CHEMISTRY

JEE (MAIN AND ADVANCED) CHEMISTRY

ELECTROCHEMISTRY

EXAMPLES

1. $BaSO_4$ is ionic and PCl_3 is covalent but a saturated solution of $BaSO_4$ is a weak electrolyte, while that the PCl_3 is a strong electrolyte. Explain.

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2. A column of 0.05 M NaOH solution of diameter 1 cm and length 1m has resistace 1.11×10^4 ohm. Calculate the resistivity, conductivity and molar conductivity.

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3. The conductivity of 0.1 M KCl solution is $1.29Sm^{-1}$. If the resistance of the cell filled with 0.1 M KCl is 100Ω, Calculate the cell constant.

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4. It is practically difficult to calculate the equivalent conductivity of a weak electrolyte in aqueous solution. Comment.

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5. Using Kohlrausch law, calculate Λ_0 for acetic acid, if Λ_0 value for hydrochloric acid, sodium chloride and sodium acetate are respectively 426, 126 and 91 Scm^2mol^{-1}.

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6. Equivalent conductivity of a weak acid HA at infinite dilution is $390 Scm^2 eq^{-1}$. Conductivity of $1 \times 10^{-3} NHA$ solution is $4.9 \times 10^{-5} Scm^{-1}$. Calculate the extent of dissociation and dissociation constant of the acid.

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7. Electrolysis of queous potassium sulphate containing litmus, develop red colour at anode and blue colour at cathode. Why ?

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8. Aqueous silver nitrate is subjected to electrolysis, using platinum electrodes. What will be the nature of the solution after some time?

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9. Calculate the equivalent weight and electrochemical equivalent of copper deposited from cupric salt (At. Wt of $Cu = 63.5$).

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10. If a current of one ampere flows through a metal wire for one hour, how many electrons would flow through the wire?

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11. Find the total charge in coulmb on one gram ion of nitride.

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12. What is the ratio of (a) gram atoms and (b) weights of the metals liberated during the electrolysis of fused sodium fluroide, magnesium fluoride and aluminium fluoride connected in a series?

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13. A solution of copper sulphate is electrolysed using a current strength of 3 amp to deposite 60 grams of copper. What is the time taken for the electrolysis?

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14. An oxide of metal (at . Wt = 112) contains 12.5% of oxygen by weight. What is the valency of metal? What mass of the metal will be liberated when the oxide is converted to chloride with HCl and electrolysed using a current of 9.65 amp for a period of 30 min?

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15. The electrical expenditure is two rupees to produce one gram of calcium from fused $CaSO_4$. What is the production cost of 2 grams of hydrogen produced electrically from acidulated water?

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16. Calculate the quantity of electricity needed to reduce one centimole of dichromate in acid medium, to chromic state.

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17. A 200W, 110 V incadescent lamp was connected with an electrolytic cell containing $ZnCl_2$. What weight of metal will be deposited on passing current for 1 hour? (At. Wt. of $Zn = 65.4$)

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18. During the electrolysis of fused potassium chloride at platinum electrodes, 0.25 gram atom of metal is liberated. What would be the volume of chlorine that can be collected in the experiment at STP?

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19. Density of silver metal is $10.8gcc^{-1}, A20 \times 10$ cm thin iron foil is totally immersed in aqueous silver nitrate. Making it as cathode, electrolysis is done using a current strength of 1930 amp for a period of 100 sec. Calculate the thickness of silver metal electroplated on each face of iron foil.

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20. E° of zinc electrode is $-0.762V$. Calculate the single electrode potential of Zn electrode in decimolar $ZnSO_4$ solution.

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21. At what concentration of copper sulphate solution , the potential of Cu^{2+}, Cu becomes zero? The standrd reduction potential of Cu^{2+}, Cu is 0.34 V.

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22. At $25^{\circ} C$, the reduction potential of hydrogen electrode is -0.118 V at 1 atm. What is the pH of acid solution used for the construction of the electrode?

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23. A cell is constructed using Pb^{2+}, Pb and Ni^{2+}, Ni electrodes. If E° values of Pb and Ni electrode are respectively -0.13 and $-0.25V$, write (a) the cell reaction and (b) cell notation.

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24. E° values of N^{2+}, Ni and Cl_2, Cl^- are respectively $-0.25V$ and $+1.37V$. Calculate the EMF of the cell, $Ni, Ni^{2+}(0.01M)//Cl^-(0.1M), Cl_2, Pt.$

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25. Lithium is the strongest reductant is aqueous solutions. Why ?

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26. Calculate the standard Gibbs energy change for the redox reaction of Daniell cell.

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27. Mention electrodes and write the cell representing a redox reaction, $Zn + H_2SO_4 \rightarrow ZnSO_4 + H_2$.

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28. Calculate the solubility product of Ag_2CrO_4 at $298K$, if the EMF of the concentration cell, Ag, Ag^+ (Solide $Ag_2CrO_4\big)//Ag^+(0.1M), Ag$ is 0.164 V.

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29. $Mg(s) + 2Ag^{+}(0.0001M) \rightarrow 2Ag(s) + Mg^{2+}(0.13M)$. Calculate the E_{cell} is given as 3.17 V.

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30. E°_{cell} for the redox reaction $2Ag^{+}(aq) + Cu \rightarrow Cu^{2+}(aq) + 2Ag$ is 0.46 V. Calculate the equilibrium constant of the reaction.

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31. Second law of thermodynamics is not a restriction in the working of a fuel cell. Explain.

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32. What happens when lead storage battery is subjected to charging?

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33. Potash solution is not recommended in a hydrocarbon - oxygen fuel cell. Why ?

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34. What are the limitations of fuel cells?

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35. Highly conducting solution favour rapid corrosion. Explain.

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36. A long iron rod is partially dipped in common salt solution. What happens?

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37. Concentrated nitric acid can be transported in vessels of iron. Why ?

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EXERCISE - 4.1.1

1. Write the types of electrical conductors with suitable examples.

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2. What is degree of dissociation? How is it useful to distinguish between strong and weak electrolytes?

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3. Define the terms resistance , resistivity , conductance and specific conductance. Write their units.

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4. Discuss (a) molar conductance and (b) equivalent conductance.

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5. Why does the conductivity of a solution decrease with dilution?

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6. Suggest a way to determine the Λ_m^0 value of water .

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7. How is the conductance of an electrolytic solution influenced by various factors?

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8. State and explain Kohlrausch's law of indendent migration of ions.

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9. At$25^{\circ}C$, the specific conductance of 0.01 M alkaline earth metal chloride is $0.000158 \text{ohm}^{-1} cm^{-1}$ Calculate the equivalent conductance.

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10. Calculate the limiting molar conductivities of

a)magnesium sulphate and b) calcium chloride.

Limiting molar conductivity of $Mg^{2+}, Ca^{2+}, SO_4^{2-}$ and CI^- are respectively $106, 119, 160$ and 76.3scn mol^{-1}.

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11. Calculate the equivalent conductance of NH_4OH at infinite dilution using Kohlrausch law. Given that Λ_0 values of $NaOH, NaCI$ and NH_4Cl are respectively 217.4, 108.9 and $129\text{ohm}^{-1}cm^2$.

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12. The conductivity of $0.001028 molL^{-1}$ acetic acid is $4.95 \times 10^{-5} Scm^{-1}$. Calculate its dissociation constant if Λ_m^0 for acetic is $390.5 Scm^2 mol^{-1}$?

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13. The molar conductivity of $0.024\text{mol}L^{-1}$ methanoic acid is $46.1 Scm^{-2}\text{mol}^{-1}$. Calculate its degree of dissociation and dissociation constant. Given $\lambda^0\left(H^+ = 349.6 Scm^2 mol^{-1}\right.$ and $\lambda^0\left(HCOO^-\right) = 54.6 Scm^2 mol^{-1}$.

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14. At $25^{\circ}C$ equivalent conductance of a week acid HAc is $16.2\text{ohm}^{-1}cm^2eq^{-1}$.If the ionic conductances of Ac^- and H^+at infinite dilution are respectively 40.9 and $349.8\text{ohm}^{-1}cm^2eq^{-1}.$, calculate the percentage dissociation of the week acid at $25^{\circ}C$.

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EXERCISE - 4.1.2

1. Describe the phenomenon electrolysis with the help of two examples.

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2. Write the important applications and uses of electrolysis .

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3. State and explain Faraday's laws of electrolysis .

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4. Find the ratio of electrochemical equivalents of silver and aluminium .

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5. How many hours are needed to deposit the metal based on the reaction .

$Fe^{2+}(aq) + 2e^{-} \rightarrow Fe(s)$. using a current strength of 0.02amp.

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6. Calculate the electrochemical equivalent of the lightest element .

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7. Suggest a list to metals that are extracted electrolytically.

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8. A matel wire carries a current of one amp. How many electrons pass a point in the wire in one sec.

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9. A solution of $CuSO_4$ is electrolysed for 10 minutes with a current of 1.5 amperes. What is the mass of copper deposited at the cathode ?

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10. 16 grams of copper sulphate is dissolved in one litre of water . It is electrolysed using a current strength of 10 amp for a period of 965 sec. What is the concentration of copper sulphate after electrolysis ? Take atomic weight of copper as 64 and assume there is no loss in water during electrolysis.

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11. 3g of metal ions were discharged at cathode using a current of 3 amperes for 2 hours from aqueous cupric sulphate solution. Calculate the current efficiency. At wt . of Cu is 63.5 .

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12. Calculate the current in amperes required to liberate 10g of silver electrolytically in one hour from $AgNO_3$ solution .

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13. Same quantity of electrical charge that deposited $0.583g$ of silver was passed through a solution of gold salt. If 0.335 g of gold is deposited, calculate the oxidation state of gold in the given salt. At wt of Au = 197.

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EXERCISE - 4.1.3

1. How is electrical energy generated by performing a chemical reaction ?

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2. Describe the construction and working of Daniell cell.

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3. What is single electrode potential? How is it dependent on various factors ?

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4. Write the Nernst equation for a metal electrode and for a non-metal electrode.

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5. Describe the constitution of standard hydrogen electrode.

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6. What is electrochemical series ? Write different applications of the series.

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7. How are the cells systemically represented ? Given examples.

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8. $E^{0}_{Ag^{+}, Ag} = 0.8V$. Calculate the single electrode potential in $0.01 M Ag^{+}$

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9. E° values of Zn^{2+}, Zn and Cu^{2+}, Cu are respectively $-0.76V$ and $+0.34.$ Calculate the EMF of the cell $Zn/Zn^{2+}(0.1M)//Cu^{2+}(0.1M)/Cu.$

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10. The potential of the cell $Cu, Cu^{2+}(0.1M)//HCl(xM), Cl_2, Pt$is 1.07 V. If the standard potential of copper and chlorine electrodes are 10.34 V and 1.36 V, calculate the concentration of HCl.

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11. Represent the cell in which the following reaction takes place

$Mg(s) + 2Ag^{+}(0.0001M) \rightarrow Mg^{2+}(0.130M) + 2Ag(s)$

Calculates its E_{cell} if $E^{\Theta}_{\text{cell}} = 3.17V$

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12. E° value of $Co^{2+}, Co, Al^{3+}, Al, Ag^{+}, Ag$ and Ba^{2+}, Ba are respectively $0.28, -1.66, +0.8$ and $-2.9V$. write the increasing order of the reduction ability of metals and discuss .

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13. E° for $Mg \rightarrow 2e^{-} + Mg^{2+}$ is $+2.37V$ and for $Cu \rightarrow 2e^{-} + Cu$ is $-0.34V$. What will be the standard potential of cell constructed with these electrodes ? Which electrode will be positive terminal to draw the current?

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14. Standard reduction potential of I_3^{-}, I^{-} and Fe^{3+}, Fe^{2+} are 0.54 and $0.77V$, respectively . Calculate the equilibrium constant for the reaction. `2Fe^(3+) + 3I^(-)

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15. Two students use of the same stock solutions of zinc sulphate and a solution of copper sulphate . The EMF of one cell is 0.0295 V higher then the other. The concentration of cupric ions used in the cell with higher EMF Value is 0.2. Calculate the concentration of cupric ions used in the other cell.

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16. Calculate the equilibrium constant of the reaction :

$$Cu_{(s)} + 2Ag^{+}_{(aq)} \rightarrow Cu^{2+}_{(aq)} + 2Ag_{(a)}$$

$$E^{\Theta}_{(cell)} = 0.46V$$

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17. The standard emf of Deniell cell is 1.1 V. Calculate the standard Gibbs energy for the cell reactions:

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

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EXERCISE - 4.1.4

1. Distinguish between primary and secondary cells used as batteries.

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2. Write the construction and working of dry cell.

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3. Explain the functions of lead accumulator.

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4. Discuss the working of hydrogen – oxygen fuel cell. What are the advantages of using this fuel cell?

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EXERCISE - 4.1.5

1. What is corrosion ? Discuss the methods for preventing corrosion .

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2. Discuss on the hydrogen evolution type corrosion of metals .

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3. Discuss the process of rusting of iron.

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EXERCISE - 4.2

1. Distinguish between strong electrolytes, weak electrolytes, and non-electrolytes.

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2. Define conductance , speific conductance , molar conductivity and equivalent conductivity Discuss.

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3. Write Debye-Huckel-Onsager equation . Based on the equation how is the equivalent conductance at infinite dilution calculated?

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4. Equivalent conductance of a week electrolyte at infinite dilution cannot be dilution cannot be directly measured. Why ? How is this calculated ?

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5. The electrical resistance of a column of $0.05 mol L^{-1} NaOH$ solution of diameter 1 cm and length 50 cm is 5.55×10^3 ohm. Calculate its resistivity , conductivity and molar conductivity.

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6. Passage of charge through aqueous $CuSO_4$ in the presence of Pt electrodes increases it pH value . Explain.

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7. What do you mean by the electrolysis at active electrodes?

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8. Discuss the electrolysis products of (a) fused NaCl and (b) aqueous NaCl at pt electrodes.

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9. Write the difference in the electrolysis of dilute sulphuric acid and 50% sulphuric acid at Pt electrodes.

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10. Define and discuss electrochemical equivalent and chemical equivalent.

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11. Write on the techniques , electroplating and electrotyping.

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12. What are the main differences between electromotive force of cells and cell potential?

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13. Write the IUPAC notations of representing cathode , anode and galvanic cell.

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14. What are reference electrodes ? How is a secondary reference electrode used in measuring electrode potentials ?

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15. Calculate the time required for a current of 2 amp to decompose one gram mole of water.

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16. An electric current is passed through two solutions (a) $AgNO_3$ and (b) a solution of 10g of blue vitriol in 500 ml water, using Pt separately After 30 min , it was found 1.307 g Ag was deposited. What was the concentration of Cu^{2+} after electrolysis?

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17. A current of 1.7 amp is passed through 300 ML of $0.16 M ZnSO_4$ solutions for 230 s with a current efficiency of 90%. Find the concentration of divalent zinc in solutions.

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18. A 200 W, 110 V in candescent lamp is connected in series with cells containing aqueous ZuCI . solution. What is the time required to deposit 1.109 g of metal ?

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19. E° of In^{3+}, In^{+} and $Cu^{2+} mCu^{+} are$ - $0.4V$ and - $0.42V$ respectively, Calculate the equilibrium constant for the reaction. $In^{2+} + Cu^{2+} \rightarrow In^{3+} + Cu^{+}$ at $25^{\circ}C$.

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20. $NO_3^{-}(aq) + 2H^{+}(aq) + e^{-} \rightarrow NO_2(g) + H_2O$. Calculate the reduction potential of the half reaction in neutral solution, if all other species to be at unit concentration and the standard reduction potential is 0.78 V.

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21. How is Nernst equation useful in calculating the potential of a cell?

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22. Write the working of concentration cell, mercury dry cell and nickel cadmium cell.

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23. Discuss the construction and working of lead storage battery.

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24. What are fuel cells? Write their advantage and de-merits .

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25. Distinguish between corrosion and passivity .

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26. Mention the reason for corrosion and discuss the preventive methods for corrosion.

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27. One normal salt solution surrounding two platinum electrodes, 2.1 cm apart and $6.3cm^2$ in area was found to offer a resistance of 50 ohm. Calculate the equivalent conductivity solution.

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28. Find the number coulombs needs to plate $10cm \times 10cm$ area to a 0.1 mm thickness of copper metal (density $8.94gcc^{-1}$) using aqueous cupric sulphate (At wt. of Cu is 63.5).

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29. Degree of dissociation of decinormal acetic acid is 3.66% at $25^\circ C$.If the equivalent conductance at infinite dilution of acetic acid at $25^\circ C$ is 390.7ohm^{-1},calculate the equivalent conductance at given concentration.

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30. When a current strength of 965 amp can deposit 0.9g of At metal in 20 sec. What is the efficiency of electrolysis ?

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31. Certain quantity of electricity is passed through aqueous $AgNO_3$ and aqueous HCl connected in a series. If 10.8g Silver was deposited, what is the volume of hydrogen collected at one atm and $25^\circ C$?

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32. Potential of normal calomel electrode is -0.28 V . The emf of cell obtained by combining Zn and Cu electrodes of a Daniel cell with normal calomel electrodes are 1.083 V and - 0.018 V at $25^{\circ} C$. Determine the EMF of Daniel cell.

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33. The standard potential of Ni^{2+}, Ni is $-0236V$. It this electrode is coupled with a hydrogen electrode, the EMF of the cell becomes zero. Calculate the pH of acid used in electrode .

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34. The oxidation power of halogens and the reducing power of halides is just reverse . Support based on the activity series.

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35. E_0 for the reaction , $Ag^+ + e^- \to Ag$, is $0.8V$. Calculate E° for the reaction.

$Ag\left(NH_3\right)_2^+ + e^- \to Ag + 2NH_3$, if the dissociation constant for. $Ag\left(NH_3\right)_2^+$ into NH_3 and Ag^+ is 6×10^{-14}.

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36. Standard oxidation potential of iron electrode is + 0.44 V. Calculate the potential of $Fe, FeSO_4(0.1M)$ at $25^\circ C$.

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37. Colour of potassium iodide solution containing starch turns blue when chlorine water is added Explain.

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38. E_0 values of Zn^{2+}, Zn, Mg^{2+}, Mg and Cu^{2+}, Cu are $-0.76V, -2.36$ and $0.34V$ respectively.

(a) Which metal can be extracted even from its aqueous solutions by electrolysis ?

(b) Which metal acts as best reductant ? Write reactions .

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39. At 298 K the equilibrium constant for the redox reaction `CuSO_4 + Fe

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40. $Ag^{+} + e^{-} \rightarrow Ag, E^{0} = +0.8V$ and $Zn^{2+} + 2e^{-} \rightarrow Zn, E^{0} = -076V$.

Calculate the cell potential for the reaction, $2Ag + Zn^{2+} \rightarrow Zn + 2Ag^{+}$

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41. E° value for $Fe^{3+}3e^{-} \rightarrow Fe$ and $Fe^{2+} + 2e^{-} \rightarrow Fe$ are $-0.036V$ and $-0.44V$ respectivley. Calculate E° and ΔG^{0} for the cell potential for the reaction $Fe + 2Fe^{3+} \rightarrow 3Fe^{2+}$.

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42. The EMI of the cell $Pt, H_2(2atm)|HCl(1M)|H_2(10atm), Pt$ is xV and of $Pt, Cl_2(2atm)|HCl(1M)|Cl_2(10atm), Pt$ is yV . How are x and y related?

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43. At $25^{\circ}C$ the EMF of the cell $Zn, ZnSO_4//CuSO_4, Cu$ is $0.03V$. The temperature coefficient of EMF is $-1.4 \times 10^{-4}VK^{-1}$. Calculate the enthalpy change of the cell reaction .

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44. The molar conductivity of $0.025 mol L^{-1}$ methanoic acid is $46.1 S cm^2 mol^{-1}$. Calculate its degree of dissociation and dissociation constant.

Given, $\lambda^0\left(H^+\right) = 349.6 S cm^2 mol^{-1}$

and $\lambda^0\left(HCOO^-\right) = 54.6 S cm^2 mol^{-1}$

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45. E_{cell} for the reaction $Pt, H_2(1 atm)/H^+(1M)//C_6H\Big)5NH_3Cl(1/32M)/H_2(1 atm)$, Pt at 300K is -0.188 V. Calculate the proton concentration and hydrolysis constant of aniline hydrochloride.

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46. At $25^\circ C$ potential of the cell, $Pt, H_2(g), HCl(aq)//AgCl(s), Ag(s)$ is 0.22 V. If E° of silver electrode is 0.8 V , calculate the solubility of AgCl in water .

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47. When salt is spread on a road during winter, corrosion of motor cars is a major problem Justify .

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48. $E^0 = -08275V$ for the reaction, $2H_2O + 2e^- \rightarrow 2OH^- + H_2$.Calculate the ionic product for the reaction, `2H_2O

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49. E^0 of silver electrode is 0.8 V and solubility product of Agl is 1×10^{-16}. Calculate the potential of silver electrode at $25\,^\circ C$ in a saturated Ago solution in water.

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50. The cell in which the following reaction occurs:

$2Fe^{3+}(aq) + 2I^{-}(aq) \rightarrow 2Fe^{2+}(aq) + I_2(s)$ has $E^0_{cell} = 0.236V$ at 298 K.

Calculate the standard Gibbs energy and the equilibrium constant of the cell reaction .

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LEVEL-I (EXERCISE-I)

1. Which one of the following materials conducts electricity ?

A. diamond

B. barium sulphate

C. crystalline sodium chloride

D. fused potassium chloride

Answer: D

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2. An electronic conductor is

A. NaCl

B. Diamond

C. Ag

D. KCl

Answer: C

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3. Which of the following is a conductor of electricity

A. diamond

B. graphite

C. carborundum

D. silica

Answer: B

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4. In metallic conductor the current is conducted by flow of

A. ions

B. atoms

C. electrons

D. molecules

Answer: C

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5. In which of the following, HCl conducts electricity to a large extent ?

A. liquid HCl

B. HCl aq. solution

C. HCl solution in benzene

D. gaseous HCl

Answer: B

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6. Solid NaCl is a bad conductor of electricity because

A. solid NaCl is a covalent compound

B. solid NaCl has no free ions

C. solid NaCl has no free electrons

D. In solid NaCl there is no migration of ions

Answer: B

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7. The decrease in electrical conductivity of metals with increase in temperature is due to increase in

A. the velocity of electrons

B. the resistance of the metal

C. the number of electrons

D. the number of metal atoms

Answer: B

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8. The reason for increase in electrical conduction of electrolyte with increase in temperature is

A) increase in the number of ions

B) increase in the speed of ions

C) increase in the degree of dissociation of electrolyte

A. A, B only

B. B, C only

C. A, C only

D. A, B, C

Answer: D

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9. Sodium metal in liquid ammonia is

A. an ionic conductor

B. an electronic conductor

C. a mixed conductor

D. non - conductor

Answer: C

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10. A solution of Sodium metal in liquid ammonia is strongly reducing agent due to a

A. Sodium atoms

B. Sodium hydride

C. Sodamide

D. Solvated electrons

Answer: D

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11. Choose the wrong statement

A. electrical conductance of an electrolytic conductor increases with increase in temperature

B. electrical conductance of a metallic conductor increases with increase in temperatures

C. electrical conductance of a metallic conductor dccrcascs with increase in temperature

D. degree of dissociation of an electrolyte increases with dilution

Answer: B

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12.

LIST - I	LIST - II
A) Electronic conductor	1) Aqueous urea solution
B) Non-electrolyte	2) Solid sodium
C) Electrolytic dissociation	3) Electrolytic conductor
D) Arrhenius	4) Radioactivity increases
	5) Conductivity raises with temperature

The correct match is

	A	B	C	D		A	B	C	D
1)	5	1	2	3	2)	5	2	1	4
3)	2	1	5	3	4)	2	5	1	4

The correct match is

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13. Which of the following is 100% ionised at any dilution ?

A. CH_3COOH

B. HCN

C. $NaCl$

D. NH_4OH

Answer: C

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14. Which of the following (1M) conducts more electricity ?

A. sulphuric acid

B. boric acid

C. nitric acid

D. phosphorous acid

Answer: A

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15. The degree of dissociation of an electrolyte in aqueous solution depends on

A) Temperature

B) Concentration of the electrolyte

C) Nature of the electrolyt

A. Only A

B. Only A, B

C. Only B, C

D. A, B, C

Answer: D

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16. What happens at infinite dilution in a given solution ?

A. The degree of dissociation is unity for weak electrolytes

B. The electrolyte is 100% ionised

C. All inter ionic attractions disappear

D. All the three

Answer: D

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17. At infinite dilution the degree of dissociation for sucrose in aqueous solution is

A. 0

B. 0.5

C. 0.99

D. 1

Answer: A

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18. Choose the correct statement regarding electrolytic cell

A. It is a device in which chemical energy is converted into electrical energy

B. Anode is shown by negative sign

C. Oxidation reaction takes place at the anode

D. Electrons flow from cathode to anode

Answer: C

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19. The following are some statements about electrolytic cell

A) in this cell, chemical energy is converted into electrical energy

B) in this cell, electrons flow from cathode to anode

C) in this cell, reduction takes place at cathode

D) in this cell, cathode is a +ve electrode The correct combination is

A. only B

B. only C

C. only C, D

D. only B, C

Answer: B

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20. The reactions taking place al anode and cathode are

A. Oxidation and Reductions

B. Reduction and Oxidation

C. Oxidation and Hydrolysis

D. Reduction and Hydrolysis

Answer: A

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21. The electrode through which the electrons enter the electrolytic solution is

A. cathode

B. anode

C. may be anode or cathode

D. neither anode nor cathode

Answer: A

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22. As electrolysis is in progress, if the cathode plate is removed

A. the movement of ions stops

B. the ions move at random

C. all ions move towards anode

D. only anions move towards the anode

Answer: B

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23. In the electrolytic cell, flow of electrons is from

A. cathode to anode in the solution

B. cathode to anode through external circuit

C. anode to cathode through external circuit

D. all of these

Answer: C

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24. In electrolysis of dilute H_2SO_4, what is liberated at anode in the presence of inert electrode ?

A. H_2

B. SO_2

C. SO_3

D. O_2

Answer: D

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25. Which process occurs in the electrolysis of aqueous solution of nickel chloride at nickel anode?

A. $Ni^{2+} \rightarrow 2e \rightarrow Ni$

B. $2H^{+} + 2e \rightarrow H_2$

C. $2Cl^{-} \rightarrow Cl_2 + 2e$

D. $Ni \rightarrow Ni^{2+} + 2e$

Answer: D

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26. Molten $CuCl_2$, is electrolysed using platinum electrode. The reaction occuring at anode is

A. $2Cl^{-} \rightarrow Cl_2(g) + 2e^{-}$

B. $Cl_2(g) + 2e^{-} \rightarrow 2Cl^{-}$

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

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

Answer: A

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27. During the electrolytic reduction of alumina, the reaction at cathode is

A. $2H_2O \rightarrow O_2 + 4H^+ + 4e^-$

B. $3F^- \rightarrow 3F + 3e^-$

C. $Al^{3+} + 3e^- \rightarrow Al$

D. $2H^+ + 2e^- \rightarrow H_2$

Answer: C

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28. When an aqueous solution of copper sulphate is electrolysed using copper electrodes the reaction at the anode is represented by

A. $H^+ + e^- \rightarrow H$

B. $Cu^{2+} + 2e^- \rightarrow Cu$

C. $SO_4^{2-}(aq) \rightarrow SO_4 + 2e^-$

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

Answer: D

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

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

B. $F_2 \rightarrow 2F^-$

C. $\frac{1}{2}O_2 + 2H^+ \rightarrow H_2O$

D. None of these

Answer: A

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30. Aqueous solution of $CuSO_4$ is electrolysed using inert electrodes till the blue coloured solution becomes colourless. The colourless solution formed is

A. $Cu(OH)_2$

B. H_2SO_4

C. $CuSO_4$

D. H_2O

Answer: B

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31. After the electrolysis of aqueous solution of NaCl using Pt electrodes, the pH of the solution

A. increases

B. decreases

C. remains constant

D. becomes zero

Answer: A

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32. During the electrolysis of aqueous solution of the following, molarity of the solution increases without changing the chemical composition

A. $NaCl$

B. HCl

C. $CuSO_4$

D. H_2SO_4

Answer: D

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33. Aqueous NaCl solution is electrolyzed using platinum electrodes. What is the product formed at cathode?

A. Na

B. H_2

C. O_2

D. Cl_2

Answer: B

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34. At anode in the electrolysis of fuscd sodium chloride

A. Na^+ is oxidised

B. Cl^- is oxidised

C. Cl is reduced

D. Na is reduced

Answer: B

Watch Video Solution

35. In electrolysis of NaCl when Pt electode is taken then H_2 is liberated at cathode while with Hg cathode, it forms sodium amalgam. This is because

A. Hg is more inert than Pt

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

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

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

Answer: B

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36. (A): Hydrogen gas always evolved only at cathode during electrolysis

(R) : H^+ ions undergo reduction by gaining electrons

The correct answer is

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

B. Both (A) and (R) are true and (R) is not the correct explanation of (A)

C. (A) is true but (R) is false

D. (A) is false but (R) is true

Answer: D

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37. Which of the following ions is discharged at the cathode when an aqueous solution of sodium hydroxide is electrolysed ?

A. Hydrogen

B. Hydroxyl

C. Oxygen

D. Sodium

Answer: A

Watch Video Solution

38. During electrolysis of fused NaOH

A. H_2 is liberated at cathode

B. O_2 is liberated at cathode

C. H_2 is liberated at anode

D. O_2 is liberated at anode

Answer: D

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39. Aqueous solution of $AgNO_3$ is electrolysed using inert electrodes. At the end of electrolysis

A. pH of the solution increases

B. pH of the solution decreases

C. pH of the solution remains unchanged

D. pH of the solution becomes

Answer: B

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40. At cathode, the electrolysis of aqueous Na_2SO_4 gives

A. Na

B. H_2

C. SO_3

D. SO_2

Answer: B

Watch Video Solution

41. An aqueous solution containing one mole per litre of each $Cu(NO_3)_2, AgNO_3. Hg(NO_3)_2, Mg(NO_3)_2$ is being electrolysed using inert electrodes. The values of standard electrode potential (reduction potential) in volts are

$Ag/Ag^+ = +0.80V \quad Hg/Hg^{2+} = +0.79V \quad Cu/Cu^{2+} = +0.34V \quad Mg/Mg^{2+} =$

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

A. Ag , Hg , Cu ,Mg

B. Mg, Cu, Hg, Ag

C. Cu, Hg, Ag

D. Cu, Hg, Ag, Mg

Answer: C

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42. The electrolysis of an aqueous solution of KNO_3 between platinum electrode gives

A. K at the cathode NO_2 at the anode

B. H_2 at cathode and O_2 at anode

C. H_2 at cathode and NO_2 at anode

D. K at cathode and O_2 at anode

Answer: B

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43. According to Faraday's first Law of electrolysis mass of substance liberated is equal to

A. eC

B. eQ

C. et

D. eCt/nF

Answer: B

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44. When the same charge is passed through the solutions of different electrolytes in series, the amounts of elements deposited in the electrodes are in the ratio of their

A. atomic numbers

B. atomic weights

C. specific gravities

D. equivalent weights

Answer: D

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45. According to 2nd law of Faraday's electrolysis the correct one is

i) $\frac{\text{wt. of } H_2 \text{ liberated}}{\text{wt. of } Cl_2 \text{ librated}} = \frac{\text{eq. wt . of} H_2}{\text{eq. wt . of } Cl_2}$ ii) $\frac{m_{Ag}}{m_{cu}} = \frac{E_{Ag}}{E_{Cn}}$

iii) $\frac{m_{Ag}}{m_{Cu}} = \frac{E_{Cu}}{E_{Ag}}$ iv) $\frac{m_{H_2}}{m_{Cu}} = \frac{E_{H_2}}{E_{Cu}}$

The correct combination is

A. only ii, iv

B. only i

C. only i,ii ,iv

D. only ii,iii

Answer: C

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46. One Faraday is equal to

A. $96.5c\ \text{mol}^{-1}$

B. $96500c\ \text{mol}^{-1}$

C. $6.023 \times 10^{23}\ \text{mol}^{-1}$

D. $96.5 \times 10^{23} c\text{mol}^{-1}$

Answer: B

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47. One Faraday of electricity will liberate 1 gram atom of the metal from the solution of

A. $CuCl_2$

B. $CuSO_4$

C. $AgNO_3$

D. $AuCl_3$

Answer: C

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48. For the discharge of equal masses of the following ions, the number of electrons required is maximum in the case of

A. H^{+}

B. Cu^{2+}

C. Ag^{+}

D. Al^{3+}

Answer: A

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49.

