CHEMISTRY

FOR IIT JEE ASPIRANTS OF CLASS 12 FOR CHEMISTRY

ELECTRO CHEMISTRY

EXAMPLE

1. Can 1 M $ZnSO_4$ be stored in a vessel made up of copper ?

Given : $E^{\circ}_{Zn^{2+}/Zn} = -0.76$ and $E^{\circ}_{Cu^{2+}/Cu} = +0.34$ V?

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2. Consult the table of standard electrode potential and suggest three substances that can oxidize Fe^{2+} ions under suitable conditions.

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3. KCl is used in salt bridge because:

A. KCl

B. K_2SO_4

C. KNO_3

D. All of these

Answer: d

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

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

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

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

A. Co

B. Co^{2+}

C. Cr

D. Cr^{3+}

Answer: b

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5. The standard reduction potential of Cu^{2+}/Cu and Cu^{2+}/Cu^{+} are 0.337 and 0.153 respectively. The standard electrode potential of Cu^{+}/Cu half $-$ cell is

A. $+0.184$ V

B. -0.827 V

C. $+0.521$V

D. $+0.490$ V

Answer: c

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6. The e.m.f. of the cell

$Ti|Ti^{+}(0.001M)||Cu^{2+}(0.01M)|Cu$ is 0.83V the emf of this cell could b e increased by

A. Increasing the concentration of TI^{+} ions

B. Increasinig the concentration of Cu^{2+} ions

C. Increasing the concentration of both

D. None of the above

Answer: b

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7. The electrochemical cell is set up as pt,

$H_2(1atm)|HCl(0.1M)||CH_3COOH(0.1M)|H_2(1atm)$, pt. The emf of the cell is (Ka $= 10^{-3} \times 1.8$)

A. 0

B. Positive

C. Negative

D. Cannot be determined

Answer: c

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8. Write each half cell reaction as well as redox reaction for the following electrochemical cell

$AL(s)\left|AL^{3+}(1M)\right|\left|Zn^{2+}(1M)\right|Zn(s)$

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9. Write the cell reaction that occurs when the following half-cells are combined.

$I_2 + 2e^- \rightarrow 2l^-(IM), \qquad E^\circ = 0.54V$

$Br_2 + 2e^- \rightarrow 2Br^-(IM), \qquad E^\circ = 1.08V$

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10. Calculate the e.m.f. of the cell in which the following reaction takes place :

$Ni(s) + 2Ag^+(0.002M) \rightarrow Ni^{2+}(0.160M) + 2Ag(s)$

Given E°_{cell}=1.05 v

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11. Calculate the electrode potential of given electrode

$Pt, Cl_2(1.5\text{bar}) \mid 2Cl^-(0.01M),$

Solu $E^\circ_{Cl_2/2Cl^-} = 1.36V$ tion:

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12. Calculate the emf of given cell

$\left(Ag|AgNO_3||AgNO_3|Ag, , E_{Ag^+/Ag} = 0.80V\right), (0.001M, 0.1M)$

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13. Metal rod A is dipped in 0.1 M solution of ASO_4. The salt is $95\,\%$ dissociated at this dilution at 298 K. Calculate the electrode potential $\left(E^{\circ}_{A^{2+}/A} = -0.76V\right)$

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14. Calculate the equilibrium constant for the cell reaction :

$4Br^- + O_2 + 4H^+ \rightarrow 2Br_2 + 2H_2O$. Given $E^{\circ}_{cell} = 0.16V$

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15. Find out work done for the given cell

$Cr\left|Cr^{+3}\right|\left|Fe^{+2}\right|Fe$

$E^{\circ}_{Cr\,/\,Cr^{3+}} = 0.74V,\ E^{\circ}_{Fe^{2+}\,/\,Fe} = -0.44V$

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16. Calculate ΔG° for the given reaction occuring fuel cell

(i) $O_2 + 4H^+ + 4e^- \rightarrow 2H_2O,\ E^{\circ} = 1.229$ volt

(ii) $2H_2 \rightarrow 4H^+ + 4e^-,\ E^{\circ} = 0$ volt

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17. Find out given cell is spontaneous or non-spontaneous.

$H_2(P_1)\,/\,H^+\ \|\ \|\ H^+\,/\,H_2(P_2)$, If $P_1 > P_2$

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18. Represent the cell in which following reaction takes place :

$Mg(s) + 2Ag^{\oplus}(0.0001M) \rightarrow Mg^{2+}(0.130M) + 2Ag(s)$ calculate its E_{cell} if $E^{c-}{}_{\cdot cell} = 3.17V$.

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19. Calculate the potential of hydrogen electrode in contact with a solution whose pH is 10.

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20. Calculate the equilibrium constant for the reaction given $E^{\circ}_{\text{cell}} = +0.46V$

`Cu(s) + 2Ag^(+) (aq)

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21. The cell in which the following reaction occurs

$2Fe^{3+}(aq) + 2I^{-}(aq) \rightarrow 2Fe^{2+}(aq) + I_2(aq) + I_2(s)$ has

$E^0_{cell} = 0.236V$ at 298 K.

Calculate the stadard gibbs energy and the equilibrium constant of the cell reaction.

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22. In the button cells widely used in watches and other devices the following reaction takes place:

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

Determine ΔG° and E° for the reaction

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

$Ag_2O + H_2O + 2e^{-} \rightarrow 2Ag + 2OH^{-}$

$E^\circ = +0.34\,\text{V}$

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23. The EMF of Westron standard cell is 1.0153 at $20^\circ C$ and 1.01807 at $25^\circ C$. CalculateΔG, ΔH, and ΔS for the cell reaction at $25^\circ C$.

