CHEMISTRY

BOOKS - R SHARMA CHEMISTRY (HINGLISH)

ELECTROCHEMISTRY

Example

1. Sketching and labeling a galvanic cell: Design a galvanic cell that uses the redox reaction

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

Identify the anode cathode half-reactions and sketch the experimental setup. Label the anode and cathode, indicate the directon of elecron and ion flow, and identify the sign of each elctrode.

Strategy: First sepreate the overall cell reaction into anode (oxidation) and cathode (reduction) half-reactions. Then, set up two half-cells that

use half-reactions, and connect the half-cells with a conducating wire and a salt bridge.

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2. Writing the cell reaction from the cell notation:

Given the following shorthand notation

$Pt(s)\left|Sn^{2+}(aq.\,,1M),Sn^{4+}(aq.\,,1M)\right|\left|Fe^{3+}(aq.\,,1M),Fe^{2+}(aq.\,,1M)\right|$

Write a balanced equation for the cell reaction and give a brief description of the cell.

Strategy: We can write the overall cell reaction from the cell notation by first writing the approprite half-cell reactions. We can obtain the cell half-reactions simply by reading the short-hand notation. The shorthand notation specifies the anode (on the extreme left), the cathode (on the extreeme right), and the reactants in tghe half-cell compartments. To find the balanced equation for the cell reaction, we first write the approprite half-cell reactions. two half-reactions after multiplying each (if necessary) by an approprite factor so that the electrons will cancel. The result is the cell reaction.

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3. Determining the realtive strengths of oxidizing and reducing agents

a. Arrange the following oxidizing agents in order of increasing strength unde standard-state conditions: $Br_2(1)$, $Fe^{3+}(aq.)$, $Cr_2O_7^{2-}(aq.)$

b. Arrange the following reducine agents in order of increasing strength under standard state condition: $Al(a)$, $Na(s)$, $Zn(s)$

Strategy: Pick our the half reactions in Table 3.1 that involve the given oxidizing or reducing agents and list them, along with their E° value increases (i.e. becomes more positive) whereas the strength of a reducing agent increases as the E° value decreases (i.e. becomes more negative).

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4. Determining the directiom of spontaneity from electrode pot $Na^+(aq.) + e^- \rightarrow Na(s) E^\circ = -2.71 V$entials : Predict from Table 3.1, whether $Pb^{2+}(aq.)$ can oxidize $Al(s)$ or $Cu(s)$ under standard conditions. Calculate $E^\ominus$ for each reaction at $25^\circ C$.

Strategy: To predict whether a redox reaction is spontaneous, remember that an oxidizing agent can oxidize any reducing agent that lies below it in the table but can't oxidize one that lies above it.

Alternatively, write the expected reaction. Find the oxidizing agents in the equations, one is on the left side and the other on the right side. Locate these oxidizing agents in a table of electrode potentials (the oxidizing agent is on the left side of the reduction half-reaction). The stronger oxidizing agent is the one involved in the half-reaction with the more positive standard electrode potential.

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5. Calculating the emf from standard potentials:

A galvanic cell consists of an Al electrode in a $1.0MAl(NO_3)_3$ solution and an Fe electrode in a $1.0MFe(NO_3)_2$ solution. Calculate the standard emf of this electrohemical cell at $25^\circ C$. Also write the cell reaction.

Strategy: From the table of standard electrode potentials, write the two reduction half reaction and standard electrode potentials for the cell.

Change the direction of the half-cell reaction corresponding tol the smaller (or more negative) electrode potential. Multiply the when the half-reactions are added the electrons cancel. The sum of the half-reactions is the cell reaction. Add the electrode potentials to get the cell emf.

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6. Using the data in Table 3.1, predict whether Cl_2 disproportionates in alkaline solution:

Strategy: Chlorine can exist in manu oxidation states. Chlorine in the 0 oxidation state, as in Cl_2, can be reduced. Chorine can also be oxidized to one of several positive oxidation states. so Cl_2 can react with itself in a redox reaction, which means that it is possible for chlorine to disproportionate. Search out two different half reactions involving Cl_2

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7. The Nearst Equation: Calcualte the nonstandard electrode potential, E, for the Fe^{3+}/Fe^{2+} electrode when the concentration of Fe^{2+} is exactly firve time that of Fe^{3+}

Strategy: The Nearst equation helps us calculate electrode potentials for concentrations other than one molar. The Tabulation of standard electrode potentials gives us the value of E° for the reduction half-reaction. Use the balanced half-reaction and the given concentration ratio to calculate the value of Q. Finally substitude this into the Nearst equation with n equal to the number of moles of elecrons involved in the half-reaction.

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8. The Nearst Equation: A galvanic cell is constructed at $25^{\circ}C$ as follows. Once half-cell consists of the Fe^{3+}/Fe^{2+} couple in which $C_{Fe^{3+}} = 1.00M$ and $C_{Fe^{2+}} = 0.100M$, the other involves the MnO_4^-/Mn^{2+} couple in which $C_{MnO_4^-} = 1.00 \times 10^{-2}M, C_{Mn^{2+}} = 1.00 \times 10^{-4}M,$ and

$C_M n^{2+} = 1.00 \times 10^{-3} M$. (a) Find the elecrode potential for each half-cell with these concentrations, and (b) calculate the overall cell potential.

Strategy: (a) Apply the Nernst equation to find the electrode potential of each half-cell with the given concentrations.

Write the half-reaction with the more positive (or less negative) potentikal (after correction) as the cathode reaction along with its potential. Reverse the other half-reaction (to make it anode reaction) and change the sign of its E value. Finally balance the electron transfer and then add the half-reactions and their electrode potentials to find the overall cell potentail.

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9. Calculating the cell emf for Nonstandard condition : A galvanic cell is constructed at $298K$ as follows. One half-cell consists of a chlorine gas electrode (i.e. Cl_2 / Cl^- couple) with the partial pressure of $Cl_2 = 0.100$ bar and $C_{CI-} = 0.100M$. The other half-cell involves the MnO_4^- / Mn^{2+} couple in acidic solution with $C_{MnO_4^-} = 0.100M, C_{Mn^{2+}} = 0.100M$, and $C_{H+} = 1.00M$. Apply the

Nernst equation to datermine the cell potenital for this cell.

Strategy: First datermine the overall cell reaction and then calculate the standard cell potential $\left(E_{\text{cell}}^{\circ}\right)$ from the standard electrode potenital in Table 3.1. then use the Nernst equation to find the cell potential (E) under cited conditions.

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10. Predicating the spontaneity of cell reaction: Predict whether following reaction would spontaneously as written at $298K$:

$Co(s) + Fe^{2+}(aq.) \rightarrow Co^{2+}(aq.) + Fe(s)$

given that $C_{Co^{2+}} = 0.15M$ and $C_{Fe^{2+}} = 0.68M$

Strategy: Calculate E_{cell} by applying the Nernst equaltion to the overall cell reaction. The cell is spontaneous in the direction written, for the concentration given, if E_{cell} is positive. However the reverse reaction would be favoured at those concentrations, if resulting cell potential is negative.

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11. The Nernst equation: Consider the following galvanic cell

$Pb(s)\left|Pb^{2+}(aq.)\right|\left|Ag^{2+}(aq.)\right|Ag(s)$

(a) What is the quantitative change in the cell voltage on increas-ing the ion concentrations in the anode compartment by a factor of 10?

(b) What is the quantitative change in the cell voltage on increas-ing the ion concentration in the cathode compartment by a factor of 10

Strategy: The conventional notation of the cell tells us that lead is the anode while silve is the cathode. Therfore, the cell reaction is

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

The cell potantial (at $25^{\circ}C$) is given by the Nernst equation, where $n=2$ and $Q=C_{Pb^{2+}}/C_{Ag^{+}}$:

$$E_{\text{cell}}=E^{\circ}_{\text{cell}}-\frac{0.0592V}{n}\text{logQ}$$

$$E^{\circ}_{\text{cell}}-\frac{0.0592V}{n}\text{logQ}\frac{C_{Pb^{2+}}}{C^{2}_{Ag^{+}}}$$

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12. Converting measured potentials to standard potentials: In investigating the properties of rare and expensive metal such as rhenium

$(Z = 75)$, it is both impractical and uneconomical to prepare cells with standard concentrations. The find the standard potential of the $Re^{3+}(aq.)/Re(s)$ electrode, the following cell is constructed:

$Pt(s)|Re(s)|Re^{3+}(aq., 0.018M) \mid |Ag^{+}(aq., 0.010M)|Ag(s)$

The potential of this cell is found to be $0.42V$ with the Re electrode as the node. Calculate the standard potential of the half reaction

$Re^{3+}(aq.) + 3e^{-} \Leftrightarrow Re(s)$

Strategy: Table 3.1 lists the $E_{\circ}$ for the $Ag^{+}(aq.) \mid Ag(s)$ electrode as 0.80. We can find the E° of the other electrode by finding the E° of the cell through the application of the Nernst equation.

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13. Determine of pH: The following cell has a potential of $0.55V$ at $25^{\circ}C$:

$Pt(s)|H_2(1^{-})|H^{+}(aq.\ ?M)||Cl^{-}(1M)|Hg_2Cl_2(s)|Hg(l)$

What is the pH of the solution in the anode compartment?

Strategy: First, read the shorthand notation to obtain the cell reaction. Then, calculate the half cell potential for the hydrogen electrode from the

observed cell potential and the half cell poten-tial for the calomel reference electrode. Finally, apply the Nernst equation to find the pH.

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14. Calculating the thermodynamic equilibrium constant from the cell emf: The standard emf for the following galvanic cell is $0.46V$

$Cu(s)\left|Cu^{2+}(aq.)\right|\left|Ag^{+}(aq.)\right|Ag(s)$

Calculate the equilibrium cosntant K_C for the reaction

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

Strategy : Substitute the standard emf into the Equation (3.9) realting this quantity to the thermodynatmic equilibrium constant, $K_{eq.}$. Solve $K_{eq.}$. Note that $K_{eq.}=K_C$.