LIST - I	LIST - II
A) Faraday's first law	1) $e \times 96500$
B) Chemical equivalent	2) $\frac{m_1}{E_1} = \frac{m_2}{E_2}$
C) Faraday's second law	3) S.H.E.
D) Pt, H_2 (atm)/H^+(1M)	4) $m = eQ$
	5) Salt bridge

The correct match is

	A	B	C	D
1)	4	1	3	2
2)	4	5	2	3
3)	1	1	2	3
4)	4	1	2	3

The correct match is

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50. Copper can be deposited from acidified copper sulphate and alkaline cuprous cyanide. If the same current is passed for a definite time:

A. The amount of copper deposited from acidic copper sulphate will be higher

B. The amount of copper deposited from alkaline cuprous cyanide will be higher

C. The same amount of copper will be deposited

D. None of the above

Answer: B

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51.

LIST - I

A) One faraday
B) Anode
C) Cathode
D) 1 coulomb

LIST - II

1) Reduction
2) 96500 coulomb
3) 6.24×10^{18} electrons
4) Oxidation
5) $Z \times 96,500$

The correct match is

	A	B	C	D
1)	5	4	2	3
2)	2	4	1	3
3)	2	4	1	5
4)	5	2	1	3

The correct match is

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52. The minimum conductance in fused state is shown by

A. $MgCl_2$

B. $CaCl_2$

C. $BaCl_2$

D. $SrCl_2$

Answer: C

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53. The ionic conductance of following cations in a given conc. is in the order

A. $Li^{+} < Na^{+} < K^{+} < Rb^{+}$

B. $Li^{+} > Na^{+} > K^{+} > Rb^{+}$

C. $Li^{+} < Na^{+} > K^{+} > Rb^{+}$

D. $Li^{+} = Na^{+} < K^{+} < Rb^{+}$

Answer: A

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54. The value of molar conductivity of HCl is greater than that of NaCl at a particular temperature because

A. Molecular mass of HCl is greater than that of NaCl

B. Mobility of H^{+} ions is more than that of Na^{+} ions

C. HCl is strongly acidic

D. Ionisation of HCl is larger than that of NaCl

Answer: B

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55. (A) : The conductivity of an aqueous solution of NaCl is greater than that of pure solvent.

(R) : Conductivity is independent of the number of ions in solution.

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

B. Both (A) and (R) are true and (R) is not the correct explanation of (A)

C. (A) is true but (R) is false

D. (A) is false but (R) is true

Answer: C

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56. The unit of specific conductivity is

A. ohms cm^{-1}

B. ohms cm^{-2}

C. $ohms^{-1}cm$

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

Answer: D

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57. The unit of equivalent conductivity is

A. ohm cm

B. $ohm^{-1}cm^2$ (g equivalent)$^{-1}$

C. ohm cm^2 (g equivalent)

D. Scm^{-2}

Answer: B

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58. The equivalent conductance of 1N solution of an electrolyte is nearly

A. Same as its specific conductance

B. 10^{-3} times its specific conductance

C. 10^2 times more than its specific conductance de

D. 10^3 times more than its specific conductance

Answer: D

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59. (A): The molar conductance of weak electrolytes is low as compared to that of strong electrolytes at moderate concentrations

(R) :Weak electrolytes at moderate concentrations dissociate to a much greater extent when compared to strong electrolytes

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

B. Both (A) and (R) are true and (R) is not the correct explanation of (A)

C. (A) is true but (R) is false

D. (A) is false but (R) is true

Answer: C

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60. The highest electrical conductivity among the following aqueous solutions is of

A. 0.1 M acetic acid

B. 0.1 M chloroacetic acid

C. 0.1 M fluoroacetic acid

D. 0.1 M difluoroacetic acid

Answer: D

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61. Conductance is directly proportional to area of the vessel and the concentration of solution in it and is inversly proportional to the length of the vessel, then the unit of the constant of proportionality is

A. $S.m \ \mathrm{mol}^{-1}$

B. $S.m^2 \ \mathrm{mol}^{-1}$

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

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

Answer: B

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62. If the specific conductance and conductance of a solution are same, then its cell constant is equal to

A. 1

B. 0

C. 10

D. 100

Answer: A

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63. (A) : The conductivity of 0.1M solutions of different electrolytes is same.

(R) : The conductivity depends on the size of the ions.

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

B. Both (A) and (R) are true and (R) is not the correct explanation of (A)

C. (A) is true but (R) is false

D. (A) is false but (R) is true

Answer: D

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64. Specific conductivity of a solution

A. increases with dilution

B. decreases with dilution

C. remains unchanged with dilution

D. depends on mass of electrolyte

Answer: B

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65. For measuring conductivity of an electrolyte, its solution should be prepared in

A. Tap water

B. Distilled water

C. Conductivity water

D. Polywater

Answer: B

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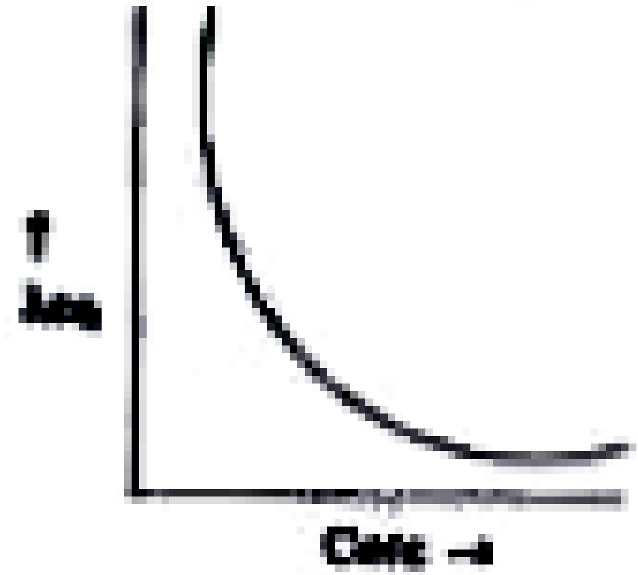
66. A graph is drawn between the λ_{eq} values and concentration of an electrolyte. Which of the following electrolyte will correspond to the

graph given ?



A. KCl

B. $BaCl_2$

C. H_2SO_4

D. CH_3COOH

Answer: D

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67. For which case $'\lambda'$ values v/s $\sqrt{c}$ shows a straight line

A. KCl

B. HCOOH

C. CH_3NH_2

D. CH_3COOH

Answer: A

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68. According to Kohlrausch law, the limiting value of molar conductivity of an electrolyte A_2B is

A. $\lambda_A^{\infty} + \lambda_B^{\infty}$

B. $\frac{1}{2}\lambda_A^{\infty} + \lambda_{B^{-2}}^{\infty}$

C. $2\lambda_A^{\infty} + \frac{1}{2}\lambda_{B^{-2}}^{\infty}$

D. $2\lambda_A^{\infty} + \lambda_{B^{-2}}^{\infty}$

Answer: D

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69. The expression showing the relationship between equivalent conductivity and molar conductivity is

A. $\lambda_m = Z \times \lambda_{eq}$

B. $\lambda_{eq} = Z \times \lambda_m$

C. $\lambda_m = \frac{\lambda_{eq}}{Z}$

D. $\lambda_m = \lambda_{eq}^2$

Answer: A

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70. The molar conductivities Λ^0_{NaOAc} and Λ^0_{HCl} at infinite dilute in water at $25\,^\circ C$ are $91.0 Scm^2/\text{mol}$ and $426.2 Scm^2/\text{mol}$ respectively . To calculate

Λ_{HOAc}^{0} the additional value required is

A. Λ_{NaCl}^{0}

B. $\Lambda_{H_2O}^{0}$

C. Λ_{KCl}^{0}

D. Λ_{NaOH}^{0}

Answer: A

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71. The equivalent conductances of two strong electrolytes at infinite dilutution in H_2O (where ion move freely through a solution) at $25\,^{\circ}C$ are give below $\Lambda_{CH_3COONa}^{0} = 91.0 Scm^2/\text{equiv}, \Lambda_{HCl}^{0} = 426.2 Scm^2/\text{equiv}$ What additional information / quantity one needs to calculate Λ^0 of an aqueous solution of acetic acid ?

A. Λ^0 of CH_3COOK

B. Λ^0 of H^+

C. Λ^0 of $ClCH_2COOH$

D. Λ^0 of NaCl

Answer: D

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72. In a Galvanic cell, the electrons flow from

A. anode to cathode through the solution

B. cathode to anode through the solution

C. anode to cathode through the external circuit

D. cathode to anode through the external circuit

Answer: C

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73. Which of the following statements is wrong about galvanic cells

A. cathode is the positive electrode

B. cathode is the negative electrode

C. electrons flow from anode to cathode in the external circuit

D. reduction occurs at cathode

Answer: B

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74. Which of the following statements is correct w.r.t. both electrolytic cell and Galvanic cell

A. in both cells, anode is shown by +ve sign

B. in both cells, cathode is shown by -ve sign

C. in both cells, reduction reaction takes place at the cathode

D. in both cells, oxidation reaction takes place at the cathode

Answer: C

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75. Saturated solution of KNO_3 is used to inake salt bridge because

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

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

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

D. KNO_3 is highly soluble in water

Answer: C

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76. (A): A salt bridge allows the flow of current by completing the electrical circuit

(R) : A salt bridge maintains the electrical neutrality of the two half cells

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

B. Both (A) and (R) are true and (R) is not the correct explanation of (A)

C. (A) is true but (R) is false

D. (A) is false but (R) is true

Answer: A

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77. The function of a salt bridge is

A. to provide a link between two half cells

B. to allow ions to go from one cell to another

C. to keep the emf of the cell positive

D. to maintain electrical neutrality of the solution in the two half cells

Answer: D

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78. Which of the following is correct?

A. Zinc acts as cathode in Daniel cell

B. In a Li-Zn couple, zinc acts as anode

C. Copper displaces iron from its salt solution

D. Zinc displaces tin from its salt solution

Answer: D

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

A. Electrons flow from copper electrode to zinc electrode

B. Current flows from zinc electrode to copper electrode

C. Cations move towards copper electrode

D. Cations move toward zinc electrode

Answer: C

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80. The cell reaction of the galvanic cell, $Cu(s)/Cu^{2+}(aq)/Hg^{2+}(aq)/Hg(l)$ is

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

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

C. $Hg + Cu^{+} \rightarrow CuHg$

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

Answer: D

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81. (A) : The Daniel cell becomes dead after some time

(R) : Oxidation potential of zinc anode increases and that of copper cathode decreases

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

B. Both (A) and (R) are true and (R) is not the correct explanation of (A)

C. (A) is true but (R) is false

D. (A) is false but (R) is true

Answer: C

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82. The cell for which the cell reaction is $H_2 + Cu^{2+} \rightarrow 2H^+ + Cu$ is represented as

A. $Cu/Cu^{2+}//H^+H_2$

B. $H_2(g)/H^+//Cu^{2+}/Cu$

C. $Pt, H_2(1atm), H^+//Cu^{2+}/Cu$

D. $Pt, H_2/H^+(aq)(1atm)//Cu^{2+}/Cu$

Answer: C

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83. Which metal will dissolve if the cell works $Cu\left|Cu^{2+}\right|| Ag^+|Ag$

A. Cu

B. Ag

C. Both (1) and (2)

D. None of these

Answer: A

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84. The chemical reaction $2AgCl_{(s)} + H_{2(g)} \rightarrow 2HCl_{(aq)} + 2Ag_{(s)}$ taking place in a galvanic cell is represented by the notation.

A. $Pt(s)\left|H_2(g), 1 \text{ bar}\right| 1MKCl(aq)|AgCl(s)|Ag(s)$

B. $Pt(s)\left|H_2(g), 1 \text{ bar}\right| 1MHCl(aq) \,|\, \left| 1MAg^+(aq)\right| Ag(s)$

C. $Pt(s)\left|H_2(g), 1 \text{ bar}\right| 1MHCl(aq) \,|\, |AgCl(s)|Ag(s)$

D. $Pt(s)\left|H_2(g), 1 \text{ bar}\right| 1MHCl(aq)|Ag(s)|AgCl(s)$

Answer: C

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85. Which is a correct cell reaction ?

A. $Zn + 2Ag^+ \rightarrow Zn^{2+} + 2Ag$

B. $2Ag + Zn^+ \rightarrow 2Ag^+ + Zn$

C. Both

D. None

Answer: A

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86. Stronger the oxidising agent greater is the

A. Oxidation potential

B. Reduction potential

C. Redox potential

D. Hydration potential

Answer: B

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87. The reaction , $1/2H_{2(g)} + AgCl_{(s)} \rightarrow H^{+}_{(aq)} + Cl^{-}_{(aq)} + Ag_{(s)}$ occurs in the galvanic cell :

A. $Ag \left| AgCl_{(s)} \right| KCl_{(\text{soln})} \left| AgNO_{3(\text{soln})} \right| Ag$

B. $Pt, H_{2(s)} \left| HCl_{(\text{soln})} \right| AgNO_{3(\text{soln})} \mid Ag$

C. $Pt, H_{2(g)} \left| HCl_{(\text{soln})} \right| AgCl_{(s)} \mid Ag$

D. $Pt, H_{2(g)} \left|\left| KCl_{(\text{soln})} \right|\right| AgCl_{(s)} \mid Ag$

Answer: C

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88. For spontanity of a cell, which is correct ?

A. $\Delta G = 0, \Delta E = 0$

B. $\Delta G = -Ve, \Delta E = 0$

C. $\Delta G = +Ve, \Delta E = 0$

D. $\Delta G = -Ve$

Answer: D

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89. If the cell reaction is spontaneous

A. E^0 is -ve

B. ΔG is positive

C. E^0 is +ve

D. $\left(\Delta G + E^0\right)$ is positive

Answer: C

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90. (A) : If E^0 of $Cu^{2+}/Cu = +0.34V$ and E^0 of $Ag^+/Ag = +0.80V$ then galvanic cell constructed from these is $Ag/Ag^+//Cu^{2+}/Cu$

(R) : In any galvanic cell the reaction that takes place is a redox reaction

Electrode potentials & EMF

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

B. Both (A) and (R) are true and (R) is not the correct explanation of (A)

C. (A) is true but (R) is false

D. (A) is false but (R) is true

Answer: D

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91. The metal that cannot displace hydrogen from dilute hydrochloric acid is

A. aluminium

B. iron

C. copper

D. zinc

Answer: C

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92. 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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93. The following statements about electro chemical series are

i) the metals occupying top positions in the series do not liberate hydrogen with dilute acids

ii) the substances which are stronger reducing agents and stronger oxidising agents are placed below & top respectively

iii) a metal higher in the series will displace the metal from its solution which is lower in the series

iv) various electrodes are arranged in a series in the descending order of their potentials The correct statements are

The correct statements are

A. iv

B. iii

C. all

D. iii & iv

Answer: B

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94. The following are some statements about normal hydrogen electrode

a) when a 'Zn' electrode is in combination of NHE, Zn electrode acts as cathode

b) when a ‘Cu' electrode is in combination with NHE, Cu electrode is the anode

c) when a 'Ag' electrode is in combination with NHE, Ag electrode is the anode

d) when a chlorine electrode is in combination with NHE, chlorine electrode is the anode

A. only (a) is correct

B. all are correct

C. all are incorrect

D. both (b) & (c) correct

Answer: C

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95. Which defines the standard reduction electrode potential of Zn^{2+} ions?

A. $Zn^{2+}_{(aq)} + 2e \rightarrow Zn_{(s)}, \left[Zn^{2+}\right] = 1M$

B. $Zn_{(g)} \rightarrow Zn^{2+} + 2e, \left[Zn^{2+}\right] = 1M$

C. $Zn^{2+}_{(aq)} \rightarrow Zn_{(s)} + 2e, \left[Zn^{2+}\right] = 1M$

D. $Zn^{2+}_{(g)} \rightarrow Zn_{(s)} - 2e, \left[Zn^{2+}\right] = 1M$

Answer: A

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96. (A) : Lithium has less electrode potential than caesium

(R) : Hydration energy of lithium ion is high.

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

B. Both (A) and (R) are true and (R) is not the correct explanation of (A)

C. (A) is true but (R) is false

D. (A) is false but (R) is true

Answer: A

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97. The reference electrode is made by using

A. $ZnCl_2$

B. $CuSO_4$

C. $HgCl_2$

D. Hg_2Cl_2

Answer: D

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98. The more electro positive element has

A. positive reduction potential

B. negative reduction potential

C. tendency to gain electrons

D. negative oxidation potential

Answer: B

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99.

LIST - I	LIST - II
A) Very dilute H_2SO_4 by inert electrodes	1) $Hg/Hg_2Cl_{2(S)}$, KCl(salt)
B) Potential is zero Volts	2) $H_2S_2O_8$ at anode
C) 50% H_2SO_4 by inert electrodes	3) Daniel cell
D) $Zn/Zn^{+2}(aq)//Cu^{+2}(aq)/Cu$	4) O_2 at anode
	5) Pt, $H_2(1atm)/H^+(1M)$

The correct match is

	A	B	C	D
1)	4	5	2	3
2)	2	1	4	3
3)	2	5	4	3
4)	5	3	1	2

The correct match is

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100. A smuggler could not carry gold by depositing iron on the gold surface since

A. Gold is denser

B. Iron rusts

C. Gold has higher reduction potential than iron

D. Gold has lower reduction potential than iron

Answer: C

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101. Standard reduction electrode potential of three metals A, B and C are respectively +0.05 V, -3.0 and -1.2 V. The reducing powers of

A. $B > C > A$

B. $A > B > C$

C. $C < B < A$

D. $A > C > B$

Answer: A

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102. The difference of potential of two electrodes in a galvanic cell is known as

A. EMF

B. Potential difference

C. Electrode difference

D. Ionic difference

Answer: A

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

A. Zn acts as oxidizing agent when reacts with HNO_3

B. HNO_3 is weaker acid than H_2SO_4 and HCl

C. In electrochemical series Zn is above hydrogen

D. NO_3^- is reduced in preference to hydronium ion

Answer: D

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104. When Zn piece is kept in $CuSO_4$ solution, copper gets precipitated because :

A. Standard reduction potential of zinc is more than copper

B. Standard reduction potential of zinc is less than copper

C. Atomic number of zinc is larger than copper

D.) Atomic number of zinc is lower than copper

Answer: B

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105. For $I_2 + 2e \rightarrow 2I^-$, standard reduction potential = $+0.54$ volt. For $2Br^- \rightarrow Br_2 + 2e^-$. Standard oxidation potential = - 1.09 volt. For

$Fe \rightarrow Fe^{2+} + 2e^-$, standard oxidation potential = + 0.44 volt. Which of the following reaction is non-spontaneous ?

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

B. $Fe + Br_2 \rightarrow Fe^{2+} + 2Br^-$

C. $Fe + I_2 \rightarrow Fe^{2+} + 2I^-$

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

Answer: D

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106. Beryllium is placed above magnesium in the II group. When beryllium dust is added to $MgCl_2$ solution, it

A. Has no effects

B. Precipitates Mg metal

C. Precipitates MgO

D. Leads to dissolution of Be metal

Answer: A

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107. E° for $Fe^{2+} + 2e \rightarrow Fe$ is -0.44 V , E° for $Zn^{2+} + 2e \rightarrow Zn$ is - 0.76 V .

Then

A. Zn is more electropositive than Fe.

B. Fe is more electropositive than Zn

C. Zn is more electronegative

D. None of the above

Answer: A

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108. Based on the data given below , the correct order of reducing power is :

$Fe^{3+}_{(aq)} + e \rightarrow Fe^{2+}_{(aq)}, E^{\circ} = 077V$

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

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

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

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

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

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

Answer: A

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109. For the cell prepared from electrod A , $Cr_2O_7^{2-} \mid Cr^{3+}, E^{\circ}_{\text{red}} = +1.33V$ and electrode

$B: Fe^{3+} \mid Fe^{2+}, E^{\circ}_{\text{red}} = 0.77V$. Which of the following statement is correct ?

A. The electrons will flow from B to A when the connection is made

B. The e.m.f. of the cell will be 0.56V

C. A will be positive electrode

D. All of the above

Answer: D

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110. The S.R.Ps of $Cu^{2+}/Cu, Hg^{2+}/Hg$ and Zn^{2+}/Zn are respectively 0.34 V , 0.85 V and -0.76 V . The wrong statement is

A. Cu reduces Hg^{2+}

B. Zn reduces Cu^{2+}

C. Hg reduces Zn^{2+}

D. Zn reduces both Cu^{2+} and Hg^{2+}

Answer: C

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111. The $E^{0}_{M^{3+} \mid M^{2+}}$ values for Cr, Mn, Fe and Co are -0.41, +1.57V, + 0.77 and +1.97V respectively. For which one of these metals the change in oxidation sate from +2 to +3 is easiest?

A. Co

B. Mn

C. Fe

D. Cr

Answer: D

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112. (A): A blue colour is obtained when a copper wire is immersed in $AgNO_3$ solution

(R) : Silver reduces Cu^{2+} to copper

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

B. Both (A) and (R) are true and (R) is not the correct explanation of (A)

C. (A) is true but (R) is false

D. (A) is false but (R) is true

Answer: C

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113. The half cell reaction, with its standard reduction potentials are

I) $Pb^{2+} + 2Ag \rightarrow 2Ag^{+} + Pb\left(E^0 = -0.13V\right)$

II)$Ag^{+} + e^{-} \rightarrow Ag\left(E^0 = +0.80V\right)$

Which of the following reactions will occur ?

A. $Pb^{2+} + 2Ag \rightarrow 2Ag^{+} + Pb$

B. $Pb^{+} + H_2 \rightarrow 2H^{+} + Pb$

C. $2H^{+} + 2Ag \rightarrow 2Ag^{+} + H_2$

D. $2Ag^{+} + Pb \rightarrow Pb^{2+} + 2Ag$

Answer: D

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114. A student made the following observations in the laboratory,

A) Clean copper metal did not react with 1 molar $Pb(NO_3)_2$ solution

B) Clean lead metal dissolved in a 1 molar $AgNO_3$ solution and crystals of Ag metal appeared

C) Clean silver metal did not react with 1 molar $Cu(NO_3)_2$ solution.

The order of decreasing reducing character of the three metals is :

A. Cu, Pb, Ag

B. Cu, Ag, Pb

C. Pb, Cu, Ag

D. Pb, Ag, Cu

Answer: C

Watch Video Solution

115. Four colourless salt solutions are placed in separate test tubes and a strip of copper is placed in each. Which solution finally turns blue?

A. $Pb(NO_3)_2$

B. $Zn(NO_3)_2$

C. $AgNO_3$

D. $Cd(NO_3)_2$

Answer: C

Watch Video Solution

116. (A): In the construction of Galvanic cell, lithium electrode can not be used as cathode

(R) : Lithium has the highest negative S.R.P value.

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

B. Both (A) and (R) are true and (R) is not the correct explanation of (A)

C. (A) is true but (R) is false

D. (A) is false but (R) is true

Answer: A

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117. The potential of single electrode depends upon

A. the nature of the electrode

B. temperature

C. concentration of the ion with respect to which it is reversible

D. all the above

Answer: D

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118. The Nernst equation giving dependence of electrode potential on concentration is

A. $E = E^0 + \frac{2.303RT}{nF}\log\frac{[M]}{\left[M^{n+}\right]}$

B. $E = E^0 + \frac{2.303RT}{nF}\log\frac{\left[M^{n+}\right]}{[M]}$

C. $E = E^0 - \frac{2.303RT}{nF}\log\frac{\left[M^{n+}\right]}{[M]}$

D. $E = E^0 - \frac{2.303RT}{nF}\log\left[M^{n+}\right]$

Answer: B

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119. Consider the following four electrode :

$A = Cu^{2+}(0.0001M)/Cu(S)$ B=$Cu^{2+}(0.1M)/Cu(s)$

C =$Cu^{2+}(0.01M)/Cu(s)$ D) $= Cu^{2+}(0.001M)/Cu(s)$

If the standard reduction potential of Cu^{+2}/Cu is + 0.34 V , the reduction

potential (in volts) of the above electrodes follow the order

A. $A > D > C > B$

B. $B > C > D > A$

C. $C > D > B > A$

D. $A > B > C > D$

Answer: B

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120. The Nernst equation for the reduction potential of a non metal A

when $\left[A^{n-}\right] = C$ is given by

A. $E^0 + \frac{0.059}{n}\log C$

B. $E^0 - \frac{0.059}{n}\log C$

C. $E^0 + \frac{0.059}{n}\log C^n$

D. $E^0 - \frac{0.059}{n}\log\frac{1}{C}$

Answer: B

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121. Which of the following is not correct ?

A. Aqueous solution of NaCl is an electrolyte

B. The units of electrochemical equivalent are g.coulomb

C. In the Nernst equation, 'n' represents the number of electrons transferred in the elctrode reaction

D. Standard reduction potential of hydrogen electrode is zero volts

Answer: B

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122. The e.m.f of the following Deniell at $298K$ is $E_1, Zn/ZnSO_4(0.01M)//CuSO_4(1.0M)/Cu$ When the concentration of $ZnSO_4$ is 1.0 M and that of $CuSO_4$ is 0.01M, the e.m.f. 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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123. $Zn(s) + Cl_2(1atm) \rightarrow Zn^{2+} + 2Cl^-$, the E^0 of the cell is 2.12 V . To increase E

A. Zn^{2+} concentration should be increased

B. Zn^{2+} concentration should be decreased

C. Cl^{-} concentration should be increased

D. partial pressure of Cl_2 should be decreased.

Answer: B

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124. For the cell $Zn/Zn^{2+}//Cu^{2+}/Cu$, if the concentration of Zn^{2+} and Cu^{2+} ions is doubled , the emf of the cell

A. doubles

B. reduces to half

C. remains same

D. remains zero

Answer: C

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125. In a cell that utilises the reaction $Zn_{(s)} + 2H^{+}_{(aq)} \rightarrow Zn^{2+}_{(aq)} + H_{2(g)}$ addition of H_2SO_4 to cathode compartment, will

A. lower the E and shift equilibrium to the left

B. increase the E and shift equlibrium to the left

C. increase the E and shift equlibrium to the right

D. lower the E and shift equilibrium to the right

Answer: C

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126. For a cell reaction , $Cu^{2+}\left(C_1, aq\right) + Zn(s) \rightarrow Zn^{2+}\left(C_2, aq\right) + Cu(s)$ of an electro chemical cell , the change in standard free energy , ΔG^0 at a given temeprature is

A. $\ln C_1$

B. $-RT\ln\frac{C_2}{C_1}$

C. $\ln C_2$

D. $\ln\left(C_1 + C_2\right)$

Answer: B

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127. The relationship between standard reduction potential of a cell and equilibrium constant is shown

A. $E^0_{\text{cell}} = \frac{n}{0.059}\log K_c$

B. $E^0_{\text{cell}} = \frac{0.059}{n}\log K_c$

C. $E^0_{\text{cell}} = 0.059n\log K_c$

D. $E^0_{\text{cell}} = \frac{\log K_c}{n}$

Answer: B

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128. For a spontaneous reaction the ΔG, equilibrium constant (K) and E_{cell}^{0} will be respectively .

A. $-ve, \ > 1, \ +ve$

B. $-ve, \ > 1, \ -ve$

C. $-ve, \ < 1, \ -ve$

D. $-ve, \ > 1, \ -ve$

Answer: A

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129. For the reaction $Pt/H_2(1atm)/H^+(aq)//Cl^-(aq)/AgCl/Ag, K_c$ (equilibrium constant) is represented as

A. $K_c = \frac{[Cl^-][AgCl]}{[H^+][H_2]}$

B. $K_c = [H^+][Cl^-]$

C. $K_c = \frac{[H^+][H_2]}{[Cl^-][AgCl]}$

D. $K_c = \frac{[H_2]}{[Ag]}$

Answer: B

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130. The relationship between free energy and electrode potential is

A. $\Delta G = nFE$

B. $\Delta G = nFE$

C. $\Delta G = \frac{nFE}{R}$

D. $\Delta G = \frac{\Delta H}{nFE}$

Answer: A

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131. When an electric cell is charged, then

A. voltage of cell increases

B. electrolyte of cell dilutes

C. resistance of cell increases

D. None of these

Answer: A

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132. When lead storage battery is discharged

A. SO_2 is evolved

B. Lead sulphate is consumed

C. lead is formed

D. H_2SO_4 is consumed

Answer: D

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133. When lead storage battery is charged

A. PbO_2 dissolves

B. The lead electrode becomes coated in the lead sulphate

C. H_2SO_4 is regenerated

D. The amount of acid decreases

Answer: C

Watch Video Solution

134. During the charging of lead storage battery, the reaction occuring at cathode is represented by

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

B. $Pb^{2+} + 2e^- \rightarrow Pb$

C. $Pb^{2+} + SO_4^{2-} \rightarrow PbSO_4$

D. $PbSO_4 + 2H_2O \rightarrow PbO_2 + 4H^+ + SO_4^{2-} + 2e^-$

Answer: D

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135. With respect to fuel cell prepared from H_2 and O_2 gases, the false statement is

A. It is free from pollution

B. This is more efficient than conventional method of generating electricity

C. The reaction occuring at anode is $O_{2(g)} + 2H_2O + 4e^- \rightarrow 4OH^-$

D. These take little time to go into operation.

Answer: C

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136. Hydrogen - oxygen fuel cells are used in space prograins to supply

A. Power

B. drinking water

C. oxygen

D. Both (1) and (2)

Answer: D

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

A. generate heat

B. remove adsorbed oxygen from electrode surfaces

C. produce high purity water

D. create potential difference between the two electrodes

Answer: D

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138. Which of the following reactions is used to make a fuel cell ?

A. $Cd_{(s)} + 2Ni(OH)_{3(s)} \rightarrow CdO(s) + 2Ni(OH)_{2(s)} + H_2O_{(l)}$

B. $Pb_{(s)} + PbO_{2(s)} + 2H_2SO_{4(aq)} \rightarrow 2PbSO_{4(s)} + 2H_2O_{(l)}$

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

D. $2Fe_{(s)} + O_{2(g)} + 4H^{2+}_{(aq)} + 2H_2O_{(l)}$

Answer: C

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139. Corrosion is basically a/an

A. altered reaction in presence of H_2O

B. electrochemical phenomenon

C. interaction

D. union between two light metals and a heavy metal

Answer: B

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

A. In pure water

B. In pure oxygen

C. In air and moisture

D. In air and saline water

Answer: D

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141. Which of the following metals acts as a sacrificial anode for iron articles ?