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24. The molar conductivity of a saturated solution of $BaCl_2$ is $10^{-12} ohm^{-1} cm^2 mol^{-1}$. If the value for specific conductivity of the solution is $10^{-14} ohm^{-1} cm^{-1}$, the value for K_{sp} for $BaCl_2$ is

A. $10^3 \times 4$

B. 10^2

C. 10

D. 10^5

Answer: a

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25. For which of the following electrolyte the value of Λ_m and Λ_{eq} are same?

A. Na_2SO_4

B. $BaCl_2$

C. KCl

D. $Al_2(SO_4)_3$

Answer: c

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26. The equivalent conductivity of a solution containing 2.45 g of $CuSO_4$ per litre, is $91.0\Omega^{-1}cm^2eq^{-1}$. Its conductivity would be

A. $1.45 \times 10^{-3}\Omega^{-1}cm^{-1}$

B. $2.17 \times 10^{-3}\Omega^{-1}cm^{-1}$

C. $2.90 \times 10^{-3}\Omega^{-1}cm^2$

D. $2.9 \times 10^{-3} \Omega^{-1} cm^{-1}$

Answer: d

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27. The conductivity of 0.25 M solution of KCI at 300 K is 0.0275 Scm^{-1} calculate molar conductivity

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28. The resistance of conductivity cell containing 0.001 M KCI solution at 298 K is 1500 ohm. What is the cell constant if the conductivity of 0.001 M KCI solution at 298 K is $0.146 \times 10^{-3} Scm^{-1}$

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29. Calculate λ_m° for NH_4OH given that values of λ_m° for $Ba(OH)_2$, $BaCI_2$ and NH_4CI as $523.28, 280.0$ and $129.8 Scm^2 mol^{-1}$ respectively

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30. The resistance of 0.01 M CH_3COOH solution is found to be 2220 ohm when measured in a cell of cell constant 0.366 cm^{-1}. Given that $\lambda_m^\circ\left(H^+\right)$ and $\lambda_m^\circ\left(CH_3COO^-\right)$ as 349.1 and $40.9 Scm^2 mol^{-1}$. Calculate

(a) Conductivity

(b) Molar conductivity

(c) Degree of dissociation

(d) Dissociation constant

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31. Resistance of a conductivity cell filled with 0.1 M KCl is 100 ohm. If the resistence of the same cell when filled with 0.02 M KCl solution is 520

ohms, calculate the conductivity and molar conductivity of 0.02 M KCl solution. Conductivity of 0.1 KCl solution is 1.29×10^{-2} ohm $^{-1}cm^{-1}$.

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32. The elctrical resistance of a column of $0.05MNaOH$ solution of diameter $1cm$ and length $50cm$ is $5.55 \times 10^{3}ohm$. Calculate its resisteivity , conductivity, and molar conductivity.

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33. The conductivity of 0.1m KCl solution is $1.29sm^{-1}$. If the resistance of the cell filled with 0.1 M KCl is 100 ohm. Calculate the cell constant.

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34. $\wedge^{\circ}{}_{m}$ for $CaCl_2$ and $MgSO_4$ from the given data.

$\lambda^{\circ}_{Ca^{2+}} = 119.0Scm^2mol^{-1}$ ltbr. $\lambda^{\circ}_{Cl^{c-}} = 76.3Scm^2mol^{-1}$

$\lambda^{\circ}_{Mg^{2+}} = 106.0 Scm^2 mol^{-1}$

$\lambda^{\circ}_{SO_4^{2-}} = 160.0 cm^2 mol^{-1}$

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35. The equivalent conductances of sodium chloride, hydrochloric acid and sodium acetate at infinite dilution are $126.45, 426.16$ and $91.0 ohm^{-1} cm^{-1} \text{equiv}^{-1}$, respectively, at $25^{\circ} C$. Calculate the equivalent conducatance of acetic acid at infinite dilution.

$\Lambda^0_m(HCl) = 426.16 \text{ S cm}^2 mol^{-1}$

$\Lambda^0_m(NaCl) = 126.45 \text{ S cm}^2 mol^{-1}$

$\Lambda^0_m(CH_3COONa) = 91 \text{ S cm}^2 mol^{-1}$

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36. The conductivity of $0.001028 M$ acetic acid is $4.95 \times 10^{-5} Scm^{-1}$. Calculate its dissociation constant if Λ^0_m for acetic acid is $390.5 Scm^2 mol^{-1}$.

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37. The molar conductivity of 0.025 M methanoic acid (HCOOH) is $46.15\ \text{S}\ cm^2mol^{-1}$. Calculate its degree of dissociation and dissociation constant. Given $\lambda^{\circ}_{(H^+)} = 349.6\ \text{S}\ cm^2mol^{-1}$ and $\lambda^{\circ}_{(HCOO^-)} = 54.6\ \text{S}\ cm^2mol^{-1}$.

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

A. 9.0×10^3 g

B. 8.1×10^4 g

C. 2.4×10^{-4}

D. 1.3×10^4 g

Answer: b

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39. In the electrolysis of acidulated water, it is desired to obtain 1.12 cc of hydrogen per second under STP condition. The current to be passed is:

A. 9.65 A

B. 19.3 A

C. 0.965 A

D. 1.93 A

Answer: a

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40. How much copper is deposited on the cathode if a current of 3A is passed through aqueous $CuSO_4$ solution for 15 minutes?