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15. Calculating the Gibbs Energy change from electrode Potentials: Using standard electrode potentials, clacu-late the standard Gibbs energy change at $25^{\circ}C$ for the following cell reaction.

Strategy: To calculate $\Delta G^{\circ}_{\text{cell}}$, we use the equation $\Delta G^{\circ}_{\text{cell}} = -nFE^{\circ}_{\text{cell}}$, where E°_{cell} is obtained by using a table of standard potentails and n can be inferred from the balanced chemical equation. The cell reaction equals the sum of the half-cell reactions after they have been multiplied by factors so that the electrons cancel in the summation. Note that n is the number of electrons involved in each half-reaction.

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16. Calculating the cell emf from free-energy change: Suppose the reaction of zinc ions and chloride ions are formed in aqueous solution.

$$Zn(s) + Cl_2(g) \xrightarrow{H_2O} Zn^{2+}(aq.) + 2Cl^{-}(aq.)$$

Calculate the standard emf for this cell at $25^{\circ}C$ from standard free energies of formation.

Strategy: Calculate $\Delta_r G^{\circ}$ and substitute it along with the value of n into the equation $\Delta_r G^{\circ} = -nfE^{\circ}_{\text{cell}}$. Solve for E°_{cell}

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17. Calculating half-reaction potential: Using the data in Table 3.1, find the standard potential of the half-reaction for the reduction of iron from the $+3$ to the 0 oxidation state.

Strategy: Write the desired half-cell reaction:

$Fe^{3+}(aq.) + 3e^{-} \Leftrightarrow Fe(s)$

Inspect the table for half-reactions that include these oxidantion states of iron.

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18. Calculating cell constant: Conductivity of a decimolar solution of potassium chloride at $180^{\circ}C$ is $1.12Sm^{-1}$. The resistance of a conductivity cell containing the solution at $180^{\circ}C$ was found to be $55ohm$. What is the cell constant.

Strategy: Use Equation (3.18) and solve for cell constant.

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19. Calculating molar conductance: The resistance of $0.01M$ solution of an electrolyte was found to be $210ohm$ at $25^\circ C$. Calculate them molar conductance of the colution at $25^\circ C$, if the cell constant is $0.88cm^{-1}$

Strategy: First conductivity in Sm^{-1} (SI units) and then divide it by molar concentration in mole m^{-3} (SI units) to get molar conductance in Sm^2mol^{-1}.

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20. Calculating conductivity and molar conductivity: Resistance of a conductivity cell filled with $0.1MKCl$ solution is 100Ω. If the resistance of the same cell when filled with $0.02MKCl$ solutions 520Ω and the conductivity of $0.1KCl$ solution is $1.29Sm$, calculate the conductivity and moalr conductivity of $0.02MKCl$ solution.

Strategy : Calculate the cell constant with the help of $0.01MKCl$ solution (both R and κ are Known). Use the cell constant to determine the conductivity of $0.02MKCl$ solution and finally find its molar conductivity using the molarity

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21. Calculating resistivity, conductivity and motor conductivity : The electrical resistance of a column of 0.05 mol $L^{-1}NaOH$ solution of diameter $1cm$ and length $50cm$ is $55 \times 10^3 ohm$. Calculate its resistivity, conductivity and molar conductivity

Strategy: Assuming the column of solution to be cylindrical determine the area of cross-section, A. Using it along with the length of column, calculate resistivity. Reciprocal of resistivity yields conductivity. When we divide conductivity by molar concentration, we get molar conductivity.

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22. Calcualting limiting molar conductivity: Calculate the limiting molar conductivity of acetic acid at $298K$ Given that at that temperature the limiting molar conductivites infinit dilution of hydrochloric acid, sodium chloride and sodium acetate are 426, 126 and $91 Scm^{92}) mol^{-1}$.

Strategy: A_m^0 for electroyles is obtained by using Kohlrausch law of independent migration of ions

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23. Calculating The Degree of ionization: The molar conductance of an infinitely dilute solution NH_4Cl is $150Scm^2mol^{-1}$ and the limiting ionic conductacnes of Cl^- and OH^- ions are 76 and $198Scm^2mol^{-1}$ respectively. If the molar conductivity of a $0.01M$ solution of NH_4OH is $9.6Scm^2mol^{-1}$, what will be its degree of ionization

Strategy: At any concentration C, if α is the degree of ionization then it can be approximented to the ratio of molar conductivity Λ_m^c at the concentration C to limiting molar conducting, Λ_m^0. We are given Λ_m^c but we need to find Λ_m^0.

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24. Calculating the value of dissociation constant of weak electrolyte: The conductivity of $0.001028molL^{-1}$ acetic acid is $4.95 \times 10^{-5}Scm^{-1}$.

Calculate its dssociation constatnt if Λ_m^0 for acetic acid is 390.5 S cm^2mol^{-1}. Strategy: We can determine the value of the dissociation constant for week electrolytes once we know the Λ_m^0 and Λ_m at any given concentration C.

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25. Conductivity water (prepared by repeated distillation of water containing a small quantity of $NaOH$ and $KMnO_4$) has conductivity $5.50 \times 10^{-6} Sm^{-1}$. If $\lambda_{H+}6(0) = 3.498 Sm^2mol^{-1}$ and $\lambda_{OH-}^0 = 1.980 \times 10^{9-2} Sm^2mol^{-1}$, then calculated lthe ionic product of water.

Strategy : Water is known to be slightly ionized as

	$H_2O(1) \Leftrightarrow$	$H^+(aq.) +$	$OH^-(aq.)$
I.C	C	0	0
F.C	$C(1-\alpha)$	$C\alpha$	$C\alpha$

According to the law of chemical equilibrium

$$K_{eq.} \times = \frac{[H^+][OH^-]}{[H_2O]}$$

Since water ionizes only very slightly, the concentration of H_2O may be taken as constant. Thus

$K_{eq} \times \text{constant} = K_w = [H^+][OH^-]$

The product of the concentrationof H^+ and OH^- ions expressed in mol L^{-1} is known as ionic product of water (K_w):

$(K_w) = [H^+][OH^-]$

$= (C\alpha)(C\alpha)$

$= C^2\alpha^2$ Thus we need to find C and α

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26. Calculalting the amount the product from the amount of charge in an electrolysis: A constant current of $0.452A$ is passed through an electrolytic cell containing molten $CaCl_2$ for a time of 1.50 hours. Write the electrode reactions and calculate the quantity of products (in grams) formed at the electrodes. Also find the volume (at STP) of any gaseous product formed.

Strategy: to convert the current and time to grams or litres of product, carry out the sequence of conversions in Figure 3.9.

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27. Calculating the amount of charge from the amount of product in an electrolysis: How many amperes must be passed through a Downs cell to produce sodium metal a rate of $30.0 Kg/h$.

Strategy : Producted through a sequence of conversion similar to that in worked Example 3.26 but in reverse order

$Na^{+1} + e^{-} \rightarrow Na$

The electrode equation for sodium says that 1 mol Na is equiva-lent to 1 mole e^{-}. We can use this in the conversion of grams of Na. The Faraday constant (which says that one mole of electrons is equivalent to $9.65 \times 10^{4} C$) converts mole of electrons to cou-lombs. The conversions are

$gNa \rightarrow molNa \rightarrow mole^{-} \rightarrow \text{coulombs}(C)$

The current in ampres (A) equals the charge in coulombs divided by the time in seconds.

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28. Application of Faraday's laws: An acidic solution of Cu^{2+} salt containing $0.4g$ of Cu^{2+} is electroysed until all the copper is deposited. The electrolysis is futher continueed for seven more minutes with the volume of the solution kept at $100mL$ and the current at $1.0amp$. Calculate the volumes of gases evolved at NTP during the entire electrolysis.

Strategy: Since we do not know which Cu^{2+} salt is electrolysed, we can say that (in the first stage of electrolysis)Cu^{2+} is reduced at the cathode to deposit Cu while H_2O is oxidized to liberate O_g at the anode. In the second stage of electrolysis, only water gets oxidized to librate O_g as well as reduced to librate H_2g

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29. Predicating the products of electrolysis: What do you expect to be the half reactions in the electrolysis of aqueous Na_2So_4 solution.

Strategy: Before we look at the electrode reations, we should consider the following facts: (1) Since Na_2So_2 does not hydrolyze in water, the pH

of the solution is close to 7. (2) The Na^+ ions are not reduced at the cathode and the SO_4^{2-} ions are not oxidized at the anode. These conclusions are drawn from the electrolysis of water in the presence of sulphuric acid in aqueous sodium chloride solution.

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Question Bank Building The Knowledge Level I

1. The molar conductance is given by the relation (M = concentration in molarity)

A. $\Lambda_m = 1000\frac{k}{M}$

B. $\Lambda_m = 1000\frac{M}{k}$

C. $\Lambda_m = 1000kM$

D. $\Lambda_m = 1000\frac{k}{M^2}$

Answer: A

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Question Bank Building The Knowledge Level 1

1. The units of specific conductance (κ) are

A. ohm cm^{-1}

B. $ohm^{-1}cm$

C. ohm cm

D. $ohm^{-1}cm^{-1}$

Answer: D

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2. Reduction potential for the following h alf-cell reaction are

$Zn \to Zn \to Zn^{2+} + 2e^{-}, E^{\circ}_{Zn^{2+}/Zn} = -0.76V$

$Fe \to Fe^{2+} + 2e^{-}, E^{\circ}_{Fe^{2+}/Fe} = -0.76V$

The emf for the cell reaction

$Fe^{2+} Zn \rightarrow Zn^{2+} + Fe$

will be

A. $+0.32V$

B. $-0.32V$

C. $+1.20V$

D. $-1.20V$

Answer: A

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Question Bank Building The Knowledge Level Ii

1. The hydrogen electrode is prepared electrochemically by depositing

A. Platinum on copper metal

B. Silver on platinum metal

C. Platinum on platinum metal

D. Palladium on palladium metal

Answer: C

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2. The emf of a cell is the ratio of the difference in

A. charge in coulombs to the electrical potential energy in joules

B. electrical potential energy in joules to the charge in coulombs

C. electrical potential energy in joules to the resistance

D. electrical potential energy in joules to the time

Answer: B

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3. Which of the following relations is incorrect ($l =$ length, a = area) ?