A. Cu

B. Zn

C. Ag

D. Sn

Answer: B

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142. The composition of rust is

A. $Fe_2O_3 . xH_2O$

B. $Fe_2O_3 . 2H_2O$

C. $Fe_2O_3 . 6H_2O$

D. Fe_2O_3

Answer: A

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143. Zinc is used to protect corrosion of iron because

A. E_{ox} of $Zn < E_{\text{ox}}$ of iron

B. E_{red} of $Zn < E_{\text{red}}$ of iron

C. Zn is cheaper than iron

D. Zn is abundantly available

Answer: B

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144. The Zn acts as sacrificial or cathodic protection to prevent rusting of iron because :

A. $E^{\circ}_{OP} of Zn < E^{\circ}_{OP}$ of Fe

B. $E^{\circ}_{OP} of Zn > E^{\circ}_{OP}$ of Fe

C. $E^{\circ}_{OP} of Zn = E^{\circ}_{OP} of$Fe

D. Zn is cheaper than iron

Answer: B

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145. The corrosion of iron object is favoured by

A. Presence of H^+ ion

B. Presence of moisture of air

C. Presence of impurities in iron object

D. All of the above

Answer: D

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146. Galvanization includes plating iron with

A. zinc

B. tin

C. copper

D. aluminium

Answer: A

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LEVEL-I (EXERCISE-II)

1. During the electrolysis of cryolite, aluminium and fluorine are formed in .... molar ratio

A. $1:2$

B. $2:3$

C. $1:1$

D. $1:3$

Answer: B

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2. Weight of copper (atomic mass 63.5) deposited when 2 Faradays of electricity is passed through

A. 63.5g

B. 31.15g

C. 127g.

D. 2g.

Answer: A

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3. By passing 0.1 Faraday of electricity through fused sodium chloride, the amount of chlorine liberated is

A. 35.45 g

B. 70.9 g

C. 3.545 g

D. 17.77 g

Answer: C

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4. The number of coulombs required to deposit 5.4 g. of Aluminium when the given electrode reaction is represented as $Al^{3+} + 3e^{-} \rightarrow Al$

A. $1.83 \times 10^5 C$

B. 57900 C

C. $5.86 \times 10^5 C$

D. $3F$

Answer: B

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5. The number of electrons involved in the electro deposition of 63.5 g. of Cu from a solution of $CuSO_4$ is

A. 6.0×10^{23}

B. 3.011×10^{23}

C. 12.04×10^{23}

D. 6.02×10^{22}

Answer: C

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6. The electrochemical equivalent of a metal is "y"g. coulomb^{-1}. The equivalent weight of metal is

A. y

B. $y \times 96500$

C. $y/96500$

D. $1.6 \times 10^{-19} \times y$

Answer: B

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7. The electro chemical equivalent of an element is 0.0006735 g/C. Its equivalent weight is

A. 65

B. 67.35

C. 130

D. 32.5

Answer: A

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8. The current strength required to displace 0.1 g. of H_2 in 10 sec is

A. 9.65 amp

B. 1.988 amp

C. 198 amp

D. 965 amp

Answer: D

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9. On electrolysing a sample of acidified water, 22.4 ml of hydrogen was obtained. The volume of oxygen in ml obtained is

A. 22.4

B. 44.8

C. 11.2

D. 2.24

Answer: C

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10. An electrolytic cell is constructed for preparing hydrogen. For the average current of 1 ampere in the circuit, the time required for producing 112 ml of H_2 at STP is approximately

A. 500 sec

B. 800 sec

C. 1930 sec

D. 965 sec

Answer: D

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11. One coulomb of charge passes through solutions of $AgNO_3$ and $CuSO_4$. The ratio of the amounts of silver and copper deposited on platinum electrodes used for electrolysis is

A. $108 : 63.5$

B. $54 : 31.75$

C. $108 : 31.75$

D. $215.8 : 31.75$

Answer: C

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12. When electricity is passed through molten $AlCl_3$, 13.5 g. of Al is deposited. The number of Faradays must be

A. 0.5

B. 1.0

C. 1.5

D. 2.0

Answer: C

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13. One Faraday charge was passed through the electrolytic cell placed in series containing solutions of Ag^+, Ni^{2+} and Cr^{3+}. Then Ag, Ni and Cr deposited will be (Atomic masses , Ag= 108, Ni = 59 and Cr = 52)

	Ag	Ni	Cr
1)	108 g	29.5 g	17.3 g
2)	108 g	59 g	52 g
3)	108 g	108 g	108 g
4)	108 g	116 g	156 g

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14. The weight in grams of O_2 formed at Pt anode during the electrolys of aq. K_2SO_4 solution during the passage of one coulomb of electricity is

A. $\frac{16}{96800}$

B. $\frac{8}{96500}$

C. $\frac{32}{96500}$

D. $\frac{64}{96500}$

Answer: B

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15. When one ampere current is passed through a Cu wire for 10 sec., the number of electrons passing through it is

A. 1.6×10^{19}

B. 1×10^{35}

C. 1×10^{16}

D. 6.24×10^{19}

Answer: D

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16. How many coulombs of electricity are required for the reduction of 1 mol of MnO_4^- to Mn^{2+} ?

A. 96500 C

B. $1.93 \times 10^5 C$

C. $4.83 \times 10^5 C$

D. $9.65 \times 10^6 C$

Answer: C

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17. Electric charge on 1gm ion of N^{3-} is

A. $4.8 \times 10^{-19} C$

B. $10 \times 1.6 \times 10^{-19} C$

C. $1.6 \times 10^{-19} C$

D. $2.89 \times 10^5 C$

Answer: D

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18. The charge required for the oxidation of one mole of Mn_3O_4 to MnO_4^{2-} in alkaline medium is____

A. 10

B. 5

C. 3.34

D. 2

Answer: A

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19. Time required to deposit one millimole of aluminium metal by the passage of 9.65 amperes through aqueous solution of aluminium ions is

A. 30 s

B. 10 s

C. 30,000 s

D. 10,000 s

Answer: A

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20. Two electrolytic cells, one containing acidified ferrous sulphate and another acidified ferric chloride, are in series. The ratio of masses of Iron deposited at the cathode in the two cells will be

A. $3:1$

B. $2:1$

C. $1:1$

D. $3:2$

Answer: D

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21. On passing a current through a KCl solution, 19.5g of potassium is deposited. If the same quantity of electricity is passed through a solution of aluminium chloride, the amount of aluminium deposited is

A. 4.5 g

B. 9 g

C. 13.5 g

D. 2.7 g

Answer: A

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22. When an electric current is passed through acidulated water, 112 ml of hydrogen gas at NTP is collected at the cathode in 965 seconds. The current passed in amperes is

A. 1.0

B. 0.5

C. 0.1

D. 2.0

Answer: A

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23. The amount of chlorine evolved when 2 amperes of current is passed for 30 minutes in an aqueous solution of NaCl

A. 66 g

B. 1.32 g

C. 33 g

D. 99 g

Answer: B

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24. The conductivity of 0.001 M acetic acid is 5×10^{-5} S cm^{-1} and $\wedge^{0}$ is 390.5 S $cm^2 \text{mol}^{-1}$ then the calculated value of dissociation constant of acetic acid would be

A. 81.78×10^{-4}

B. 81.78×10^{-5}

C. 18.78×10^{-6}

D. 18.78×10^{-5}

Answer: C

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25. The distance between two electrodes of a cell is 2.5 cm and area of each electrode is 5 cm2 the cell constant (in cm^{-1}) is

A. 2

B. 12.5

C. 7.5

D. 0.5

Answer: D

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26. The limiting molar conductivities (Λ^0) for NaCl, KBr and KCl are 126, 152 and 150 S.$cm^2 \text{mol}^{-1}$ respectively. Then A for NaBr is

A. $128 Scm^2 \text{ mol}^{-1}$

B. $302 Scm^2 \text{mol}^{-1}$

C. $278 Scm^2 \text{ mol}^{-1}$

D. $176 Scm^2 \text{ mol}^{-1}$

Answer: A

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27. Which of the following solutions of NaCl has the higher specific conductance ?

A. 0.001N

B. 0.01N

C. 0.1 N

D. 1 N

Answer: D

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28. Molar conductivity of a solution is $1.26 \times 10^2 \Omega^{-1} cm^2 \text{mol}^{-1}$. Its molarity is 0.01M. Its specific conductivity will be

A. 1.26×10^{-5}

B. 1.26×10^{-3}

C. 1.26×10^{-4}

D. 6.3×10^{-3}

Answer: B

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29. The values of equivalent conductivity at infinite dilutions for NH_4Cl, NaOH and NaCl are respectively 149.74, 248.1 and 126.4 $\text{ohm}^{-1}cm^2\text{equi}^{-1}$. The value of λ_{eg}^{∞} of NH_4OH is

A. 371.44

B. 271.44

C. 71.44

D. It cannot be calculated from the data given

Answer: B

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30. Specific conductance of 0.1 M Nitric acid is $6.3 \times 10^{-2} \text{ohm}^{-1} cm^{-1} \text{mol}^{-1}$

The molar conductance of the solution is

A. $630 \ \text{ohm}^{-1} cm^2 \ \text{mol}^{-1}$

B. $315 ohm^{-1} cm^2 \ \text{mol}^{-1}$

C. $100 ohm^{-1} cm^2 \text{mol}^{-1}$

D. $6300 ohm^{-1} cm^2 \text{mol}^{-1}$

Answer: A

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31. For an electrolytic solution of 0.05 mole litre^{-1}, the conductivity has been found to be 0.0110 S cm^{-1}. The molar conductivity (in $Scm^2 \text{mole}^{-1}$) is

A. 0.055

B. 550

C. 0.22

D. 220

Answer: D

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32. Molar ionic conductivities of a bivalent electrolyte are 57 and 73. The molar conductivity of the solution will be

A. $130 Scm^2 \text{ mol}^{-1}$

B. $65 Scm^2 \text{mol}^{-1}$

C. $260 Scm^2 \text{ mol}^{-1}$

D. $187 Scm^2 \text{mol}^{-1}$

Answer: A

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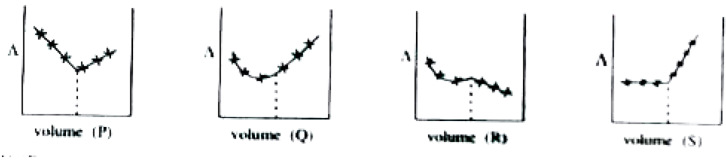
33. $AgNO_{3(aq)}$ was added to an aqueous KCl solution gradually and the conductivity of the solution was measured. The plot of conductance A versus the volume of $AgNO_3$ is



A. (P)

B. (Q)

C. (R)

D. (S)

Answer: D

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34. EMF of a cell in terms of reduction potential of its left and right electrodes is

A. $E = E_{\text{left}} - E_{\text{right}}$

B. $E = E_{\text{left}} + E_{\text{right}}$

C. $E = E_{\text{right}} - E_{\text{left}}$

D. $E = -\left(E_{\text{right}} + E_{\text{left}}\right)$

Answer: C

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35. E^0 for the half cell Zn^{2+}/Zn is - 0.76 V . Emf of the cell $Zn/Zn^{2+}(1M)//H^{+}(1M)/H_2$ at 1 atm is

A. $-0.76V$

B. $+0.76V$

C. $-0.38V$

D. $+0.38V$

Answer: B

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36. If the standard electrode protential of Cu^{2+}/Cu electrode is 0.34 V , what is the electrode potential at 0.01 M concentration of Cu^{2+}? (T = 298° K)

A. $0.399V$

B. $0.281V$

C. $0.222V$

D. $0.176V$

Answer: B

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37. The potential of hydrogen electrode is -118 mV . The H^{+} concentration of the solution is

A. $0.01M$

B. $2M$

C. $10^{-4}M$

D. 1 M

Answer: A

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38. The standard potential (E^0) for the half reaction are as $Zn \rightarrow Zn^{2+} + 2e^-, E^0 = +0.76V$

$Fe \rightarrow Fe^{2+} + 2e^-, E^0 = +0.41V$. The emf for the cell reaction $Fe^{2+} + Zn \rightarrow Zn^{2+} + Fe$ is

A. $-0.35V$

B. $+0.35V$

C. $+1.17V$

D. $-1.17V$

Answer: B

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39. E^0 for $F_2 + 2e^- \rightarrow 2F^-$ is 2.8 V , E^0 for $1/2F_2 + e^- \rightarrow F^-$ is

A. $2.8V$

B. $1.4V$

C. $-2.8V$

D. $-1.4V$

Answer: A

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40. Consider the following E^0 values $E^0_{Fe^{3+}/Fe^{2+}} = +0.77V, E^0_{Sn^{2+}/Sn} = -0.14V$ Under standard condition the potential for the reaction $Sn_{(s)} + 2Fe^{3+}_{(aq)} \rightarrow 2Fe^{2+}_{(aq)} + Sn^{2+}_{(aq)}$ is

A. $1.68V$

B. $0.63V$

C. $0.91V$

D. $1.40V$

Answer: C

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41. E^0 for the reaction $Fe + Zn^{2+} \rightarrow Zn + Fe^{2+}$ is -0.35 V . The given cell reaction is

A. feasible

B. not feasible

C. explosive

D. slow

Answer: B

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42. E.M.F of the cell reaction , $2Ag^{+} + Cu \rightarrow 2Ag + Cu^{2+}$ is 0.46 V . If $E^{0}_{Cu^{2+}/Cu}$ is | 0.34 V , $E^{0}_{Ag^{+}/Ag}$ is

A. 0.80

B. $0.12V$

C. $0.40V$

D. $1.60V$

Answer: A

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43. If the SRP of nickel and chlorine electrodes are -0.25 V and + 1.36 V respectively . The EMF of the cell $Ni/Ni^{2+}(0.01M)//Cl^{-}(0.01M)/Cl_2$, Pt is - V

A. $+1.61$

B. -1.61

C. $+1.79$

D. -1.79

Answer: C

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44. The standard electrode potential of the htwo half cells are given below

$Ni^{+2} + 2e^{-} \rightarrow Ni, E^{\circ} = -0.25V, Zn^{+2} + 2e^{-} \rightarrow Zn, E^{0} = -0.77V$

The voltage of cell formed by combining the two half cells would be

A. $-1.02V$

B. $+0.52V$

C. $+1.02V$

D. $-0.52V$

Answer: B

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45. Aluminium displaces hydrogen from dilute HCl whereas silver does not. The e.m.f. of a cell prepared by combining Al/Al^{3+} and Ag/Ag^{+} is 2.46 V. The reduction potential of silver electrode is + 0.80 V. The reduction potential of aluminium electrode is

A. $+1.66V$

B. $-3.26V$

C. $+3.26V$

D. $-1.66V$

Answer: D

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46. A cell constructed by coupling a standard copper electrode and a standard magnesium electrode has emf of 2.7 volts. If the standard reduction potential of copper electrode is +0.34 volt, that of magnesium electrode is

A. $+3.04$ volts

B. -3.04 volts

C. $+2.36$ volts

D. -2.36 volts

Answer: D

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47. The solution of nickel sulphate in which nickel rod is dipped is diluted 10 times. The potential of nickel

A. decreases by 60 mV

B. increases by 30V

C. decreases by 30 mV

D. decreases by 60V

Answer: C

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48. Normal aluminium electrode coupled with normal hydrogen electrode gives an emf of 1.66V. So the standard electrode potential of aluminium is

A. $-1.66V$

B. $+1.66V$

C. $-0.83V$

D. $+0.83V$

Answer: A

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49. The standard reduction potentials for the two half-cell reactions are given below :

$Cd^{2+}(aq) + 2e^- \rightarrow Cd(s), E^0 = -0.40V$ $Ag^+(aq) + e^- \rightarrow Ag(s), E^0 = 0.80V$

The standard free energy change for the reaction $2Ag^+_{(aq)} + Cd_{(s)} + Cd^{2+}_{(aq)}$ is given by

A. $115.8kJ$

B. $-115.8kJ$

C. $-231.6kJ$

D. $231.6kJ$

Answer: C

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50. The standard EMF for the cell reaction , $Zn + Cu^{2+} \rightarrow Cu + Zn^{2+}$ is 1.1 volt at $25^\circ C$. The EMF for the cell reaction , when $0.1MCu^{2+}$ and

$0.1 M Zn^{2+}$ solutions are used , at $25\ ^\circ C$ is

A. 1.10 V

B. 0.10 V

C. $-1.10 V$

D. $-0.110 V$

Answer: A

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51. Consider the following cell reaction :

$2Fe_{(s)} + O_{2(g)} + 4H^{+}_{(aq)} \rightarrow 2Fe^{2+}_{(aq)} + 2H_2O_{(l)}, E^0 = 1.67V$

At $\left[Fe^{2+}\right] = 10^{-3} M, P_{(O_2)} = 0.1 atm$ and $pH = 3$, the cell potential at $25\ ^\circ C$ is

A. $1.47V$

B. $1.77V$

C. $1.87V$

D. $1.57V$

Answer: D

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LEVEL-II (LECTURE SHEET (EXERCISE -I (SINGLE & ONE OR MORE THAN ONE CORRECT ANSWER)))

1. Which of the following reaction occur during the electrolysis of $CuSO_4$ solution using copper electrodes?

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

B. $2SO_4^{2-} + 2H_2O \rightarrow 2H_2SO_4 + O_2$

C. $Cu^{+2} + 2e^- \rightarrow Cu$

D. $2H^+ + 2e^- \rightarrow He$

Answer: A::C

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2. Equivalent conductance of saturated $BaSO_4$ is $400 ohm^{-1} cm^2 \text{equiv}^{-1}$ and specific conductance is $8 \times 10^{-5} ohm^{-1}, cm^{-1}$. Hence K_{sp} of $BaSO_4$ is

A. $4 \times 10^{-8} M^2$

B. $1 \times 10^{-8} M^2$

C. $2 \times 10^{-4} M^2$

D. $1 \times 10^{-4} M^2$

Answer: B

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3. The equivalent conductivity of 0.1 N CH_3COOH at $25^\circ C$ is 80 and at infinite dilute is $400 ohmcm^2 eq^{-1}$. The degree of dissociation of CH_3COOH

A. 1

B. 0.2

C. 0.1

D. 0.5

Answer: B

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4. For a dilute solution of a strong electrolyte, which of the folllowing 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 betweenλ_m and $\sqrt{C}$ is linear

D. The graph between λ_m and $\sqrt{C}$ has a negative slope.

Answer: C::D

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5. Which of the following changes will increase the emf of the cell :

$Co(s)\left|CoCl_2\left(M_1\right)\right|\left|HCl\left(M_2\right)\right|Pt\left(H_2, g\right)$

A. increase the volume of $CoCl_2$ solution from 100 mL to 200 ml

B. increase M_2 from 0.01 M to 0.50 M

C. increase the pressure of the $H_2(g)$ from 1.00 to 2.00 atm

D. increase M_1 from 0.01 M to $0.50M$

Answer: A::B

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6. For the cell given below

$Zn\left|Zn^{2+}\right|\left|Cu^{2+}\right|Cu, \left(E_{\text{cell}} - E^0_{\text{cell}}\right)$ is -0.12 V . It will be when :

A. $\left[Zn^{2+}\right]/\left[Cu^{2+}\right] = 10^2$

B. $\left[Zn^{2+}\right]/\left[Cu^{2+}\right] = 10^{-2}$

C. $\left[Zn^{2+}\right]/\left[Cu^{2+}\right] = 10^4$

D. $\left[Zn^{2+}\right]/\left[Cu^{2+}\right]=10^{-4}$

Answer: C::D

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7. If the e.m.f of a galvanic cell is negative , it implies that :

A. the cell reaction is spontaneous

B. the cell reaction is non-spontaneou

C. the cell reaction is exothermic

D. the cell is working in reverse direction

Answer: B::D

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8. When a lead storage battery is discharged :

A. SO_2 is evolved

B. lead sulphate is produced at both electrodes

C. sulphuric acid is consumed

D. water is formed.

Answer: B::C::D

Watch Video Solution

9. If the half cell reaction $A \rightarrow e^{-} \rightarrow A^{-}$ has a larger negative potential , it follows that :

A. A is not readily redused

B. A is readily oxidised

C. A^{-} is readily reduced

D. A^{-} is readily oxidised

Answer: A::D

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10. Identify the true ones

A. Daniel cell is a reversible cell

B. Lead storage battery is a reversible cell

C. $Zn/H_2SO_4/Ag$ cell is reversible

D. Any reversible cell will receive current flow from the external source when connected if its emf is less than that of the source.

Answer: A::B::D

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11. The cell emf depends on

A. Temperature

B. Size of cell

C. [Cathodic electrolyte]

D. [Anodic electrolyte]

Answer: A::C::D

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12. The cell emf in a cell with cell reaction $Cr_2O_7^{2-} + 14H^+ + 6Fe^{+2} \rightarrow 2Cr^{+3} + 6Fe^{+3} + 7H_2O$ could be increased above the standard emf by

A. Increasing $\left[Cr^{+3}\right]$

B. Decreasing $\left[Fe^{+3}\right]$

C. Decreasing $\left[Cr_2O_7^{2-}\right]$

D. Decreasing the pH

Answer: B::D

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13. Which of the following facts are true ?

A. If $E^0\left(M^{n+}/M\right)$ is negative , H^+ will be reduced to H_2 by the metal M.

B. If $E^0\left(M^{n+}/M\right)$ is positive , M^{n+} will be reduced to M by H_2

C. In a cell , M^{n+}/M assembly is attached to hydrogen -half cell. To produce spontaneou cell reaction, metal M will act as negative electrode if the potential M^{n+}/M is negative. It will serve as positive electrode , if M^{n+}/M has a positive cell potential.

D. Compound of active metal (Zn,Na, Mg) are reducible by H_2 where as those of noble metals (Cu , Ag , Au) are not reducible

Answer: A::B::C

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14. In a lead storage battery

A. Increase the emf with increase in the percentage of H_2SO_4

B. The emf decreases with increase in the percentage of H_2SO_4

C. Equivalent weight of H_2SO_4 is 98

D. Equivalent weights of $H_2SO_4 = 49$

Answer: A::C

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15. Which one is correct among the following give, the half cell emf's $E^0 Cu^{+2}/Cu = 0.337V$ and $E^0_{Cu^{+1}/Cu} = 0.521V$

A. Cu^{+1} disproportionates

B. Cu and Cu^{+2} comproportionates

C. $E^0_{Cu/Cu^{+2}} + E^0_{Cu^{+}/Cu}$ is positive

D. $E^0_{Cu/Cu^{+2}} + E^0_{Cu^{+}/Cu}$ is negative

Answer: A::C

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16. For the cell (at 298 K) $Ag_{(g)}/AgCl_{(s)}/Cl^{-}_{(aq)} \mid \mid AgNO_{3(aq)}/Ag_{(s)}$

Which of the following is correct ?

A. The cell emf will be zero when $\left[Ag^{+}\right]_{a} = \left[Ag^{+}\right]_{c}$

B. The amount of $AgCl_{(s)}$ ppt in anodic compartment will decrease the working of the cell .

C. The $\left[Ag^{+}\right]$= constant in the anodic compartment during the working of the cell.

D. Anode is metal - sparingly soluble salt, half cell .

Answer: A::D

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17. The value of the reaction quotient ,Q for the cell

$Zn(s)\left|Zn^{2+}(0.01M)\right|\left|Ag^{+}(1.25M)\right|Ag(s)$ is :

A. 156

B. 125

C. 1.25×10^{-2}

D. 6.40×10^{-3}

Answer: D

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18. $\Delta G = \Delta H - T\delta S$ and $\Delta G = \Delta H + T\left[\frac{d(\Delta G)}{dT}\right]$ then $\left(\frac{dE_{\text{cell}}}{dT}\right)$ is

A. $\frac{\Delta S}{nF}$

B. $\frac{nE}{\Delta S}$

C. $-nFE_{\text{cell}}$

D. $+nFE_{\text{cell}}$

Answer: A

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19. For the cell $Zn\left|Zn^{2+}\left(C_1\right)\right|\left|Zn^{2+}\left(C_2\right)\right|Zn$. ΔG is negative if :

A. $C_1 = C_2$

B. $C_1 > C_2$

C. $C_2 > C_1$

D. none of these

Answer: C

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20. The Nernst equation , $E = E^0 - \frac{RT}{nF}$. In Q indicates that the equilibrium constant K_c will be equal to Q when :

A. $E = E^0$

B. $\frac{RT}{nF} = 1$

C. E= zero

D. $E^0 = 1$

Answer: C

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21. The half cell reaction for the corrosion are , $2H^+ + \frac{1}{2}O_2 + 2e^- \rightarrow H_2O, E^0 = 1.23V$ and $Fe^{2+} + 2e^- \rightarrow Fe(s), E^0 = -0.44V$. Find the ΔG^0 (in kJ) for the overall reaction

A. $-76K$

B. $-322kJ$

C. - $161 kJ$

D. - $152 kJ$

Answer: B

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22. The E° at $25^{\circ}C$ for the following reaction at the indicated concentrations is 1.50 V . Calculate the ΔG in kJ at $25^{\circ}C, Cr(s) + 3Ag^{+}(aq. 0.1M) \rightarrow Ag(s) + Cr^{3+}(aq. 0.1M)$

A. - 140.94

B. - 295

C. - 212

D. - $422.83 kJ$

Answer: D

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23. A fuel cell develops an electrical potential from the combustion of butane at 1 bar and 298 K

$C_4H_{10(g)} + 6.5O_{2(g)} \rightarrow 4CO_{2(g)} + 5H_2O_{(l)}, \Delta G^0 = -2746kUJ/mol$

A. 4.74 V

B. 0.547 V

C. 4.37 V

D. 1.07 V

Answer: D

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24. For a cell reaction $2H_{2(g)} + O_{2(g)} \rightarrow 2H_2O_{(l)}\Delta S^{\circ}_{298} = -0.32kJ/K.$ What is the value $\Delta_i H^{\circ}_{298}\left(H_2O, l\right)$? Given : $O_{2(g)} + 4H^{+}_{(aq)} + 4e^{-} \rightarrow 2H_2O_{(l)}, E^{\circ} = 1.23V$

A. $-285.07kJ/mol$

B. $-570.14 kJ/mol$

C. $285.07 kJ/mol$

D. None of these

Answer: A

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25. Copper reduces NO_3^- into NO and NO_2 depending upon concentration of HNO_3 in solution . Assuming $\left[Cu^{2+}\right] = 0.1M$, and $P_{NO} = P_{NO_2} = 10^{-3}$ bar . At which concentration of HNO_3. Thermodynamic tendency for reduction of NO_3^- intoNO and NO_2 by copper is same ?

Given : $E^{\circ}_{Cu^{2+} | Cu} = +0.34V, E^{\circ}_{NO_3^- | NO} = +0.96V, E^{\circ}_{NO_3^- | NO_2} = +0.79V$

A. $10^{1.32}M$

B. $10^{0.56}M$

C. $10^{0.66}M$

D. None

Answer: D

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26. Consider the following standard reduction potentials

$Fe^{3+}(aq) + e^{-} \Leftrightarrow Fe^{3+}(aq), E^{\circ} = 0.77V, H_2O_2(aq) + 2e^{-} \Leftrightarrow 2OH^{-}(aq), E^{\circ} = 0.$

For the voltaic cell reaction below , calculate the Fe^{2+} concentration (in M) that would be needed to produce a cell potential equal to 0.16 V at $25^{\circ}C$ when $\left[OH^{-}\right] = 0.1M, \left[Fe^{3+}\right] = 0.5M$ and $\left[H_2O_2\right] = 0.35M$

$2Fe^{2+}(aq) + H_2O_2(aq) \Leftrightarrow 2Fe^{3+}(aq) + 2OH^{-}(aq)$

A. $0.3M$

B. $0.6M$

C. $0.41M$

D. $0.354M$

Answer: D

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

A. ΔG° depends on cell reaction

B. E°_{cell} depends upom making up of the cell

C. Both ΔG° and E° are path functions

D. E° is path function but ΔG° is a state function.

Answer: A::B::D

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28. Which of the following facts regarding the movement of anions in the solution is incorrect ?

A. Towards cathode in an electrolyte cell and towards anode in a galvanic cell .

B. Towards anode in an electrolytic cell and towards cathode in a galvanic cell.

C. Towards cathode in both type cells.

D. Towards anode in both type cells.

Answer: A::B::C

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29. Which of the following statements is correct ?

If $E^{\circ}_{Cu^{2+} \mid Cu} = 0.34V$ and $E^{\circ}_{Sn^{2+} \mid Sn} = -0.136V, E^{\circ}_{H^{+} \mid H_2} = -0.0V$

A. Cu^{+2} ions can be reduced by $H_2(g)$

B. Cu can be oxidized by H^{+}

C. Sn^{2+} ions can be reduced by H_2

D. Sn can be oxidized by Cu^{2+}

Answer: A::D

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30. The oxidation potential of hydrogen half-cell will be negative if :

A. $p(H_2) = 1atm \text{ and } [H^+] = 1M$

B. $p(H_2) = 1atm \text{ and } [H^+] = 2M$

C. $p(H_2) = 0.2atm \text{ and } [H^+] = 1M$

D. $p(H_2) = 0.2atm \text{ and } [H^+] = 0.2M$

Answer: B::C

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31. Coulomb is the quantity of charge defined as :

A. One ampere of current passing for 1 sec

B. The charge which deposits 0.001118 g of Ag on cathode

C. The charge which deposits electrochemical equivalence of metal

D. 1/2 ampere current for two second.

Answer: A::B::C

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32. E° for two reactions are given below :

$Cr^{+3} + 3e^{-} \rightarrow Cr, E^{\circ} = -0.74V$

$Ocl^{-} + H_2O + 2e^{-} \rightarrow Cl^{-} + 2OH^{-}, 2OH, E^{\circ} = 0.94V$

What will be the E° for $3OCl^{-} + 2Cr + 3H_2O \rightarrow 2Cr^{+3} + 3Cl^{-} + 6OH^{-}$

A. $-1.68V$

B. $1.68V$

C. $-0.20V$

D. $+0.20V$

Answer: B

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LEVEL-II (LECTURE SHEET (EXERCISE -II (LINKED COMPREHENSION TYPE QUESTIONS)))

1. The E° values for the changes given below are measured against NHE at $27^{\circ} C$

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

$Cu^{+} + e \rightarrow Cu, E^{\circ} = +0.50V,$

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

The temperature coefficient of emf a cell designed as $Zn|Zn^{2+}||Cu^{2+}|$ | Cu is $-1.4 \times 10^{-4} v$ per degree . For a cell reaction in equilibrium $\Delta G = 0$ and $\Delta G^{\circ} = -2.303RT\log K_c$. The heat of reaction and entropy changes during the reaction are related by $\Delta G = \Delta H - T\Delta S$.

The E° for the reaction $2Cu^{+} \rightarrow Cu^{2+} + Cu$ is :

A. $+0.35V$

B. $-0.35V$

C. $+0.65V$

D. $-0.65V$

Answer: A

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2. The E° values for the changes given below are measured against NHE at $27^{\circ}C$

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

$Cu^{+} + e \rightarrow Cu, E^{\circ} = +0.50V,$

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

The temperature coefficient of emf a cell designed as $Zn\left|Zn^{2+}\right|\left|Cu^{2+}\right| | Cu$ is $-1.4 \times 10^{-4}v$ per degree . For a cell reaction in equilibrium $\Delta G = 0$ and $\Delta G^{\circ} = -2.303RT\log K_c$. The heat of reaction and entropy changes during the reaction are related by $\Delta G = \Delta H - T\Delta S$.

The decrease in free energy during the cell reaction in $Zn\left|Zn^{2+}(1M)\right|\left|Cu^{2+}(1M)\right|Cu,$ when its changes to $1M\left(Zn^{+2}\right)$ and $0.1M\left(Cu^{+2}\right)$ is ....

A. $2.037 \times 10^{5}J$

B. $2.116 \times 10^5 J$

C. $2.037 \times 10^6 J$

D. $2.116 \times 10^6 J$

Answer: A

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3. The E° values for the changes given below are measured against NHE at $27^\circ C$

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

$Cu^+ + e \rightarrow Cu, E^\circ = +0.50V,$

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

The temperature coefficient of emf a cell designed as $Zn\left|Zn^{2+}\right|\left|Cu^{2+}\right|$ | Cu is $-1.4 \times 10^{-4} v$ per degree . For a cell reaction in equilibrium $\Delta G = 0$ and $\Delta G^\circ = -2.303RT\log K_c$. The heat of reaction and entropy changes during the reaction are related by $\Delta G = \Delta H - T\Delta S$.

The equilibrium constant constant for the reaction :

$Zn + Cu^{2+} \Leftrightarrow Zn^{2+} + Cu$ is

A. 6.0×10^{36}

B. 1.94×10^{37}

C. 1.47×10^{38}

D. 7.0×10^{30}

Answer: A

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

$Ag^{+} + e^{-} \rightarrow ag, E_1^{\circ} = 0.8V, C_6H_{12}O_6 + H_2O \rightarrow \text{Gluconic acid}$

$\left(C_6H_{12}O_7\right) + 2H^{+} + 2e^{-}, E_2^{\circ} = -0.05V, \left[Ag\left(NH_3\right)_2\right]^{+} e^{-} \rightarrow Ag(s) + 2NH_3$

,

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

$2Ag^{+} + C_6H_{12}O_6 + H_2O \rightarrow 2Ag(s) + C_6H_{12}O_7 + 2H^{+}$. Find $\log_{10}K$ of this reaction :

A. 12.7

B. 25.33

C. 28.30

D. 46.29

Answer: B

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

$Ag^{+} + e^{-} \rightarrow ag, E_1^{\circ} = 0.8V, C_6H_{12}O_6 + H_2O \rightarrow \text{Gluconic acid}$

$\left(C_6H_{12}O_7\right) + 2H^{+} + 2e^{-}, E_2^{\circ} = -0.05V, \left[Ag\left(NH_3\right)_2\right]^{+}e^{-} \rightarrow Ag(s) + 2NH_3$

,

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

When ammonia is added to the solution , pH is raised to 11 . Which is affected by pH amount by how much ?