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41. Calculate the number of coulombs required to deposit 5.4 g of Al when the electrode reaction is

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

(Given , atomic mass of Al =27 g mol^{-1}, $F = 96500 C mol^{-1}$)

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42. How much time would be needed to deposit 0.25 g of metallic nickel. (Atomic mass = 58.5) on a metal object using a current of 1A during electroplating?

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43. A current of 2A was passed for 1.5 hours through a solution of $CuSO_4$ when 1.6 g of copper was deposited. Calculate percentage current efficiency.

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44. Exactly 0.2 mole electrons are passed through two electrolytic cells in series containing $CuSO_4$ and $ZnSO_4$ respectively. How many grams of each metal will be deposited on the respective cathodes in the two cells ?

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45. How much charge is required for the following reductions?

(i) 1 mole of Al^{+3} to Al

(ii) 1 mole of MnO_4^- to Mn^{2+}

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

(Molar mass of $Cu = 63.5g/mol$)

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

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48. How much electricity in terms of Faraday is required to produce $40.0g$ of Al from molter Al_2O_3?

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49. Which of the following reactions occur at the cathode during the charging of lead storage battery ?

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

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

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

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

Answer: d

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50. In lead storage battery, the anode reaction is

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

B. $Pb + H_2SO_4 \rightarrow PbSO_4 + 2H^+ + 2e^-$

C. $PbO + H_2SO_4 \rightarrow PbSO_4 + H_2O$

D. None of these

Answer: b

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51. Which of the following reaction is reaction 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. $2Fe(s) + O_2(g) + 4H^+(aq) \rightarrow 2Fe^{2+}(aq) + 2H_2O(l)$

Answer: c

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52. The rusting of iron is catalysed by

A. Fe

B. O_2

C. H^+

D. Zn

Answer: c

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53. Explain how rusting of iron is envisaged as setting up of an electroCHMemical cell.

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EVALUATE YOURSELF - 1

1. Standard electrode potential of an electrode is :

A. The hydrogen electrode

B. The calomel electrode

C. The glass electrode

D. All of these

Answer: D

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2. The half-cell reduction potential of a hudrogen electrode at $pH = 10$ will be.

A. -0.50 V

B. -0.59 V

C. 0.059 V

D. -0.059 V

Answer: B

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3. A graph plotted between log N vs, time gives a slope and intercept equal to:

A. 1

B. 3

C. 2

D. 4

Answer: C

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4. The half reactions for a cell are

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

$Fe \rightarrow Fe^{2+} + 2e^{-}, E^{\circ} = 0.41V$

The ΔG° (in kJ) for the overall reaction

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

A. 67. kJ

B. -67.6 kJ

C. 33.78 kJ

D. -33.78 kJ

Answer: B

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EVALUATE YOURSELF - 2

1. Equivalent conductance of 1M CH_3COOH is $10 ohm^{-1} cm^2 \text{equiv}^{-1}$ and that at inifinite dilution is 200 $ohm^{-1} cm^2 \text{equiv}^{-1}$. Hence, % ionisation of CH_3COOJ is:

A. 0.05

B. 0.02

C. 0.04

D. 0.01

Answer: A

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2. If 0.01 M solution of an electrolyte has a resistance of 40 ohms in a cell having a cell constant of 0.4 cm^{-1} then its molar conductance in $ohm^{-1}cm^2mol^{-1}$ will be

A. 10^4

B. 10^3

C. 10^2

D. 10

Answer: B

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3. The molar conductance of NaCl, HCl and CH_3COONa at infinite dilution are 126.45, 426.16 and 91 $ohm^{-1}cm^2mol^{-1}$ respectively. The molar conductance of CH_3COOH at infinite dilution is :

A. $201.28ohm^{-1}cm^{-2}$

B. $390.71 ohm cm^{-2}$

C. $698.25 ohm cm^{-2}$

D. $570.71 ohm cm^{-2}$

Answer: B

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

A. $0.918 cm^{-1}$

B. $0.66 cm^{-1}$

C. $0.142 cm^{-1}$

D. $1.12 cm^{-1}$

Answer: B

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5. A conductance cell when filled with $0.5MKCI$ solution (conductivity $= 6.67 \times 10^{-3}\Omega^{-1}cm^{-1}$) register a resistance of 243Ω. Its cell constant is .

A. 1.62 cm

B. 1.62 cm^{-1}

C. 1.62 m

D. $1.62m^{-1}$

Answer: B

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EVALUATE YOURSELF - 3

1. In electrolysis of dilute H_2SO_4 using platinum electrodes .

A. H_2 is evolved at cathode

B. SO_2 is produced at anode

C. O_2 is obtained cathode

D. SO_2 is produced at cathode

Answer: A

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2. $4.5g$ of aluminium (at mass $27u$) is deposited at cathode from Al^{3+} solution by a certain quantity of electric charge. The volume of hydrogen gas produced at STP from H^+ ions in solution by the same quantity of electric charge will be:

A. 44.8 L

B. 11.2 L

C. 22.4 L

D. 5.6 L

Answer: D

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

A. 96500 C

B. 9.65×10^6 C

C. 4.83×10^5 C

D. 1.93×10^5 C

Answer: C

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4. In the electrolytic cell, flow of electrons is form :

A. cathode to anode in solution

B. cathode to anode through external circuit

C. cathode to anode through internal circuit

D. anode to cathode through external circuit

Answer: D

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EVALUATE YOURSELF - 4

1. When lead storage battery discharges

A. SO_2 is evolved

B. $PbSO_4$ is consumed

C. Lead is formed

D. H_2SO_4 is consumed

Answer: D

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2. When a lead storage battery is charged:

A. lead dioxide dissolves

B. sulphuric acid is regenerated

C. the lead electrode becomes coated with lead sulphate

D. the amount of sulphuric acid decreases.

Answer: B

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3. Which of the following statements is true for fuel cells ?