A. $\Lambda = kV$ (V = dilution of the solution mL/equiv. or mL/mol)

B. $G = k\frac{a}{l} ohm$

C. $G = k\frac{a}{l} ohm^{-1}$

D. $R = \frac{1}{k}\frac{a}{l} ohm$

Answer: B

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4. The unit of equivalent conductivity $(\Lambda_{eq.})$ are

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

B. $ohm^{-2} cm^2$

C. $ohm^{-1} cm^{-1}$

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

Answer: A

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5. If conductivity is directly proportional to the cross-sectional area of the solution and the concentration of the solution in it and is inversely proportional to the length of the cessel then the constant proportionality is expressed in

A. Sm^2mol^{-1}

B. S^2m^2mol

C. $Smmol^{-1}$

D. $S^2m^2mol^{-1}$

Answer: C

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6. The ion which has the lowest ionic mobility is

A. Rb^+

B. K^+

C. Na^+

D. Li^+

Answer: D

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7. Faraday's laws of electrolysis are relate to the

A. speed of the cation

B. equivalent weight of the electrolyte

C. atomic number of the cation

D. atomic number of the anion

Answer: B

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8. The electrochemical equivalent of zinc (atomic mass $= 65.4$) is

A. 3.4×10^{-3}

B. 3.4×10^{-2}

C. 3.4×10^{-5}

D. 3.4×10^{-4}

Answer: D

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9. Which of the following cells has a constant voltage through-out its life?

A. Leclanche cell

B. Daniell cell

C. Mercury cell

D. Electrolytic cell

Answer: C

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10. The specific conductance of a $0.1NKCl$ solution at $23^\circ C$ is $0.012ohm^{-1}cm^{-1}$. The resistance of cell containing the solution at the same tempreature was found to be $55ohm$. The cell constant will be

A. $0.142cm^{-1}$

B. $0.66cm^{-1}$

C. $0.918cm^{-1}$

D. $1.12cm^{-1}$

Answer: B

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11. Which one of the following pairs of substances on reaction will not not evolve H_2 gas?

A. Iron and H_2SO_4 (aqueous)

B. Iron and copper

C. Copper and HCl (aqueous)

D. Sodium and ethyl alcohol

Answer: C

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12. Without losinf its concentration, $ZnCl_2$ solution can't be kept in contact with

A. Al

B. Ag

C. Pb

D. Au

Answer: A

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13. For the cell reaction

$Cu^{2+}(C_1, aq.) + Zn(s) \Leftrightarrow Zn^{2+}(C_2, aq) + Cu(s)$

of an electrochemical cell, the change in free energy (ΔG) of a given temperature is a funcation of

A. In C_1

B. In C_2

C. In$(C_1 + C_2)$

D. In(C_2 / C_1)

Answer: D

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14. A $5A$ current in passed through a solution of zinc sulphate for $40\ \min$. These amount of zinc deposited at the cathode is

A. $40.65g$

B. $0.4065g$

C. $4.065g$

D. $65.04g$

Answer: C

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15. An electrochemical cell is shown below $Pt, H_2(1\text{atm})|HCl(0.1M)|CH_3COOH(0.1M) \mid H_2(1\text{atm})$, The emf of

the cell will not be zero, because

A. pH of $0.1MHCl$ and $0.1MCH_3COOH$ are not same

B. acids used in two compartments are different

C. the temperature is constant

D. emf depends on molarities of acids used

Answer: A

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16. On heating one end of a piece of a metal, the other end becomes hot because of

A. minor perturbation in the energy of atoms

B. mobility of atoms in the metal

C. resistance of the metal

D. energised electrons moving to the other end

Answer: D

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17. Standard reducation potential at $25^{\circ}C$ of Li^{+}/Li, Ba^{2+}/Ba, Na^{+}/Na and Mg^{+}/Mg are -3.05, -2.90, -2.71 and -2.37 volt respectively. Which one of the following is the strongest oxidising agent ?

A. Li^{+}

B. Na^{+}

C. Mg^{+}

D. Ba^{2+}

Answer: C

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18. Two faraday of electricity is passed through a solution of $CuSO_4$. The mass of copper deposited at the cathode is: (at mass of Cu = 63.5 amu)

A. $0g$

B. $63.5g$

C. $127g$

D. $2g$

Answer: B

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19. Given below are half-cell reaction:

$Mn^{2+} + 2e^- \rightarrow Mn, , E^\circ = -1.18V$

$2\left(Mn^{3+} + e^- \rightarrow Mn^{2+}\right), , E^\circ = +1.51V$

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

A. $-0.33V$, the reaction will not occur

B. $-0.33V$, the reaction will occur

C. $-2.69V$, the reaction will not occur

D. $-2.69V$, the reaction will occur

Answer: C

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Question Bank Building The Knowledge Level Iii

1. Passing electricity through a dilute solution of sulphuric acid for a certain period of time liberates $168mL$ of gases at STP. The quantity of electricity used is

A. $965C$

B. $9640C$

C. $96500C$

D. $96.5C$

Answer: A

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2. A solution containing one mole per litre of each $Cu(NO_3)_2, AgNO_3, Hg_2(NO_3)_2$ is being electrolysed by using inert electrodes. The values of standard electrode potentials in volts (reduction potentials) are

$Ag^+/Ag = +0.80V, HG_2^{2+}/Hg = +0.79V$

$Cu^+/Cu = +0.34V, Mg^{2+}/Mg = -2.37V$

With increasing valtage, the sequence of deposition of metals on the cathode will be

A. Cu, Hg, Ag

B. Ag, Hg, Cu, Mg

C. Ag, Hg, Cu

D. Mg, Cu, Hg, Ag

Answer: C

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3. All the energy realesed from the reation $X \to Y, \Delta_r G^\circ = -193 kJ mol^{-1}$, is used for oxidizing M^+ as $M^+ \to M^{3+} + 2e^-, E^\circ = -0.25V$. Under standard consistions, the number of moles of M^+ oxidized when on e mol of X is converted to Y is $\left[F = 96,500 C \text{mol}^{-1}\right]$

A. 4

B. 3

C. 1

D. 5

Answer: A

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4. Resistance of $0.2M$ solution of an electrolyte is 50Ω. The specific conductance of the solution is $1.3Sm^{-1}$. If resistance of the $0.4M$ solution of the same electrolyte is 260Ω, its molar conductivity is .

A. 5×10^3

B. 5×10^2

C. 5×10^{-4}

D. 5×10^{-3}

Answer: C

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5. The equivalent conductance of $NaCl$ at concentration of C and at infinite dilution are λ_C and λ_∞ respectively. The correct relationship between λ_C and λ_∞ is given as :

(where the constant B is positive)

A. $\lambda_C = \lambda_\infty - (B)\sqrt{C}$

B. $\lambda_C = \lambda_\infty + (B)\sqrt{C}$

C. $\lambda_C = \lambda_\infty + (B)C$

D. $\lambda_C = \lambda_\infty - (B)C$

Answer: A

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6. In a galvanic cell, the salt bridge

(i) does not participate chemically in the cell reaction

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

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

(iv) ensures mixing of the two elecrolytic solutions

A. $(i), (ii), (iii), (iv)$

B. $(i), (iii), (iv)$

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

D. $(i), (iii)$

Answer: D

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Question Bank Building The Knowledge Level Iv

1. The Weston standard cell is represented by

A. $Cd(Hg)|CdSO_4(aq.\ ,\ sat'd)|PbSO_4(s)\ |\ Pb(s)$

B. $Cd(Hg)|CdSO_4(aq.\ ,\ sat'd)|HgSO_4(s)\ |\ Hg(s)$

C. $Cd(Hg)|CdSO_4(aq.\ ,\ sat'd)|CdSO_4(aq.\ 1M)\ |\ Cd(Hg)$

D. $Cd(Hg)|CdSO_4(aq.\ ,\ sat'd)|ZnSO_4(aq.\ 1M)\ |\ Zn(s)$

Answer: B

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2. The resistance of a solution $'X'$ is 50Ω and that of solution $'Y'$ is 100Ω, both solution beinf taken in the same conductivity cell. If equal volumes of solution X and Y are mixed, what will be the resistance of the mixture using the same cell?

A. 66.67Ω

B. 76.66Ω

C. 85.58Ω

D. 58.85Ω

Answer: A

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3. The molar conductivity of a solution of a weak acid $HX(0.01M)$ is 10 times smalller than the molar conductivity of a solution of a weak acid $HY(0.10M)$. If $\lambda^{\circ}_{X^-} = \lambda^{\circ}_{Y^-}$, the difference in their pK_a values,

$pK_a(HX) - pK_a(HY)$, is (consider degree of ionisation of both acids to be $< \ < 1$):

A. 4

B. 1

C. 2

D. 3

Answer: D

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Archives

1. The molar conductivity of a $0.5 mol / dm^3$ solution of $AgNO_3$ with electrolytic conductivity of $5.76 \times 10^{-3} Scm^{-1}$ at $298 K$ is

A. $2.88 Scm^2 / mol$

B. $11.52 Scm^2 / mol$

C. $0.086 Scm^2 / mol$

D. $28.8 Scm^2 / mol$

Answer: B

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2. During the electrolysis of molten sodium chloride, the time required to produce $0.10 mol$ of chlorine gas using a current of 3 amperes is

A. 55 minutes

B. 110 minutes

C. 220 minutes

D. 330 minutes

Answer: B

Watch Video Solution

3. If $E_{cell}^{\ominus}$ for a given reaction is negative, which gives the correct relationships for the values of $\Delta G^{\ominus}$ and K_{eq}?