A. E_{oxid} glucose will increase by a factor of $0.65V$ from E°_{oxid}

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

C. $E_{\text{red}} Ag^{+}$ will increase by a factor of 0.65 V from E°_{red}

D. $E_{\text{red}} Ag^{+}$ will decrease by a factor of 0.65 V from E°_{red}

Answer: A

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

$$Ag^{+} + e^{-} \rightarrow ag, E^{\circ}_{1} = 0.8V, C_6H_{12}O_6 + H_2O \rightarrow \text{Gluconic acid}$$

$$\left(C_6H_{12}O_7\right) + 2H^{+} + 2e^{-}, E^{\circ}_{2} = -0.05V, \left[Ag\left(NH_3\right)_2\right]^{+} e^{-} \rightarrow Ag(s) + 2NH_3$$

,

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

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. $\left[Ag\left(NH_3\right)_2\right]^+$ 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: C

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7. Redox reactions play a pivotal role I chemistry and bilogy . The values of standard redox potential $\left(E^\circ\right)$ of two half - cell reaction decided which way the reaction is expected to proceed. A simple example is a Daniel cell in which zinc goes into solution and copper get deposited. Given below are a set of half 0 cell reactions (acidic medium) along with their E°

values (with respect to normal hydrogen electrode) Using this data :

$I_2 + 2e^- \rightarrow 2I^- E^\circ = 0.54, Cl_2 + 2e^- \rightarrow 2Cl^- \quad E = 1.36V$

$Mn^{3+} + e^- \rightarrow Mn^{2+} E^\circ = 1.50, Fe^{3+} + e^- \rightarrow Fe^{2+} E = 0.77V$

$O_2 + 4H^+ + 4e^- \rightarrow 2H_2O \quad E^\circ = 1.23,$

Among the following , identify the correct statement :

A. Chloride ion is oxidised by O_2

B. Fe^{2+} is oxidised by iodine

C. Iodide ion is oxidised by chlorine

D. Mn^{2+} is oxidised by chlorine

Answer: C

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8. Redox reactions play a pivotal role I chemistry and bilogy . The values of standard redox potential $\left(E^\circ\right)$ of two half - cell reaction decided which way the reaction is expected to proceed. A simple example is a Daniel cell in which zinc goes into solution and copper get deposited. Given below are a set of half 0 cell reactions (acidic medium) along with their E° values (with respect to normal hydrogen electrode) Using this data :

$I_2 + 2e^- \rightarrow 2I^- E^\circ = 0.54, Cl_2 + 2e^- \rightarrow 2Cl^- \quad E = 1.36V$

$Mn^{3+} + e^- \rightarrow Mn^{2+} E^\circ = 1.50, Fe^{3+} + e^- \rightarrow Fe^{2+} E = 0.77V$

$O_2 + 4H^+ + 4e^- \rightarrow 2H_2O \quad E^\circ = 1.23,$

While Fe^{3+} is stable , Mn^{3+} is not stable in acid solution because :

A. O_2 oxidises Mn^{2+} to Mn^{3+}

B. O_2 oxidises bothMn^{2+} to Mn^{3+} and Fe^{2+} to Fe^{3+}

C. Fe^{3+} oxidises H_2O to O_2

D. Mn^{3+} oxidises H_2O to O_2

Answer: D

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9. The concentration of potassium ions inside a biological cell is at least twenty times higher than the outside. The resulting potential difference across the cell is important in several processes such as transmission of nerve impulses and maintaining the ion balance. A simple model for such concentration cell involving a metal M is :

$M_{(s)} \mid M_{(aq, 0.05(\text{ molar}))}^{+} \mid \left| M_{aq}^{+} \text{ 1 molar} \right| M_{s}$

For the above electrolytic cell the magnitude of the cell potential $|E_{\text{cell}}| = 70mV.$

For the above cell

A. $E_{\text{cell}} < 0, \Delta G > 0$

B. $E_{\text{cell}} > 0, \Delta G < 0$

C. $E_{\text{cell}} < 0, \Delta G^{0} > 0$

D. $E_{\text{cell}} > 0, \Delta G^{\circ} < 0$

Answer: B

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10. The concentration of potassium ions inside a biological cell is at least twenty times higher than the outside. The resulting potential difference across the cell is important in several processes such as transmission of nerve impulses and maintaining the ion balance. A simple model for such concentration cell involving a metal M is :

$M_{(s)} \mid M^{+}_{(aq, 0.05(\text{ molar}))} \| M^{+}_{aq \text{ 1 molar}} | M_{s}$

For the above electrolytic cell the magnitude of the cell potential $|E_{\text{cell}}| = 70 mV$.

If the 0.05 molar solution of M^{+} is replaced by a 0.0025 molar M^{+} solution, then the magnitude the cell potential would be

A. $35 mV$

B. $70 mV$

C. $140 mV$

D. $700 mV$

Answer: C

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11. The electrochemical cell shown below is a concentration cell.

$M \mid M^{2+}$ (saturated solution of a sparingly soluble salt, MX_2 $\|$ M^{2+}

$(0.001 \text{ mol } dm^{-3})$ |M

The emf of the cell depends on the difference in concentration of M^{2+} ions at the two electrode The emf of the cell at 298 is 0.059 V

The solubility product $\left(K_{sp}, mol^3 dm^{-9}\right)$ of MX_2 at 298 based on the information available the given concentraiton cell is (take $2.303 \times R \times 298/F = 0.059V$)

A. 1×10^{-15}

B. 4×10^{-15}

C. 1×10^{-12}

D. 4×10^{-12}

Answer: B

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12. The electrochemical cell shown below is a concentration cell.

$M \mid M^{2+}$ (saturated solution of a sparingly soluble salt, MX_2 || M^{2+}

$(0.001 \text{ mol } dm^{-3})$ |M

The emf of the cell depends on the difference in concentration of M^{2+} ions at the two electrode The emf of the cell at 298 is 0.059 V

The value of $\Delta G\left(kJ \text{ mol}^{-1}\right)$ for the given cell is (take$1F = 96500C \text{ mol}^{-1}$)

A. -5.7

B. 5.7

C. 11.4

D. -11.4

Answer: D

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LEVEL-II (LECTURE SHEET (EXERCISE -III(MATCH THE FOLLOWING QUESTIONS)))

1. Match the following

COLUMN - I (Quantity)	COLUMN - II (Symbol)
A) Conductivity	p) Λ_m
B) Cell constant	q) k
C) Molar conductance	r) Λ_e
D) Equivalent conductance	s) l/a

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2. Match the following

COLUMN - I (In fused state)	COLUMN - II (Conductivity in $Ohm^{-1}cm^{-1}$)
A) H^+	p) 350
B) Na^+	q) 50
C) Li^+	r) 39
D) Cs^+	s) 77

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3. Match the following

COLUMN - I (Term)	COLUMN - II (Relation)
A) α (Degree of ionization)	p) λ^+ / λ
B) t_+ (Transport number)	q) $\Lambda_m^c / \Lambda_m^o$
C) Fraction of a mole undergoing ionization	r) $U^+ / U^+ + U^-$
D) transport number of Na^+ ion in $NaCl$	s) $\Lambda_e^c / \Lambda_e^o$

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4. Match the following

COLUMN - I	COLUMN - II
A) $Pt\|Fe^{3+}, Fe^{2+}$	p) Metal-metal ion half-cell
B) $Pt\|H_2\|H^+$	q) Gas-gas ion half cell
C) $Pt\|Hg\|Hg_2^{2+}$	r) Oxidation - reduction half-cell
D) $Pb\|PbSO_4\|SO_4^{2-}$	s) Metal Sparing soluble salt half-cell

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5. Match the following

COLUMN - I	COLUMN - II
A) Hg_2Cl_2	p) Salt bridge
B) Agar-agar	q) Calomel electrode
C) 0.1 N KCl	r) Used in ice cream
D) Quinhydrone	s) Redox electrode

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6. Match the following

COLUMN - I	COLUMN - II (SRP)
A) $F_2 + 2e^- \rightleftharpoons 2F^-$	p) 0.54 V
B) $Cl_2 + 2e^- \rightleftharpoons 2Cl^-$	q) 1.09 V
C) $Br_2 + 2e^- \rightleftharpoons 2Br^-$	r) 1.36 V
D) $I_2 + 2e^- \rightleftharpoons 2I^-$	s) 2.87 V

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LEVEL-II (LECTURE SHEET (EXERCISE -IV (INTEGER ANSWER TYPE QUESTIONS)))

1. 10800C of electricity past through the electrolyte deposited 2.977 g of metal with atomic mass $106.4 g mol^{-1}$. Find the charge on the metal cations.

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2. A current of 2 ampere passing for 5 hr through a molten tin salt deposits 22.2 g of tin. Find the oxidation number of tin (atomic weight of tin is 118.7) in the salt

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3. What current is to be passed for 0.25 sec for depostion of certain weight of metal which is equal to its electrochemical equivalent ?

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4. The ratio of $\left(\frac{\Lambda_m}{\Lambda_c}\right)$ for $Ca_3(PO_4)_2$ will be equal to ....

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5. At what pH the oxidation potential of hydrogen electrode will be -0.413 V ?

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6. How many faradays are required for reduction of 1 mol $C_6H_5NO_2$ into $C_6H_5NH_2$

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7. What is the equivalent weight of O_2 in the following reaction, $H_2O + \frac{1}{2}O_2 + 2e^- \rightarrow 2OH^-$?

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8. During the electrolysis of a concentrated brine solution. Calculate the moles of chlorine gas produced by the passage of 4F electricity.

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9. Calculate the cell potential (in V) if ΔG = - 96.5 kJ/mol and n = 1.

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10. If K_c for the reaction $Cu^{2+}_{(aq)} + Sn^{2+}_{(aq)} \rightarrow Sn^{4+}_{(aq)} + Cu_{(s)}$ at $25^\circ C$ is represented as $y \times 10^6$ then find the value of y . (Given : $E\left(Cu^{2+} \mid Cu\right)^\circ = 0.34V, E^\circ_{Sn^{4+} \mid Sn^{2+}} = 0.15V)$

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11. The equilibrium constant of the reaction

$Cu_{(s)} + 2Ag^+_{(aq)} \Leftrightarrow Cu^{+2}_{(aq)} + 2Ag_{(s)},$ is $x \times 10^{15}, 'x'$ is $(E^\circ = 0.46V$ at 298 K)

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PRACTICE SHEET -1 (SINGLE OR MORE THAN ONE OPTION QUESTIONS)

1. A quantity of electrical charge that brings about the deposition of 4.5 g Al from Al^{3+} at the cathod will also produce the following volume (STP) of $H_2(g)$ from H^+ at the cathode

A. 44.8 L

B. 22.4 L

C. 11.2 L

D. 5.6 L

Answer: D

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2. The electrolysis of acetate solution produces ethane according to reaction:

$2CH_3COO^- \rightarrow C_2H_6(g) + 2CO_2(g) + 2e^-$. The current efficiency of the process is 80% . What volume of gases would be produced at $27^\circ C$ and 740 torr. If the current of 0.5 amp is passes through the solution for 96.45 min ? $\left(V_{C_2H_6} + V_{CO_2}\right) = ?$

A. $6.0L$

B. $0.60L$

C. $1.365L$

D. $0.91L$

Answer: D

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3. A 0.200M KOH solutions is electrolysed for 1.5 h using a current of 8.00

A. How many moles O_2 were produced at the anode?

A. 0.48

B. 0.224

C. 0.112

D. 2.24×10^{-2}

Answer: C

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4. Which pair of electrolytes give different products at anode

A. 1M $CuSO_4$ solution $1MCuCl_2$ solution

B. $1MKCl$ solution $1MCu(NO_3)_2$ solution

C. $1MAgNO_3$ solution 1 M $CuSO_4$ solution

D. $1MCuBr_2$ solution $1MCuSO_4$ solution

Answer: A::B::D

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5. A layer of chromium metal 0.25 mm thick is to be plated on an auto bumper with a total area $0.32m^2$ from a solution containing CrO_4^{2-} ? What current flow is required for this electroplate if bumper is to be plated in 60s ? The density of churomnium metal is 7.20g / cm^3

A. $4.9 \times 10^3 A$

B. $1.78 \times 10^3 A$

C. $5.3 \times 10^4 A$

D. $10.69 \times 10^4 A$

Answer: D

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6. Cost of electricity for the production of x L H_2 at STP at cathode is Rs. x, then cost of electricity for the production of x L O_2 gas at STP at anode will be (assume 1 mol of electrons as one unit electricity) :

A. $2x$

B. 4x

C. 16x

D. 32 x

Answer: A

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7. An acidic solution of Cu^{2+} salt containing 0.4 g of Cu^{2+} is electrolysed until all the copper is deposited. The electrolysis is continued for seven more minutes with the volume of solution kept at 100 ml and the current at 1.2 amp. Calculate the volume of gases evolved at NTP during the entire electrolysis.

A. $O_2 = 99.79ml, H_2 = 48.45ml$

B. $O_2 = 87.91ml, H_2 = 58.48ml$

C. $O_2 = 99.79ml, H_2 = 58.48ml$

D. $O_2 = 100ml, H_2 = 50ml$

Answer: C

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8. The charge required for the reduction of 0.4 mol of $K_2Cr_2O_7$ to Cr^{3+} ions is

A. 0.6 F

B. $2.4 \times 96500C$

C. $6 \times 96500C$

D. $12.4 \times 96500F$

Answer: B

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9. The two aqueous solutions , $A:\left(AgNO_3\right)$ and B : (LiCl) were electrolysed using Pt. Electrodes. The pH of the resulting solutions will

A. increase in A and decrease in B

B. decrease in both

C. increase in both

D. decrease in A and increase in B

Answer: D

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10. A current of 9.65 A is passed for 3 hours between platinum electrodes immersed in 0.5 dm^3 solution of concentration 2 mol $dm^{-3} Ni(NO_3)_2$. The molarity of solution after electrolysis would be

A. 0.46 M

B. 0.91 M

C. $1.25M$

D. $0.625M$

Answer: B

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11. Which of the folllowing gives the charge of an electron ? $\left(N_A \rightarrow \text{ avegadro numbers}\right)$

A. $\frac{1F}{1N_A}$

B. $1F$

C. $1F \times 1N_A$

D. $\frac{96500C}{1N_A}$

Answer: A::D

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12. When an aqueous concentrate solution of lithium chloride is electrolysed using inert electrodes:

A. Cl_2 is liberated at the anode

B. Li is deposited at the cathode

C. as the current flows, pH of the solution around the cathode remains constant

D. as the current flows, pH of the solution around the cathode increases

Answer: A::D

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13. Select right statement(s) about electrolysis :

A. Electric current is used to drive a non - spontaneous reaction

B. ΔG is positive for chemical process during electrolysis

C. Cations and anions move towards the anode and cathode respectively.

D. Over voltage is genarally associated with evolution of O_2 gas.

Answer: A::B::D

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14. Which of the following are correct?

A. Chloride liberates Cl_2 but O_2 is also liberated as the solution is diluted which is due to over voltage.

B. Soluble iodides always liberate iodine at anode

C. Water is reduced in preference to cations having more negative reduction potential than -0.828V

D. Cation having less negative potential than 0.828 V are reduced in preference to water.

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

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15. Electrolysis of dilute aqueous solution of KCl gives?

A. O_2 at anode

B. Cl_2 at anode

C. K at cathode

D. H_2 at cathode

Answer: A::D

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16. Oxygen and hydrogen gases are produced at the anode and cathode during the electrolysis of fairly concentrate aqueous solution of :

A. K_2SO_4

B. $AgNO_3$

C. H_2SO_4

D. $NaOH$

Answer: A::C::D

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PRACTICE SHEET -1 (LINKED COMPREHENSION TYPE QUESTIONS(PASSAGE-I))

1. Electrolysis is the process in which electrical energy is converted to chemical energy. In electrolyte cell, oxidation takes place at anode and reduction at cathode. Electrode process depends on the electrode taken for electrolysis. Amount of substance liberated at an electrode is directly proportionation to the amount of charge passed through it. The mass of substance liberated at electrode is calculate using the following realation : $m = \frac{itE}{96500}$

Here, E represent the equivalent mass and 96500 C is called the faraday constant. Faraday (96500 C) is the charge of 1 mole electron i.e., 6.023×10^{23} electrons, it is used to liberate on gram equivalent of the substance.

The platinum electrodes were immersed in a solution of cupric sulphate $\left(CuSO_4\right)$ and electric current is passed through the solution. After sometimes, it was observed that the colour of copper sulphate disappeared with evolution of a gas at the electrode. The colourless solution contains.

A. platinum sulphate

B. copper nitrate

C. copper sulphate

D. sulphuric acid

Answer: D

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2. Electrolysis is the process in which electrical energy is converted to chemical energy. In electrolyte cell, oxidation takes place at anode and reduction at cathode. Electrode process depends on the electrode taken for electrolysis. Amount of substance liberated at an electrode is directly proportionation to the amount of charge passed through it. The mass of substance liberated at electrode is calculate using the following realation : $m = \frac{itE}{96500}$

Here, E represent the equivalent mass and 96500 C is called the faraday constant. Faraday (96500 C) is the charge of 1 mole electron i.e., 6.023×10^{23} electrons, it is used to liberate on gram equivalent of the substance.

The passage of current liberates H_2 at cathode and Cl_2 at anode. The solution is

A. copper chloride in water

B. NaCl in water

C. mercuric chloride in water

D. $AuCl_3$ in water

Answer: B

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3. Electrolysis is the process in which electrical energy is converted to chemical energy. In electrolyte cell, oxidation takes place at anode and reduction at cathode. Electrode process depends on the electrode taken for electrolysis. Amount of substance liberated at an electrode is directly proportionation to the amount of charge passed through it. The mass of substance liberated at electrode is calculate using the following realation : $m = \frac{itE}{96500}$

Here, E represent the equivalent mass and 96500 C is called the faraday constant. Faraday (96500 C) is the charge of 1 mole electron i.e., 6.023×10^{23} electrons, it is used to liberate on gram equivalent of the substance.

Calculate the volume of gas liberated at the anode at STP during the electrolysis of a $CuSO_4$ solution by a current of 1 A passed for 16 minutes and 5 seconds.

A. $224mL$

B. $56mL$

C. $112mL$

D. $448mL$

Answer: B

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PRACTICE SHEET -1 (LINKED COMPREHENSION TYPE QUESTIONS(PASSAGE-II))

1. Electrolysis involves electronation and de-electronation at the respective electodes. Anode electrolytic cell is the electode at which de-electronation takes place whereas at cathod electronation is noticed. If two or more ions of same charge are to be electonated or deelectronate the ion having lasser discharge potential is discharged. Discharge potential of anion refers for EP°_{OP} of E°_{RP} as the case may be. The products formed at either electode is given in terms

Faraday's laws of electrolusis i.e.$w = \frac{Eit}{96500}$

During electrolysis of $CH_3COONa_{(aq)}$, the mole ratio of gases formed at cathode and anode is

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2. Electrolysis involves electronation and de-electronation at the respective electodes. Anode electrolytic cell is the electode at which de-electronation takes place whereas at cathod electronation is noticed. If two or more ions of same charge are to be electonated or deelectronate the ion having lasser discharge potential is discharged. Discharge potential of anion refers for EP°_{OP} of E°_{RP} as the case may be. The products formed at either electode is given in terms

Faraday's laws of electrolusis i.e.$w = \frac{Eit}{96500}$

During electrolysis of $CuSO_{4(aq)}$, the pH of solution becomes

A. < 7

B. > 7

C. $= 7$

D. ≥ 7

Answer: A

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3. Electrolysis involves electronation and de-electronation at the respective electodes. Anode electrolytic cell is the electode at which de-electronation takes place whereas at cathod electronation is noticed. If two or more ions of same charge are to be electonated or deelectronate the ion having lasser discharge potential is discharged. Discharge potential of anion refers for EP°_{OP} of E°_{RP} as the case may be. The products formed at either electode is given in terms

Faraday's laws of electrolusis i.e.$w = \frac{Eit}{96500}$

During electrolysis of $CuSO_{4(aq)}$, the pH of solution becomes

A. $322.56L$

B. $32.256L$

C. $3.22mL$

D. $1.612 \times 10^2 mL$

Answer: D

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PRACTICE SHEET -1 (MATCH THE FOLLOWING QUESTIONS)

1. Match the following

COLUMN - I	COLUMN - II
A) Dilute solution of HCl	p) O_2 evolved at anode
B) Dilute solution of NaCl	q) H_2 evolved at cathode
C) Concentrate solution of NaCl	r) Cl_2 evolved at anode
D) Fairly concentrate solution of $AgNO_3$	s) Ag deposition at cathode

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2. Match the following

COLUMN - I	COLUMN - II
A) 1 mole of MnO_4^- to Mn^{2+}	p) 193000 C
B) 1 mole of $Cr_2O_7^{2-}$ to Cr^{3+}	q) 289500 C
C) 1 mole of Sn^{4+} to Sn^{2+}	r) 482500 C
D) 1 mole of Al^{3+} to Al	s) 579000 C

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PRACTICE SHEET -1 (INTEGER ANSWER TYPE QUESTIONS)

1. Total charge required for the oxidation of two moles Mn_3O_4 into MnO_4^{2-} in presence of alkaline medium is 2.0×10^x, x is

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2. The element indium is to be obtained by electrolysis of a molten halide of the element. Passage of a current of 3.20 A for a period of 40.0 min results in formation of 3.05 g of In. What is the oxidation state of indium in the halide melt ? (At.wt of In = 114.81)

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3. In the oxidation of ferric oxalate $\left[Fe_2\left(C_2O_4\right)_3\right]$ to carbondioxide, if 18F of electricity is required how many moles of ferric oxalate is oxidized

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4. How many kJ energy is expected during the passes of 1 ampere current for 90 sec under a potential of 100 V?

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5. 3 ampere current was passed through an aqueous solution of an unknown salt of Pd for 1 hr 2.977 g of Pd^{n+} was deposited at cathode. Find the value of n. (atomic weight of Pd is 106.4)

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6. What is the quantity of charge needed for the reduction of 1 mole of MnO_4^- ion to Mn^{2+} ion ?

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PRACTICE SHEET -2 (SINGLE OR MORE THAN ONE OPTION QUESTIONS)

1. The equivalent conductance at infinite dilution of NaCl, HCl and CH_3COONa at 298K are 126.0, 426.0 and 91.0 $ohm^{-1}cm^2$ respectively. The value of equivalent conductance of acetic acid at infinite dilution at the same temperature is

A. 644.0

B. 300.0

C. 517.0

D. 391.0

Answer: D

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2. Given the following molar conductivities are $25^{\circ}C$, HCl , $426\Omega^{-1}cm^2mol^{-1}$, NaCl , $126\Omega^{-1}cm^2mol^{-1}$, NaC(sodium crotonate) , $83\Omega^{-1}cm^2mol^{-1}$, what is the ionization constant of crotonic acid ? If the conductivity of a 0.001 M corotonic acid solution is $3.83 \times 10^{-5}\Omega^{-1}cm^{-1}$?

A. 10^{-5}

B. 1.11×10^{-5}

C. 1.11×10^{-4}

D. 0.01

Answer: B

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3. Molar conductances of $BaCl_2, H_2SO_4$ and HCl at infinite dilution are and $X_1, X_2,$ and X_3 respectively. Molar conductance of $BaSO_4$ at infinte dilution is

A. $\dfrac{500x}{\left(x_1 + x_2 - 2x_3\right)}$

B. $\dfrac{10^6 x^2}{\left(x_1 + x_2 - 2x_3\right)^3}$

C. $\dfrac{2.5 \times 10^5 x^2}{\left(x_1 + x_2 - x_3\right)^2}$

D. $\dfrac{0.25x^2}{\left(x_1 + x_2 - x_3\right)^2}$

Answer: C

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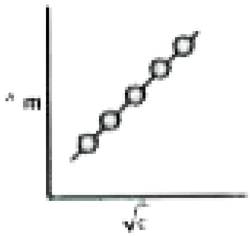
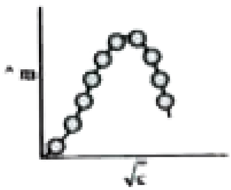
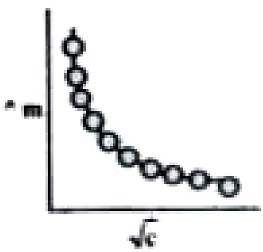
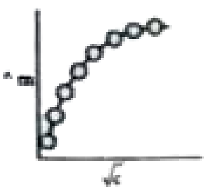
4. The variation of $\wedge_m$ of acetic acid with concen-tration is correctly represented by

A. 

B. 

C. 

D. 

Answer: C

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5. CH_3COOH is titrated in the NaOH solution which of the following statements is correct for such titration?

A. Conductance increases upto equivalence point, then it decreases.

B. Conductance decreases upto equivalence point, then it increases.

C. First conductance increases slowly upto equivalence point and then increases rapidly.

D. Before the equivalent point, there exists buffer solution.

Answer: C::D

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6. The specific conductivity of dichloroacetic acid at dilution of 8 litres is 0.0238 C.G.S. unit, $\lambda_0$fom this acid is 385 C.G.S. unit, calculate the degree of jonisation at this dilution.

A. 50 %

B. 45 %

C. 49.45 %

D. 36.02 %

Answer: C

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7. Metallic conduction depends on which of the following ?

A. The nature of the metal

B. No.of valence electrons per atom

C. Density of metal

D. Temperature

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

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8. The specific conductance of a saturated solution of a salt MX is $2.8 \times 10^{-7} \Omega^{-1} cm^{-1}$ and the equivalent conductances at infinite dilution of M^{+1} and X^{-1} ions are 68 and $72\Omega^{-1} cm2$/ equivalent respectively Hence, the K_{sp} of MX is found to be

A. 2×10^{-6}

B. 4×10^{-12}

C. 10^{-12}

D. 4×10^{-6}

Answer: B

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9. Which of the following is/are correct

A. If the solutions pressure which is in contact with a metal rod is greater than osmotic pressure then such metal half cell behaves as anode.

B. Generally the solutions pressure tends to drive the ions into the solution.

C. If the solutions pressure which is in contact with a metal rod is lesser than the osmotic pressur then solution tries to acquire -ve charge with respect to the metal (or) such half cell behaves a cathode.

D. Solution's pressure has no contribution in deciding the nature of the electrode.

Answer: A::B::C

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10. Within the cell, it is important to prevent mixing or direct contact of

A. $Cr_2O_7^{2-}, Fe^{+2}$

B. Cr^{+3}, Fe^{+2}

C. H_3O^+, Fe^{+2}

D. H_3O^+, MnO_4^-

Answer: A::D

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11. The emf of hydrogen electrode in term of pH is (at 1 atm pressure)

A. $E_{H_2} = (RT/F)xpH$

B. $E_{H_2} = (RT/F)1/pH$

C. $E_{H_2} = (2.303RT/F)pH$

D. $E_{H_2} = -0.0591pH$

Answer: D

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12. Given

$E^0_{Ag^+/Ag} = 0.80V, E^0_{Mg^{2+}/Mg} = -2.37V, E^0_{Cu^{2+}/Cu} = 0.34 E^0_{Hg^{2+}/Hg} = 0.79V$

Which of the following statement is / are correct ?

A. $AgNO_3$ can be stored in copper vessel

B. $Cu(NO_3)_2$ can be stored in magnesium vessel

C. $CuCl_2$ can be stored in silver vessel

D. $HgCl_2$ can be stored in copper vessel

Answer: C

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13. For the reduction of NO_3^- ion in an aqueous solution , E^0 is + 0.96 V , the values of E^0 for some metal ions ar given below :

$i) V^{+2}_{(aq)} + 2e^- \rightarrow V, E^0 = 1.19V$

$ii) Fe^{+3}_{(aq)} + 3e^- \rightarrow Fe, E^0 = -0.04V$

$iii) Au^{+3}_{(aq)} + 3e^- \rightarrow Au, E^0 = +1.40V$

$iv) Hg^{+2}_{(aq)} + 2e^- \rightarrow Hg, E^0 = +0.86V$

The pair(s) of metals that is/are oxidizd by NO_3^- in aqueous solution is /are

A. Fe and Au

B. Hg and Fe

C. V and Hg

D. Fe and V

Answer: B::C::D

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14. The emf of the cell in which of the following reaction , $Zn_{(s)} + Ni^{2+}(0.1M) \rightarrow Zn^{2+}(1.0M) + Ni_{(s)}$ occurs is found to 0.5105 V at 298 K . The standard emf of the cell is

A. $0.4810V$

B. $0.5696V$

C. $-0.5105V$

D. $0.5400V$

Answer: D

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15. For the electrochemical cell $M/M^{+}//X^{-}/X, E^{0}M^{+}/M = 0.44V$ and $E^{0}\left(x/x^{-}\right) = 0.33V$. From the one can deduce that

A. $M + X \rightarrow M^{+} + X^{-}$ is the spontaneous reaction

B. $M^{+} + X^{-} \rightarrow M + X$ is the spontaneous reaction

C. E_{cell} for this couple = 0.77 V

D. E_{cell} for this couple = -0.11 V

Answer: B::D

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16. The ionization constant of a weak acid is 1.6×10^{-5} and the molar conductivity at infinite dilution is 380×10^{-4}sm^(2) mol^(-1) $. Ifthecellconstantis$0.01m^(-1)`, then conductance of 0.01M acid solution is

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

B. $1.52s$

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

D. 1.52×10^{-4} s

Answer: B

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PRACTICE SHEET -2 (LINKED COMPREHENSION TYPE QUESTIONS (PASSAGE-I))

1. Molar conductivity $\left(\wedge_m\right)$ is defined as conducting power of the ions produced by 1 mole of an electrolyte in a solution. $\wedge_m = \frac{K}{C}$ where K is conductivity (in $S - cm^{-1}$), $\wedge_m$ is molar conductivity (in Scm^2mol^{-1}) and C is molar concentration (in mole/cm^3)

The molar conductivity of 0.04 M solution of $MgCl_2$ is $200Scm^2mol^{-1}$ at 298 K. A cell with electrodes that are $2.0cm^2$ in surface area and 0.50 cm apart is filled with $MgCl_2$ solution.

The cell constant is

A. $8 \times 10^{-3}Scm^{-1}$

B. $32Scm^{-1}$

C. $0.032Scm^{-1}$

D. None of these

Answer: A

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2. Molar conductivity $\left(\wedge_m\right)$ is defined as conducting power of the ions produced by 1 mole of an electrolyte in a solution. $\wedge_m = \frac{K}{C}$ where K is conductivity (in $S\text{-}cm^{-1}$), $\wedge_m$ is molar conductivity (in Scm^2mol^{-1}) and C is molar concontration (in mole/cm^3)

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The cell constant is

A. $156.25A$

B. $0.16A$

C. $160A$

D. None of these

Answer: B

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3. Molar conductivity $\left(\wedge_m\right)$ is defined as conducting power of the ions produced by 1 mole of an electrolyte in a solution. $\wedge_m = \frac{K}{C}$ where K is conductivity (in $S\text{-}cm^{-1}$), $\wedge_m$ is molar conductivity (in Scm^2mol^{-1}) and C is molar concentration (in mole/cm^3)

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The cell constant is

A. $0.25cm^{-1}$

B. $0.50cm^2$

C. $0.025cm$

D. $0.35cm^2$

Answer: A

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PRACTICE SHEET -2 (LINKED COMPREHENSION TYPE QUESTIONS (PASSAGE-II))

1. Conductors allow the passage of electric current through them. Metallic and electrolytic are the two types of conductors. Current carriers in metallic and electrolytic conductors are free electrons and free ions respectively. Specific conductance or conductivity of the electrolyte solution is given by the following relation: $K = cx\frac{l}{A}$

where, c=1/R is the conductance and 1/A is the cell constant, Molar conductance $\left(\wedge_m\right)$ and equivalence conductance $\left(\wedge_e\right)$ of an electrolyte solution are calculated using the following similar relations:

$\wedge_m = K \times \frac{1000}{M}$ $\wedge_e = K \times \frac{1000}{N}$ where, M and N are the molarity and normality of the solution respectively. Molar conductance of strong electrolyte depends on concentration : $\wedge_m = \wedge_m^0 - b\sqrt{C}$

$\wedge_m^0$ = molar conductance at infinite dilution

C = concentration of the solution b = constant

The degrees of dissociation of weak electrolytes are calculated as

$$\alpha = \frac{\Lambda_m}{\Lambda_m^0} = \frac{\Lambda_e}{\Lambda_e^0}$$

Which of the following decreases on dilution of electrolytic solution?

A. Equivalent conductance

B. Molar conductance

C. Specific conductance

D. Conductance

Answer: C

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$\wedge_m^0$ = molar conductance at infinite dilution

C = concentration of the solution b = constant

The degrees of dissociation of weak electrolytes are calculated as

$$\alpha = \frac{\wedge_m}{\wedge_m^0} = \frac{\wedge_e}{\wedge_e^0}$$

For which of the following electrolytic solution $\wedge_m$ and $\wedge_e$ are equal ?

A. $BaCl_2$

B. KCl

C. $Al_2\left(SO_4\right)_3$

D. $CaCl_2$

Answer: B

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3. Conductors allow the passage of electric current through them. Metallic and electrolytic are the two types of conductors. Current carriers in metallic and electrolytic conductors are free electrons and free ions respectively. Specific conductance or conductivity of the electrolyte solution is given by the following relation: $K = cx\frac{l}{A}$

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$\wedge_m^0$ = molar conductance at infinite dilution

C = concentration of the solution b = constant

The degrees of dissociation of weak electrolytes are calculated as

$$\alpha = \frac{\Lambda_m}{\Lambda_m^0} = \frac{\Lambda_e}{\Lambda_e^0}$$

Which of the following equality holds good for the strong electrolytes?