A. They run till the reactants are active

B. They are free from pollution

C. They are more efficient

D. All of the above

Answer: D

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

A. generate heat

B. create potential difference between the two electrodes

C. produce high purity water

D. remove adsorbed oxygen from electrode surfaces.

Answer: B

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EVALUATE YOURSELF - 5

1. Galvanized iron sheets are coated with

A. copper

B. tin

C. Zinc

D. Carbon

Answer: C

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2. A smuggler could not carry gold by chemicaly 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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3. Corrosion is

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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CHECK YOUR GRASP

1. The function of salt bridge is

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2. Which of the followigng metal is obtained by the reduction of metal oxide with Hydrogen gas

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3. Daniel cell, the EMF of the cell can b e increased b y

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4. What is the relationship between Gibbs free energy of the cell reaction in a galvanic cell and the emf of the cell ? When will the maximum work be obtained froma galvanic cell ?

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5. Explain the criteria for feasibility of redox reaction.

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6. Define Molar conductivity $\wedge_m$, explain its variation with dilution.

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7. How much charge is required for the following reductions:

(i) 1 mol of Al^{3+} to Al?

(ii) 1 mol of Cu^{2+} to Cu?

(iii) 1 mol of MnO_4 to Mn^{2+} ?

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8. How much electricity in terms of Faraday is required to produce.

$a.$ $20.0g$ fo Ca from molten $CaCl_2$

$b.$ $40g$ of Al from molten Al_2O_3

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9. How much electricity is required in coulomb for the oxidation of :

(a) 1 mol of H_2O to O_2,

(b) 1 mole of FeO to Fe_2O_3 ?

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10. Name the type of cell which was used in Apollo space programme for providing electrical power.

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11. What is the basis of working of a fuel cell?

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12. Why does mercury cell gives a constant voltage throughout its life ?

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13. Which metals can be used in the cathodic protection of Fe against rusting.

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14. Rusting of iron is quicker in salline water than in ordinary water. Why is it so?

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CUQ (ELECTROCHEMICAL CELLS)

1. Which of the following statements is wrong about galvanic cells?

A. Electric energy $\Rightarrow$ Chemical Energy

B. Chemical Energy $\Rightarrow$ Electrical Energy

C. Chemical Energy $\Rightarrow$ Internal Energy

D. Internal Energy $\Rightarrow$ Electrical Energy

Answer: B

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2. In a galvanic cell electron flow will be from

A. Negative electrode to positive electrode

B. Positive electrode to negative electrode

C. there will be no flow of electrons

D. Cathode to anode in the external circuit

Answer: A

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3. In a galvanic cell, the reactions taking place in the anodic half cell the cathodic half cell will be

A. Reduction

B. Oxidation

C. Oxidation and reduction

D. Reduction and oxidation

Answer: C

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4. Which of the following is not true for a galvanic cell represented in IUPAC system

A. Right hand electrode is a +ve terminal

B. Right hand electrode acts as cathode

C. Electrons are given out in the external circuit from the anode

D. Electrons are given out in the external circuit from the anode

Answer: D

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5. In a galvanic cell, the positive ions of salt bridge migrate towards

A. $-ve$ electrode

B. $+ve$ electrode

C. Either anode or cathode

D. Neither anode nor cathode

Answer: B

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6. A half cell reaction is one that

A. Involves only half a mole of electrolyte

B. Goes only half way to completion

C. Takes place at one electrolyte

D. Consumes half a unit of electricity

Answer: C

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7. The purpose of the salt bridge in a galvanic cell is to

A. Prevent accumulation of charges around the electrodes.

B. Facilitate continuity of the cell reaction

C. To produce current at a constant strength

D. All the above

Answer: D

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8. Agar-Agar is used in salt bridge since it is

A. Electrolyte

B. Non-electrolyte

C. Inert electrolyte

D. A solid

Answer: B

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9. The chemical used in salt bridge in a galvanic cell is

A. Agar - Agar

B. Gum Arabic

C. Gel

D. Potassium nitrate

Answer: D

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10. The thermodynamic efficiency of cell is given by

A. $\Delta \frac{H}{\Delta}(G)$

B. $\frac{-nFE}{\Delta}(G)$

C. $-\frac{nFE}{\Delta}(H)$

D. $-nFE$

Answer: C

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11. The metal which cannot liberate H_2 gas from hydrochloric acid

A. Zn

B. Cu

C. Mg

D. Al

Answer: B

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12. For which of the following SOP and SRP are equal

A. SHE

B. Mg electrode

C. Ni elctrode

D. Copper electrode

Answer: A

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13. The electrode potential measures the

A. tendency of the elctrode to gain or lose electrons

B. electron affinity of elements

C. difference in the ionization potential of electrode and metal ion

D. heat of combination

Answer: A

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14. The potential across the metal and the aqueous solution of its ions of unit activity at 298K is known as

A. Electrode potential

B. Standard electrode potential

C. Formal electrode potential

D. Oxidation potential

Answer: B

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15. Which of the following metal will not reduce H_2O ?