A. $\Delta G^{\circ} > 0, K_{eq} < 1$

B. $\Delta G^{\circ} > 0, K_{eq} > 1$

C. $\Delta G^{\circ} < 0, K_{eq} > 1$

D. $\Delta G^{\circ} < 0, K_{eq} < 1$

Answer: A

Watch Video Solution

4. The number of electrons delivered at the cathode during electrolysis by a current of 1 ampere in 60 seconds is (charger on electron $= 1.60 \times 10^{-19} C$)

A. 6×10^{23}

B. 6×10^{20}

C. 3.75×10^{20}

D. 7.48×10^{23}

Answer: C

Watch Video Solution

5. The pressure of H_2 required to make the potential of H_2- electrode zeno in pure water at $298K$ is

A. 10^{-4} atm

B. 10^{-14} atm

C. 10^{-12} atm

D. 10^{-10} atm

Answer: B

Watch Video Solution

6. Aqueous solution of which of the following compounds is the best conductor of electric current?

A. Ammonia, NH_3

B. Fructose, $C_6H_{12}O_6$

C. Acetic acid, $C_2H_4O_2$

D. Hydrochloric HCl

Answer: D

Watch Video Solution

7. A device that convers energy of combustion of fueles like hydrogen and methane, directly into electrical energy is known as .

A. Ni-Cd cell

B. Fuel cell

C. Electrolytic cell

D. Dynamo

Answer: B

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8. When $0.1 mol MnO_4^{2-}$ is oxidized the quantity of electricity required to completely oxidize MnO_4^{2-} to MnO_4^- is

A. $96500C$

B. $2 \times 96500C$

C. $9650C$

D. $96.50C$

Answer: C

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9. The weight of silver (at $wt. = 108$) displaced by a quantity of electricity which displaced $5600mL$ of O_2 at STP will be:

A. $5.4g$

B. $10.8g$

C. $54.0g$

D. $108.0g$

Answer: D

Watch Video Solution

10. The pair of compounds that can exist together is:

A. $FeCl_3, SnCl_2$

B. $HgCl_2, SnCl_2$

C. $FeCl_2, SnCl_2$

D. $FeCl_3, KI$

Answer: C

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11. A hydrogen gas electrode is made by dipping platinum wire in a solution of HCl or $pH = 10$ and by passing bydrogen gas around the platinum wire at one atm pressure . The oxidation potential of electrode would be ?

A. $0.59V$

B. $0.118V$

C. $1.18V$

D. $0.059V$

Answer: A

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12. At $25^{\circ}C$ molar conductance of 0.1 molar aqueous solution of ammonium hydroxide is $9.54ohm^{-1}cm^{2}mol^{-1}$ and at infinte dilution its molar conductance is $238ohm^{-1}cm^{2}mol^{-1}$ The degree of ionisation of ammonium hydroxide at the same concentration and termperature is

A. $20.800\ \%$

B. $4.008\ \%$

C. $40.800\ \%$

D. $2.080\ \%$

Answer: B

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13. A button cell used in watched funcations as follwing

$$Zn(s) + Ag_2O(s) + H_2O(l) \Leftrightarrow 2Ag(s) + Zn^{2+}(aq.) + 2OH^{-}(aq)$$

If half cell potentials are

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

$Ag_2O(s) + H_2O(l) + 2e^- \rightarrow 2Ag(s) + 2OH^-(aq.),, E^\circ = 0.34V$

The cell potential will be

A. $0.42V$

B. $0.84V$

C. $1.34V$

D. $1.10V$

Answer: D

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14. Limiting molar conductivity of NH_4OH [i.e., $\Lambda_m^\circ(NH_4OH)$] is equal to:

A. $\Lambda_m^\circ(NH_4Cl) + \Lambda_m^\circ(Na_4Cl) - \Lambda_m^\circ(NaOH)$

B. $\Lambda_m^\circ(NaOH) + \Lambda_m^\circ(NaCl) - \Lambda_m^\circ(NH_4Cl)$

C. $\Lambda_m^\circ(NH_4OH) + \Lambda_m^\circ(NH_4Cl) - \Lambda_m^\circ(HCl)$

D. $\Lambda_m^\circ(NH_4Cl) + \Lambda_m^\circ(NaOH) - \Lambda_m^\circ(NaCl)$

Answer: D

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

$$\frac{2}{3}Al_2O_3 \rightarrow \frac{4}{3}Al + O_2, \Delta_r G = +960 kJ mol^{-1}$$

The potential difference needed for the electrolytic reduction of aluminium oxide (Al_2O_3) at $500^\circ C$ is

A. $5.0V$

B. $4.5V$

C. $3.0V$

D. $2.5V$

Answer: D

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16. Molar conductivities (Λ_m°) at infinite dilution of $NaCl, HCl$ and CH_3COONa arc $126.4, 425.9$ and $91.0 Scm^2mol^{-1}$ respectively. Λ_m° for CH_3COOH will be

A. $390.5 Scm^2mol^{-1}$

B. $425.5 Scm^2mol^{-1}$

C. $180.5 Scm^2mol^{-1}$

D. $290.8 Scm^2mol^{-1}$

Answer: A

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17. Standard reduction potentails of the half reactions are given below:

$F_2(g) + 2e^- \rightarrow 2F^-(aq.),, E^\ominus = +2.87$

$Cl_2(g) + 2e^- \rightarrow 2Cl^-(aq.),, E^\ominus = +1.36V$

$Br_2(g) + 2e^- \rightarrow 2Br^-(aq.),, E^\ominus = +1.09V$

$I_2(s) + 2e^- \rightarrow 2l^-(aq.),, E^{\ominus} = +0.54V$

The strongest oxidizing and reducing agents respectively are:

A. Cl_2 and I_2

B. F_2 and I^-

C. Br_2 and Cl^-

D. Cl_2 and Br^-

Answer: B

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18. The electrotrode potentials for

$Cu^{2+}(aq.) + 2e^- \rightarrow Cu^+(aq.)$

and $Cu^+(aq.) + e^- \rightarrow Cu(s)$

are $+0.15V$ respectively. The value of $E^{\ominus}_{Cu^{2+}}/Cu$ will be:

A. $0.150V$

B. $0.500V$

C. $0.325V$

D. $0.650V$

Answer: C

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19. Standard electrode potential for Sn^{4+}/Sn^{2+} couple is $0.15V$ and that for the Cr^{3+}/Cr couple is $-0.74V$. These two couples in their standard state are connected to make a cell. The cell potential will be

A. $+1.83V$

B. $+1.19V$

C. $+0.89V$

D. $+0.18V$

Answer: D

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20. Standard electrode potential of three metal X, Y and Z are $-1.2V$, $+0.5V$ and $-3.0V$ respectively. The reducing power of these metals will be:

A. $X > Y > Z$

B. $Y > Z > X$

C. $Y > X > Z$

D. $Z > X > Y$

Answer: D

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21. A solution contains Fe^{2+}, Fe^{3+} and T^- ions. This solution was treated with iodine at $35^\circ C$. E° for Fe^{3+}, Fe^{2+} is $0.77V$ and E° for $I_2/2I^-$ = 0.536 V. The favourable redox reaction is:

A. Fe^{2+} will be oxidized to Fe^{3+}

B. I_2 will be reduced to I^-

C. There will be no redox reaction

D. I^- will be oxidized to I_2

Answer: D

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22. An increase in equivalent conductance of a strong electrolyte with dilution is mainly due to:

A. increase in number of ions

B. increase in ionic mobility of ions

C. 100% ionisation of electrolyte at normal dilution

D. increase in both number of ions and ionic mobility of ions

Answer: B

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23. For the reduction of silver ions with copper metal, the standard cell potential was foound to be $+0.46V$ at $25^{\circ}C$. The value of standard Gibbs energy, ΔG° will be $\left(F = 96,500 Cmol^{-1}\right)$:

A. $-98.00kJ$

B. $-89.0kJ$

C. $-89.0J$

D. $-44.5kJ$

Answer: B

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24. Which of the following expressions correctly represents the equivalent conductance at infinite dilution of Al_{SO_4}. Given that $\overset{\circ}{\Lambda}_{Al^{3+}}$ and $\overset{\circ}{\Lambda}_{SO_4^{2-}}$ are the equivalent conduactance at infinite dilution of the respective ions?

A. $2\Lambda^{\circ}_{Al^{3+}} + 3\Lambda^{\circ}_{SO_4^{2-}}$

B. $\Lambda^{\circ}_{Al^{3+}} + \Lambda^{\circ}_{SO_4^{2-}}$

C. $\left(\Lambda^{\circ}_{Al^{3+}} + \Lambda^{\circ}_{SO_4^{2-}}\right) \times 6$

D. $\frac{1}{3}\Lambda^{\circ}_{Al^{3+}} + \frac{1}{2}\Lambda^{\circ}_{SO_4^{2-}}$

Answer: B

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25. Consider the following relations for emf of a electrochemical cell

(i) emf of cell = (Oxidation potential of anode)-(Reduction potential of cathode)

(ii) emf of cell = (Oxidation potential of anode)+(Reduction potential of cathode)

(iii) emf of cell = (Reduction potential of anode)+(Reduction potential of cathode)

(iv) emf of cell = (Oxidation potential of anode)-(Oxidation potential of

cathode)

Which of the above realtions are correct?

