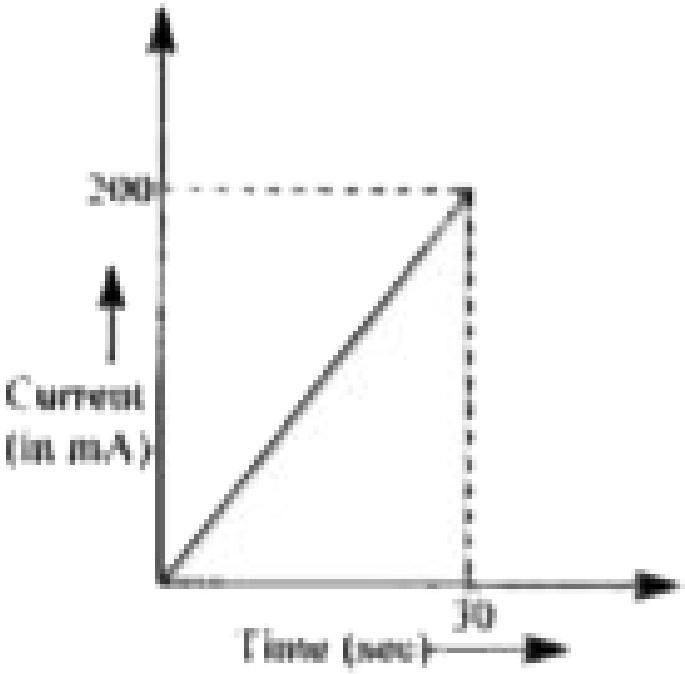
W= Zit where Z= electrochemical equivalent of the substance.

(i) In order to deposit or liberate 1 mole of substance, integeral no of Faradays are required.

(ii) In order to deposit one gram equivalent of substance, 1 Faraday electricity is required.

Current efficiency $= \dfrac{\text{Actual yield}}{\text{Theoritical yield}} \times 100\,\%$

When $CuSO_4$ solution is electrolysed in a copper voltameter for 30 sec, then 'm' gram of copper was deposited. Time current graph for the electrolysis is:



The electrochemical equivalent of copper from above plot will be

A. $\frac{M}{2}$

B. $\frac{m}{5}$

C. 2m

D. $\frac{m}{3}$

Answer: D

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4. A 4.0 molar aqueous solution of NaCl is prepared and 500mL of this solution is electrolysed. This leads to the evolution of chlorine gas at one of the electrodes (Atomic mass: Na= 23: Hg=200, 1 faraday= 96500 coulomb)

The total number of moles of chlorine gas evolved is

A. 0.5

B. 1.0

C. 2.0

D. 3.0

Answer: B

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5. A 4.0 molar aqueous solution of NaCl is prepared and 500mL of this solution is electrolysed. This leads to the evolution of chlorine gas at one of the electrodes (Atomic mass: Na= 23: Hg=200, 1 faraday= 96500

coulomb)

If the cathode is a Hg electrode, the maximum weight (in g) of Na-Hg amalgam formed from this solution is

A. 200

B. 225

C. 400

D. 446

Answer: D

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6. A 4.0 molar aqueous solution of NaCl is prepared and 500mL of this solution is electrolysed. This leads to the evolution of chlorine gas at one of the electrodes (Atomic mass: Na= 23: Hg=200, 1 faraday= 96500 coulomb)

The total charge (in coulombs) required for complete electrolysis is

A. 24125

B. 48250

C. 96500

D. 193000

Answer: D

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7. Fuel cells are galvanic cells in which the chemical energy of fuel is directly converted into electrical energy. Type of fuel cell is a hydrogen - oxygen fuel cell. It consists of two electrodes made up of two porous graphite impregnated with a catalyst (platinum, silver, or metal oxide). The electrodes are placed in aqueous solution of NaOH. Oxygen and hydrogen are continuously fed into the cell. Hydrogen gets oxidized to $H^{\oplus}$ which is neutralized by $\overset{\Theta}{O}H$, ie., anodic reaction.

$H_2 \Leftrightarrow 2H^{\oplus} + 2e^{-}$

$2H^{\oplus} + 2\overset{\Theta}{O}H \Leftrightarrow 2H_2O$

$H_2 + 2\overset{\Theta}{O}H \Leftrightarrow 2H_2O + 2e^-$

At cathode, O_2 gets reduced to $\overset{\Theta}{O}H$ i.e., $O_2 + 2H_2O + 4e^- \Leftrightarrow \overset{\Theta}{4}OH$

Hence, the net reaction is $2H_2 + O_2 \Leftrightarrow 2H_2O$

The overall reaction has $\Delta H = -285.6kJmol^{-1}$ and $\Delta G = -237.4kJmol^{-1}$ at $25^\circ C$

If the cell voltage is 1.23V for the $H_2 - O_2$ fuel cell and for the half cell: $O_2 + 2H_2O + 4e^- \Leftrightarrow 4\overset{\Theta}{O}H$ has $E^\Theta = 0.40V$, then E^Θ for $2H_2O + 2e^- \Leftrightarrow H_2 + 2\overset{\Theta}{O}H$ will be

A. 0.41V

B. 0.83V

C. $-0.41V$

D. $-0.83V$

Answer: D

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8. Fuel cells are galvanic cells in which the chemical energy of fuel is directly converted into electrical energy. Type of fuel cell is a hydrogen - oxygen fuel cell. It consists of two electrodes made up of two porous graphite impregnated with a catalyst (platinum, silver, or metal oxide). The electrodes are placed in aqueous solution of NaOH. Oxygen nad hydrogen are continuously fed into the cell. Hydrogen gets oxidized to $H^{\oplus}$ which is neutralized by $\overset{\Theta}{O}H$, ie., anodic reaction.