A. Ca

B. Fe

C. Cu

D. Li

Answer: C

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16. Arrange the following in the order of their decreasing electrode potentials:Mg, K, Ba,Ca

A. K, Ba, Ca, Mg

B. Ba, Ca, K, Mg

C. Ca, Mg, K, Ba

D. Mg, Ca, Ba, K

Answer: D

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17. If a cell reaction is spontaneous, then :

A. negative

B. positive

C. zero

D. some times positive and some times $-ve$

Answer: B

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18. The EMF of a galvanic cell is measured by

A. Voltmeter

B. Spectrometer

C. Coulometer

D. Ammeter

Answer: A

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19. Cathodic standard reduction potential minus anodic standard reduction potential is equl to

A. Faraday

B. Coulomb

C. Cell potential

D. Ampere

Answer: C

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

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

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

C. $E = E^0 + \frac{2.303RT}{n} F \frac{\log[M^{n+}]}{M}$

D. $E = E^0 + \frac{2.303RT}{n} F \log[M^{n+}]$

Answer: B

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21. The potential of a 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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22. The relationship between standard reduction potential of a cell and equilibrium constant is shown by

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

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

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

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

Answer: B

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23. 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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24. The best conductor of electricity is a 1M solution of

A. Boric acid

B. Acetic acid

C. H_2SO_4

D. Phosphoric acid

Answer: C

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25. Which of the following aqueous solutions will conduct an electric current quite well?

A. Sugar

B. Glycerol

C. Pure water

D. HCl

Answer: D

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26. Pure water does not conduct electricity because it :

A. Neutral

B. Readily decomposed

C. Almost unionised

D. Completely ionised

Answer: C

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27. In aqueous solution, strong electrolytes ionize and yield

A. Ions

B. Electrons

C. Acids

D. Oxides

Answer: A

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28. Which of the following is a poor conductor of enectricity

A. CH_3COONa

B. CH_3OH

C. NaCl

D. KOH

Answer: B

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29. Arrhenius theory is applicable only to

A. weak electrolyte

B. Strong electrolyte

C. both 1 & 2

D. non electrolyte

Answer: A

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30. Which of the following does not conduct current in aqueous solution

A. KNO_3

B. CH_3COOH

C. CH_3OH

D. NaOH

Answer: C

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31. Which of the following solid is an electronic conductor

A. NaCl

B. Diamond

C. CuS

D. KCl

Answer: C

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32. The units of conductivity of the solution are

A. ohm^{-1}

B. ohm

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

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

Answer: C

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33. The unit of cell constant is

A. ohm^{-1}

B. ohm - cm

C. cm^{-1}

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

Answer: C

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34. The cell constant is the product of resistance and

A. conductance

B. molar conductance

C. specific conductance

D. specific resistance

Answer: C

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35. 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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36. A solution of concentration 'C' g equiv/litre has a specific resistance R. The equivalent conductance of the solution is

A. $\frac{1000}{R}C$

B. $\frac{C}{R}$

C. $\frac{R}{C}$

D. $\frac{1000R}{C}$

Answer: A

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37. Which of the following is correct for the solution of C_2H_5COOH upon dilution regarding currect species?

A. The number in $1cm^3$ as well as in total volume increases

B. The number in $1cm^3$ decreases whereas that in the total volume remains constant

C. The number in $1cm^3$ decreases but that in the total volume increases

D. The number in $1cm^3$ as well as in total volume decreases.

Answer: C

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38. If X is the specific resistance of the solution and N is the normality of the solution, the equivalent conductivity of the solution is given by

A. $\frac{1000x}{N}$

B. $\frac{1000}{N}x$

C. $\frac{1000N}{x}$

D. $\frac{Nx}{1000}$

Answer: B

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39. Which of the following solutions has the highest equivalent conductance?

A. 0.5 M NaCl

B. 0.05 M NaCl

C. 0.005 M NaCl

D. 0.02 M NaCl

Answer: C

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40. Debye-Huckel-Onsager equation is represented as $\wedge_c = \wedge_0 - b\sqrt{c}$.

'b' is

A. $\frac{82.4}{DT^{\frac{1}{2}}}e \to + \frac{8.20 \times 10^5}{(DT)^{\frac{3}{2}}}e \to \lambda_0$

B. $\frac{82.4}{DT^{\frac{1}{2}}}e \to + \frac{8.20 \times 10^5}{(DT)^{\frac{1}{2}}}e \to \lambda_0$

C. $\frac{8.24}{DT^{\frac{1}{2}}}e \to + \frac{8.20 \times 10^5}{(DT)^{\frac{1}{2}}}\lambda_0$

D. $\frac{8.24}{DT^{\frac{1}{2}}} + \frac{8.20 \times 10^5}{(DT)^{\frac{1}{2}}}e \to \lambda_0$

Answer: A

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

A. The degree of dissociation is unity for weak electrolysis

B. The electrolysis is 100% ionised

C. All inter ionic attraction disappear

D. All the three

Answer: D

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42. The relationship $\lambda_m = \lambda_m^0 - B\sqrt{C}$ will not hold good for the electrolyte?

A. HCl

B. KCl

C. $BaCl_2$

D. HCN

Answer: D

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43. The Kohlrausch law is related to

A. Conductance of ions at infinite dilution

B. Independent migration of ions

C. Both 1 and 2

D. Neither 1 and 2

Answer: C

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44. The expression showing the relationship between equivalent conductance and molar conductance is (z = Total positive (or) negative charge per formula unit of electrolyte)

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

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

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

D. $\lambda_m = \lambda_m^2$

Answer: A

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45. The equation representing Kohlrausch law from the following is $\left(V^+ = \text{No. of cations}, V^- = \text{No. of anions}\right)$

A. $\lambda_m = \frac{100K}{C_m}\left(V^+ + V^-\right)$

B. $\lambda_m^0 = v^+\lambda_+^0 + v^-.\lambda_-^0$

C. $\lambda_{eq} = \frac{1000K}{C_{eq}}\left(V^+ - V^-\right)$

D. $\lambda_m^0 = \lambda_c + \lambda_a$

Answer: B

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46. In the plot of Λ and $\sqrt{C}$, the slope is