A. (i) and (iii)

B. (i) and (ii)

C. (iii) and (iv)

D. (ii) and (iv)

Answer: B

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26. Given:

(i) $Cu^{2+} + 2e^- \rightarrow Cu, E^\circ = 0.337V$

(ii) $Cu^{2+} + e^- \rightarrow Cu^+, E^\circ = 0.153V$

Electrode potential, E° for the reaction, $Cu^+ + e^- \rightarrow Cu$, will be

A. $0.90V$

B. $0.30V$

C. $0.38V$

D. $0.52V$

Answer: D

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27. Al_2O_3 is reduced by electrolysis at low potentials and high current. If 4.0×10^4 amperes of currernt is passed through molten Al_2O_3 for 6 hours, what mass of aluminium is produced? (Assume 100 % current efficiency, At. Mass of $Al = 27u$)

A. $8.1 \times 10^4 g$

B. $2.4 \times 10^5 g$

C. $1.3 \times 10^4 g$

D. $9.0 \times 10^3 g$

Answer: A

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28. The equivalent conductance of $M/32$ solution of a weak monobasic acid is 8.0 and at infinite dilution is 400. The dissociation constant of this acid is :

A. 1.25×10^{-6}

B. 6.25×10^{-4}

C. 1.25×10^{-4}

D. 1.25×10^{-5}

Answer: D

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29. Kohlrausch`s law states that at :

A. infinite dilution, each ion makes denitie contribution to equivalent conductance of an electrolyte, whatever be the nature of the ion of the electrolyte

B. finite dilution, each ion makes definite contribution to equivalent conductance of an electrolyte, whatever be the nature of the other ion of the electrolyte

C. infinite dilution each ion makes denite contribution to equivalent conductance of an electrolyte depending on the nature of the other ion of the electrolyte

D. infinite dilution, each ion makes definite contribution to conductance of an electrolyte whatever be the nature of the other ion of the electrolyte

Answer: A

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30. On the basis of the following E° values, the stongest oxidizing agent is $\left[Fe(CN)_6\right]^{4-} \rightarrow \left[Fe(CN)_6\right]^{3-} + e^-, E^\circ = -0.35V$

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

A. $\left[Fe(CN)_6\right]^{4-}$

B. Fe^{2+}

C. Fe^{3+}

D. $\left[Fe(CN)_6\right]^{2-}$

Answer: C

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31. The efficiency of a fuel cell is given by:

A. $\Delta G / \Delta H$

B. $\Delta S / \Delta G$

C. $\Delta H / \Delta G$

D. $\Delta G / \Delta S$

Answer: A

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32. Calculate the equilibrium constant for the reaction $Cu(s) + 2Ag^{+}(aq) \rightarrow Cu^{2+}(aq) + 2Ag(s), E^{\circ}_{cell} = 0.46V.$

A. 4.0×10^{10}

B. 4.0×10^{15}

C. 2.4×10^{10}

D. 2.0×10^{10}

Answer: B

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33. If $E^{\circ}_{Fe^{2+}}/Fe = -0.441V$

and $E^{\circ}_{Fe^{3+}}/Fe^{2+} = -0.771V$

The standard EMF of the reaction

$Fe + 2Fe^{3+} \rightarrow 3Fe^{2+}$

will be:

A. $0.111V$

B. $0.330V$

C. $1.653V$

D. $1.212V$

Answer: D

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34. A hypothetical elecrochemical cell is shown below:

$A^{\ominus}|A^{+}(xM)||B^{+}(yM)|\ |\ B^{\oplus}$

The emf measured is $+0.20V$. The cell reaction is

A. $A + B^+ \rightarrow A^+ + B$

B. $A^+ + B \rightarrow A + B^+$

C. $A^+ + e^- \rightarrow A, B^+ + e^- \rightarrow B$

D. The cell reaction can't be predicated

Answer: A

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35. $4.5g$ of aluminium (at mass $27u$) is deposited at cathode from Al^{3+} solution by a certain quantity of electric charge. The volume of hydrogen gas 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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36. The standard emf of a galvanic cell involving cell reaction with $n = 2$ is found to be $0.295V$ at $25^\circ C$. The equilibrium constant of the reaction would be (Given$F = 96, 500Cmol^{-1}$, $R = 8.314JK^{-1}mol^{-1}$):

A. 2.0×10^{11}

B. 4.0×10^{12}

C. 1.0×10^{2}

D. 1.0×10^{10}

Answer: D

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37. On the basis of information available from the reaction $\frac{4}{3}Al + O_2 \rightarrow \frac{2}{3}Al_2O_3, \Delta G = -827kJmol^{-1}$ of O_2, the minimum emf required to carry out of the electrolysis of Al_2O_3 is $(F = 96,500Cmol^{-1})$

A. $2.14V$

B. $4.28V$

C. $6.42V$

D. $8.56V$

Answer: A

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38. The emf of a Daniell cell at $298K$ is E_1

$Zn|ZnSO_4(0.01M)||CuSO_4(1.0M)|Cu$

When the concentration of $ZNSO_4$ is $1.0M$ and that of $CuSO_4$ is $0.01M$

, the emf changed to E_2. What is the relationship between E_1 and $E(2)$?

A. $E_1 > E_2$

B. $E_1 < E_2$

C. $E_1 > E_2$

D. $E_2 = 0 \neq E_1$

Answer: A

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39. In electrolysis of $NaCl$ when Pt electrode is taken H_2 is liberated at cathode while Hg cathode it forms sodium amalgam because

A. Hg is more insert than Pt

B. More valtage is required to reduce H^+ at Hg than at Pt

C. Na is dissolved in Hg while it does not dissolve in $Pt -$

D. Concentration of H^+ ions is larger when Pt electrode is taken

Answer: B

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40. Standard electrode potentials are

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

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

If Fe^{3+}, Fe^{2+}, and Fe block are kept together, then

A. Fe^{3+} increases

B. Fe^{3+} decreases

C. Fe^{2+}/Fe^{3+} remains uncharged

D. Fe^{2+} decreases

Answer: B

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41. The most convenient method to protect the bottom of the ship made of iron is

A. coating it with red lead oxide

B. white tin plating

C. connecting it with Mg block

D. connecting it with Pb block

Answer: C

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42. Cell reactiomn is spontaneous when

A. E°_{red} is negative

B. E°_{red} is positive

C. ΔG° is negative

D. ΔG° is positive

Answer: C

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43. $Cu^{2+}(aq.)$ is unstable in solution and under goes simultaneous oxidation and reduction according to the reaction

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

Choose the correct E° for the above reaction if

$E^{\circ}_{Cu^{2+}}/Cu = 0.34V$ and $E^{\circ}_{Cu^{2+}}/Cu^{+} = 0.15V$

A. $-0.38V$

B. $+0.49V$

C. $+0.38V$

D. $+0.19V$

Answer: D

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

A. 139.52

B. 203

C. 279

D. 101.5

Answer: A

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Follow Up Test 1

1. Which of the following involves electrochemnical phenomenon?

A. The transmission of sensory singnals through cell to brain and vice cersa and communication between the cells

B. Manufacture of fluorine

C. Refining of metal copper

D. All of these

Answer: D

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2. An electrochemical cell is used to convert

A. electrical energy to chemical energy

B. chemical energy to chemical energy

C. both (1) and (2)

D. chemical energy to mechanical energy

Answer: C

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3. If we immerse a strip of zinc metal in an equeous solution of copper sulphate we notice that

A. a dark coloured solid deposits on the surface of the zinc

B. blue colour characteristic of the Cu^{2+} ions slowly disappears from the solution

C. the enthalpy of reaction is lost to the surroundings as heat

D. All of these

Answer: D

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Follow Up Test 2

1. In a galvanic cell

A. oxidation occurs at cathode

B. reduction occurs at anode

C. electrical energy produces chemical reaction

D. chemical reaction produces electrical energy

Answer: D

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2. Which of the following experimental oberservations is wrong about the Daniell cell?

A. The initital voltage is 1.100volts

B. The anode has a positive sign while the cathode has a nagative sign.

C. The mass of the zinc electrode decreases while the concentration of Zn^{2+} ions increases in the solution around the zinc electrode as the cells operates

D. The mass of the copper electrode increases while the concentration of Cu^{2+} ions decreases in the solution around this electrode as the cell operates.

Answer: B

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3. In preparing a salt bridge we sue KCl because

A. the hydration power of K^+ and Cl^- ions are the same

B. the electropositive character of K and electronegative character of Cl^- are comparable

C. the equivalent conductance of K^+ and Cl^- are nearly the same at infinte dilution

D. the sizes of the K^+ and Cl^- are almost equal

Answer: C

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4. Which of the following regarding the movement of ions in solution is true?

A. Cation towards cathode and anions towardes anode in all electrochemical cell.

B. Cations towards cathode and anions towards cathode and anions towards anode in electrolytic cell while reverse is ture for galvanic cell.

C. Cations towards anode and anions towards cathode in electrolytic cell while reverse is true for galvanic cells.

D. Cation towards anode and anions towards cathode in all electrochemical cells

Answer: A

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5. In the galvanic cell, flow of electrons is from

A. cathode to a anode in solution

B. anode to caltlhode in external wire

C. cathode to anode in external wire

D. anode to cathode in solution

Answer: B

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6. Which of the following statements is incorrect?

A. We can best regard the galvanic cell as a combincation of two half-cells.

B. A galvanic cell has an external source of current but the electrolytic cell does not.

C. The galvanic cell has a porous barrier unlike the elec-trolutic cell

D. The reactions that takes place in the galvanic cell is pre-cisely the spontaneous reaction that takes place when the components of the cell are mixed in a beaker.

Answer: B

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Follow Up Test 3

1. The conventional notation for representing galvanic cells is the cell diagram. For the Daniell cell, using KCl as the electrolyte in the salt bridge and assuming $1M$ concentration, the cell diagram is

A. $Cu(s)\left|Cu^{2+}(aq.\ ,1M)\right|KCl(sat'd)\left|Zn^{2+}(aq.\ ,1M)\right|Zn(s)$

B. $Zn^{2+}(aq.\ ,1M)|Z(s)|KCl(sat'd)\left|Cu^{2+}(aq.\ ,1M)\right|Cu(s)$

C. $Zn(s)\left|Zn^{2+}(aq.\ ,1M)\right|KCl(sat'd)\left|Cu^{2+}(aq.\ ,1M)\right|Cu(s)$

D. $Cu^{2+}(aq.\ ,1M)|Cu(s)|KCl(sat'd)|Zn(s)|Zn^{2+}(aq.\ ,1M)$

Answer: B

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2. The reaction

$1/2H2(g)+AgCl(s)\rightarrow H^{\oplus}(aq)+Cl^{c-}(aq)+Ag(s)$ occurs in the galvanic cell.