A. $\Lambda = \Lambda^0$ as $C \to 1$

B. $\Lambda = \Lambda^0$ as $C \to 0$

C. $\Lambda = \Lambda^0$ as $C \to \infty$

D. $\Lambda = \Lambda^0$ as $C \to \sqrt{b}$

Answer: B

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PRACTICE SHEET -2 (MATCH THE FOLLOWING QUESTION)

1. Match the following questions

COLUMN - I (Property)	COLUMN - II (Unit)
A) Conductance	p) Sm^{-1}
B) Conductivity	q) $S^{-1}m$
C) Molar conductivity	r) $Sm^2 mol^{-1}$
D) Surface conductivity	s) S

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2. Match the following questions

COLUMN - I (Property)	COLUMN - II (Unit)
A) Resistance	p) ohm
B) Resistivity	q) volt amp^{-1}
C) Conductivity	r) ohm m
D) Specific conductance	s) $ohm^{-1}m^{-1}$

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3. The resistance of 0.1 N solution of formic acid is 200 ohm and cell constant is $2.0cm^{-2}$. The equivalent conductivity (in Scm^2eg^{-1}) of 0.1 N formic acid is 1.0×10^x , x is

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4. The conductance of a salt solution (AB) measured by two parallel electrodes of area $100cm^2$ separated by 10 cm was found to be $0.0001\Omega^{-1}$. If volume enclosed between two electrode contains 0.1 mole of salt, and

the molar conductivity $\left(Scm^2mol^{-1}\right)$ of salt at same concentration is 1.0×10^{-x}, x is

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5. The resistance of a conductivity cell containing 0.001M KCl solution at 298K is 1500Ω .What is the cell constant (inmm^{-1}). If the conductivity of 0.001 M KCl solution is $2 \times 10^{-3}Smm^{-1}$

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6. The specific conductance of a saturated solution of AgCl at $25^\circ C$ is $2.28 \times 10^{-6}Scm^{-1}$. If solubility of $AgCl$ is $2.35 \times 10^{-x}gL^{-1}\left(\lambda^\circ_{AgCl} = 138.3Scm^2mol^{-1}\right)$ then x is

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7. Molar conductivities at infinite dilution of KCl, HCl and CH_3COOK are 0.013o and 0.038 and $0.09Sm^2mol^{-1}$ respectively at 291 K . If conductivity of 0.001 M CH_3COOH is $2.72 \times 10^{-3}Sm^{-1}$ then find % degree of ionization of CH_3COOH.

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8. For $H^+, \lambda^0 = 349.8Scm^2mol^{-1}$. Calculate the velocity of H^+ electrodes are 5 cm apart to which 1 volt of potential is applied. If the answer is 7.0×10^{-x} cm/s then x is -

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PRACTICE SHEET -3 (SINGLE OF MORE THAN ONE OPTION QUESTIONS)

1. 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 potential E and E volts respectively at $25\,^\circ C$ $\left(pH_2 = 1atm\right)$.

pK_a for CH_3COOH will be :

A. $E_1 + E_2$

B. $E_1 - E_2$

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

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

Answer: C

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2. For the cell $Zn(s)\left|Zn^{2+}\right|\left|Cu^{2+}\right|Cu(s)$, the standard cell voltage E^0_{cell} is 1.10 V . When a cell using these reagents was prepared in the lab, the measured cell voltage was 0.97 V . One possible explanaiton of the observed voltage is

A. there are 2.00 mol of Cu^{2+} bu only 1.00 mol of Zn^{2+}

B. the Zn electrode had twice the surface of the Cu electrode

C. the $\left[Zn^{2+}\right]$ was larger than the $\left[Cu^{2+}\right]$

D. the volume of the Zn^{2+} solution was larger than the volume of the Cu^{2+} solution

Answer: C

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3. What is the reaction quotient , Q for the cell

$Ni_{(s)}\left|Ni^{2+}(0.190M)\right|\left|Cl^{-}(0.40M)\right|Pt_{(s)}Cl_{2(g)}(1.0atm)$

A. 3.1×10^{-1}

B. 1.3×10^{-1}

C. 8.0×10^{-2}

D. $3.0XX10^{-2}$

Answer: D

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4. A 1.0 M solution of Cd^{+2} is added to excess iron and the system is allowed to reach equilibrium . What is the concentration of Cd^{+2}?

$Cd^{2+}(aq) + Fe(s) \rightarrow Cd(s) + Fe^{2+}(aq), E^0 = 0.037$

A. 0.195

B. 0.097

C. 0.053

D. 0.145

Answer: C

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5. Standard electrode potential $\left(E^0\right)$ for OCl^- / Cl^- and $Cl^- / \frac{1}{2}Cl_2$ are respectively 0.94 V and -1.36 V . The E° value of OCl^- / Cl_2 will be

A. $-0.42V$

B. $-2.20V$

C. $0.52V$

D. $1.04V$

Answer: C

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6. The standard reduction potential of Cu^{2+}/Cu and Cu^{+}/Cu are 0.337 and 0.153 V respectively . The standard electrode poetential of Cu^{2+}/Cu^{+} half cell will be

A. $0.184V$

B. $0.827V$

C. $0.521V$

D. $0.490V$

Answer: C

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7. The oxidation potential of hydrogen half-cell will be negative if :

A. $p(H_2) = 1atm \text{ and } [H^+] = 1M$

B. $p(H_2) = 1atm \text{ and } [H^+] = 2M$

C. $p(H_2) = 2atm \text{ and } [H^+ = 1M$

D. $p(H_2) = 2atm \text{ and } [H^+] = 2M$

Answer: C

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8. Consider the cell $Ag|AgBr|KBr||KCl|AgCl|Ag$ with EMF 0.059 V . Assume that $[Br^-] = [Cl^-]$. Here , conclusion inferred may be

A. The ratio of the simultaneous solubilities of AgCl and AgBr in pure water is 1000

B. It is concentration cell

C. Change in concentration of KCl will not effect EMF

D. $K_{sp}(AgCl) > K_{sp}(AgBr)$

Answer: B::D

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9. For the cell (at 298 K) $Ag_{(g)}/AgCl_{(s)}/Cl^{-}_{(aq)} \mid \mid AgNO_{3(aq)}/Ag_{(s)}$

Which of the following is correct ?

A. The EMF of the cell is zero when $\left[Ag^{+}\right]_{\text{anodic}} = \left(Ag^{+}\right)_{\text{cathodic}}$

B. The amount of $AgCl_{(s)}$ precipitate in anodic compartment will decrease with the working of the cell

C. The concentration of $\left[Ag^{+}\right]$ is constant in anodic compartment with the working of cell

D. $E_{\text{cell}} = E^{0}_{Ag^{+}/Ag} - E^{0}_{Cr^{-}/AgCl/Ag^{-}} \frac{0.059}{1} \log \frac{1}{\left[Cl^{-1}\right]}$ anodic

Answer: B::C::D

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10. The standard electrode potential of a metal-metal ion $\left(Ag/Ag^{+}\right)$ and metal- sparingly soluble salt anion $\left(Ag|AgCl|Cl^{-}\right)$ are related as :

A. $E^{\circ}_{Ag^{+}|Ag} = E^{\circ}_{Cl^{-}|AgCl|Ag} + \frac{RT}{F} \ln K_{sp}$

B. $E^{\circ}_{Cl^{-}|AgCl|Ag} = E^{\circ}_{Ag^{+}|Ag} + \frac{RT}{F} \ln K_{sp}$

C. $E^{\circ}_{Cl^{-}|AgCl|Ag} = E^{\circ}_{Ag^{+}|Ag} - \frac{RT}{F} \frac{\ln\left(\left[Cl^{-1}\right]\right)}{K_{sp}}$

D. $E^{\circ}_{Cl^{-}||AgCl|Ag} = E^{\circ}_{Ag^{+}|Ag} - \frac{RT}{F} \frac{\ln\left(K_{sp}\right)}{\left[Cl^{-}\right]}$

Answer: B

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11.

$Pt:H_2\left(1atm 25^{\circ}C\right)/HCOOK(0.01M)//\left(NH_4Cl\right)(0.01M)/H_2, Pt\,1atm\ \ 25^{\circ}C\,K_b$ value of $HCOO^-$ and NH_3 are 10^{-6} and 10^{-8} respectively. The potential of the given cell is

A. $-0.0591V$

B. $0.3546V$

C. $0.2364V$

D. $-0.3564V$

Answer: B

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12. For a Ag -Zn button cell , net reaction is : $Zn_{(s)} + Ag_2O_{(s)} \rightarrow ZnO_{(s)} + 2Ag_{(s)}, \Delta G^0 f\left(Ag_2O\right) = -11.21 kJmol^{-1}$

$\Delta G^0 F(ZnO) = -318.3 kJmol^{-1}$ Hence E^0_{cell} of the button cell is :

A. $3.182V$

B. $1.71V$

C. $-1.591V$

D. $1.591V$

Answer: D

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13. Consider the reaction , $PbO_2 \rightarrow PbO, \Delta G_{298} < 0 l SnO_2 \rightarrow SnO, \Delta G_{298} > 0$ the most probable oxidation state of Pb and Sn will be

A. Ph^{+4}, Sn^{+2}

B. Pb^{+4}, Sn^{+4}

C. Pb^{+2}, Sn^{+3}

D. Pb^{+2}, Sn^{+4}

Answer: D

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14. E^0_{red} (Standard reduction potential) of different half-cells are given $E^0_{Cu^{+2}/Cu} = 0.34V$

$E^0_{Zn^{+2}/Zn} = -0.76V, E^0_{Ag^+/Ag} = 0.80V, E^0_{Mg^{2+}/Mg} = -2.37$ V . In which cell ΔG° is most negative ?

A. $Zn/Zn^{2+}(1M)//Mg^{2+}(1M)/Mg$

B. $Zn/Zn^{2+}(1M)//Ag^+(1M)/Ag$

C. $Cu/Cu^{2+}(1M)/Ag^+(1M)/Ag$

D. $Ag/Ag^+(1M)/Mg^{+2}(1M)/Mg$

Answer: B

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15. For a reaction in a galvanic cell the value of $-\Delta G^{\circ}$ at certain temperature is not necessarily equal to

A. nFE°

B. $RT\ln K$

C. $T.\Delta S^{\circ}-\Delta H^{\circ}$

D. Zero

Answer: B::D

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16. Which of the following statement are correct regarding to galvanic cell ?

A. A reaction is spontaneous from left to right if $E_{\text{cell}} > 0$

B. A reaction occurs from right to left if $E_{\text{cell}} < 0$

C. If the system is at equilibrium no net reaction occurs

D. E_{cell} is temperature - independent

Answer: A::B::C

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PRACTICE SHEET -3 (LINKED COMPREHENSION TYPE QUESTIONS(PASSAGE-I))

1. The cell potential $\left(E_{\text{cell}}\right)$ of a reaction is related as $\Delta G = -nFE_{\text{cell}}$, where ΔG represents max. useful electrical work .

n=no. of moles of electrons exchanged during the reactino of reversible cell reaction $d(\Delta G) = (\Delta V)dP - (\Delta S).\, dT$

at constant pressure $d(\Delta G) = -(\Delta S).\, dT$

$\because$ At constant pressure $\Delta G = \Delta G = \Delta H - T\Delta S$.......(1)

$\therefore \Delta G = \Delta H + T\left(\frac{d(\Delta G)}{dT}\right)_P$ .... (B)

$\left(\frac{dE_{\text{cell}}}{dT}\right)_P$ is known as temperature coefficient of the e.m.f of the cell

When ΔS increases, temperature coefficient of the emf of cell

A. Constant

B. Decreases

C. Suddenly decreases

D. Increases

Answer: D

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2. The cell potential $\left(E_{\text{cell}}\right)$ of a reaction is related as $\Delta G = -nFE_{\text{cell}}$,

where ΔG represents max. useful electrical work .

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at constant pressure $d(\Delta G) = -(\Delta S).\ dT$

$\because$ At constant pressure $\Delta G = \Delta G = \Delta H - T\Delta S$.......(1)

$$\therefore \Delta G = \Delta H + T\left(\frac{d(\Delta G)}{dT}\right)_P \text{ .... (B)}$$

$\left(\frac{dE_{\text{cell}}}{dT}\right)_P$ is known as temperature coefficient of the e.m.f of the cell

When ΔS increases, temperature coefficient of the emf of cell

A. $-4.2 \times 10^{-4} VK^{-}$

B. $-3.81 \times 10^{-4} VK^{-1}$

C. $0.11 VK^{-}$

D. $7.62 \times 10^{-4} VK^{-1}$

Answer: B

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3. The cell potential $\left(E_{\text{cell}}\right)$ of a reaction is related as $\Delta G = -nFE_{\text{cell}}$, where ΔG represents max. useful electrical work .

n=no. of moles of electrons exchanged during the reactino of reversible cell reaction $d(\Delta G) = (\Delta V)dP - (\Delta S).\, dT$

at constant pressure $d(\Delta G) = -(\Delta S).\,dT$

$\because$ At constant pressure $\Delta G = \Delta G = \Delta H - T\Delta S$.......(1)

$$\therefore \Delta G = \Delta H + T\left(\frac{d(\Delta G)}{dT}\right)_P \text{ .... (B)}$$

$\left(\frac{dE_{\text{cell}}}{dT}\right)_P$ is known as temperature coefficient of the e.m.f of the cell

When ΔS increases, temperature coefficient of the emf of cell

A. $-73.53 J/Kmol$

B. $83.53 J/Kmol$

C. $100 J/Kmol$

D. none of these

Answer: A

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PRACTICE SHEET -3 (LINKED COMPREHENSION TYPE QUESTIONS(PASSAGE-II))

1. The relationship between standard reduction potential of a cell and equilibrium constant is shown

A. $2.14V$

B. $4.28V$

C. $6.42V$

D. $8.56V$

Answer: A

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2. The driving force ΔG diminishes to zero on the way to equilibrium, just as in any other spontaneous process. Both ΔG and the corresponding cell potential $\left(E = \frac{\Delta G}{nF}\right)$ zero when the redox reaction comes to equilibrium. The Nernst equation for the redox process of the cell may be given as :

$$E = E^{\circ} - \frac{0.059}{n}\log Q$$

The key to the relationship is the standard cell potential E°, derived from the standard free energy change as : $E^\circ = -\dfrac{\Delta G^\circ}{nF}$. At equilibrium, the Nernst equation is given as :$E^\circ = -\dfrac{0.059}{n}\log K$

At equilibrium , when K = 1 the correct relation is

A. $\Delta G \neq 0, \Delta G^\circ \neq 0$

B. $\Delta G = 0, \Delta G^\circ \neq 0$

C. $\Delta G = 0, \Delta G^\circ = 0$

D. $\Delta G \neq 0, \Delta G^\circ = 0$

Answer: C

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3. The driving force ΔG diminishes to zero on the way to equilibrium, just as in any other spontaneous process. Both ΔG and the corresponding cell potential $\left(E = \dfrac{\Delta G}{nF}\right)$ zero when the redox reaction comes to equilibrium. The Nernst equation for the redox process of the cell may be given as :

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At equilibrium , when K = 1 the correct relation is

A. 10^{-37}

B. 10^{37}

C. 10^{-39}

D. 10^{39}

Answer: B

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PRACTICE SHEET -3 (MATCH THE FOLLOWING QUESTIONS)

1. Match the following Questions

COLUMN - I	COLUMN - II
A) If SOP of substance is exist between -1.23 to $-0.81V$	p) Oxidation of substance is not possible
B) If SOP of substance is exist between $-0.81V$ to $-0.40V$	q) Possible only in acidic medium
C) If SOP is less than -1.23 V	r) Possible in any medium
D) If SOP is greater than -0.40 V	s) Oxidation easily takes place

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2. Match the following Questions

COLUMN - I	COLUMN - II
A) $Pt H_2(0.1\ Bar) \| H^+(0.1M) \| H^+(1M) \| H_2(0.01\ Bar)\ Pt$	p) Concentration cell
B) $Ag \| AgCl\ (KCl\ 0.1\ M) \| Ag^+\ (0.01M) \| Ag$	q) $E_{cell} > 0$
C) $Cu \| Cu^{2+}(0.1\ M) \|\| Cu^{2+}\ (0.01\ M) \| Cu$	r) $E^0_{cell} = 0$ but cell is working
D) $Pt\ /\ Cl_2(1bar)\ HCl(0.1M) \|\| NaCl(0.1M) \| Cl_2(1\ bar)\ pt$	s) non working condition

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PRACTICE SHEET -3 (INTEGER ANSWER TYPE QUESTIONS)

1. The E° at $25^\circ C$ for the following reaction is 0.22 V $H_{2(g)} + 2AgCl_{(s)} \rightarrow 2Ag_{(s)} + 2HCl_{(aq)}$. If the equilibrium constant at

$25^{\circ} C$ is 2.8×10^{x}, x is

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2. Given the following standard electrode potentials,

$PbBr_2(s) + 2e^- \rightarrow Pb(s) + 2Br^-(aq), E^{\circ} - 0.248V$

$Pb^{2+}(aq) + 2e^- \rightarrow Pb(s), E^{\circ} - 0.126V$. If the K_{sp} for $PbBr_2$ is 7.4×10^{-x}, x is

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3. If the value of equilibrium constant $\left(K_f\right)$ for the operation $Zn^{2+}_{(aq)} + 4OH^-_{(aq)} \Leftrightarrow Zn(OH)^{2-}_{4(aq)}$ is 10^{10x}, then x is

(Given :

$Zn^{2+}_{(aq)} + 2e^- \rightarrow Zn_{(s)}, E^{\circ} = -0.76V, Zn(OH)^{2-}_{4(aq)} + 2e^- \rightarrow Zn_{(s)} + 4OH^-_{(aq)}$

)

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4. $I_2(s) \mid I^-(0.1M)$ half cell is connected to a $H^+(aq)\Big|H_2(1 \text{ bar })\Big|Pt$ half cell and e.m.f is found to be $0.7714V$. If $E^\circ_{I_2 \mid I^-} = 0.535V$, find the pH of $H^+ \mid H_2$ half - cell .

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5. The e.m.f of the cell : $H_2(g)$ |Buffer | Normal calomel electrodes is 0.6885 volt at $25^\circ C$, when barometric pressure is 760 mm Hg. What is the pH of the buffer solution ? Given $E^\circ_{\text{calomel}} = 0.28$ volt

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6. The standard potential of Ni^{2+}, Ni is $-0236V$. It this electrode is coupled with a hydrogen electrode, the EMF of the cell becomes zero. Calculate the pH of acid used in electrode .

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PRACTICE SHEET -4 (SINGLE OR MORE THAN ONE OPTION QUESTIONS)

1. An ion is reduced to the element when it absorbs 6×10^{20} electrons. The number of equivalence of the ion is

A. 0.1

B. 0.01

C. 0.001

D. 0.0001

Answer: C

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2. Consider the following cell reaction : $2Fe_{(s)} + O_{2(g)} + 4H^{+}_{(aq)} \rightarrow 2Fe^{2+}_{(aq)} + 2H_2O_{(l)}, E^0 = 1.67V$

At $\left[Fe^{2+}\right] = 10^{-3}M, P_{\left(O_2\right)} = 0.1atm$ and $pH = 3$, the cell potential at $25^{\circ}C$ is

A. $K_C = 2.63 \times 10^{56}$

B. $K_C = 1.54 \times 10^{26}$

C. $E^{\circ}_{\text{cell}} = 1.16V$

D. $E^{\circ}_{\text{cell}} = 1.67V$

Answer: A::D

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3. Four colourless salt solutions are placed in separate test tubes and a strip of copper is placed in each. Which solution finally turns blue?

A. $Pb(NO_3)_2$

B. $AgNO_3$

C. $Zn(NO_3)_2$

D. $Cd(NO_3)_2$

Answer: B

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4. Calculate the current (in ma) required to deposit 0.195 gr of platinum metal in 5.0 hours from a solution of $PtCl_6^{-2}$ (Atomic weight : pt 195)

A. 310

B. 31

C. 21.44

D. 5.36

Answer: C

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5. Equivalent conductance of saturated $BaSO_4$ is $400 ohm^{-1} cm^2 \text{equiv}^{-1}$ and specific conductance is $8 \times 10^{-5} ohm^{-1}, cm^{-1}$. Hence K_{sp} of $BaSO_4$ is

A. $4 \times 10^{-8} M^2$

B. $1 \times 10^{-8} M^2$

C. $2 \times 10^{-4} M^2$

D. $1 \times 10^{-4} M^2$

Answer: B

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6. Given , $Cu^{2+} + e^- \rightarrow Cu^+ E^\circ = 0.15 \text{ volt}$, $Cu^+ + e^- \rightarrow CuE^\circ = 0.5$ volt

Calculate potential for $Cu^{2+} + 2e^- \rightarrow Cu$

A. $0.65V$

B. $0.325V$

C. $0.45V$

D. $1.2V$

Answer: B

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7. Calculate the potential of a half cell having reaction : $Ag_2S(s) + 2e^- \Leftrightarrow 2Ag(S) + S^{2-}(aq)$ in a solution buffered at $p^H = 3$ and which is also saturated with $0.1MH_2S(aq)$

[Given : $K_{sp}\left(Ag_2S\right) = 2 \times 10^{-49}, K_{a1}.K_{a2} = 1.1 \times 10^{-21}, E^{\circ}_{As^+/Ag} = 0.8V$]

A. $-0.19V$

B. 0.19

C. $1.18V$

D. $-0.166V$

Answer: D

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8. Cu^+ ion is not stable in aqueous solution because of diproportionation reaction . E° value for the disproportionation of Cu^+

is :

$\left(E^{\circ}_{cu^{2+}/cu^{+}} = +0.15V, E^{\circ}_{cu^{+}/cu} = +0.34V\right)$

A. $-0.19V$

B. $-0.38V$

C. $+0.19V$

D. $+0.38V$

Answer: C

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9. Given the standard oxidation potential

$$Fe \xrightarrow{+0.4V} Fe^{2+}(aq) \xrightarrow{-0.8V} Fe^{3+}(aq), Fe \xrightarrow{+0.9V} Fe(OH)_2 \xrightarrow{0.6V} Fe(OH)_3$$

It is easier to oxidize Fe^{2+} to Fe^{3+} in :

A. Acid medium

B. alkalihne medium

C. neutral medium

D. both in acidic and alkaline mediums

Answer: A

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10. Let a fully charged lead-storage battery contains 1.5 L of $5MH_2SO_2$. What will be the concentratis of H_2SO_4 in the battery after 2.5 ampere current is drawn from the battery for 6 hour?

A. 4.626M

B. $0.1865M$

C. $0.373M$

D. $9.627M$

Answer: A

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11. Identify the correct statements.

A. The conductance of $1cm^3$ of a conductor is called conductivity

B. Limiting molar conductivity of a weak electrolyte can not be determined from the plot of a λ against $\sqrt{C}$

C. Conductivity of an electrolyte increases with increase in concentration

D. Molar conductivity of an electrolyte increases with increase in concentration

Answer: A::B::C

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12. The correct statements among the following are

A. The potential of metallic electrode increases with increase in concentration of metal ions

B. The potential of metallic electrode decreases with increase in concentration of metal ions

C. The potential of non-metallic electrode increases with increase in concentration of non-metal ions

D. The potential of non-metallic electrode decreases with increase in concentration of non-metal ions

Answer: A::D

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13. Given

$E^0_{Ag^+/Ag} = 0.80V, E^0_{Mg^{2+}/Mg} = -2.37V, E^0_{Cu^{2+}/Cu} = 0.34E^0_{Hg^{2+}/Hg} = 0.79V$

Which of the following statement is / are correct ?

A. $AgNO_3$ can be stored in copper vessel

B. $Cu(NO_3)_2$ can be stored in magnesium vessel

C. $CuCl_2$ can be stored in silver vessel

D. $HgCl_2$ can be stored in copper vessel

Answer: A::B::D

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14. In which electrolysis equal volumes of gases are released at anode and cathode during electrolysis

A. aq NaCl

B. aq KNO_3

C. aq HCOOK

D. aq CH_3COOK

Answer: A::C

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15. In which electrolysis one faraday can produce one mole at cathode or anode ?

A. aq NaCl

B. aq $AgNO_3$

C. fused NaCl

D. aq $CuSO_4$

Answer: B::C

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16. Which is/are concentration cells ?

A. pt , $H_2/HCl//HCl/H_2$, pt

B. Pt : $H_2/HCl\left(P^H=4\right)/HCl\left(P^H=2\right)/H_2, Pt$

C. $Ag/AgCl(1M)/AgBr(1M)/Ag$

D. $Ag/AgCl(s), KCl/AgNO_3(1M)/Ag$

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

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PRACTICE SHEET -4 (LINKED COMPREHENSION TYPE QUESTIONS (PASSAGE-I))

1. The Edison storage cell is represented as $Fe_{(s)}/FeO_{(s)}/KOH_{(aq)}/Ni_2O_3/Ni_{(s)}$

The half - cell reaction are

$Ni_2O_3(s) + H_2O(l) + 2e^- \rightarrow 2NiO + 2OH^-(aq), E^\circ = +0.40V$

$+(s)H_2O(l) + 2e^- \rightarrow Fe(s) + 2OH^-(aq), E^\circ = -0.87V$

The cell potential is

A. $1.27V$

B. $-0.47V$

C. Cannot be determined, because it depends on $\left[OH^-\right]$

D. $E^{\circ}_{\text{cell}} + P^{OH}$

Answer: A

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2. The Edison storage cell is represented as

$Fe_{(s)}/FeO_{(s)}/KOH_{(aq)}/Ni_2O_3/Ni_{(s)}$

The half - cell reaction are

$Ni_2O_3(s) + H_2O(l) + 2e^- \rightarrow 2NiO + 2OH^-(aq), E^{\circ} = +0.40V$

$+(s)H_2O(l) + 2e^- \rightarrow Fe(s) + 2OH^-(aq), E^{\circ} = -0.87V$

The cell potential is

A. $268.2kJ$

B. 145.5 cal

C. $245.11kJ$

D. $245.$ 11 cal

Answer: C

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3. The Edison storage cell is represented as

$Fe_{(s)}/FeO_{(s)}/KOH_{(aq)}/Ni_2O_3/Ni_{(s)}$

The half - cell reaction are

$Ni_2O_3(s) + H_2O(l) + 2e^- \rightarrow 2NiO + 2OH^-(aq), E^\circ = +0.40V$

$+(s)H_2O(l) + 2e^- \rightarrow Fe(s) + 2OH^-(aq), E^\circ = -0.87V$

The cell potential is

A. 0.2 V

B. 0.8 V

C. 0.6 V

D. 0.0V

Answer: D

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PRACTICE SHEET -4 (LINKED COMPREHENSION TYPE QUESTIONS (PASSAGE-II))

1. hydrogen-oxygen fuel cell may have an acidic or alkaline electrolyte. The half-cell reactions are

$$\frac{1}{2}O_2(g) + 2H^+ + 2e^- = H_2O(\ell) \qquad E^\circ = 1.22\,88\ V$$

$$2H^+ + 2e^- = H_2(g) \qquad E^\circ = 0$$

$$H_2(g) + \frac{1}{2}O_2(g) = H_2O(\ell) \qquad E^\circ = 1.2288V$$

or

$$\frac{1}{2}O_2(g) + H_2O(\ell) + 2e^- = 2OH^- \qquad E^\circ = 0.4009\ V$$

$$2H_2O(\ell) + 2e^- = H_2(g) + 2OH^- \qquad E^\circ = -0.8279\ V$$

$$H_2(g) + \frac{1}{2}O_2(g) = H_2O(\ell) \qquad E^\circ = 1.2288\ V$$

To maximize the power per unit mass of an electrochemical cell, the electronic and electrolytic resistances of the cell must be minimized. Since fused salts have lower electrolytic resistances that aqueous solutions, high-temperature electrochemical cells are of special interest for practical applications.

High temperature also allow the use of liquid metal electrode, which make possible higher current densities than solid electrodes

If 560 mL of H_2 gas at STP is fed into and is consumed by the fuel cell in 10 minutes, then what is the current output of the fuel cell?

A. 4A

B. 8A

C. 16A

D. 12A

Answer: B

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2. hydrogen-oxygen fuel cell may have an acidic or alkaline electrolyte. The half-cell reactions are

$\frac{1}{2}O_2(g) + 2H^+ + 2e^- = H_2O(l)$	$E^\circ = 1.22\ 88\ V$
$2H^+ + 2e^- = H_2(g)$	$E^\circ = 0$
$H_2(g) + \frac{1}{2}O_2(g) = H_2O(l)$	$E^\circ = 1.2288 V$
or	
$\frac{1}{2}O_2(g) + H_2O(l) + 2e^- = 2OH^-$	$E^\circ = 0.4009\ V$
$2H_2O(l) + 2e^- = H_2(g) + 2OH^-$	$E^\circ = -0.8279\ V$
$H_2(g) + \frac{1}{2}O_2(g) = H_2O(l)$	$E^\circ = 1.2288\ V$

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High temperature also allow the use of liquid metal electrode, which make possible higher current densities than solid electrodes

For a Hydrogen-Oxygen fuel cell if $\Delta H_f^{\circ} = (H_2O, l) = -285 kJ/\text{ mole}$, then what will be its thermodynamic efficiency under standard conditions

A. 0.91

B. 0.41

C. 0.63

D. 0.83

Answer: D

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3. hydrogen-oxygen fuel cell may have an acidic or alkaline electrolyte. The half-cell reactions are

$\frac{1}{2}O_2(g) + 2H^+ + 2e^- = H_2O(l)$	$E^\circ = 1.22\ 88\ V$
$2H^+ + 2e^- = H_2(g)$	$E^\circ = 0$
$H_2(g) + \frac{1}{2}O_2(g) = H_2O(l)$	$E^\circ = 1.2288 V$

or

$\frac{1}{2}O_2(g) + H_2O(l) + 2e^- = 2OH^-$	$E^\circ = 0.4009\ V$
$2H_2O(l) + 2e^- = H_2(g) + 2OH^-$	$E^\circ = -0.8279\ V$
$H_2(g) + \frac{1}{2}O_2(g) = H_2O(l)$	$E^\circ = 1.2288\ V$

To maximize the power per unit mass of an electrochemical cell, the electronic and electrolytic resistances of the cell must be minimized. Since fused salts have lower electrolytic resistances that aqueous solutions, high-temperature electrochemical cells are of special interest for practical applications.

High temperature also allow the use of liquid metal electrode, which make possible higher current densities than solid electrodes

How many grams of water is produced in the cell if 2 Faradays of charge is derived from the fuel cells

A. 18g

B. 36g

C. 42g

D. 9g

Answer: A

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PRACTICE SHEET -4 (MATCH THE FOLLOWING QUESTIONS)

1. Match the following questions

COLUMN - I	COLUMN - II
A) Non spontaneous reaction is made to occur	p) Secondary voltaic cell
B) Spontaneous redox reaction occurs	q) conductivity cell
C) No chemical reaction occurs	r) Dry cell
D) Reaction can be reversed	s) Nelson cell

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2. Match the following questions

COLUMN - I (Electrolysis of)	COLUMN - II (Electrode products)
A) $AgNO_3$ between 'Pt' electrodes	p) H_2
B) $CuSO_4$ between 'Cu' electrodes	q) Peroxide
C) H_2SO_4 (50%) between 'Pt' electrodes	r) Electronegative gas
D) Aq. $NaCl$ with 'Hg' electrodes	s) Dissolved meta ions

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PRACTICE SHEET -4 (INTEGER ANSWER TYPE QUESTIONS)

1. During electrolysis of one mole or aq HCOOK . How many moles of H_2 is formed overall ?

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2. During electrolysis of 1 litre of aq. $CuSO_4$, the P^H of the solution is changed from 5.0 to 4.3 . Then the number of faradays consumed in the process is $\left(x \times 10^{-4}\right)$, here , $(x + y) = ?$

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3. $10^{-2}F$ charge can remove entrie Cl_2 from 100 ml of HCl solution. What is the P^H of the solution initially

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4. How many faradays of charge is consumed during electrolysis of acidified water producing 33.6lt of gases at both electrodes .

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5. 10 litres of $0.1MAgNO_3$ is electrolysed with 2 faradays . '5.6 x' litres of O_2 is released as STP what is x ?

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6. λ_{HCN} is 0.1 M solution is $20 Sm^2\ \text{mol}^{-1}$

λ°_{HCN} is 200S $m^2 \text{mol}^{-1}$. The P^H of 0.1M HCN solution is __________

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PRACTICE SHEET -5 (SINGLE OR MORE THAN ONE OPTION QUESTIONS)

1. The E° at $25^{\circ} C$ for the following reaction at the indicated concentrations is 1.50 V . Calculate the ΔG in kJ at $25^{\circ} C$, $Cr(s) + 3Ag^{+}(aq.\ 0.1M) \rightarrow Ag(s) + Cr^{3+}(aq.\ 0.1M)$

A. -637

B. -424

C. -106

D. $+1.0542V$

Answer: A

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2. The standard electrode potential for the following reaction is + 1.33V.What is potential at pH=2.0?