A. Λ^0

B. $-b$

C. $\frac{-2.303}{R}$

D. ∞

Answer: B

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47. Electrolysis of selt solutions is due to to the formation of

A. Electron

B. Ions

C. Oxides

D. Acids

Answer: B

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48. The reactions taking place at anode and cathode of a cell respectively are

A. Reduction, oxidation

B. Oxidation, reduction

C. Hydrolysis, oxidation

D. Reduction, hydrolysis

Answer: B

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49. Electrode at which electrons flow into the electrolyte is

A. Anode

B. Cathode

C. Both anode & cathode

D. $+ve$ cathode

Answer: B

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50. During electrolysis electrons flow from

A. Cathode to anode in outer circuit

B. Anode to cathode outside the cell

C. Cathode to anode inside the cell

D. Current does not flow

Answer: A

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51. During electrolysis electrons flow from

A. cations to cathode

B. anode to anions

C. cathode to anode

D. anions to anode

Answer: D

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52. The cathode of an electrolysis and a reducing agent are similar because both

A. are metals

B. supply electrons

C. remove electrons

D. absorb electrons

Answer: B

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53. The cathode reaction in electrolysis of dilute sulphuric acid with Platinum electrode is

A. Oxidation

B. Reduction

C. Both oxidation and reduction

D. Neutralization

Answer: B

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54. Schematic diagram of an electrolytic-cell is:

A. 

B. 

C. 

D. None is correct presentation

Answer: B

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55. The following are some statements about electrolytic cell

A) In this, chemical energy converted into electrical enegy

B) In this cell, electrons flow from cathode to anode through external circuit

C) In this cell reduction takes place at cathode

D) In this, 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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56. In the electrolytic cell, flow of electrons is form :

A. anode to cathode 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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57. In electrolysis of $NaCl$ when Pt electrode is taken H_2 is liberated at cathode while Hg cathode it forms sodium amalgam because

A. Hg is more 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. $\text{Conc of} H^+$ ions is larger when Pt electrode is taken

Answer: B

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58. Faraday's laws of electrolysis are related to the

A. Molecular mass of the electrolyte

B. Equivalent weight of the cation/anion

C. Atomic weight of the electrolyte

D. Atomic number of the cation/anion

Answer: B

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59. The unit of electrochemical equivalent is

A. Gram

B. Gram/Ampere

C. Gram/Coulomb

D. Coulomb/Gram

Answer: C

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60. When 1 amp of currentis passed through an electrolyte for one second, the mass deposited is equal to

A. 1 mole of hydrogen

B. 1 gram equivalent of hydrogen

C. 1 electro-chemical equivalent

D. 1 gram of any substance

Answer: C

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61. One electrolysis 1 mole Al atoms will be deposited by

A. 1 mole of electrons

B. 2 moles of electrons

C. 3 moles of electrons

D. 6 moles of electrons

Answer: C

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62. When the same quantity of electricity is passed through the solution of different electrolytes in series, the amount of product obtained is proportional to their

A. Atomic weighs

B. Chemical Equivalence

C. Gram molecular mass

D. Gram atomic ions

Answer: B

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63. The electric charge for electrode deposition of one gram equivalent of a substance is:

A. 96,500 coulombs

B. One ampere per sec

C. One ampere for one hour

D. Charge in faradays

Answer: A

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64. The number of faradays required to liberate 1 mole of any element indicates

A. weight of the element.

B. conductance of the electrolyte

C. charge on the ion of the element

D. isotopic number

Answer: C

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65. 6.24×10^{19} electrons are equal approximately to

A. 10 coulombs

B. 96500 coulombs

C. one electron volt

D. 0.1F

Answer: A

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66. Use of lithium metal as an electrode in high energy density batteries is due to:

A. Lithium is the lightest elements

B. Lithium has quite high negative reduction potential

C. Lithium is quite reactive

D. Lithium does not corrode easily

Answer: B

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67. When a lead storage battery is discharged.

A. SO_2 is evolved

B. lead sulphate is consumed

C. sulphuric acid is consumed

D. lead is formed

Answer: C

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68. W.r.t. Ni - Cd storage cell, the incorrect statement is

A. anode is cadmium metal

B. it is a primary cell

C. cell potential is 1.4V

D. electrolyte used in KOH

Answer: B

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69. In dry cell cathode is

A. Zn

B. Carbon rod

C. $Zn + NH_4Cl$

D. $C + MnO_2$

Answer: B

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70. Cathode is made of .....in mercury battery

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71. In Leclanche cell, Zinc rod is placed in

A. $10\ \%\ NH_4Cl$

B. $20\ \%\ NH_4Cl$

C. $30\ \%\ NH_4Cl$

D. $40\ \%\ NH_4Cl$

Answer: B

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72. In fuel cell oxidants used are

A. O_2

B. H_2O_2

C. HNO_3

D. All

Answer: D

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73. Theoretical efficiency of fuel is

A. Nearly 60%

B. 0.5

C. 0.33

D. Nearly 100%

Answer: D

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74. W.r.t. $H_2 - O_2$ fuel cell the correct statement is

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75. Which of the following statements is true for fuel cells ?