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

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

C. $Pt|H_2(g)|HCl(aq.)|AgNO_{30}(aq.)|Ag(s)$

D. $Ag|AgCl(s)|KCl(aq.)|AgNO_{30}(aq.)|Ag$

Answer: D

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3. In a hydrogen electrode a steady stream of hydrogen gas in passed over

A. a piece of platinum with a rough surface immersed in a salt solution

B. a carbon immersed in an acidic solution

C. silver metal immersed in an acidic solution

D. a platinized platinum strip immersed ina n acidic solution

Answer: C

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4. A metal-insoluble salt electrode consists of

A. crystals of an insoluble salt coated with a metal

B. a piece of metal placed in a solution containing a sparingly soluble salt

C. a piece of metal coated with one of its insoluble salts.

D. a metal fused with an insoluble salt at high temeperature

Answer: A

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5. Which of the following represents the electrodes of the first kind ?

A. $Zn^{2+} \mid Zn$

B. $Fe^{3+}, Fe^{2+} \mid Pt$

C. $AgCl|Ag|Cl^-$

D. $Pt|Cl_2|Cl^-$

Answer: B

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6. Calomal electrode is a

A. redox electrode

B. metal-insoluble salt electrode

C. fas electrode

D. metal-metal ion electrode

Answer: D

Watch Video Solution

7. KCl cannot be used as a salt bridege for the cell

$Cu(s)|CuSO_4(aq.)||AgNo_3(aq.)|Ag(s)$

because

A. Cl_2 gas is evolved

B. $CuCl_2$ gets precipitated

C. SO_2 gas is evolved

D. $AgCl$ gets precipitated

Answer: C

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Follow Up Test 4

1. Cell potential is the difference in _____ between the two electrodes of a galvanic cell that cause charge to flow.

A. Potential energy

B. Kinetic energy

C. internal energy

D. Enthalpy

Answer: A

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2. The electromotive force (emf) of a galvanic cell is defined as the potential differnece between the elctrodes of the cell when the cell is in

A. its standant state

B. the open circuit

C. the closed circuit

D. its nonstandard state

Answer: B

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3. The EMF of a galvanic cell is measured by

A. ammeter

B. galvanometer

C. voltmeter

D. potentiometer

Answer: D

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4. Measurements show that the cell potential is affected by a number of factors such as

(i) the nature of the substance that makes up each half-cell

(ii) the concentration of dissolved ions and molecules

(iii) the pressures of gases

(iv) the terpreature

A. (i), (ii), (iii), (iv)

B. (ii), (iv)

C. (i), (ii)

D. (ii), (iii), (iv)

Answer: A

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5. When we say that a reaction takes place at standard condition, we mean

A. the temperature is the standard termodynamic tem-perature, $25^{\circ}C$, unless stated otherwise.

B. all reactants are at unit activity

C. all productes are at unit activity

D. All of these

Answer: D

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6. Consulting Table 3.1, arrange the following species in order of increaing stregth as oxidizing agents: MnO_4^- (in acidic solution) Sn^+, Al^{3+}, Co^{3+}, and Ag^+. Assume all species are in their standard states.

A. $Al^{3+} < Sn^{2+} < Ag^+ < MnO_4^- > Co^{3+}$

B. $Al^{3+} < Sn^{2+} < Ag^+ < Co^{3+} > MnO_4^-$

C. $Al^{3+} < Sn^{2+} < Co^{3+} < Ag^+ > MnO_4^-$

D. $Al^{3+} < Co^{2+} < Sn^{3+} < Ag^+ > MnO_4^-$

Answer: A

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7. Preidict what will happern if molecular bromine (Br_2) is added to a solution containing $NaCl$ and NaI at $25^\circ C$. Assume all species are in their standard states.

A. $Cl_2(g)$ is realeased

B. $I_2(s)$ is obtained

C. Both Cl_2 and I_2 are obtained

D. Neither Cl_2 nor I_2 is obtained

Answer: B

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8. Aerial oxidation gradually changes Fe^{2+} ions to Fe^{3+} ions. Which of the following should be added to Fe^{2+} ions to prevent this from happening?

Use $E^{\circ}_{Fe^{3+}/Fe^{2-}} = +0.771V, E^{\circ}_{Cu^{2+}/Cu} = +0.34V.$

$E_{Mg^{2+}/Mg = -2.37V}$

A. Cu

B. Mg^{2+} ions

C. Mg

D. Cu^{2+} ions

Answer: C

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9. Electromotive force is an intensive property. It is

A. independent of the equilibrium constant of the reaction under study

B. Independent of the tempreature of the solution under study

C. dependent on the volume of the solution and independent of the size of the electrodes

D. independent of the volume of the solution and the size of the electrodes.

Answer: D

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10. Preidict which of the following reactions would not procees spontaneously at $298K$

A. $Zn^{2+}(aq.) + H_2 \underset{\longleftarrow}{\longrightarrow} Zn(s) + 2H^+(aq.)$

B. $Cd(s) + Fe^{2+}(aq.) \underset{\longleftarrow}{\longrightarrow} Cd^{2+}(aq.) + Fe(s)$

C. $Cd^{2+}(aq.) + Fe_s \underset{\longleftarrow}{\longrightarrow} Cd(s) + Fe^{2+}(aq.)$

D. $Co(s) + Fe^{2+}(aq.) \underset{\longleftarrow}{\longrightarrow} Co^{2+}(aq.) + Fe(s)$

Answer: B

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Follow Up Test 5

1. Nernst equation halps us to understand the effect of _____ on the electrode of the half-cell and emf of the voltiv cell

A. temperature

B. concentrations of solultes

C. parical pressures of gases

D. All of these

Answer: D

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2. For a general electrochemical reaction of the type

$$\alpha A + bB \overset{ne^-}{\Longleftrightarrow} cC + dD$$

Nernst equation can be written as

A. $E_{\text{cell}} = E^{\circ}_{\text{cell}} + \frac{RT}{nF} In \frac{[C]^c[D]^d}{[A]^a[B]^b}$

B. $E_{\text{cell}} = E^{\circ}_{\text{cell}} - \frac{RT}{nF} In \frac{[C]^c[D]^d}{[A]^a[B]^b}$

C. $E_{\text{cell}} = E^{\circ}_{\text{cell}} - \frac{RT}{nF} In \frac{[A]^a[B]^b}{[C]^c[D]^d}$

D. $E_{\text{cell}} = -E^{\circ}_{\text{cell}} - \frac{RT}{nF} In \frac{[C]^c[D]^d}{[A]^a[B]}$

Answer: B

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3. At equilibrium

A. a cell operates first reversibly and then irreversibly

B. the cell potential is negative

C. the cell potential is positive

D. a cell is exhausted

Answer: D

Watch Video Solution

4. Find the the reducation potential of the half-cell

$Pt(s) \mid Cu^{2+}(aq.\ , 0.22M), Cu^{+}(aq.\ , 0.043M)$

A. $0.20V$

B. $-0.20V$

C. $0.30V$

D. $-0.30V$

Answer: A

Watch Video Solution

5. The potential of the cell

$V(s)\left|V^{3+}(aq.\ , 0.0011M)\right|\left|Ni^{2+}(aq.\ , 0.24M)\right| \mid Ni(s)$ is

A. $0.50V$

B. $0.40V$

C. $0.70V$

D. $0.80V$

Answer: C

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6. The reducation potential of a $Pt(s)|Cl_2(g)|Cl^-(aq.)$ electrode is found to be $1.42V$ when the pressure olf Cl_2 is 0.25 arm. The concentration of chloride ion in this half cell is

A. $0.43M$

B. $0.043M$

C. $0.34M$

D. $0.034M$

Answer: B

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7. The sign convention for electrical work is

A. the same as that for $P - V$ work

B. the opposite of that for $P - V$ work

C. independent of $P - V$ work

D. same as that for faraday

Answer: A

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8. The realtionship between standard $emf\left(E^{\circ}_{\text{cell}}\right)$ of a galvanic cell and standard Gibbs energy change $\left(\Delta_r G^{\circ}\right)$ for the chemi-cal reaction of the cell is

A. $\Delta_r G^\circ = nFE^\circ_{\text{cell}}$

B. $\Delta_r G^\circ = nF / E^\circ_{\text{cell}}$

C. $\Delta_r G^\circ = -nFE^\circ_{\text{cell}}$

D. $\Delta_r G^\circ = -nF / E^\circ_{\text{cell}}$

Answer: C

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9. The magnitude of the equilibrium constant (K_{eq}) for a cell reaction is related to the magnitude of the standard Gibbs energy change for cell reaction by.

A. $\Delta_r G^\circ = -nRT \ln K$

B. $\Delta_r G^\circ = -\frac{RT}{nF} \ln K$

C. $\Delta_r G^\circ = -\frac{nRT}{F} \ln K$

D. $\Delta_r G^\circ = -nRT \ln K$

Answer: D

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10. The EMF of a cell is related to the equilitbrium constant of the cell reaction by

A. $E^{\circ}_{\text{cell}} = \frac{RT}{nF} \ln K$

B. $E^{\circ}_{\text{cell}} = \frac{2.303RT}{nF} \log K$

C. 'ln K = (nFE_("cell")^(@))/(RT)`

D. all of these

Answer: D

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11. A voltaice cell constructed form two half-cells composed of the same material but differing in ion concentration is called

A. a chemical cell

B. a concentration cell

C. electrolytic cell

D. an electrochemical cell.

Answer: B

Watch Video Solution

12. Which of the following things can be determind for a reac-tion that is a combination of two half-reaction of known standard potential?