$Cr_2O_7^{2-}(aq. 1M) + 14H^+(aq) + 6e^- \rightarrow 2Cr^{3+}\left(aq. 1M0 + 7H_2O(l)\right)$

A. $+1.820V$

B. $+1.990V$

C. $+1.608V$

D. $+1.0542V$

Answer: D

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3. The equilibrium constant for the following general reaction is 10°. Calculate E° for the cell at 298 K. $2X_2(s) + 3Y^{2+}(aq) \rightarrow 2X_2^{3+}(aq) + 3Y(s)$

A. $+0.105V$

B. $+0.2955V$

C. $0.0985V$

D. $-0.2955V$

Answer: B

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4. If $E^{\circ}_{Au^{+}/Au}$ is 1.69 V and $E^{\circ}_{Au^{3+}/Au}$ is 1.40 V . Then $E^{\circ}_{Au^{+}/Au^{3+}}$ will be :

A. 0.19 V

B. 2.945 V

C. 1.255 V

D. None of these

Answer: D

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5. The molar conductivities of H^{+} and $HCOO^{-}$ ions at infinite dilution are 34.7 and 5.4 mSm^{2} mol^{-1} respectively. The molar conductivity of 0.25 M HCOOH is $4.0mSm^{2}mol^{-1}$. Then pK_{a} of formic acid is

A. 3.6

B. 4.2

C. 4.8

D. 1.8

Answer: A

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6. Limiting equivalent conductivities of different ions are given below

Ion	K^{+}	Na^{+}	SO_4^{2-}
λ^0_{eq} / Scm^2eq^{-1}	73	81	58.8

The limiting equivalent conductivity of the salt $NaKSO_{4}$ is ________ $Scm^{2}eq^{-1}$

A. 239.8

B. 201.4

C. 212.8

D. 141.6

Answer: C

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7. $\lambda_m^\circ\left(AgNO_3\right), \lambda_m^\circ(HCl)$ and $\lambda_m^\circ\left(HNO_3\right)$ are a,b and c Scm^2mol^{-1} respectively . If the conductivity of a saturated solution is Z S cm^{-1} . Then the solubility of AgCl is

A. $\dfrac{a+b+c}{1000MZ}$

B. $\dfrac{(a+b+c)1000}{Z}$

C. $\dfrac{1000Z}{a+b-c}$

D. $\dfrac{Z(a+b-c)}{1000M}$

Answer: C

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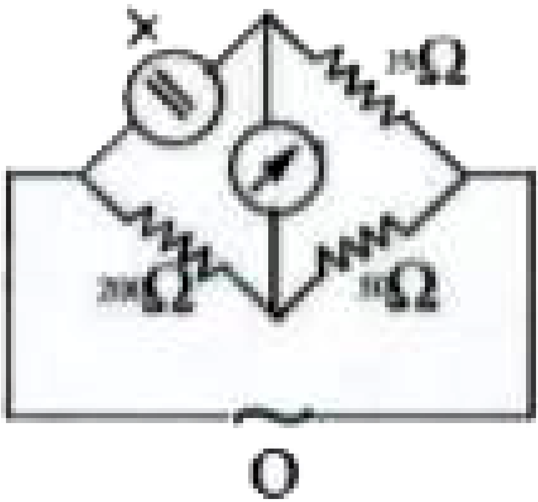
8. A conductivity cell (X) employs two electrodes having surface area of $10cm^2$ and separated by a distance of 10 cm. It is filled with 0.01M solution of an electrolyte and connected in the wheatstone bridge. The balanced bridge is shown in the diagram . What is the molar conductivity of the electrolyte ?



A. $10^3 Scm^2 mol^{-1}$

B. $250 Scm^2 mol^{-1}$

C. $100 S cm^2 mol^{-1}$

D. $500 S cm^2 mol^{-1}$

Answer: A

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9. Aqueous solution of $AgNO_3$ is electrolysed using inert electrodes. At the end of electrolysis

A. pH of the solution increases

B. pH of the solution decreases

C. pH of the solution remains unchanged

D. pH of the solution becomes 14

Answer: B

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10. An aqueous solution containing one mole per litre of each $Cu(NO_3)_2$, $AgNO_3$. $Hg(NO_3)_2$, $Mg(NO_3)_2$ is being electrolysed using inert electrodes. The values of standard electrode potential (reduction potential) in volts are

$Ag/Ag^+ = +0.80V \quad Hg/Hg^{2+} = +0.79V \quad Cu/Cu^{2+} = +0.34V \quad Mg/Mg^{2+} =$

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

A. Ag , Hg , Cu ,Mg

B. Mg , Cu , Hg , Ag

C. Ag, Hg, Cu, H_2

D. Cu, Hg, Ag

Answer: C

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11. Which statements is/are correct ?

A. In voltaic cell oxidation occurs at at anode

B. In an electrolitic cell reduction occurs at cathode

C. In a conductivity cell electrolysis does not take place

D. H^+ has greater conductance then OH^-

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

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12. Which of the following statements are true ?

A. graphite is an electronic conductor.

B. $Na/liqNH_3$ is a mixed conductor.

C. Si-Ga' allows in a semiconductor

D. Aqueous urea solution is not a conductor.

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

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13. Fused AlF_3 and fused NaF are electrolysed in a series of cells with same quantity of charge. Which statements are correct ?

A. Equal molar of Al and Na are formed

B. Al and Na are formed in 3:1 mole ratio

C. Al and Na are formed in 1:3 molar ratio

D. Equal volumes of F_2 gases are released

Answer: C::D

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14. In hydrogen fule cell ___________

A. H_2 and O_2 are consumed in 1:8 mass ratio

B. H_2 and O_2 are consumed in 1:8 mass ratio

C. H_2 and O_2 are consumed in 2:1 mole ratio

D. 18 gms of water is formed on producing 2 faradays of current

Answer: A::C::D

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15. In the following concentration cell

$Ag(s)/AgCl(\text{saturated})//AgNO_3(aq)(0.1M)/Ag_{(s)}, K_{SP}$ of AgCl $= 1 \times 10^{-10}$

The cell potential will be

A. $E_{\text{cell}} = 0.295V$

B. $E_{\text{cell}} = 0.236V$

C. $E_{\text{cell}} = \frac{0.059}{1}\log\frac{\left[Ag^+\right]_{\text{cathode}}}{\sqrt{K_{sp} \text{ of } AgCl}}$

D. $E_{\text{cell}} = E^{\circ}_{\text{cell}} + \frac{0.059}{1}\log\frac{\sqrt{K_{SP} \text{ of AgCl}}}{\left[Ag^+\right]_{\text{cathode}}}$

Answer: B::C::D

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16. Standared electrode potential of two half-reactions are given below :

$Fe^{2+} \Leftrightarrow Fe \quad E^{\circ} = -0.44V, Fe^{3+} \Leftrightarrow Fe^{2+} \quad E^{\circ} = +0.77V$

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

A. The concentration of Fe^{3+} increases

B. The concentration of Fe^{3+} decreases

C. The mass of Fe increases

D. The concentration of Fe^{2+} increases

Answer: B::D

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PRACTICE SHEET -5 (LINKED COMPREHENSION TYPE QUESTIONS (PASSAGE-I))

1. Nernst equation gives the variation of potential of an electrode based on activity of ions temperature and pressure. The equation is

$$E = E^{\circ} - \frac{2.303RT}{nF}\log Q(\text{ or })E = E^{\circ} - \frac{0.0591}{n}\log Q$$

E° = Standard potential and 'Q' is the reaction quotient.

What is the reduction potential of a hydrogen electrode in an aqueous solution containing 0.1 M $NH_4OH, \left(Kb = 10^{-5}\right)$, ?

A. 0.02 V

B. 0.03 V

C. 0.06 V

D. 0.01 V

Answer: A

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2. Nernst equation gives the variation of potential of an electrode based on activity of ions temperature and pressure. The equation is

$$E = E^{\circ} - \frac{2.303RT}{nF}\log Q(\text{ or })E = E^{\circ} - \frac{0.0591}{n}\log Q$$

E° = Standard potential and 'Q' is the reaction quotient.

What is the reduction potential of a hydrogen electrode in an aqueous solution containing 0.1 M NH_4OH, $\left(Kb = 10^{-5}\right)$, ?

A. $-0.45V$

B. $-0.85V$

C. $-0.9V$

D. $-0.6501V$

Answer: D

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3. Nernst equation gives the variation of potential of an electrode based on activity of ions temperature and pressure. The equation is

$$E = E^\circ - \frac{2.303RT}{nF}\log Q(\text{ or })E = E^\circ - \frac{0.0591}{n}\log Q$$

E° = Standard potential and 'Q' is the reaction quotient.

Which cell has least potential ?

A. $ZN/Zn^{+2}1M/Cu^{+2}1M/Cu$

B. $Zn/Zn^{+2}0.1M//Cu^{+2}0.1M/Cu$

C. $Zn/Zn^{+2}0.1M/Cu^{+2}1M/Cu$

D. $Zn/Zn^{+2}1M/Cu^{+2}0.1M/Cu$

Answer: D

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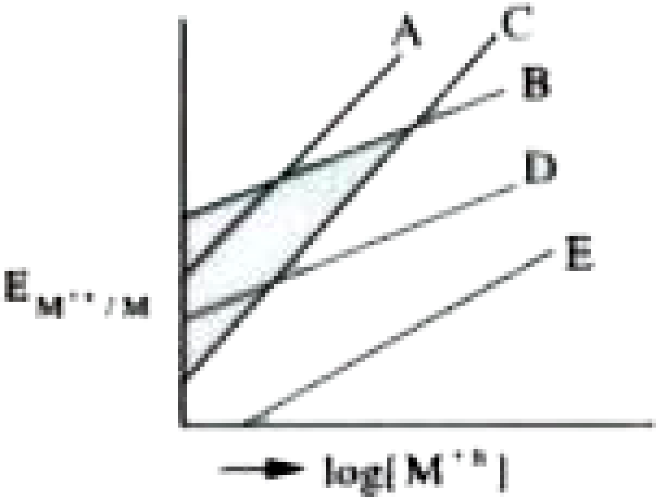
PRACTICE SHEET -5 (LINKED COMPREHENSION TYPE QUESTIONS (PASSAGE-II))

1. For metal electrodes show the variation in their reduction potential as shown.



Which is the most reactive metal ?

A. A

B. B

C. C

D. D

Answer: C

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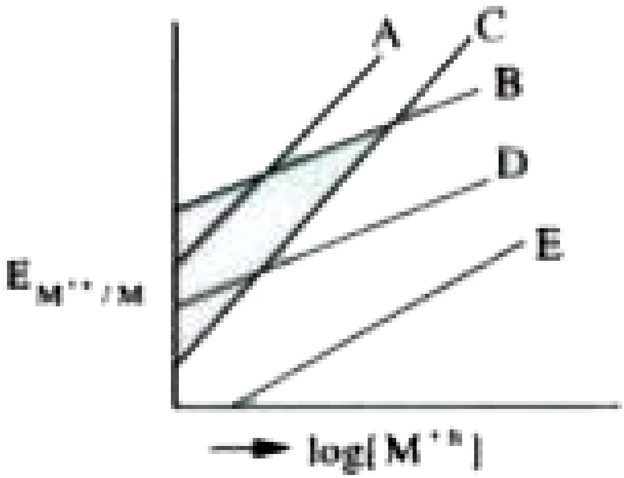
2. For metal electrodes show the variation in their reduction potential as shown.



Which statement is true ?

A. B can reduct $A^{+n}(1M)$

B. E can replace H^{+} from acids

C. A-D' cell has maximum E° among the given

D. C' can reduced the ions of A,B and D

Answer: B::D

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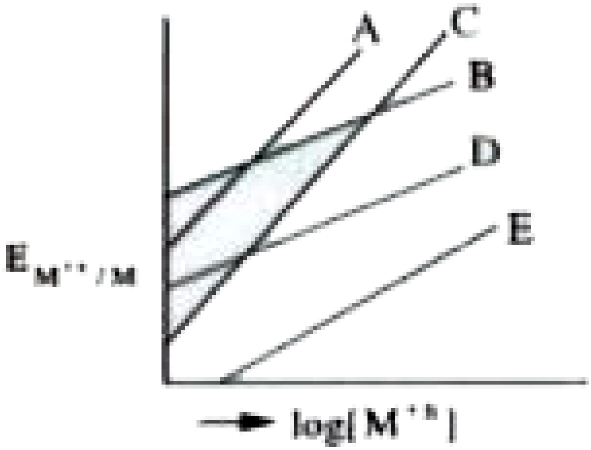
3. For metal electrodes show the variation in their reduction potential as shown.



Which metal requires maximum voltage for deposition of one mole through electrolysis process ?

A. A

B. B

C. C

D. D

Answer: C

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PRACTICE SHEET -5 (MATCH THE FOLLOWING QUESTIONS)

1. Match the following questions

COLUMN - I (Substance)	COLUMN - II (Molar conductance at 0.1M)
A) HCl	p) 40
B) $NaOH$	q) 120
C) $NaCl$	r) 240
D) HCN	s) 370

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2. Match the following questions

COLUMN - I (Conversion)	COLUMN - II (No.of Faradays transferred per mole of reactant)
A) Nitrobenzne $\longrightarrow$ Aniline	p) 1
B) Glucose $\longrightarrow$ Gluconic acid	q) 4
C) $H_2O_2 \longrightarrow H_2O + \frac{1}{2}O_2$	r) 2
D) $HCHO \longrightarrow CH_4$	s) 6

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PRACTICE SHEET -5 (INTEGER ANSWER TYPE QUESTIONS)

1. How many electrons would reflect in the nernst equation of the conversion of one mole of Mn_3O_4 in the MnO_2 ?

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2. $E_{MnO_4^- / Mn^{+2}, H^+}$ can be 0.48 V greater than from E° value if the $\left[MnO_4^-\right]$ is equal to $\left[Mn^{+2}\right]$ at a P^H of ________

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3. Potential of a hydrogen electrode at one atmosphere in 0.48 V if the P^H value is ________

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4. The anodic solution of standard " Al-Ag" voltaic dilute by 100 times. The potential of the cell is increased by '0.01x' volts what is x ?

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5. How many faradays of charge is transfered during disproportionation of two moles of cuprous ?

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6. $Ag/AgBr(s), KBr0.1M/KCl0.1M, AgCl(3)/Ag$ the cell potential is 0.1x volts. What is x ?

$\left(KspAgBr = 10^{-16}, AgCl = 10^{-11}\right)$

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PROBLEM

1. Is it possible to determine Λ_{∞} of propionic acid experimentally. Give reason.

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2. $BaSO_4$ is ionic and PCl_3 is covalent but a saturated solution of $BaSO_4$ is a weak electrolyte, while that the PCl_3 is a strong electrolyte. Explain.

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3. The conductivity of 0.1 M KCl solution is $1.29Sm^{-1}$. If the resistance of the cell filled with 0.1 M KCl is 100Ω, Calculate the cell constant.

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4. A column of 0.05 M NaOH solution of diameter 1cm and length 1m has resistance 1.11×10^4 ohm. Caluclate the resistivity, conductivity and molar conductivity.

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5. It os practically difficult to calculate the equivalent conductivity of a weak electrolyte in aqueous solutions. Comment.

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6. Equivalent conductivity of a weak acid HA at infinite dilution is $390 Scm^2 eq^{-1}$. Conductivity of 1×10^{-3} N HA solution is $4.9 \times 10^{-5} Scm^{-1}$. Calculate the extent of dissociation and dissociation constant of the acid.

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7. Using Kohlrausch law, calculate Λ_0 for acetic acid, if Λ_0 value for hydrochloric acid, sodium chloride and sodium acetate are respectively 426, 126 and 91 $Scm^2 mol^{-1}$.

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8. Aqueous silver nitrate is subjected to electrolysis, using platinum electrodes. What will be the nature of the solution after some time?

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9. Find the total charge in coulmb on one gram ion of nitride.

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10. Electrolysis of aqueous solution of ammonium sulphate and sulphuric acid at anode gives

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11. Calculate the equivalent weight and electrochemical equivalent of copper deposited from cupric salt (At. Wt of $Cu = 63.5$).

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12. If a current of one ampere flows through a metal wire for one hour, how many electrons would flow through the wire?

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13. Calculate the quantity of electricity needed to reduce one centimole of dichromate in acid medium, to chromic state.

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14. A solution of copper sulphate is electrolysed using a current strength of 3 amp to deposite 60 grams of copper. What is the time taken for the electrolysis?

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15. The electrical expenditure is five rupees to produce 4 grams of calcium from fused $CaSO_4$. What is the production cost of 2 grams of hydrogen produced electrically from acidulated water ?

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16. What is the ratio of (a) gram atoms and (b) weights of the metals liberated during the electrolysis of fused sodium fluroide, magnesium fluoride and aluminium fluoride connected in a series?

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17. During the electrolysis of fused potassium chloride at platinum electrodes, 0.25 gram atom of metal is liberated. What would be the volume of chlorine that can be collected in the experiment at STP?

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18. A 200 W, 110 V in candescent lamp is connected in series with cells containing aqueous ZuCI . solution. What is the time required to deposit 1.109 g of metal ?

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19. An oxide of metal (at . Wt = 112) contains 12.5% of oxygen by weight. What is the valency of metal? What mass of the metal will be liberated when the oxide is converted to chloride with HCl and electrolysed using a current of 9.65 amp for a period of 30 min?

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20. E° of zinc electrode is -$0.762V$. Calculate the single electrode potential of Zn electrode in decimolar $ZnSO_4$ solution.

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21. At what concentration of copper sulphate solution, the potential of Cu^{2+}, Cu becomes zero? The standard reduction potential of Cu^{2+}, Cu is 0.34 V.

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22. At $25^{\circ}C$, the reduction potential of hydrogen electrode is -0.118 V at 1 atm. What is he pH of acid solution used for the construction of the electrode ?

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23. E° values of Ni^{2+}, Ni and Cl_2, Cl^- are respectively $-0.25V$ and $+1.37V$. Calculate the EMF of the cell $Ni, Ni^{2+}(0.01M)/Cl^-(0.1M), Cl_2$, pt. Potential of nickel electrode is given as,

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24. A cell is constructed Pb^{2+} Pb and Ni^{2+}, Ni electrodes. If E° values of Pb and Ni electrodes are respectively -0.13 and -0.25V, write (a) the cell reaction and (b) cell notation.

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25. Calculate the standard Gibbs energy change for the redox reaction of Daniel cell .

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26. E°_{cell} for the redox reation

$2Ag^{+}_{(aq)} Cu \rightarrow Cu^{2+}_{(aq)} + 2Ag$ is 0.46V.

Calculate the equibilrium constant of the reaction.

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27. Represent the cell in which the following reaction takes place

$Mg(s) + 2Ag^{+}(0.0001M) \rightarrow Mg^{2+}(0.130M) + 2Ag(s)$

Calculates its E_{cell} if $E^{\Theta}_{\text{cell}} = 3.17V$

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28. Lithinum is the strogest reductant in aqueous solutions. Why ?

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29. Calculate the solubility product of Ag_2CrO_4 at 298k, if the EMF of the concentration cell, Ag, $Ag^{+}\left(\text{solid}Ag_2CrO_4\right)//Ag^{+}(0.1M)$, Ag is 0.164 V.

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30. What are the limitations of fuel cells?

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31. What happens when lead storage battery is subjected to charging ?

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32. Potash solution is not recommended in a hydrocarbon-oxygen fuel cell. Why?

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33. A long iron rod is partially dipped in common salt solution. What happens ?

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34. Concentrated nitric acid can be transported in vessels of aluminium or tin cans. Why ?

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35. Highly conducting solutions favour rapid corrosion. Explain.

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Subjective Exercise -1 (Short Answer Questions)

1. Write the types of electrical conductors with suitable examples.

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2. What is degree of dissociation? How is it useful to distinguish between strong and weak electrolytes?

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3. Define the terms resistance , resistivity , conductance and specific conductance. Write their units.

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4. Discuss (a) molar conductance and (b) equivalent conductance.

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5. How is the conductance of an electrolytic solution influenced by various factors?

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6. State and explain Kohlrausch's law of indendent migration of ions.

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7. At $25^{\circ}C$, the specific conductance of 0.01 M alkaline earth metal chloride is $0.000158 \text{ohm}^{-1} cm^{-1}$ Calculate the equivalent conductance.

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Subjective Exercise -1 (Very Short Answer Questions)

1. For which of the following electrolytes Λ and u are equal and why ? $BaCl_2, MgCl_2, KCl, Na_2SO_4$.

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2. In which case α is high ? $0.01 M CH_3COOH$ and $0.1 M CH_3COOH$ and why ?

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3. Is ionic conductance more for aqueous Cs^{+} or aqueous Li^{+} ? Why ?

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Subjective Exercise -1 (Problems)

1. At $25^{\circ} C$ equivalent conductance of a week acid HAc is $16.2 \text{ohm}^{-1} cm^{2} eq^{-1}$.If the ionic conductances of Ac^{-} and H^{+}at infinite dilution are respectively 40.9 and $349.8 \text{ohm}^{-1} cm^{2} eq^{-1}$., calculate the percentage dissociation of the week acid at $25^{\circ} C$.

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2. Calculate the equivalent conductance of NH_4OH at infinite dilution using Kohlrausch law. Given that Λ_0 values of $NaOH, NaCI$ and NH_4Cl are respectively 217.4, 108.9 and $129 \text{ohm}^{-1} cm^{2}$.

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3. At$25^{\circ}C$, the specific conductance of 0.01 M alkaline earth metal chloride is $0.000158\text{ohm}^{-1}cm^{-1}$ Calculate the equivalent conductance.

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4. Λ_c of acetic acid at $25^{\circ}C$ is $16.3ohm^{-1}cm^2eq^{-1}$. The ionic conductances of H^+ and CH_3COO^- are 349.83 and $40.89ohm^{-1}$. What is $\propto$ of CH_3COOH?

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5. The resistance of 0.1N KCl solution is found 702Ω awhen measured in a conductivity cell. The specific conductance of 0.1N KCl is $0.14807\Omega^{-1}m^{-1}$. Calculate the cell constant.

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6. The specific conductance of a salt of 0.01M solution is $1.061 \times 10^{-4} ohm^{-1} cm^{-1}$. Molar conductance of a same solution is (in $ohm^{-1} cm^{2} \text{mole}^{-1}$)

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7. At $25^{\circ} C$ equivalent conductance of a week acid HAc is $16.2 \text{ohm}^{-1} cm^{2} eq^{-1}$.If the ionic conductances of Ac^{-} and H^{+}at infinite dilution are respectively 40.9 and $349.8 \text{ohm}^{-1} cm^{2} eq^{-1}$., calculate the percentage dissociation of the week acid at $25^{\circ} C$.

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Subjective Exercise -2 (Long Answer Questions)

1. Describe the phenomenon electrolysis with the help of two examples.

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2. State Faraday's first law of electrolysis.

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Subjective Exercise -2 (Short Answer Questions)

1. Write the important applications and uses of electrolysis .

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2. What are electrolytes ? Distinguish between metallic electrodes and electrolytes.

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3. Find the ratio of electrochemical equivalents of silver and aluminium .

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4. How many hours are needed to deposit the metal based on the reaction .

$Fe^{2+}(aq) + 2e^{-} \rightarrow Fe(s)$. using a current strength of 0.02amp.

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5. A current of 5 amp is passed through molten $CaCl_2$ for 2 hrs. Calculate the mass of metal as well as mass of non-metal liberated.

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6. Same quantity of electrical charge that deposited $0.583g$ of silver was passed through a solution of gold salt. If 0.335 g of gold is deposited, calculate the oxidation state of gold in the given salt. At wt of Au = 197.

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7. A matel wire carries a current of one amp. How many electrons pass a point in the wire in one sec.

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8. Calculate the current in amperes required to liberate 10g of silver electrolytically in 2 hrs from $AgNO_3$ solution.

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9. 3g of metal ions were discharged at cathode using a current of 3 amperes for 2 hours from aqueous cupric sulphate solution. Calculate the current efficiency. At wt . of Cu is 63.5 .

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10. 16 grams of copper sulphate is dissolved in one litre of water . It is electrolysed using a current strength of 10 amp for a period of 965 sec. What is the concentration of copper sulphate after electrolysis ? Take atomic weight of copper as 64 and assume there is no loss in water during electrolysis.

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11. A current of 0.965 amp. Is passed through an aqueous solution of $AgNO_3$ for 10 minutes during electroysis, Calculate the mass of Ag deposited at the cathode (Atomic weight of $Ag = 108$).

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12. A current of 0.25 amp is passed through $CuSO_4$ solution for 45 minutes. Calculate the mass of copper deposited on the cathode (At.wt of $Cu = 63$.)

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13. A current of 10 amp is passed through molten $AlCl_3$ for 96.5 seconds. Calculate the mass of Al deposited at the cathode (At. wt of $Al = 27$)

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14. 9.65 amp current is passed through molten $AlCl_3$ for one minute forty seconds during electrolysis. The mass of Al deposited is 0.09g at the cathode. What is the valency of Al

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15. How much time (in hours) is required for a current of 2 amp to decompose electrolytically 18g of water.

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16. The ration of weights of Ag and Al deposited at the cathode respectively, when the same current is passed for the same period thorugh molten $Al_2(SO_4)_3$ and aqueous $AgNO_3$ is

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Subjective Exercise -2 (Very Short Answer Questions)

1. Calculate the electrochemical equivalent of the lightest element .

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2. What products are obtained in the electrolysis of fused KCl and aqueous solution of KCl between platinu electrodes ?

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3. In which of the following cases, Na is not obtained at the cathode during electrolysis, fused NaCl, fused NaOH, aq. NaOH and why ?

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Subjective Exercise -3 (Long Answer Questions)

1. What is electrochemical series ? Write different applications of the series.

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2. Describe the construction and working of Daniell cell.

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Subjective Exercise -3 (Short Answer Questions)

1. How is electrical energy generated by performing a chemical reaction ?

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2. What is single electrode potential? How is it dependent on various factors ?

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3. Write the Nernst equation for a metal electrode and for a non-metal electrode.

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4. Describe the constitution of standard hydrogen electrode.

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5. How are the cells systemically represented ? Given examples.

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6. E° values of Zn^{2+}, Zn and Cu^{2+}, Cu are respectively $-0.76V$ and $+0.34.$ Calculate the EMF of the cell $Zn/Zn^{2+}(0.1M)//Cu^{2+}(0.1M)/Cu.$

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7. The potential of the cell $Cu, Cu^{2+}(0.1M)//HCl(xM), Cl_2, Pt$is 1.07 V. If the standard potential of copper and chlorine electrodes are 10.34 V and 1.36 V, calculate the concentration of HCl.

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8. E° for $Mg \rightarrow 2e^- + Mg^{2+}$ is $+2.37V$ and for $Cu \rightarrow 2e^- + Cu$ is $-0.34V$. What will be the standard potential of cell constructed with these electrodes ? Which electrode will be positive terminal to draw the current?

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9. E° value of $Co^{2+}, Co, Al^{3+}, Al, Ag^{+}, Ag$ and Ba^{2+}, Ba are respectively $0.28, -1.66, +0.8$ and $-2.9V$. write the increasing order of the reduction ability of metals and discuss .

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10. Two students use of the same stock solutions of zinc sulphate and a solution of copper sulphate . The EMF of one cell is 0.0295 V higher then the other. The concentration of cupric ions used in the cell with higher EMF Value is 0.2. Calculate the concentration of cupric ions used in the other cell.

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11. Calculate the Electrode potential of single electrode. $Cu^{2+}(0.01M)/Cu \quad \left(E^{\circ} = +0.337V\right)$

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12. Standard reduction potential of I_3^-, I^- and Fe^{3+}, Fe^{2+} are 0.54 and $0.77V$, respectively . Calculate the equilibrium constant for the reaction. `2Fe^(3+) + 3I^(-)

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13. Calculate single electrode potential of Pt, $Cl_2/Cl^-(0.01)\left(E^{\circ} = +1.36V\right)$

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14. Calculate the EMF of $Zn/Zn^{2+}(0.1)//Cu^{2+}(0.1)/Cu E^{\circ}$ of $Zn^{2+}/Zn = 0.762V, E^{\circ}$ of $Cu^{2+}/Cu = +0.337V$

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15. Calculate the EMF of cell

$Ni/Ni^{2+}(0.01M)//Cl^{-}0.1M/Cl_2,$ Pt

$E^{\circ}Ni^{2+}/Ni = -0.250V : E^{\circ}Cl_2/Cl^{-} = +1.360V$

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16. Calculate the EMF of the cell formd from Ag & Ni electrodes

$E^{\circ}.Ag^{+}/Ag = (+0.799V)$

$E^{\circ}Ni^{2+}/Ni = -0.250V$

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17. Write the cell reactions of the cell fored from

$Sn^{2+}/Sn, Pb^{2+}/Pb$ electrode

$E^{\circ}Sn^{2+}/Sn = -0.140V,$

$E^{\circ}Pb^{2+}/Pb = -0.126V$

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18. Calculate electrode potential of

$Zn^{2+}(0.1M)/Zn||Cl^{-}(0.01)/Cl_2, Pt$

$E^{\circ} Zn^{2+}/Zn = -0.762V,$

$E^{\circ} \frac{1}{2}Cl_2/Cl^{-} = +1.36V$

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19. Calculate the EMF of the cell

$Cu/Cu^{2+}(0.1M)//Cl^{-}(0.01)/\frac{1}{2}Cl_2$, Pt

$E^{\circ} Cu^{2+}/Cu = +0.33V$

$E^{\circ} \frac{1}{2}Cl_2/Cl^{-} = +1.36V$

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20. What is nernst equation. Calculate the EMF of the galvanic cell construted fro these electrodes.

$Zn/Zn^{2+}(1.0M)||Cu^{2+}(1.0M)/Cu$

$E^\circ Zn^{2+}/Zn = -0.766V, E^\circ Cu^{2+}/Cu = +0.327V$

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21. Electrode potentials of Cu^{2+}/Cu and Ag^{+}/Ag electrodes are $+0.33V$ and $+0.8V$ respectively. What is the EMF of the cell constructed from these electrodes.

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22. $E^\circ Zn^{2+}/Zn = -0.77V$. What is the 'E' value of the electrode containing $0.01MZn^{2+}$ ions

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23. Write the cell reactions for

a) $Ni/Ni^{2+}//Cu^{2+}/Cu$

b) $Cu^{2+}/Cu//Cl^{-}\frac{1}{2}Cl_2$

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24. Calculate E of the cell with $Cu^{2+}(0.1)/Cu$

electrode and $Cl^{-}(0.1M)/\frac{1}{2}Cl_2$, Pt electrode.

$E^\circ Cu^{2+}/Cu = +0.33V$ and

$E^\circ \frac{1}{2}Cl_2/Cl^{-} = 1.36V$

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Subjective Exercise -3 (Very Short Answer Questions)

1. $E^0_{Ag^+, Ag} = 0.8V$. Calculate the single electrode potential in $0.01MAg^+$

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2. What us SHE ?

Watch Video Solution

3. What happens to the reduction potetial up on dilution of the electrolyte ?

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Subjective Exercise -4 (Long Answer Questions)

1. Write the construction and working of dry cell.

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2. Explain the functions of lead accumulator.

Watch Video Solution

3. Discuss the working of hydrogen – oxygen fuel cell. What are the advantages of using this fuel cell?

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Subjective Exercise -4 (Short Answer Questions)

1. Explain the functions of lead accumulator.

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2. Distinguish between primary and secondary cells used as batteries.

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3. What are primary and secondary batteries ? Give one example for each.

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4. Describe Dry cell and Leclanche cell.

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5. What are fuel cells? Discuss the working of fuel cell.

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Subjective Exercise -4 (Very Short Answer Questions)

1. What is a primary battery ? Give one example.

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2. Can torch battery be recharged ? Give reason.

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3. Which of the following is a secondary cell : Daniel dry cell and lead accumulator.

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4. How is a fuel cell represented ?

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5. Mention the fuels and oxidants used in fuel cells ?

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Subjective Exercise -5 (Long Answer Questions)

1. What is corrosion ? Discuss the methods for preventing corrosion .

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Subjective Exercise -5 (Short Answer Questions)

1. Discuss the process of rusting of iron.

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2. Write the mechanism of corrosion.

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Subjective Exercise -5 (Very Short Answer Questions)

1. What is metallie corrosion ? Give one example.

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2. What is meant by sacrifical anode ?

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3. Represent the chemical forula of iron rust.

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4. Which of the following is corroded faster ? Iron pole in sea water or iron pole on the beach.