A. They are more efficient

B. They are free from pollution

C. They run till reactants are active

D. All of the above

Answer: D

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76. CORROSION

A. Physical change

B. Neutralisation

C. Electrochemical change

D. None is true

Answer: C

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77. Prevention of corrosion of iron by Zn coating is called

A. Galvanization

B. Cathodic protection

C. Electrolysis

D. Photoelectrolysis

Answer: A

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

A. In pure water

B. In pure oxygen

C. In air and pure water

D. In air and saline water

Answer: D

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79. Prevention of corrosion of iron by Zn coating is called

A. Painting the metal surface

B. Alloying the metal with more anodic metal

C. To prevent the contact of the metal surface with good electrical conducting media

D. All

Answer: D

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80. The rusting of iron is catalysed by which of the following ?

A. Fe

B. Zn

C. O_2

D. H^+

Answer: D

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81. Chemical passivity is possible with

A. Conc HNO_3

B. Air

C. Both 1 and 2

D. Metal oxides

Answer: C

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EXERCISE -1 (C.W.) ELECTROCHEMICAL SERIES & EMF

1. The SRP values of Ag^+ / Ag and Zn^{2+} / Zn electrodes are 0.80V and -0.7v. In the cell built with these two electrodes

A. Ag electrode acts as anode and Zn electrode acts as cathode.

B. Ag electrode acts as cathode and Zn electrode acts as anode

C. both the electrodes act as cathode.

D. the cell can't built with these two electrons.

Answer: B

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2. Which of the following is most powerful oxidizing agent?

A. $Cl_2 + 2e^- \rightarrow 2Cl^-, E^\circ = 1.36$ V

B. $Na^+ + e^-, N, E^\circ = 2.71V$

C. $MnO_4^- + 2H_2O + 2e^- \rightarrow MnO_2 + 4OH^-, E^\circ = 0.6v$

D. $H_2O_2 + 2H^+ + 2e^- \rightarrow 2H_2O, E^\circ = 1.78$ V

Answer: D

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3. The standard reduction potentials of $Cu^{=2}$, Ag^{+}, Hg^{+2} and Mg^{+2} are $0.34v$, $+0.80v$, $+0.79V$ and $-2.37V$ respectively. With increasing voltage, the squence of deposition of metals on the cathode from a molten mixture containing all those ions is

A. Ag, Hg, Mg, Cu

B. Cu, Hg, Ag, Mg

C. Ag, Hg, Cu, Mg

D. Cu, Hg, Mg, Ag

Answer: C

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4. Which metal pairs when coupled will get maximum emf for a voltaic cell

A. Fe and Cu

B. Pb and Cu

C. Cu and Au

D. Ca and Cu

Answer: D

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5. At 298 K, the standard reduction potentials for the following half reactions are given. Which acts as anode with others in electrochemical cell

$Zn^{+2}(aq) + 2e^- \rightarrow Zn(s), \ -0.762$

$Cr^{+3}(aq) + 3e^- \rightarrow Cr(s), \ -0.740$

$2H^+(aq) + 2e^- \rightarrow H_2(g), \ -0.000$

$Fe^{+3}(aq) + e^- \rightarrow Fe^{2+}(aq), \ +0.762$

A. Zn(s)

B. H_2(g)

C. Cr(s)

D. Fe^{2+} (aq)

Answer: A

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6. $Cu - 2e^- \rightarrow Cu^{2+}, E^\circ = -0.347V$

$Sn - 2e^- \rightarrow Sn^{2+}, E^\circ = +0.143V$

The standard EMF of the cell constructed with these electrodes is

A. $+0.066$ V

B. -0.066 V

C. $+0.490$ V

D. -0.82 V

Answer: C

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7. The voltage of a cell whose half-cells are given below is

$Mg^{2+} + 2e^- \rightarrow Mg(s), E^\circ = -2.37V$

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

standard EMF of the cell is

A. -2.03V

B. 1.36 V

C. 2.71 V

D. 2.03 V

Answer: C

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8. The standard reduction potentials of Ag, Cu, Co and Zn are $0.799, 0.337, -0.277, -0.762V$ respectively. Which of the following cell will have maximum cell e.m.f?

A. $Zn|Zn^{+2}(1M)||Cu^{2+}(1M)|Cu$

B. $Zn|Zn^{2+}(1M)||Ag^{+}(1M)|Ag$

C. $Cu|Cu^{2+}(1M)||Ag^{+}(1M)|Ag$

D. $Zn|Zn^{2+}(1M)||Co^{2+}(1M)|Co$

Answer: B

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9. When KCN is added to $CuSO_4$ solution:

A. Oxidation of Cu^{2+}

B. Reduction of Cu^{2+}

C. Hydrolysis of $CuSO_4$

D. Ionization of $CuSO_4$

Answer: B

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EXERCISE -1 (C.W.) NERNST EQUATION

1. Consider the following four electrodes:

$A = Cu^{2+}(0.0001M)/Cu_{(s)}$

$B = Cu^{2+}(0.1M)/Cu_{(s)}$

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

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

If the standard reduction potential of Cu^{+2}/Cu is $+0.34V$, the reduction potentials (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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2. Which of the following is always true regarding the spontaneity of reaction occuring in a galvanic cell?

A. $E^{\circ}_{\text{cell}} > 0, \Delta G^{\circ} < 0$ and $Q > K_c$

B. $E^{\circ}_{\text{cell}} < 0, \Delta G^{\circ} < 0$ and $Q < K_c$

C. $E^{\circ}_{\text{cell}} > 0, \Delta G^{\circ} > 0$ and $Q > K_c$

D. $E^{\circ}_{\text{cell}} > 0, \Delta G < 0$ and $Q < K_c$

Answer: D

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3. The reduction potential of hudrogen electrode is $-118mV$. The concentration of H^+ in the solution is .