$H_2 \Leftrightarrow 2H^{\oplus} + 2e^{-}$

$2H^{\oplus} + 2\overset{\Theta}{O}H \Leftrightarrow 2H_2O$

$H_2 + 2\overset{\Theta}{O}H \Leftrightarrow 2H_2O + 2e^{-}$

At cathode, O_2 gets reduced to $\overset{\Theta}{O}H$ i.e., $O_2 + 2H_2O + 4e^{-} \Leftrightarrow \overset{\Theta}{4}OH$

Hence, the net reaction is $2H_2 + O_2 \Leftrightarrow 2H_2O$

The overall reaction has

$\Delta H = -285.6kJmol^{-1}$ and $\Delta G = -237.4kJmol^{-1}$ at $25^{\circ}C$

Suppose the concentration of hydroxide ion in the cell is doubled, then the cell voltage will be

A. Reduced by half

B. increased by a factor of 2

C. Increased by a factor of 4

D. Unchanged

Answer: D

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9. Which of the following statements are correct?

Fuel cells are galvanic cells in which the chemical energy of fuel is directly converted into electrical energy. Type of fuel cell is a hydrogen - oxygen fuel cell. It consists of two electrodes made up of two porous graphite impregnated with a catalyst (platinum, silver, or metal oxide). The electrodes are placed in aqueous solution of NaOH. Oxygen nad hydrogen are continuously fed into the cell. Hydrogen gets oxidized to $H^{\oplus}$ which is neutralized by $\overset{\Theta}{O}H$, ie., anodic reaction.

$H_2 \Leftrightarrow 2H^{\oplus} + 2e^{-}$

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Hence, the net reaction is $2H_2 + O_2 \Leftrightarrow 2H_2O$

The overall reaction has $\Delta H = -285.6kJmol^{-1}$ and $\Delta G = -237.4kJmol^{-1}$ at $25^\circ C$

A fuel cell is

I. A voltaic cell in which continuous supply of fuels are sent at anode to perform oxidation

II. A voltaic cell in which fuels such as CH_4, H_2 and CO are used up at anode.

III. One which involves the reaction of $H_2 - O_2$ fuel cell such as: Anode $2H_2 + 4\overset{\Theta}{O}H \rightarrow 4H_2O(I) + 4e^-$

cathode : $O + 2H_2O(I) + 4e^- \rightarrow 4\overset{\Theta}{O}H$

IV. The efficiency of $H_2 - O_2$ fuel cell is 70 to 75%

A. I, III

B. I, III, IV

C. I, II, III, IV

D. I, II, III

Answer: C

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10. Tollen's reagent is used for the detection of aldehyde when a solution of $AgNO_3$ is added to glucose with NH_4OH then gluconic acid is formed

$Ag^+ + e^- \rightarrow Ag, E^\circ_{red} = 0.8V$

$C_6H_{12}O_6 + e^- \rightarrow C_6H_{12}O_7$ (Gluconic acid)

$+2H^+ + 2e^-, E^\circ_{red} = -0.05V$

$Ag(NH_3)_2^+ + e^- \rightarrow Ag(s) + 2NH_3, E^\circ = -0.337V$

[Use $2.303 \times \frac{RT}{F} = 0.0592$ and $\frac{F}{RT} = 38.92$ at 298K]

Ammonia is always added in this reaction. Which of the following must be incorrect ?

A. 66.13

B. 58.35

C. 28.30

D. 46.29

Answer: A

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11. Tollen's reagent is used for the detection of aldehyde when a solution of $AgNO_3$ is added to glucose with NH_4OH then gluconic acid is formed

$Ag^+ + e^- \rightarrow Ag, E^\circ_{\text{red}} = 0.8V$

$C_6H_{12}O_6 + e^- \rightarrow C_6H_{12}O_7$ (Gluconic acid)

$+2H^+ + 2e^-, E^\circ_{\text{red}} = -0.05V$

$Ag(NH_3)_2^+ + e^- \rightarrow Ag(s) + 2NH_3, E^\circ = -0.337V$

[Use $2.303 \times \frac{RT}{F} = 0.0592$ and $\frac{F}{RT} = 38.92$ at 298K]

When ammonia is added to the solution, pH is raised to 11. Which half-cell reaction is affected by pH and by how much ?

A. E_{oxd} will increase by a factor of 0.65 from E°_{oxd}

B. E_{oxd} will decrease by a factor of 0.65 from E°_{oxd}

C. E_{red} will increase by a factor of 0.65 from E°_{red}

D. E_{red} will decrease by a factor of 0.65 from E°_{red}

Answer: C

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12. Tollen's reagent is used for the detection of aldehyde when a solution of $AgNO_3$ is added to glucose with NH_4OH then gluconic acid is formed

$Ag^+ + e^- \rightarrow Ag, E^{\circ}_{red} = 0.8V$

$C_6H_{12}O_6 + e^- \rightarrow C_6H_{12}O_7$ (Gluconic acid)

$+2H^+ + 2e^-, E^{\circ}_{red} = -0.05V$

$Ag(NH_3)_2^+ + e^- \rightarrow Ag(s) + 2NH_3, E^{\circ} = -0.337V$

[Use $2.303 \times \frac{RT}{F} = 0.0592$ and $\frac{F}{RT} = 38.92$ at 298K]

Ammonia is always added in this reaction. Which of the following must be incorrect ?

A. NH_3 combines with Ag^+ to form a complex

B. $Ag(NH_3)_2^+$ is a weaker oxidising reagent than Ag^+

C. In absence of NH_3 silver salt of gluconic acid is formed

D. NH_3 has affected the standard reduction potential of glucose/gluconic acid electrode.

Answer: D

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