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5. Iron rod is immersed in NaCl solution such that half its length is exposed to air and the other half immersed in NaCl solution. Which part

is corroded and why ?

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OBJECTIVE EXERCISE - 1 (Electrolytic conductors)

1. Which one of the following materials conducts electricity ?

A. diamond

B. barium sulphate

C. crystalline sodium chloride

D. fused potassium chloride

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2. An electronic conductor is

A. NaCl

B. Diamond

C. Ag

D. KCl

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3. Which of the following is a conductor of electricity

A. diamond

B. graphite

C. carborundum

D. silica

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4. In metallic conductor the current is conducted by flow of

A. ions

B. atoms

C. electrons

D. molecules

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5. In which of the following, HCl conducts electricity to a large extent ?

A. liquid HCl

B. HCl aq. Solution

C. HCl solution in benzene

D. gaseous HCl

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6. Solid NaCl is a bad conductor of electricity because

A. solid NaCl is a covalent compound

B. solid NaCl has no free ions

C. solid NaCl has no free electrons

D. solid NaCl has migration of ions

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7. The decrease in electrical conductivity of metals with increase in temperature is due to increase in

A. the velocity of electrons

B. the resistance of the metal

C. the number of electrons

D. the number of metal atoms

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8. The reason for increase in electrical conduction of electrolyte with increase in temperature is

A) increase in the number of ions

B) increase in the speed of ions

C) increase in the degree of dissociation of electrolyte

A. A, B only

B. B,C only

C. A,C only

D. A, B,C

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9. Sodium metal in liquid ammonia is

A. an ionic conductor

B. an electronic conductor

C. a mixed conductor

D. non - conductor

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10. A solution of Sodium metal in liquid ammonia is strongly reducing agent due to a

A. Sodium atoms

B. Sodium hydride

C. Sodamide

D. Solvated elctrons

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11. Choose the wrong statement

A. electrical conductance of an electrolytic conductor increases with increase in temperature

B. electrical conductance of a metallic conductor increases with increase in temperature

C. electrical conductance of a metallic conductor decreases with increase in temperature

D. degree of dissociation of an electrolyate increases with dilution

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12.

LIST - 1	LIST - 2
A) Electronic conductor	1) Aqueous urea solution
B) Non-electrolyte	2) Solid sodium
C) Electrolytic dissociation	3) Electrolytic conductor
D) Arrhenius	4) Radioactivity increases
	5) Conductivity raises with temperature

The correct match is

A. $\begin{matrix} A & B & C & D \\ 5 & 1 & 2 & 3 \end{matrix}$

B. $\begin{matrix} A & B & C & D \\ 5 & 2 & 1 & 4 \end{matrix}$

C. $\begin{matrix} A & B & C & D \\ 2 & 1 & 5 & 3 \end{matrix}$

D. $\begin{matrix} A & B & C & D \\ 2 & 5 & 1 & 4 \end{matrix}$

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OBJECTIVE EXERCISE - 1 (Arrhenious theory)

1. Which of the following is 100% ionised at any dilution ?

A. CH_3COOH

B. HCN

C. NaCl

D. NH_4OH

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2. Which of the following (1M) conducts more electricity ?

A. sulphuric acid

B. boric acid

C. acetic acid

D. phosphorous acid

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3. The degree of dissociation of an electrolyte in aqueous solution depends on

A) Temperature

B) Concentration of the electrolyte

C) Nature of the electrolyt

A. Only A

B. Only A,B

C. Only B,C

D. A,B,C

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4. At infinite dilution the degree of dissociation for sucrose in aqueous solution is

A. 0

B. 0.5

C. 0.99

D. 1

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5. What happens at infinite dilution in a given solution ?

A. The degree of dissociation is unity for weak electrolytes

B. The electrolyte is 100% ionised

C. All inter ionic attractions disappear

D. All the three

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OBJECTIVE EXERCISE - 1 (Electrolysis)

1. Choose the correct statement regarding electrolytic cell

A. It is a device in which chemical energy is converted into electrical energy

B. Anode is shown by negative sign

C. Oxidation reaction takes place at the anode

D. Electrons flow from cathode to anode

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2. The following are some statements about electrolytic cell

A) in this cell, chemical energy is converted into electrical energy

B) in this cell, electrons flow from cathode to anode

C) in this cell, reduction takes place at cathode

D) in this cell, cathode is a +ve electrode The correct combination is

A. only B

B. only C

C. only C, D

D. only B, C

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3. The reactions taking place al anode and cathode are

A. Oxidation and Reduction

B. Reduction and Oxidation

C. Oxidation and Hydrolysis

D. Reduction and Hydrolysis

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4. The electrode through which the electrons enter the electrolytic solution is

A. cathode

B. anode

C. may be anode or cathode

D. neither anode nor cathode

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5. As electrolysis is in progress, if the cathode plate is removed

A. the movement of ions stopped

B. the ions move at random

C. all ions move towards anode

D. only anions move towards the anode

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6. In the electrolytic cell, flow of electrons is from

A. cathode to anode in the solution

B. cathode to anode through external circuit

C. anode to cathode through external circuit

D. all the these

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7. In electrolysis of dilute H_2SO_4, what is liberated at anode in the presence of inert electrode ?

A. H_2

B. SO_2

C. SO_3

D. O_2

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8. Which process occurs in the electrolysis of aqueous solution of nickel chloride at nickel anode?

A. $Ni^2 + 2e \rightarrow Ni$

B. $2H^+ + 2e \rightarrow H_2$

C. $2Cl \rightarrow Cl_2 + 2e$

D. $Ni \rightarrow Ni^{2+} + 2e$

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9. Molten $CuCl_2$, is electrolysed using platinum electrode. The reaction occuring at anode is

A. $2Cl^- \rightarrow Cl_{2(g)} + 2e^-$

B. $Cl_{2(g)} + 2e^- \rightarrow 2Cl^-$

C. $Cu^{2+} + 2e^- \rightarrow Al$

D. $Cu_{(s)} \rightarrow Cu^{2+} + 2e^-$

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10. During the electrolytic reduction of alumina, the reaction at cathode is

A. $2H_2O \rightarrow O_2 + 4H + 4e^-$

B. $3F \rightarrow 3F + 3e^-$

C. $Al^{3+}3e^- \rightarrow Al$

D. $2H^+ \rightarrow 2e^- \rightarrow H_2$

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11. When an aqueous solution of copper sulphate is electrolysed using copper electrodes the reaction at the anode is represented by

A. $H^{+} + e^{-} \rightarrow H$

B. $Cu^{2+} + 2e^{-} \rightarrow Cu$

C. $SO_{4(aq)}^{2-} \rightarrow SO_4 + 2e^{-}$

D. $Cu_{(s)} \rightarrow Cu_{(aq)}^{2+} + 2e^{-}$

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

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

B. $F_2 \rightarrow 2F^{-}$

C. $\frac{1}{2}O_2 + 2H^+ \rightarrow H_2O$

D. None of these

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13. Aqueous solution of $CuSO_4$ is electrolysed using inert electrodes till the blue coloured solution becomes colourless. The colourless solution formed is

A. $Cu(OH)_2$

B. H_2SO_4

C. $CuSO_4$

D. H_2O

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14. After the electrolysis of aqueous solution of NaCl using Pt electrodes, the pH of the solution

A. increases

B. decreases

C. remains constant

D. becomes zero

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15. During the electrolysis of aqueous solution of the following, molarity of the solution increases without changing the chemical composition

A. NaCl

B. HCl

C. $CuSO_4$

D. H_2SO_4

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16. Aqueous NaCl solution is electrolyzed using platinum electrodes. What is the product formed at cathode?

A. Na

B. H_2

C. O_2

D. Cl_2

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17. At anode in the electrolysis of fuscd sodium chloride

A. Na^+ is oxidised

B. Cl^- is oxidised

C. Cl is reduced

D. Na is reduced

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18. In electrolysis of NaCl when Pt electode is taken then H_2 is liberated at cathode while with Hg cathode, it forms sodium amalgam. This is because

A. Hg is more inert than Pt

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

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

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

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19. Which of the following ions is discharged at the cathode when an aqueous solution of sodium hydroxide is electrolysed ?

A. Hydrogen

B. Hydroxy1

C. Oxygen

D. Sodium

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20. During electrolysis of fused NaOH

A. Hydrogen is liberated at cathode

B. Oxygen is liberated at cathode

C. Hydrogen is liberated at anode

D. Oxygen is liberated at anode

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21. Aqueous solution of $AgNO_3$ is electrolysed using inert electrodes. At the end of electrolysis

A. pH of the solution increases

B. pH of the solution decreases

C. pH of the solution remains unchanged

D. pH of the solution becomes 14

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22. At cathode, the electrolysis of aqueous Na_2SO_4 gives

A. Na

B. H_2

C. SO_3

D. SO_2

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23. An aqueous solution containing one mole per litre of each $Cu(NO_3)_2$, $AgNO_3$. $Hg(NO_3)_2$, $Mg(NO_3)_2$ is being electrolysed using inert electrodes. The values of standard electrode potential (reduction potential) in volts are

$Ag/Ag^{+} = +0.80V \quad Hg/Hg^{2+} = +0.79V \quad Cu/Cu^{2+} = +0.34V \quad Mg/Mg^{2+} =$

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

A. Ag, Hg, Cu, M,g

B. Mg,Cu, Hg, Ag

C. Ag, Hg, Cu

D. Cu, Hg, Ag

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24. The electrolysis of an aqueous solution of KNO_3 between platinum electrode gives

A. K at the cathcode NO_2 at the anode

B. H_2 at cathcode and O_2 at anode

C. H_2 at cathode and NO_2 at anode

D. K at cathode and O_2 at anode

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OBJECTIVE EXERCISE - 1 (Faradays laws)

1. According to Faraday's first Law of electrolysis mass of substance liberated is equal to

A. eC

B. eQ

C. et

D. eCt/nF

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2. When the same charge is passed through the solutions of different electrolytes in series, the amounts of elements deposited in the electrodes are in the ratio of their

A. atomic numbers

B. atomic weights

C. specific gravities

D. equivalent weights

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3. According to 2nd law of Faraday's electrolysis the correct one is

i) $\dfrac{\text{wt. of } H_2 \text{ liberated}}{\text{wt. of } Cl_2 \text{ librated}} = \dfrac{\text{eq. wt . of} H_2}{\text{eq. wt . of } Cl_2}$ ii) $\dfrac{m_{Ag}}{m_{cu}} = \dfrac{E_{Ag}}{E_{Cn}}$

iii) $\dfrac{m_{Ag}}{m_{Cu}} = \dfrac{E_{Cu}}{E_{Ag}}$ iv) $\dfrac{m_{H_2}}{m_{Cu}} = \dfrac{E_{H_2}}{E_{Cu}}$

The correct combination is

A. only ii, iv

B. only i

C. only I, ii, iv

D. only ii, iii

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4. One Faraday is equal to

A. $96.5cmol^{-1}$

B. $96500cmol^{-}$

C. $6.023 \times 10^{23}mol^{-1}$

D. $96.5 \times 10^{23}cmol^{-1}$

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5. For the discharge of equal masses of the following ions, the number of electrons required is maximum in the case of

A. H^{+}

B. Cu^{2+}

C. Ag^{+}

D. Al^{3+}

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6.

LIST-1	LIST - 2
A) Faraday's first law	1) $e \times 96500$
B) Chemical equivalent	2) $\frac{m_1}{E_1} = \frac{m_2}{E_2}$
C) Faraday's second law	3) S.H.E.
D) Pt, $H_2(atm)/H^+(1M)$	4) $m = eQ$
	5) Salt bridge

The correct match is

A.

A	B	C	D
4	1	3	2

B.

A	B	C	D
4	5	2	3

C.

A	B	C	D
1	1	2	3

D.

A	B	C	D
4	1	2	3

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7. One Faraday of electricity will liberate 1 gram atom of the metal from the solution of

A. $CuCl_2$

B. $CuSO_4$

C. $AgNO_3$

D. $AuCl_3$

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8. (A) : Same amount of copper can be deposited from cupric salt and cuprons salt using one faraday.

(R): One faraday can deposite one equivalent of copper.

The correct answer is

A. Both (A) and (R) are true and (R) properly explans (A)

B. Both (A) and (R) are true and (R) does not explan (A)

C. (A) is true, but (R) is false.

D. (A) is false, but (R) is true

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9.

LIST - 1	LIST - 2
A) One faraday	1) Reduction
B) Anode	2) 96500 coulomb
C) Cathode	3) 6.24×10^{18} electrons
D) One coulomb	4) Oxidation
	5) $Z \times 96{,}500$

The correct match is

A.
A	B	C	D
5	4	2	3

B.
A	B	C	D
2	4	1	3

C.
A	B	C	D
2	4	1	5

D.
A	B	C	D
5	2	1	3

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10. The weight of hydrogen deposited at cathode when 965 amperes current is passed for 100 seconds through acidulated water is

A. 0.1g

B. 0.01g

C. 1g

D. 2g

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OBJECTIVE EXERCISE - 1 (Electrolytic conductance)

1. The minimum conductance in fused state is shown by

A. $MgCl_2$

B. $CaCl_2$

C. $BaCl_2$

D. $SrCl_2$

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2. The ionic conductance of following cations in a given conc. is in the order

A. $Li^+ < Na^+ < K^+ < Rb^+$

B. $Li^+ > Na^+ >^+ > Rb^+$

C. $Li^+ < Na^+ >^+ > Rb^+$

D. $Li^+ = Na^+ < K^+ < Rb^+$

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3. The value of molar conductivity of HCl is greater than that of NaCl at a particular temperature because

A. Molecular mass of HCl is greater than that of NaCl

B. Mobility of H^+ ions is more than that of Na^+ ions

C. HCl is strongly acidic

D. Ionisation of HCl is larger than that of NaCl

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4. The unit of specific conductivity is

A. ohms cm^{-1}

B. ohms cm^{-2}

C. ohm^{-1} cm

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

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5. The unit of equivalent conductivity is

A. ohm cm

B. $ohm^{-1}cm^2(\text{g equivalent})^{-1}$

C. S cm^{-2}

D. ohm cm^2 (g equivalent)

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6. The equivalent conductance of 1N solution of an electrolyte is nearly

A. Same as its specific conductance

B. 10^{-3} times its specific conductance

C. 10^2 times more than its specific conductance

D. 10^3 times more than its specific conductance

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7. The highest electrical conductivity among the following aqueous solutions is of

A. 0.1 M acetic acid

B. 0.1 M chloroacetic acid

C. 0.1 M fluorocetic acid

D. 0.1 M difluoroacetic acid

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8. Conductance is directly proportional to area of the vessel and the concentration of solution in it and is inversly proportional to the length of the vessel, then the unit of the constant of proportionality is

A. S.m mol^{-1}

B. $S.\ m^2 mol^{-1}$

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

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

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9. If the specific conductance and conductance of a solution are same, then its cell constant is equal to

A. 1

B. 0

C. 10

D. 100

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10. Specific conductivity of a solution

A. increases with dilution

B. decreases with dilution

C. remains unchanged with dilution

D. depends on mass of electrolyte.

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11. A solution of concentration C g equiv/L, has a specific resistance R. The equivalent conductance of the solution is

A. R/C

B. C/R

C. $\frac{1000}{RC}$

D. $\frac{1000R}{C}$

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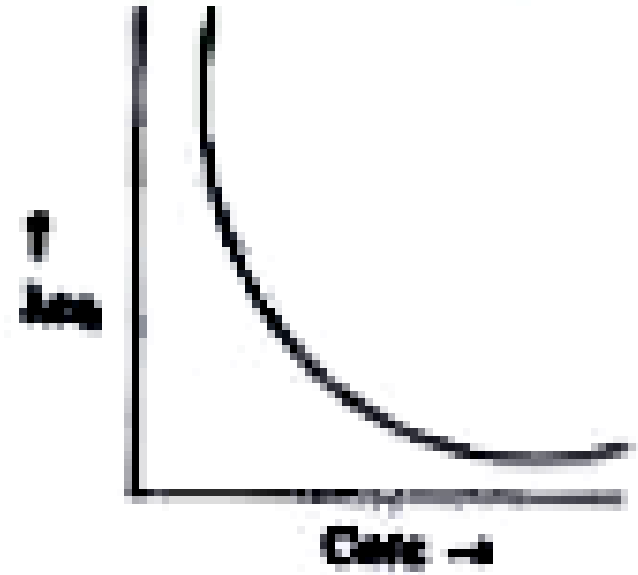
12. A graph is drawn between the λ_{eq} values and concentration of an electrolyte. Which of the following electrolyte will correspond to the graph given ?



A. KCl

B. $BaCl_2$

C. H_2SO_4

D. CH_3COOH

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13. For which case $'\lambda'$ values v/s $\sqrt{c}$ shows a straight line

A. KCl

B. HCOOH

C. CH_3NH_2

D. CH_3COOH

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14. According to Kohlrausch law, the limiting value of molar conductivity of an electrolyte A_2B is

A. $\lambda_{A^+}^{\infty} + \lambda_{B^{-2}}^{\infty}$

B. $\frac{1}{2}\lambda_{A^+}^{\infty} + \lambda_{B^{-2}}^{\infty}$

C. $2\lambda_{A^+}^{\infty} + \frac{1}{2}\lambda_{B^{-2}}^{\infty}$

D. $2\lambda_{A^+}^{\infty} + \lambda_{B^{-2}}^{\infty}$

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15. The equation representing kohlrausch law from the following is

A. $\lambda_m = \frac{100}{C_m}$

B. $\lambda_m^0 = v^+\lambda_+^0 + v^-.\lambda_-^0$

C. $\lambda_{eq} = \frac{1000K}{C_{eq}}$

D. $\lambda_m^0 = \lambda_c + \lambda_a$

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16. The expression showing the relationship between equivalent conductivity and molar conductivity is

A. $\lambda_m = Z \times \lambda_{eq}$

B. $\lambda_{eq} = Z \times \lambda_m$

C. $\lambda_m = \frac{\lambda_{eq}}{Z}$

D. $\lambda_m = \lambda_{eq}^2$

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17. The equivalent conductances of two strong electrolytes at infinite dilutution in H_2O (where ion move freely through a solution) at $25^\circ C$ are give below $\Lambda^0_{CH_3COONa} = 91.0 Scm^2/\text{equiv}, \Lambda^0_{HCl} = 426.2 Scm^2/\text{equiv}$ What additional information / quantity one needs to calculate Λ^0 of an aqueous solution of acetic acid ?

A. Λ° of CH_3COOK

B. Λ° of H^+

C. Λ° of $ClCH_2COOH$

D. Λ° of NaCl

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18. The molar conductivities Λ^0_{NaOAc} and Λ^0_{HCl} at infinite dilute in water at $25\,^{\circ}C$ are $91.0 Scm^2/\text{mol}$ and $426.2 Scm^2/\text{mol}$ respectively . To calculate Λ^0_{HOAc} the additional value required is

A. Λ°_{NaCl}

B. $\Lambda^{\circ}_{H_2O}$

C. Λ°_{KCl}

D. Λ°_{NaOH}

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OBJECTIVE EXERCISE - 1 (Galvanic cells)

1. In a Galvanic cell, the electrons flow from

A. anode to cathode through the solution

B. cathode to anode through the solution

C. anode to cathode through the external circuit

D. cathode ot anode through the external circuit.

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2. Which of the following statements is wrong about galvanic cells

A. cathode is the positive electrode

B. cathode is the negative electrode

C. electrons flow from anode to cathode in the external circuit

D. reduction occurs at cathode

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3. Which of the following statements is correct w.r.t. both electrolytic cell and Galvanic cell

A. in both cells, anode is shown by +ve sign

B. in both cells, cathode is shown by -ve sign

C. in both cells, reduction reaction takes place at the cathode

D. in both cells, oxidation reaction takes place at the cathode

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4. Saturated solution of KNO_3 is used to inake salt bridge because

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

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

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

D. KNO_3 is highly soluble in water.

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5. The function of a salt bridge is

A. to provide a link between two half cells

B. to allow ions to go from one cell to another

C. to keep the emf of the cell positive

D. to maintain electrical neutrality of the solution in two half cells

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6. Which of the following is correct?

A. Zinc acts as cathode in Daniel cell

B. In a Li-Zn couple, zinc acts as anode

C. Copper displaces iron from its salt solution

D. Zinc displaces tin from its salt solution

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

A. Electrons flow from copper electrode to zinc electrode

B. Current flows from zinc electrode to copper electrode

C. Cations move towards copper electrode

D. Cations move toward zinc electrode

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8. The cell reaction of the galvanic cell, $Cu(s)/Cu^{2+}(aq)/Hg^{2+}(aq)/Hg(l)$ is

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

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

C. $Hg + Cu^{2+} \rightarrow CuHg$

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

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9. The cell for which the cell reaction is $H_2 + Cu^{2+} \rightarrow 2H^{+} + Cu$ is represented as

A. $Cu/Cu^{2+}/H^{+}/H_2$

B. $H_{2(g)}/H^{+}//Cu^{2+}/Cu$

C. $Pt, H_2(1atm), H^{+}//Cu^{2+}/Cu$

D. $Pt, H_2/H^{+}_{(aq)}(1atm)//Cu^{2+}/Cu$

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10. Which metal will dissolve if the cell works $Cu\left|Cu^{2+}\right| \mid Ag^{+}|Ag$

A. Cu

B. Ag

C. Both (1) and (2)

D. None of these

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11. The chemical reaction $2AgCl_{(s)} + H_{2(g)} \rightarrow 2HCl_{(aq)} + 2Ag_{(s)}$ taking place in a galvanic cell is represented by the notation.

A. $Pt_{(s)}\left|H_{2(g)}, 1\text{bar}\right|1MKCl_{(aq)}\left|AgCl_{(s)}\right|Ag_{(s)}$

B. $Pt_{(s)}\left|H_{2(g)}, 1\text{bar}\right|1MHCl_{(aq)} \mid 1MAg^{+}_{(aq)}|Ag_{(s)}$

C. $Pt_{(s)}\left|H_{2(g)}, 1\text{bar}\right|1MHCl_{(aq)}\left|AgCl_{(s)}\right|Ag_{(s)}$

D. $Pt_{(s)}\left|H_{2(g)}, 1\text{bar}\right|1MHCl_{(aq)} \mid Ag_{(s)}|AgCl_{(s)}$

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12. Which is a correct cell reaction ?

A. $Zn + 2Ag^{+} \rightarrow Zn^{2+} + 2Ag$

B. $2Ag + Zn^{+} \rightarrow 2Ag^{+} + Zn$

C. Both

D. None

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13. Stronger the oxidising agent greater is the

A. Oxidation potential

B. Reduction potential

C. Redox potential

D. Hydration potential

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14. The reaction , $1/2H_{2(g)} + AgCl_{(s)} \rightarrow H^{+}_{(aq)} + Cl^{-}_{(aq)} + Ag_{(s)}$ occurs in the galvanic cell :

A. $Ag \mid AgCl_{(s)} \mid KCl_{(Soln)} \mid AgNO_{3(soln)} \mid Ag$

B. $Pt, H_{2(s)} \mid HCl_{Soln} \mid AgNO_{3(soln)} \mid Ag$

C. $Pt, H_{2(g)} \| HCl_{(Soln)} \| AgCl_{(s)} \mid Ag$

D. $Pt, H_{2(g)} \| KCl_{(Soln)} \| AgCl_{(s)} \mid Ag$

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15. For spontanity of a cell, which is correct ?

A. $\Delta G = 0, \Delta E = 0$

B. $\Delta G = - Ve, \Delta E = 0$

C. $\Delta G = + Ve, \Delta E = 0$

D. $\Delta G = - Ve$

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16. If the cell reaction is spontaneous

A. E° is -ve

B. ΔG is positive

C. E° is +ve

D. $\left(\Delta G + E^{\circ}\right)$ is positive

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OBJECTIVE EXERCISE - 1 (Electrode potentials and EMF)

1. The metal that cannot displace hydrogen from dilute hydrochloric acid is

A. aluminimum

B. iron

C. copper

D. zinc

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2. The following are some statements about normal hydrogen electrode

a) when a 'Zn' electrode is in combination of NHE, Zn electrode acts as cathode

b) when a ‘Cu' electrode is in combination with NHE, Cu electrode is the anode

c) when a ‘Ag' electrode is in combination with NHE, Ag electrode is the anode

d) when a chlorine electrode is in combination with NHE, chlorine electrode is the anode

A. only (1) is correct

B. all are correct

C. all are incorrect

D. both 2 & 3 correct

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3. 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

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4. Which defines the standard reduction electrode potential of Zn^{2+} ions?

A. $Zn^{2+}_{(aq)} + 2e \rightarrow Zn_{(s)}, \left[Zn^{2+}\right] = 1M$

B. $Zn_{(g)} \rightarrow Zn^{(2+)} + 2e, \left[Zn^{2+}\right] = 1M$

C. $Zn^{2+}_{(aq)} \rightarrow Zn_{(s)} + 2e, \left[Zn^{2+}\right] = 1M$

D. $Zn^{2+}_{(g)} \rightarrow Zn_{(s)} - 2e, \left[Zn^{2+}\right] = 1M$

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5. The reference electrode is made by using

A. $ZnCl_2$

B. $CuSO_4$

C. $HgCl_2$

D. Hg_2Cl_2

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6. The more electro positive element has

A. positive reduction potential

B. negative reduction potential

C. tendency to gain electrons

D. negative oxidation potential

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7. A smuggler could not carry gold by depositing iron on the gold surface since

A. Gold is denser

B. Iron rusts

C. Gold has higher reduction potential than iron

D. Gold has lower reduction potential than iron

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	LIST - 1	LIST - 2
	A) Very dilute H_2SO_4 by inert electrodes	1) $Hg/Hg_2Cl_{2(S)}$, KCl/(salt)
	B) Potential is zerovolts	2) $H_2S_2O_8$ at anode
8.	C) 50 % H_2SO_4 by inert electrodes	3) Daniel cell
	D) $Zn/Zn^{+2}_{(aq)}//Cu^{+2}_{(aq)}/Cu$	4) O_2 at anode
		5) Pt, $H_2(1atm)/H^+(1M)$

The correct match is

A.

A	B	C	D
4	5	2	3

B.

A	B	C	D
2	1	4	3

C.

A	B	C	D
2	5	4	3

D.

A	B	C	D
5	3	1	2

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9. Standard reduction electrode potential of three metals A, B and C are respectively +0.05 V, -3.0 and -1.2 V. The reducing powers of

A. $B > C > A$

B. $A > B > C$

C. $C > B > A$

D. $A > C > B$

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10. The difference of potential of two electrodes in a galvanic cell is known as

A. EMF

B. Potential differnce

C. Electrode differnce

D. Ionic difference

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11. Standard reduction electrode potential of three metals A, B and C are respectively +0.05 V, -3.0 and -1.2 V. The reducing powers of

A. A

B. B

C. C

D. D

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

A. Zn acts as oxidizing agent when reacts with HNO_3

B. HNO_3 is weaker acid than H_2SO_4 and HCl

C. In electrochemical series Zn is above hydrogen

D. NO_3^- is reduced in preference to hydronium ion

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13. The standard reduction potentials at 298 K for the following half cell reactions are given below

$Zn^{2+}(aq) + 2e^- \rightarrow Zn(s)$ - 0.762

$Cr^{3+}(aq) + 3e^- \rightarrow Cr(s)$ - 0.740

$2H^+(aq) + 2e^- \rightarrow H_2(g)$ - 0.000

$Fe^{3+}(aq) + e^- \rightarrow Fe^{3+}(aq)$ - 0.770

Which one is the strongest reducing agent?

A. $Zn_{(s)}$

B. $H_{2(g)}$

C. $Cr_{(s)}$

D. $Fe^{2+}_{(aq)}$

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14. When Zn piece is kept in $CuSO_4$ solution, copper gets precipitated because :

A. Standard reduction potential of zinc is more than copper

B. Standard reduction potential of zinc is less than copper

C. Atomic number of zinc is larger than copper

D. Atomic number of zinc is lower than copper

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15. Beryllium is placed above magnesium in the II group. When beryllium dust is added to $MgCl_2$ solution, it

A. Have no effect

B. Precipitate Mg metal

C. Precipitate MgO

D. Lead to dissolution of Be metal

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16. For $I_2 + 2e \rightarrow 2I^-$, standard reduction potential = $+0.54$ volt. For $2Br^- \rightarrow Br_2 + 2e^-$. Standard oxidation potential = - 1.09 volt. For $Fe \rightarrow Fe^{2+} + 2e^-$, standard oxidation potential = + 0.44 volt. Which of the following reaction is non-spontaneous ?

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

B. $Fe + Br_2 \rightarrow Fe^{2+} + 2Br^-$

C. $Fe + I_2 \rightarrow Fe^{2+} + 2I^-$

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

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17. Which of the following reactions are not feasible?

A. $2KI + Br_2 \rightarrow 2Br + I_2$

B. $2KBr + I_2 \rightarrow 2KI + Br_2$

C. $2KBr + Cl_2 \rightarrow 2KCl + Br_2$

D. $2H_2O + 2F_2 \rightarrow 4HF + O_2$

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18. E° for $Fe^{2+} + 2e \rightarrow Fe$ is -0.44 V , E° for $Zn^{2+} + 2e \rightarrow Zn$ is - 0.76 V .

Then

A. Zn is more electropositive than Fe

B. Fe is more electronegative than Zn

C. Zn is more electronegative

D. None of the above

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19. Based on the data given below , the correct order of reducing power is :

$Fe^{3+}_{(aq)} + e \rightarrow Fe^{2+}_{(aq)}, E^\circ = 077V$

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

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

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

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

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

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

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20. The S.R.Ps of Cu^{2+}/Cu, Hg^{2+}/Hg and Zn^{2+}/Zn are respectively 0.34 V , 0.85 V and -0.76 V . The wrong statement is

A. Cu redues Hg^{2+}

B. Zn reduces Cu^{2+}

C. Hg reduces Zn^{2+}

D. Zn reduces both Cu^{2+} and Hg^{2+}

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21. For the cell prepared from electrod A , $Cr_2O_7^{2-} \mid Cr^{3+}, E^{\circ}_{\text{red}} = +1.33V$ and electrode $B: Fe^{3+} \mid Fe^{2+}, E^{\circ}_{\text{red}} = 0.77V$. Which of the following statement is correct ?

A. The electrons will flow from B to A when connection is made

B. The e.m.f. of the cell will be 0.56V

C. A will be positive electroe

D. All of the above

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22. Standared electrode potential of two half-reactions are given below :

$Fe^{2+} \Leftrightarrow Fe \quad E^{\circ} = -0.44V, Fe^{3+} \Leftrightarrow Fe^{2+} \quad E^{\circ} = +0.77V$

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

A. Fe^{3+} increases

B. Fe^{3+} decreases

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

D. Fe^{2+} decreases

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23. The $E^{0}_{M^{3+} \mid M^{2+}}$ values for Cr, Mn, Fe and Co are -0.41, +1.57V, + 0.77 and +1.97V respectively. For which one of these metals the change in oxidation sate from +2 to +3 is easiest?

A. Co

B. Mn

C. Fe

D. Cr

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24. The standard reduction potentials of Zn and Ag in water at 298 K are,

$Zn^{2+} + 2e^{-} \rightarrow Zn, E^{\circ} = -0.76V$ and

$Ag^{+} + e^{-} \rightarrow Ag, E^{\circ} = +0.80V$

Which of the following reactions take place?

A. $Zn^{2+}_{(aq)} + Ag^{+}_{(aq)} \rightarrow Zn_{(s)} + Ag_{(s)}$

B. $Zn_{(s)} + Ag_{(s)} \rightarrow Zn^{2+}_{(aq)} + Ag^{+}_{(aq)}$

C. $Zn^{2+}_{(aq)} + 2Ag_{(s)} \rightarrow 2Ag^{+}_{(aq)} + Zn_{(s)}$

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

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25. A student made the following observations in the laboratory,

A) Clean copper metal did not react with 1 molar $Pb(NO_3)_2$ solution

B) Clean lead metal dissolved in a 1 molar $AgNO_3$ solution and crystals of Ag metal appeared

C) Clean silver metal did not react with 1 molar $Cu(NO_3)_2$ solution.

The order of decreasing reducing character of the three metals is :

A. Cu, Pb, Ag

B. Cu, Ag, Pb

C. Pb, Cu, Ag

D. Pb, Ag, Cu

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26. For the electrochemical cell $M/M^{+}//X^{-}/X, E^{0}M^{+}/M = 0.44V$ and $E^{0}\left(x/x^{-}\right) = 0.33V$. From the one can deduce that

A. $M + X \rightarrow M^{+} + X^{-}$ is the spontaneous reaction

B. $M^{+} + X^{-} \rightarrow M + X$ is the spontaneous reaction

C. $E_{cell} = 0.11V$

D. $E_{cell} = -0.77V$

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27. Four colourless salt solutions are placed in separate test tubes and a strip of copper is placed in each. Which solution finally turns blue?