A. Standard potential

B. Standard Gibbs energy change

C. Equilibrium constant

D. All of these

Answer: D

Watch Video Solution

13. From the following information, calculate the solubility product of silver bromide ?

$AgBr(s) + e^- \Leftrightarrow Ag(s) + Br^-(aq.)E^\circ = 0.07$
$Ag^+(aq.) + e^- \Leftrightarrow Ag(s)E^\circ = 0.80V$

A. 4×10^{-7}

B. $4. \times 10^{-17}$

C. 4×10^{-13}

D. 4×10^{-10}

Answer: C

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Follow Up Test 6

1. Electrolytic conductance is due to movement of

A. electrons

B. Cations

C. anions

D. ions

Answer: D

Watch Video Solution

2. The conductance (G) is the reciprocal of

A. concentration

B. current

C. resistance

D. potential difference

Answer: C

Watch Video Solution

3. Conductivity (κ) of any conducting material is defined as the

A. reciprocal of resistance

B. reciprocel of resistivity

C. product of resistivity and current

D. product of resistance and current

Answer: B

Watch Video Solution

4. The equivalent conductance $(\Lambda_{eq.})$ is given by the relation

A. $\Lambda_{eq.} = 1000\frac{\kappa}{N}$

B. $\Lambda_{eq.} = 1000\frac{N}{\kappa}$

C. $\Lambda_{eq.} = 1000\kappa / N$

D. $\Lambda_{eq.} = 1000\frac{\kappa}{(N)^2}$

Answer: A

Watch Video Solution

5. Under which of the following conditions, conductance conductivity and equivalent conducticity are all equal?

A. $1CC$ of the solution contanis 1 eq. of the electrolyte

B. $10CC$ of the solution contains 1 eq. of the electrolyte

C. $100CC$ of the solution contains 1 eq. of the electrolyte

D. $1000C$ of the solution contains 1 eq. of the elelctrolytes

Answer: A

Watch Video Solution

6. The cell constant is given by

A. $\frac{\kappa}{R}$

B. A/l

C. l/A

D. l/AR

Answer: C

Watch Video Solution

7. Which of the following solutions of KCl has the lowest value of equivalent conductance?

A. $0.001M$

B. $0.01M$

C. $0.1M$

D. $1M$

Answer: D

Watch Video Solution

8. Metals have conductivity in the order of $\left(ohm^{-1}cm^{-1}\right)$

A. 10^4

B. 10^5

C. 10^{-10}

D. 10^{12}

Answer: B

Watch Video Solution

9. Which of the following statement is wrong in the context of molar conductance?

A. The solution should contain one mole of the electrolyte

B. The distance the electrodes should be $1cm$

C. The area of he electrodes should be large enugh for the solution to touch completely

D. The volume of the solution should be very small.

Answer: D

Watch Video Solution

10. If V, in the equation $\Lambda_{eq.} = \kappa \times V$, is the volume in $\mathbb{C}$ constaining 1 eq. of the electrolyte, than V for a $N/10$ solutions will be

A. $1000CC$

B. $100CC$

C. $10000CC$

D. $10CC$

Answer: C

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11. The resistance of an $N/10KCl$ solution is $245ohms$. Calculate the equivalent conducatnce of the solution id the electrodes in the cell are $4cm$ apart and each having an area of 7.0 sq.cm.

A. $33.32Scm^2$

B. $23.32Scm^2$

C. $23.23Scm^2$

D. $32.23Scm^2$

Answer: B

Watch Video Solution

12. The conducativity of water is $7.6 \times 10^{-2} Sm^{-1}$ and the con-ductivity of $0.1M$ aqueous solution of KCl is $1.639 Am^{-1}$. A cell has a resistance of 33.20Ω when filled with $0.1MKcl$ solution and 300Ω when filled with 0.1 M $CH_3CO_2CO_2H$ solution. The molar conductivity of $CH_3CO_2CO_2H$ is

A. $5.3 \times 10^{-4} Sm^2 mol^{-1}$

B. $4.7 \times 10^{-4} Sm^2 mol^{-1}$

C. $6.7 \times 10^{-4} Sm^2 mol^{-1}$

D. $7.5 \times 10^{-4} Sm^2 mol^{-1}$

Answer: A

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Follow Up Test 7

1. Measurement of the coonductivity of electrolytic solutions is done with the helpof Wheatstone bridge using a/an

A. battery

B. induction coil

C. conductivity cell

D. both (2) and (3)

Answer: D

Watch Video Solution

2. A conductivity cell is platinized to

A. avoid temperature effect

B. avoid capacitance of the cell

C. avoid polarization effect

D. prolonf its life

Answer: C

Watch Video Solution

3. The cell constant of a conductivity cell is usually determined by measuring the resistance of the elctrolytic solutions _____ whose conductivity is already known accurateble various concentrations and at different temperatures.

A. KCl

B. HCl

C. $NaCl$

D. $LiCl$

Answer: A

Watch Video Solution

4. Which of the following is correct regarding the variation of conductivity with dilution ?

A. It decreases for strong electrolytic but increases weak electroyltes

B. It decreases for both strong and weak electrolytes

C. It increases for both strong electrolytes and weak electrolnytes

D. It increases for strong electrolytes but decreases weak electrolytes

Answer: B

Watch Video Solution

5. Which of the following increases with dilution?

A. Conductivity

B. Molar conductivity

C. Equivalent conductivitiy

D. both (2) and (3)

Answer: D

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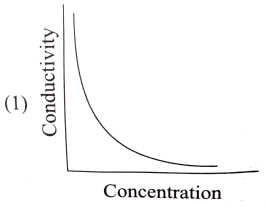
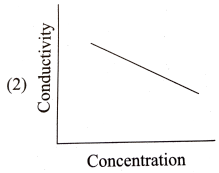
6. Which of the following plots represents correctly the variation of conductivity with concentration?

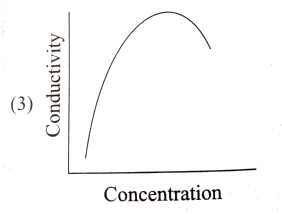
A.

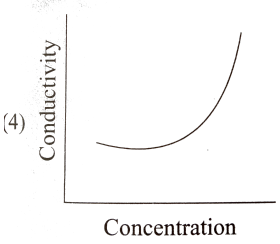


B.



C.



D. 

Answer: C

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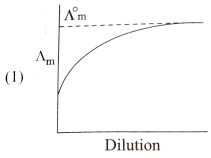
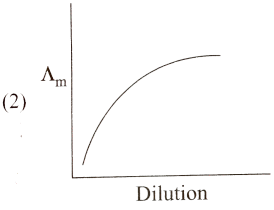
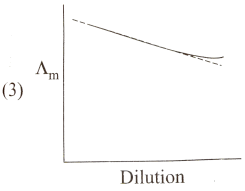
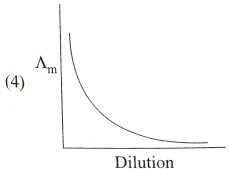
7. Which of the following plots represents correctly the variation of molar conductivity with dilution for a strong electrolyte?

A. 

B. 

C. 

D. 

Answer: A

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8. Which of the following equations corrects the molar conductivity with concentration for a strong electrolyte?

A. $\Lambda_m^0 = \Lambda_m - A\sqrt{C}$

B. $\Lambda_m = \Lambda_m^0 - A\sqrt{C}$

C. $\Lambda_m = \Lambda_m^0 - A\sqrt{C}$

D. $\Lambda_m = \Lambda_m^0 + A\sqrt{C}$

Answer: C

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9. According to Kohlrausch law, the limiting molar conductivity of an electrolyte, A_mB_n, can be expressed as

A. $\Lambda_m^0 = m_+\lambda_{A^{n+}}^0 - n\lambda_-\left(B^{m-}\right)^0$

B. $\Lambda_m^0 = m_+\lambda_{A^{m+}}^0 + n\lambda_-\left(B^{n-}\right)^0$

C. $\Lambda_m^0 = n_+\lambda_{A^{m+}}^0 - m\lambda_-\left(B^{n-}\right)^0$

D. $\Lambda_m^0 = m_+\lambda_{A^{n+}}^0 - n\lambda_-\left(B^{m-}\right)^0$

Answer: D

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10. At infinite dilution the ionic condutanc is maximum for

A. F^-

B. Na^+

C. H^+

D. OH^-

Answer: C

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11. The unit of ionic mobility are

A. $cm^2 \text{volt}^{-1} s^{-1}$

B. $cm^{-2} \text{volt}^{-2} s^{-1}$

C. $cm^{-1} \text{volt}^{-1}$

D. $cm^2 \text{volt}^{-2} s^{-1}$

Answer: A

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12. The conductivity of a saturated solution of $AgCl$ at $25^\circ C$ after subtracting the conductivity of water is $2.28 \times 10^{-6} Scm^{-1}$. Calculate

the solubility product of AgCl at $25^{\circ}C$ if $\Lambda_m^0(AgCl)$ 138.3 S cm^(2) mol^(-1)`

A. $1.7 \times 10^{-10}(mol/L)^2$

B. $3.7 \times 10^{-10}(mol/L)^2$

C. $2.7 \times 10^{-10}(mol/L)^2$

D. $5.0 \times 10^{-10}(mol/L)^2$

Answer: C

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Follow Up Test 8

1. In an electrolytic cell

A. oxidation takes place at the negative electrode

B. reduction is spontaneous

C. reduction takes place at the positive electrode

D. reduction takes place at the negative electrode

Answer: D

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2. Downs cell is used commercially to perform electrolysis of molten

A. $NaCl$

B. $LiCl$

C. KCl

D. $RbCl$

Answer: A

Watch Video Solution

3. The magnitude of charge on an electron is $1.603 \times 10^{-19} C$. The value of the faraday constant, F, is

A. $96.5 C mol^{-1}$

B. $96,\ 500 C mol^{-1}$

C. $9.65 C mol^{-1}$

D. $965,\ 000 C mol^{-1}$

Answer: B

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4. A metal wire carries a current of 1 ampere. The number of electrons passing a given point in the wire in 1 second is