A. $Pb(NO_3)_2$

B. $Zn(NO_3)_2$

C. $AgNO_3$

D. $Cd(NO_3)_2$

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OBJECTIVE EXERCISE - 1 (Nernst equation)

1. The potential of single electrode depends upon

A. the name of the electrode

B. temperature

C. concentration of the iron with respect to which it is reversible

D. all the above

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2. The Nernst equation giving dependence of electrode potential on concentration is

A. $E = E^\circ + \frac{2.303RT}{nF}\log.\frac{[M]}{\left[M^{n+}\right]}$

B. $E = E^\circ + \frac{2.303RT}{nF}\log.\frac{\left[M^{n+}\right]}{[M]}$

C. $E = E^\circ$ - $\frac{2.303RT}{nF}\log.\frac{\left[M^{n+}\right]}{[M]}$

D. $E = E^\circ$ - $\frac{2.303RT}{nF}\log\left[M^{n+}\right]$

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3. Consider the following four electrode :

$A = Cu^{2+}(0.0001M)/Cu(S)$ B=$Cu^{2+}(0.1M)/Cu(s)$

C =$Cu^{2+}(0.01M)/Cu(s)$ D) $= Cu^{2+}(0.001M)/Cu(s)$

If the standard reduction potential of Cu^{+2}/Cu is + 0.34 V , the reduction potential (in volts) of the above electrodes follow the order

A. $A > D > C > B$

B. $B > C > D > A$

C. $C > D > B > A$

D. $A > B > C > D$

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4. Which of the following is not correct ?

A. Aqueous solution of NaCl is an electrolyte

B. The units of electrochemical equivalent are g.coulomb.

C. In the Nernst reprresents the number of electrons tranferred in the elctrode raction.

D. Standard reduction potential of hydrogen electrode is zero volts.

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5. The Nernst equation for the reduction potential of a non metal A when $\left[A^{n-}\right]=C$ is given by

A. $E^{\circ}+\frac{0.059}{n}\log C$

B. $E^{\circ}-\frac{0.059}{n}\log C$

C. $E^{\circ}+\frac{0.059}{n}\log C^{n}$

D. $E^{\circ}-\frac{0.059}{n}\log.\frac{1}{C}$

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6. The e.m.f of the following Deniell at $298K$ is $E_1, Zn/ZnSO_4(0.01M)//CuSO_4(1.0M)/Cu$ When the concentration of

$ZnSO_4$ is 1.0 M and that of $CuSO_4$ is 0.01M, the e.m.f. 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. $E_2 = 0 \neq E_1$

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7. $Zn(s) + Cl_2(1atm) \rightarrow Zn^{2+} + 2Cl^-$, the E^0 of the cell is 2.12 V . To increase E

A. Zn^{2+} concentration should be increased

B. Zn^{2+} concentration should be decreased

C. Cl^- concentration should be increased

D. partial preassure of Cl_2 should be decreased.

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8. In a cell that utilises the reaction $Zn_{(s)} + 2H^{+}_{(aq)} \rightarrow Zn^{2+}_{(aq)} + H_{2(g)}$ addition of H_2SO_4 to cathode compartment, will

A. lower the E and shift equilibrium to the left

B. increase the E and shift equlibrium to the left

C. increase the E and shift equilbrium to the right

D. lower the E and shift equilibrium to the right

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9. For the cell $Zn/Zn^{2+}//Cu^{2+}/Cu$, if the concentration of Zn^{2+} and Cu^{2+} ions is doubled , the emf of the cell

A. doubles

B. reduces to half

C. remains same

D. remains zero

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10. For a cell reaction , $Cu^{2+}\left(C_1, aq\right) + Zn(s) \rightarrow Zn^{2+}\left(C_2, aq\right) + Cu(s)$ of an electro chemical cell , the change in standard free energy , ΔG^0 at a given temeprature is

A. $\Delta G^\circ = RT\ln.\dfrac{C_2}{C_1}$

B. $\Delta G^\circ = -RT\ln.\dfrac{C_2}{C_1}$

C. $\Delta G^\circ = RT\ln C_2$

D. $\Delta G^\circ = -RT\ln C_2$

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11. For a spontaneous reaction the ΔG, equilibrium constant (K) and E^{0}_{cell} will be respectively .

A. $-ve, \ > 1, \ + ve$

B. $-ve, \ > 1, \ - ve$

C. $-ve, \ < 1, \ - ve$

D. $-ve, \ > 1, \ - ve$

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12. For the reaction $Pt/H_2(1atm)/H^{+}(aq)//Cl^{-}(aq)/AgCl/Ag, K_c$ (equilibrium constant) is represented as

A. $K_c = \dfrac{\left[Cl^{-}\right][AgCl]}{\left[H^{+}\right]\left[H_2\right]}$

B. $K_c = \left[H^{+}\right]\left[Cl^{-}\right]$

C. $K_c = \frac{[H^+][H_2]}{[Cl^-][AgCl]}$

D. $K_c = \frac{[H_2]}{[Ag]}$

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13. The relationship between free energy and electrode potential is

A. $\Delta G = -nFE$

B. $\Delta G = nFE$

C. $\Delta G = \frac{nFE}{R}$

D. $\Delta G = \frac{\Delta H}{nFE}$

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14. The correct realtionship between free energy change in a reaction and the corresponding equilibrium constant $K_C$is

A. $\Delta G^\circ = RT\ln K_C$

B. $\Delta G^\circ = -RT\ln K_C$

C. $\Delta G = RT\ln K_C$

D. $\Delta = -RT\ln_C$

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OBJECTIVE EXERCISE - 1 (Batteries)

1. When an electric cell is charged, then

A. voltage of cell increases

B. electrolyte of cell dilutes

C. resistance of cell increases

D. None of these

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Exercise -2

1. The amount of chlorine evolved when 2 amperes of current is passed for 30 minutes in an aqueous solution of NaCl

A. 66 g

B. 1.32 g

C. 33 g

D. 99 g

Answer: B

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Exercise -2 (Electrolytic conductance)

1. The conductivity of 0.001 M acetic acid is 5×10^{-5} S cm^{-1} and $\wedge^{0}$ is 390.5 S $cm^{2}\text{mol}^{-1}$ then the calculated value of dissociation constant of acetic acid would be

A. 81.78×10^{-4}

B. 81.78×10^{-5}

C. 18.78×10^{-6}

D. 18.78×10^{-5}

Answer: C

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2. The distance between two electrodes of a cell is 2.5 cm and area of each electrode is 5 cm2 the cell constant (in cm^{-1}) is

A. 2

B. 12.5

C. 7.5

D. 0.5

Answer: D

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3. The limiting molar conductivities $\left(\Lambda^{0}\right)$ for NaCl, KBr and KCl are 126, 152 and 150 S.$cm^{2}\text{mol}^{-1}$ respectively. Then A for NaBr is

A. $128Scm^{2}mol^{-1}$

B. $302Scm^{2}mol^{-1}$

C. $278Scm^{2}mol^{-1}$

D. $176Scm^{2}mol^{-1}$

Answer: A

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4. Which of the following solutions of NaCl has the higher specific conductance ?

A. 0.001N

B. 0.01N

C. 0.1 N

D. 1 N

Answer: D

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5. Molar conductivity of a solution is $1.26 \times 10^2 \Omega^{-1} cm^2 \text{mol}^{-1}$. Its molarity is 0.01M. Its specific conductivity will be

A. 1.26×10^{-5}

B. 1.26×10^{-3}

C. 1.26×10^{-4}

D. 0.0063

Answer: B

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6. The values of equivalent conductivity at infinite dilutions for NH_4Cl, NaOH and NaCl are respectively 149.74, 248.1 and 126.4 $\text{ohm}^{-1}cm^2\text{equi}^{-1}$. The value of λ_{eg}^{∞} of NH_4OH is

A. 371.44

B. 271.44

C. 71.44

D. It cannot be calculated from the data given

Answer: B

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7. Specific conductance of 0.1 M Nitric acid is $6.3 \times 10^{-2} \text{ohm}^{-1} cm^{-1} \text{mol}^{-1}$

The molar conductance of the solution is

A. $630 ohm^{-1} cm^2$

B. $315 ohm^{-1} cm^2$

C. $100 ohm^{-1} cm^2$

D. $6300 ohm^{-1} cm^2$

Answer: A

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8. For an electrolytic solution of 0.05 mole litre^{-1}, the conductivity has been found to be 0.0110 S cm^{-1}. The molar conductivity (in $Scm^2 \text{mole}^{-1}$) is

A. 0.055

B. 550

C. 0.22

D. 220

Answer: D

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9. Molar ionic conductivities of a bivalent electrolyte are 57 and 73. The molar conductivity of the solution will be

A. $130 Scm^2 mol^{-1}$

B. $65 Scm^2 mol^{-1}$

C. $260 Scm^2 mol^{-1}$

D. $187 Scm^2 mol^{-1}$

Answer: A

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10. The conductivity of $0.001028 mol L^{-1}$ acetic acid is $4.95 \times 10^{-5} S cm^{-1}$. Calculate its dissociation constant if Λ_m^0 for acetic is $390.5 S cm^2 mol^{-1}$?

A. 14. 1

B. 141

C. 1410

D. 1.41

Answer: B

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Exercise -2 (Nernst equation and EMF)

1. EMF of a cell in terms of reduction potential of its left and right electrodes is

A. $E = E_{\text{left}} - E_{\text{right}}$

B. $E = E_{\text{left}} + E_{\text{right}}$

C. $E = E_{\text{right}} - E_{\text{left}}$

D. $E = -\left(E_{\text{right}} + E_{\text{left}}\right)$

Answer: C

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2. E^0 for the half cell Zn^{2+}/Zn is - 0.76 V . Emf of the cell $Zn/Zn^{2+}(1M)//H^+(1M)/H_2$ at 1 atm is

A. -0.76V

B. $+0.76$ V

C. $-0.38V$

D. $+0.38V$

Answer: B

Watch Video Solution

3. If the standard electrode protential of Cu^{2+}/Cu electrode is 0.34 V , what is the electrode potential at 0.01 M concentration of Cu^{2+}? (T = $298\,^{\circ}$K)

A. 0.399V

B. 0.281V

C. 0.222V

D. 0.176V

Answer: B

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4. The potential of hydrogen electrode is -118 mV . The H^{+} concentration of the solution is

A. 0.01M

B. 2M

C. $10^{-4}M$

D. $1M$

Answer: A

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5. The standard potential $\left(E^0\right)$ for the half reaction are as $Zn \rightarrow Zn^{2+} + 2e^-, E^0 = +0.76V$

$Fe \rightarrow Fe^{2+} + 2e^-, E^0 = +0.41V$. The emf for the cell reaction $Fe^{2+} + Zn \rightarrow Zn^{2+} + Fe$ is

A. $-0.35V$

B. $+0.35V$

C. $+1.17V$

D. $-1.17V$

Answer: B

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6. E^0 for $F_2 + 2e^- \rightarrow 2F^-$ is 2.8 V, E^0 for $1/2F_2 + e^- \rightarrow F^-$ is

A. 2.8V

B. 1.4V

C. $-2.8V$

D. $-1.4V$

Answer: A

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7. Consider the following E^0 values $E^0_{Fe^{3+}/Fe^{2+}} = +0.77V, E^0_{Sn^{2+}/Sn} = -0.14V$ Under standard condition the potential for the reaction $Sn_{(s)} + 2Fe^{3+}_{(aq)} \rightarrow 2Fe^{2+}_{(aq)} + Sn^{2+}_{(aq)}$ is

A. 1.68V

B. 0.63V

C. 0.91V

D. 1.40V

Answer: C

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8. E^0 for the reaction $Fe + Zn^{2+} \rightarrow Zn + Fe^{2+}$ is -0.35 V . The given cell reaction is

A. feasible

B. not feasible

C. explosive

D. slow

Answer: B

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9. E.M.F of the cell reaction , $2Ag^{+} + Cu \rightarrow 2Ag + Cu^{2+}$ is 0.46 V . If $E^{0}_{Cu^{2+}/Cu}$ is | 0.34 V , $E^{0}_{Ag^{+}/Ag}$ is

A. 0.80 V

B. 0.12 V

C. 0.40 V

D. 1.60 V

Answer: A

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10. The EMF of the cell $Ni/Ni^{2+}(0.01)//Cl^{-}(0.01M)/Cl_{2}$, pt is -----V if the SRP of nickel and chlorine electrodes are -0.25V and +1.36V respectively

A. $+1.61$

B. -1.61

C. $+1.79$

D. -1.79

Answer: C

Watch Video Solution

11. The standard electrode potential of the htwo half cells are given below

$Ni^{+2} + 2e^{-} \rightarrow Ni, E^{\circ} = -0.25V, Zn^{+2} + 2e^{-} \rightarrow Zn, E^{0} = -0.77V$

The voltage of cell formed by combining the two half cells would be

A. -1.02

B. $+0.52$ volt

C. $+1.02$ volt

D. -0.52 volt

Answer: B

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12. Aluminium displaces hydrogen from dilute HCl whereas silver does not. The e.m.f. of a cell prepared by combining Al/Al^{3+} and Ag/Ag^{+} is 2.46 V. The reduction potential of silver electrode is + 0.80 V. The reduction potential of aluminium electrode is

A. $+1.66$ V

B. -3.26 V

C. $+3.26$ V

D. -1.66 V

Answer: D

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13. A cell constructed by coupling a standard copper electrode and a standard magnesium electrode has emf of 2.7 volts. If the standard reduction potential of copper electrode is +0.34 volt, that of magnesium electrode is

A. +3.04 volts

B. -3.04 volts

C. +2.36 volts

D. -2.36 volts

Answer: D

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14. The solution of nickel sulphate in which nickel rod is dipped is diluted 10 times. The potential of nickel

A. decreases by 60 mV

B. increases by 30V

C. decreases by 30 mV

D. decreases by 60V

Answer: C

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15. The standard reduction potentials for the two half-cell reactions are given below :

$Cd^{2+}(aq) + 2e^{-} \rightarrow Cd(s), E^{0} = -0.40V \quad Ag^{+}(aq) + e^{-} \rightarrow Ag(s), E^{0} = 0.80V$

The standard free energy change for the reaction $2Ag^{+}_{(aq)} + Cd_{(s)} + Cd^{2+}_{(aq)}$ is given by

A. 115.8 kJ

B. -115.8 kJ

C. -231.6 kJ

D. 231.6 kJ

Answer: C

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16. Normal aluminium electrode coupled with normal hydrogen electrode gives an emf of 1.66V. So the standard electrode potential of aluminium is

A. $-1.66V$

B. $+1.66V$

C. $-0.83V$

D. $+0.83V$

Answer: A

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17. The standard EMF for the cell reaction , $Zn + Cu^{2+} \rightarrow Cu + Zn^{2+}$ is 1.1 volt at $25^{\circ}C$. The EMF for the cell reaction , when $0.1MCu^{2+}$ and $0.1MZn^{2+}$ solutions are used , at $25^{\circ}C$ is

A. 1.10 V

B. 0.10V

C. $-1.10V$

D. $-0.110V$

Answer: A

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18. At a certain temperature and at infinite dilution, the equivalent conductances of sodium benzoate, hydrochloric acid and sodium chloride are 240, 349 and 229 $ohm^{-1}cm^2 \equiv^{-1}$ respectively. The equivalent conductance of benzoic acid in $ohm^{-1}cm^2 \equiv^{-1}$ at the same conditions is

A. 80

B. 328

C. 360

D. 408

Answer: C

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19. The emf of the following three galvanic cells are respresented by E_1, E_2 and E_3 respectively.

Which of the following is correct?

(i) $Zn/Zn^{2+}(1M)//Cu^{2+}(1M)/Cu$

(ii) $Zn/Zn^{2+}(0.1M)//Cu^{2+}(1M)/Cu$

(iii) $Zn/Zn^{2+}(1M)//Cu^{2+}(0.1M)/Cu$

A. $E_1 > E_2 > E_3$

B. $E_3 > E_2 > E_1$

C. $E_3 > E_1 > E_2$

D. $E_2 > E_1 > E_3$

Answer: A

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PRACTICE EXERCISE

1. During electrolysis of a solution of $AgNO_3$, 9650 coulombs of charge pass through the electroplating bath, the mass of silver deposited on the cathode will be

A. 1.08g

B. 10.8g

C. 21.6g

D. 108g

Answer: B

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2. In which one of the following one faraday of electricity liberates 1/2 gram atom of the metal ?

A. $AuCl_3$

B. $FeCl_3$

C. $CuSO_4$

D. $NaCl$

Answer: C

Watch Video Solution

3. On passing 3 amperes of electricity for 50 minutes, 1.8 gm metal deposits. The equivalent mass of metal is

A. 20.533

B. 25.8

C. 19.3

D. 30.7

Answer: C

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4. How many coulombs are required for the oxidation of 1 mole of H_2O_2 to O_2 ?

A. $93000C$

B. 1.93×10^5C

C. 9.65×10^4C

D. 19.3×10^2C

Answer: B

Watch Video Solution

5. 1 coulomb of electricity produces m kg of a substance 'X'. The electrochemical equivalent of 'X' is

A. m

B. $m \times 10^3$

C. $m \times 10^{-3}$

D. 0.1 m

Answer: B

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6. The quantity of electricity required to liberate $112 cm^3$ of hyrogen at STP from acidified water is

A. 965 C

B. 1 Faraday

C. 0.1F

D. 96500 C.

Answer: A

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7. A current of 0.5 ampere when passed through $AgNO_3$ solution for 193 seconds deposited 0.108 g. of silver. The equivalent weight of Ag is

A. 10.8

B. 108

C. 54

D. 1

Answer: B

Watch Video Solution

8. The charge of an electron is $1.6 \times 10^{-19}C$. How many electrons pass through the cross section of a copper wire carrying 10^{-16} amp in 1 second ?

A. 300

B. 1800

C. 1200

D. 625

Answer: D

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9. The passage of electricity through dil H_2SO_4 for 16 minutes liberates a total of 224 ml of H_2. The strength of the current in ampres will be

A. 5A

B. 3A

C. 4A

D. 2A

Answer: D

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10. Silver is monovalent and has atomic mass of 108. Copper is divalent and has an atomic mass of 63.6. The same electric current is passed for the same length of time through a silver coulonent and a copper coulometer. If 27.0 g of silver is deposited, then the corresponding amount of copper deposited is

A. 63.60 g

B. 31.80 g

C. 15.90 g

D. 7.95 g

Answer: D

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11. What is the electrochemical equivalent (in g coulomb^{-1}) of silver ? (Ag = 108, F= faraday)

A. 108 F

B. 108/ F

C. F/108

D. 1 / 108F

Answer: B

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12. An electric current is passed through silver voltameter connected to a water voltameter. The cathode of the silver voltameter weighted 0.108 g more at the end of the electrolysis. The volume of oxygen evolved at STP is

A. $56cm^3$

B. $5.6cm^3$

C. $550cm^3$

D. $22.4cm^3$

Answer: C

Watch Video Solution

13. An electrolytic cell contains a solution of Ag_2SO_4 and platinum electrodes. Current is passed until 1.6 g. of O_2 has been liberated at anode. The amonut of Ag deposited at cathode would be

A. 0.8g

B. 1.6g

C. 21.6g

D. 107.88g

Answer: C

Watch Video Solution

14. The volume of O_2 at STP liberated by 5 amperes flowing for 193 sec through acidulated water will be

A. $56cm^3$

B. $112cm^3$

C. $224cm^3$

D. $448cm^3$

Answer: A

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15. 4.5 g of aluminium (at. Mass 27 amu) is deposited at cathode from a molten electrolyte containing Al^{3+} ions by a certain quantity of electric charge . The volume of hydrogen produced at STP from ions in a solution by the same quantity of electric charge will be

A. 44.8L

B. 11.2L

C. 22.4L

D. 5.6 L

Answer: D

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16. If 36 g. of Al is deposited at the cathode, the number of moles of electrons used is

A. 1

B. 2

C. 3

D. 4

Answer: D

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17. How many coulombs of electricity are consumed when 100 mA current is passed through a solution of $AgNO_3$ for 30 minutes during electrolysis ?

A. 108

B. 180

C. 18000

D. 3000

Answer: B

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18. The ration of weights of Ag and Al deposited at the cathode respectively, when the same current is passed for the same period thorugh molten $Al_2(SO_4)_3$ and aqueous $AgNO_3$ is

A. $1:4$

B. $12:1$

C. $1:12$

D. $4:1$

Answer: B

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19. When X ampress pf current is passed through molten $AlCl_3$ for 96.5 seonds 0.09 grams of aluminium is deposited. What is the value of X?

A. 10

B. 20

C. 30

D. 40

Answer: A

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20. Electrochemical equivalent of a divalent metal is 3×10^{-4} gm/coulomb. The approximate atomic weight of the metal is

A. 107.8

B. 63.6

C. 58

D. 55.9

Answer: C

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21. An electric current is passed through silver nitrate soultion using silver electrodes. 10.79 g of silver was found to be deposited on the cathode if the same amount of electricity is passed through copper sulphate solution using copper electrodes, the weight of copper deposited on the cathode is

A. 6.4 g

B. 2.3 g

C. 12.8 g

D. 3.2 g

Answer: D

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22. One ampere of current is passed for 9650 sec. through molten $AlCl_3$. What is the weight is grams of Al deposited at cathode ?

A. 0.9

B. 9

C. 0.09

D. 90.0

Answer: A

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23. The equivalent conductivity of 0.1 N CH_3COOH at $25\,^{\circ}C$ is 80 and at infinite dilute is $400 ohm cm^2 eq^{-1}$. The degree of dissociation of CH_3COOH

A. 1

B. 0.2

C. 0.1

D. 0.5

Answer: B

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24.

$\Lambda^{\circ}_{ClCH_2COONa} = 224 Ohm^{-1}cm^2gmeq^{-1}, \Lambda^{\circ}_{NaCl} = 38.2 Ohm^{-1}cm^2gmeq^{-1}, \Lambda^{\circ}_{HCl} =$

. What is the value of $L^{\circ}_{ClCH_2COOH}$?

A. $288.5 Ohm^{-1}cm^2gmeq^{-1}$

B. $289.5 Ohm^{-1}cm^2gmeq^{-1}$

C. $388.8 Ohm^{-1}cm^2gmeq^{-1}$

D. $59.5 Ohm^{-1}cm^2gmeq^{-1}$

Answer: C

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25. The specific conductance of a salt of 0.01M solution is $1.061 \times 10^{-4} ohm^{-1}cm^{-1}$. Molar conductance of a same solution is (in $ohm^{-1}cm^2\text{mole}^{-1}$)

A. 1.061×10^{-4}

B. 1.061

C. 10.61

D. 106.1

Answer: C

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26. The hydrogen electrode is dipped in a solution of $pH = 3$ at $25\ ^\circ C$. The potential of the cell would be (the value of 2.303 RT/F is 0.059 V)

A. 0.177 V

B. 0.087 V

C. -0.177V

D. 0.059 V

Answer: C

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27. The resistance of 0.01N solution of an electrolyte AB at 328K is 100 ohm. The specific conductance of solution is (cell constant $= 1cm^{-1}$)

A. 100 ohm

B. $10^{-2} ohm^{-1}$

C. $10^{-2} ohm^{-1}. cm^{-1}$

D. $10^{2} ohm. cm$

Answer: C

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28. The electrical resistance of a column of 0.04 M NaOH solution of diameter 1.2 cm and length 50 cm is 5.55×10^{3} ohm, the resistivity of the column would be

A. 125.47 ohm

B. 120.47 ohm cm

C. 102.47 ohm cm

D. 12.547 ohm cm

Answer: A

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29. The molar conductance at infinite dilution of $AgNO_3$, $NaCl$ and $NaNO_3$ are 116.5, 110.3 and $105.2 ohm^{-1} cm^2 \text{mole}^{-1}$ respectively. The molar conductance of at infinite dilution is

A. 111.4

B. 130.6

C. 121.6

D. 150.2

Answer: C

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30. Specific conductance of 0.1 M sodium chloride solution is $1.06 \times 10^{-2} ohm^{-1} cm^{-1}$. Its molar conductance in $ohm^{-1} cm^2 mol^{-1}$ is

A. 1.06×10^2

B. 1.06×19^3

C. 1.06×10^4

D. 53

Answer: A

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31. The resistance of 1N solution of acetic acid is 250 ohm when measured in a cell of cell constant $1.15 cm^{-1}$. The equivalent conductance (in $ohm^{-1} cm^2 equi^{-1}$) of 1N acetic acid is

A. 4.6

B. 9.2

C. 18.4

D. 0.023

Answer: A

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32. The resistnce of 0.1 N solution of a salt is found to be 2.5×10^3 ohms. The equivalent conductance of the solution is

(cell constant $= 1.15 cm^{-1}$)

A. 4.6

B. 5.6

C. 6.6

D. 7.6

Answer: A

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33. The equivalent conductivity of 0.1 M weak acid is 100 time less than that at infinite dilution. The degree dissociation is

A. 100

B. 10

C. 0.01

D. 0.001

Answer: C

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34. At infinite dilution molar conductivity of Ba^{2+} and Cl^- ions are $= 127.32 Scm^2/mol$ and $76.34 Scm^2/mol$ respectively. What is Λ_m^{∞} for $BaCl_2$

at same dilution?

A. $280 Scm^{2} / mol^{-1}$

B. $330.98 Scm^{2} / mol^{-1}$

C. $90.98 Scm^{2} / mol^{-1}$

D. $203.6 Scm^{2} / mol^{-1}$

Answer: A

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35. If ϕ denotes reduction potential, then which is true ?

A. $E^{\circ}_{\text{cell}} = \phi_{\text{right}} - \phi_{\text{left}}$

B. $E^{\circ}_{cell} = \phi_{\text{left}} + \phi_{\text{right}}$

C. $E^{\circ}_{cell} = \phi_{\text{left}} - \phi_{\text{right}}$

D. $E^{\circ}_{cell} = -\left(\phi_{\text{left}} + \phi_{\text{right}}\right)$

Answer: A

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36. E° Values of the half cells Mg^{2+}/Mg and Cl_2/Cl^- are respectively -2.36V and +1.36 V. The E° vlaue of the cell $Mg/Mg^{2+}//Cl_2/Cl^-$ is

A. 3.72 V

B. 1V

C. 0.18 V

D. 2.64 V

Answer: A

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37. The $E^0_{M^{3+} \mid M^{2+}}$ values for Cr, Mn, Fe and Co are -0.41, +1.57V, + 0.77 and +1.97V respectively. For which one of these metals the change in oxidation sate from +2 to +3 is easiest?

A. Cr

B. Co

C. Fe

D. Mn

Answer: A

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38. How much will the reduction potential of Zn/Zn^{2+} change if the solution of Zn^{2+} is diluted 10 times ?

A. increases by 0.03 V

B. decreases by 0.03 V

C. increase by 0.059 V

D. decreases by 0.059 V

Answer: B

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39. $E^{\circ}_{1/2Cl_2 | Cl^-} = +1.36V$. The single electrode potential of $Pt, Cl_2(1\text{atm}) \mid Cl^-(0.1M)$ is

A. $-1.36V$

B. $+1.36$

C. $+1.42V$

D. $-1.42V$

Answer: C

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40. The e.m.f of the cell,

$Ni/Ni^{2+}(1M)//Cl^-(1M)/Cl_2, Pt$ is

$E^{\circ} Ni^{2+}/Ni = -0.25V, E^{\circ} 1/2Cl_2/Cl^- = 1.36V$

A. $+1.11V$

B. $-1.11V$

C. $+1.61V$

D. $-1.61V$

Answer: C

Watch Video Solution

41. The standard reduction potential for $Fe^{2+} \mid Fe$ and $Sn^{2+} \mid Sn$ electrodes are -0.44 and -0.14 volt respectively. For the cell reaction: $Fe^{2+} + Sn \rightarrow Fe + Sn^{2+}$, the standard emf is

A. $0.30V$

B. -0.58V

C. $+0.58V$

D. $-0.30V$

Answer: D

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42. The emf of the involving the reaction $2Ag^{+}_{(aq)} + H_{2(g)} \rightarrow Ag_{(s)} + 2H^{+}_{(aq)}$ is $0.80V$. The standard oxidation potential of silver electrode is

A. 0.80V

B. $-0.80V$

C. $0.40V$

D. $0.20V$

Answer: B

Watch Video Solution

43. $Cr_2O_7^{2-} + I^- \rightarrow I_2 + Cr^{3+} E^{\circ}_{cell} = 0.79V, E^{\circ}_{Cr_2O_7^{2-}} = 1.33V$. Then $E^{\circ}_{I_2} = ?$

A. 0.54V

B. -$0.54V$

C. $+0.18V$

D. -$0.18V$

Answer: A

Watch Video Solution

44. The potential of hydrogen electrode at $pH = 10$ and $25^{\circ}C$ is

A. 0.59V

B. zero volts

C. -$0.59V$

D. -$0.059V$

Answer: C

Watch Video Solution

45. For the cell reaction,

$$Mg_{(s)} + Cu^{2+}_{(aq)} \rightarrow Cu_{(s)} + g^{2+}(aq.)$$

the standard reduction potentials of Mg and Cu are -2.37 V and 0.34 V respectively. The e.m.f. of the cell is

A. 2.03V

B. $-2.03V$

C. $2.71V$

D. $-2.71V$

Answer: C

Watch Video Solution

46. The emf of galvanic cell of the reaction $Zn + Cu^{2+} \rightarrow Zn^{2+} + Cu$ is

$$\left(E^{\circ} Zn^{2+} / Zn \text{ is } -0.76V \text{ and } Cu^{2+} / Cu \text{ is } +0.34V\right)$$

A. $-0.42V$

B. $+0.42V$

C. $-1.10V$

D. $+1.10V$

Answer: D

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47. E°_{cell} is 1.89V for the reaction

$2Ce^{4+} + Co \rightarrow 2Ce^{3+} + Co^{2+}$. If $E_{Co^{2+}/Co}$ is $-0.28V$. What is the value of $E^{\circ}_{Ce^{4+}/Ce^{3+}}$?

A. $-1.61V$

B. $+1.61V$

C. $-1.89V$

D. $2.17V$

Answer: B

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48. What is the potential of half-cell consisting of zinc electrode in 0.01 M $ZnSO_4$ solution at $25^\circ C\left(E^\circ_{ox} = 0.763V\right)$

A. 0.8221 V

B. 8.221 V

C. 0.5282 V

D. 9.282 V

Answer: A

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

$Cu^{2+}(aq) + 2e^- \rightarrow Cu(s)E^\circ = +0.34V$

What voltage is produced under standard conditions to give a spontaneous reactions by combination of these two half-cells ?

A. 1.32 V

B. $-1.32V$

C. 2.00 V

D. $-2.00V$

Answer: C

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50. If the solution of copper sulphate in which a copper rod is immersed, is diluted 100 times, what is thechange in electrode potential (Reduction) ?

A. Increases by 29.5 mV

B. Decreases by 29.5 mV

C. Increases by 59.0 mV

D. Decreases by 59.0 mV

Answer: D

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51. E.m.f. of the cell $Zn\left|Zn^{2+}(1)\right|\left|Cu^{2+}(1M)\right|Cu$ is 1.1 volt. If the standard reduction potential of Zn^{2+} | Zn is -0.78 volt, what is the oxidation potential of Cu | Cu^{2+} ?

A. $+1.86V$

B. $0.32V$

C. $-0.32V$

D. $-1.86V$

Answer: C

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52. What is the electrode potential (in V) of the following electrode at $25\,^{\circ}C? Ni^{2+}(0.1) \mid Ni_{(s)}$ (standard reduction potential of $Ni^{2+} \mid Ni$ is $-0.25V, 2.303RT/F = 0.06$)

A. -0.25

B. -0.28

C. $+0.25$

D. -0.31

Answer: B

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53. The oxidation potential of 0.05 MH_2SO_4 is

A. -2×0.0591

B. -0.01×0.0591

C. -2.321×0.00591

D. $+1 \times 0.0591$

Answer: D

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54. Molar conductances of $BaCl_2, H_2SO_4$ and HCl at infinite dilution are and $X_1, X_2,$ and X_3 respectively. Molar conductance of $BaSO_4$ at infinte dilution is

A. $\left(X_1 + X_2 - 2X_3\right)/2$

B. $X_1 + X_2 - X_3$

C. $X_1 + X_2 - 2X_3$

D. $\left(X_1 + X_2 - X_3\right)/s$

Answer: C

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55. The reduction potential of hdrogen electrode at pH 10 is

A. -0.059 V

B. $-0.59V$

C. $0.59V$

D. $0.0V$

Answer: B

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