A. 6.24×10^{20}

B. 6.24×10^{16}

C. 6.24×10^{18}

D. 6.24×10^{14}

Answer: C

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5. The number of electrons lost by $2g$ of Cl^- ions during the electrolysis of molten $NaCl$ is

A. 3.39×10^{23}

B. 3.39×10^{20}

C. 3.39×10^{21}

D. 3.39×10^{22}

Answer: D

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6. $0.2864g$ of Cu was deposited on passage of a current of 0.5 ampere for 30 minutes through a copper sulphate solution. The electrochemical equivalent of copper is

A. $0.32g$

B. $0.00032g$

C. $0.032g$

D. $0.0032g$

Answer: B

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7. If three moles of electrons are passed through molten $RbCl$, $BrCl_2$ and $AuCl_3$ then the ratio of amounts of different substances deposited at the cathodes of respective electrolytic cells is

A. $6:3:2$

B. $1:2:3$

C. $3:2:1$

D. $2:3:6$

Answer: A

Watch Video Solution

8. Which of the following mathermatical relations represents Faraday's second law of electrolysis?

A. $m_1E_1 = m_2E_2 = m_3E_3 =$ ... = constant

B. $m_1/A_1 = m_2/A_2 = m_3/A_3 =$ ... = constant

C. $m_1/M_1 = m_2/M_2 = m_3/M_3 =$ ... = constant

D. $m_1/E_1 = m_2/E_2 = m_3/E_3 =$ ... = constant

Answer: D

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9. Current necessary to produce hydrogen gas at the rate $1\mathbb{C}$ per second under standard conditions is

A. $8.61amp$

B. $7.86amp$

C. $5.55amp$

D. $9.67amp$

Answer: A

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10. In an industrial electrolytic cell it is desired to produce $36Kg$ of magnesium metal per hour. The current required will be

A. $8.04 \times 10^5 amp$

B. $8.04 \times 10^3 amp$

C. $8.04 \times 10^4 amp$

D. $8.04 \times 10^2 amp$

Answer: C

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11. Time required to completely decompose 2 moles of water using a current of 2 amperes is

A. 35.61 hours

B. 61.53 hours

C. 16.35 hours

D. 53.61 hours

Answer: D

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12. In the electrolysis of an aqueous solution of $NaOH$, 2.8 litres of $O_2(g)$ is liberated at the anode at NTP. Volume of hydrogen gas liberated at the cathode at NTP will be

A. 2.8 litres

B. 5.6 litres

C. 1.4 litres

D. 11.2 litres

Answer: B

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13. During the electrolysis of aqueous $CuSO_4$ solutions using Pt elecrodes

A. Cu is deposited at the anode

B. $O_2(g)$ is liberated at cathode

C. Cu is deposited at the cathode

D. $H_2(g)$ is liberated at the cathode

Answer: C

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14. During the electrolysis of aqueous nitric acid solution using Pt electrodes

A. $O_2(g)$ is liberated at the anode

B. $N_2(g)$ is liberated at the anode

C. $O_2(g)$ is liberated at the cathode

D. $H_2(g)$ is liberated at the anode

Answer: A

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15. The time taken to convert $1L$ of $1MNaCl$ solution to $1L$ of $1MNaCl$ solution by passing 1 amperer current is

A. 28.6 hours

B. 13.4 hours

C. 26.8 hours

D. 10 hours

Answer: C

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16. In which of the following solutions will the pH remain at 7.0 even after electrolysis?

A. CH_3COONa

B. Na_2SO_4

C. $CuSO_4$

D. $NaCl$

Answer: B

Watch Video Solution

17. A $110-$ watt $100-$ volt incandescent lamp is connectfedin series with an electrolytic cell containing cadmium sulphate solution. The mass of cadmium deposited by the current flowing for 1 hour (at mass of $Cd=112$) is

A. $1.9g$

B. $3.8g$

C. $0.19g$

D. $0.38g$

Answer: A

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18. How many faradays are required to reduce one moleof MnO_4^- to Mn^{2+}?

A. 3

B. 5

C. 2

D. 1

Answer: B

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19. $30mL$ of $0.13MNiSO_4$ is electrolysed using a current of 360 milliamperes for 35.3 minutes. The mass of the metal that would have been plated out if current efficiency is only 60% $(Ni = 58.7u)$ is

A. $0.9131g$

B. $0.3911g$

C. $0.1391g$

D. $0.2474g$

Answer: C

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20. The density of Cu metal is $8.94g$ per ml. The charge in cou-lombs needed to plate an area $10cm \times 10cm$ to a thickness of $10^{-2}cm$ using $CuSO_4$ solution as electrolyte is

A. 27129.2 coulombs

B. 57612.5 coulombs

C. 11725.6 coulombs

D. 62117.5 coulombs

Answer: A

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Follow Up Test 9

1. Which of the following statement is correct in the context of a battery?

A. It is an electrochemical cell

B. It is used as a source of energy

C. The stored energy is released during the redox reaction

D. All of these

Answer: D

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2. The most common dry cell is the Leclanche cell. It consists of a carbon (graphite) rod as cathode which is surrounded by by powdereed _____ and carbon black.

A. Mn_3O_4

B. MnO

C. MnO_2

D. Mn_2O_5

Answer: C

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3. In the dry cell or Leclanche cell, a carbon rod serves as the cathode, which is immersed in the electrolyte in the center of the cell. At cathode, manganese is reduced from the _____ oxidation state to the _____ state.

A. $+7,\ +5$

B. $+7,\ +4$

C. $+4,\ +1$

D. $+4,\ +3$

Answer: D

Watch Video Solution

4. Ammonia released during the reduction at cathode of Leclanche cell combines with zinc ions to form

A. $\left[Zn(NH_3)_4\right]^{2+}$

B. $\left[Zn(NH_3)_2\right]^{2+}$

C. $\left[Zn(NH_3)_6\right]^{2+}$

D. $\left[Zn(NH_3)_5\right]^{2+}$

Answer: A

Watch Video Solution

5. An alkaline dry cell is similar to the Leclanche cell, but it has _____ as the electrolyte in place of ammonium chloride.

A. KOH

B. $NaOH$

C. Either of two

D. $Zn(NO_3)_2$

Answer: C

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6. Which of the following is not correct fo mercury cell?

A. It consists of $Zn - Hg$ amalgam as anode

B. It consists of a paste of HgO and carbon as the cathode

C. The electrolyte is a paste of KOH and ZnO.

D. It is suitable for high current devies.

Answer: D

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7. The cathode reaction during the charging of a lead-acid battery leads to the

A. deposition of Pb

B. conversion of $PbSO_4$ to PbO_2

C. formation of $PbSO_4$

D. formation of PbO_2

Answer: B

Watch Video Solution

8. Which of the following is incorrect for a lead storage battery?

A. The anodes of a lead storage battery are filled with the spongy lead alloy

B. The cathodes are filled with lead dioxide.

C. Both electrodes are in contact with a solution of H_2SO_4 in water

D. The electrolytic solution is about $25\ \%$ sulphuric acid by mass.

Answer: D

Watch Video Solution

9. Which is the following is not ture for a lithium battery?

A. Edison cell

B. Lead storage cell

C. $Ni - Cd$ cell

D. All of these

Answer: D

View Text Solution

10. In an $Ni - Cd$ battery

A. all the reactant and products in the overall reaction are in the solid state

B. The voltage of the cell changes repidly

C. the electrolyte used is an $NaCl$ solution

D. all the above are true.

Answer: A

View Text Solution

11. Which of the following is not ture for a lithium battery?

A. Lithium metal is the anode

B. TiS_2 is the cathode

C. Molten Li salt is the electrolyte

D. During operation, Li^+ ions migrate thorugh the electro-lyte from the anode to the cathode while electrons flow externally from the anode to the cathode to complete the circuit.

Answer: C

View Text Solution

Follow Up Test 10

1. The cell reaction of the cell fuel cell used in the space program is

A. $C(s) + O_2(g) \rightarrow CO_2(g)$

B. $CH_4(g) + O_2(g) \rightarrow CO_2 + H_2(l)$

C. $2H_2(g) + O_2(g) \rightarrow 2H_2O(l)$

D. $2H_2O(l) \rightarrow 2H_2(g) + O_2(g)$

Answer: C

View Text Solution

2. Fuel cells produce electricity with an efficiency of about _____ compared to thermal plants whose efficiency is about $40\ \%$.

A. $80\ \%$

B. $90\ \%$

C. $70\ \%$

D. $100\ \%$

Answer: C

View Text Solution

3. Which of the following is not correct for a fuel cell?

A. It can strore chemical energy

B. Reactants are continously spplied to the cell

C. Products are continuosly removed from the cell

D. It is a voltaic cell

Answer: A

View Text Solution

Follow Up Test 11

1. Corrosion of

A. an oxidation process

B. a redox process

C. a redox process

D. neither an oxidation nor a redox process

Answer: C

View Text Solution

2. In which of the following will the corrosion of iron be most rapid?

A. In air and saline water

B. In air and moisture

C. In pure oxygen

D. In pure water

Answer: A

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3. According to electrochemical mechlanism for corrosion, the metal undergoing corrosion acts as

A. cathode

B. anode

C. neither anode nor cathode

D. either anode or cathode depending upon its standard electrode potential

Answer: B

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4. Chemically rust is

A. $Fe(OH)_3$

B. $Fe(OH)_2$

C. Fe_2O_3

D. $Fe_2O_3.xH_2O$

Answer: D

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5. Which of the metals does not corrode inspite of favourable standard electrode potential?

A. Ti

B. Al

C. both (1) and (2)

D. Fe

Answer: C

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6. Galvanized iron sheets are coated with

A. Cr

B. Zn

C. Ni

D. Cu

Answer: B

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7. Which of the following methods is employed to control the corrosion of underground pipelines and tanks?

A. Cathodic protection

B. Barrier protection

C. Passivation

D. Sacrificial protection

Answer: A

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