A. 0.001 M

B. 2 M

C. 10^{-4}

D. 1 M

Answer: A

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4. E° for $F_2 + 2e^- \Leftrightarrow 2F^-$ is $2.8V$, E° for $\frac{1}{2}F + e^- = F^-$ is $-$

A. 2.8 V

B. 1.4 V

C. -2.8 V

D. -1.4 V

Answer: A

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EXERCISE -1 (C.W.) ELECTROLYTIC CONDUCTANCE

1. Water is a non-electrolyte but conducts electricity on dissovling a small amount of

A. NaCl

B. Sugar

C. Acetone

D. Oxygen

Answer: A

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2. During electric conduction, the composition of which of the following is changed?

A. Graphite

B. Zinc, wire

C. Copper wire

D. H_2SO_4

Answer: D

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3. An aqueous solution of which of the following concentration of CH_3COOH is the best conductor.

A. 10^1 M

B. 10^3 M

C. 10^{-1} M

D. 10^2 M

Answer: B

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4. The degree of dissociation of an electrolyte does not depend on

A. Nature of electrolyte

B. Catalytic action

C. Dilution

D. Temperature

Answer: B

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5. Conductivity (Unit Siemen's 'S') is directly proportional to area of the vessel and the concentration of the solution in it and is inversely proportionals to the length of the vessel, then the unit of constant of proportionality is :

A. $Sm\text{mol}^{-1}$

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

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

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

Answer: B

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6. The correct order of equivalent conductance at infinite dilution of $LiCl$, $NaCl$ and KCl is:

A. $LiCl > NaCl > KCl$

B. $KCl > NaCl > LiCl$

C. $NaCl > KCl > LiCl$

D. $LiCl > KCl > NaCl$

Answer: B

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7. Which of the following solution of KCl has the lowest value of specific conductance (with same molar conductance)

A. 1 M

B. 0.1 M

C. 0.001 M

D. 0.001 M

Answer: D

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8. The variation of $\wedge_m$ of acetic acid with concentration is correctly represented by

A. 

B. 

C. 

D. 

Answer: C

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9. The molar conductance of acetic acid at infinite dilution is λ_∞. If the conductivity of $0.1M$ acetic acid is S, the apparent degree of ionisation is

A. $\frac{10000S}{\lambda_\infty}$

B. $\frac{10S}{\lambda_\infty}$

C. $\frac{\lambda_\infty}{100S}$

D. $\frac{100000}{\lambda_\infty S}$

Answer: A

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EXERCISE -1 (C.W.) KOHLRAUSCH.S LAW AND APPLICATIONS

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

A. $\lambda_A^\alpha + \lambda_B^\alpha$

B. $\lambda_A^\alpha - \lambda_B^\alpha$

C. $\lambda_A^\alpha + \frac{1}{2}\lambda^\alpha$

D. $2\lambda_A^\alpha + \lambda_B^\alpha$

Answer: D

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2. Molar conductance of $BaCl_2$, H_2SO_4 and HCl at infinite dilutions are x_1, x_2 and x_3, respectively. Equivalent conductance of $BaSO_4$ at infinite dilution will be:-

A. $x_1 + x_2 - x_3$

B. $x_1 - x_2 - x_3$

C. $x_1 + x_2 - 2x_3$

D. $x_1 - 2x_2 - x_3$

Answer: A

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EXERCISE -1 (C.W.) ELECTROLYSIS

1. In the Electrolysis of fused NaCl the product formed at cathode When Pt electrodes are used is

A. Cl_2

B. Na

C. H_2

D. O_2

Answer: B

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2. If mercury is used as cathode in the electrolysis of NaCl solution, the ions discharged at cathode are

A. H^+

B. Na^+

C. OH^-

D. Cl^-

Answer: B

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3. Dilute nitric acid on electrolysis using platinum electrodes yields

A. both oxygen & hydrogen at cathode

B. both oxygen & hydrogen at anode

C. H_2 at cathode and O_2 at anode

D. Oxygen at cathode and H_2 at anode

Answer: C

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4. Which of the following occurs at cathode

A. $2OH \rightarrow H_2O + \frac{1}{2}O_2 + 2e^-$

B. $Ag \rightarrow Ag^+ + e^-$

C. $Fe^{+2} \rightarrow Fe^{+3} + e^-$

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

Answer: D

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EXERCISE -1 (C.W.) FARADAY.S LAWS AND APPLICATIONS

1. When one faraday of current is passed, which of the following would deposit one gram atomic weight of the metal

A. $BaCl_2$

B. NaCl

C. $AlCl_3$

D. $CuCl_2$

Answer: B

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2. Number of electrons required to deposit one mole of Mg^{2+} ions is

A. 6.023×10^{23}

B. 12.046×10^{23}

C. 18.069×10^{23}

D. 3.012×10^{23}

Answer: B

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3. The electrochemical equivalent of an element is 0.001118gm/coulomb.

Its equivalent weight is

A. 10.7

B. 53.5

C. 1007

D. 107

Answer: D

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4. The number of electrons needed to reduce 3gm of Mg^{2+} to Mg are

A. N

B. $\frac{N}{2}$

C. $\frac{N}{4}$

D. $\frac{N}{8}$

Answer: C

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5. Three Faradays of electricity was passed through an aqueous solution of Magnesium bromide. The weight of Magnesium metal deposited at the cathode in grams is

A. 56

B. 84

C. 36

D. 168

Answer: C

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6. During the electorlysis 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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7. The electrochemical equivalent of a metal is "x" g coulomb^{-1} . The equivalent weight of metal is

A. x

B. $x \times 96500$

C. $x/96500$

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

Answer: B

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8. 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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9. 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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10. One coulomb of electricity produces m kg of a substance 'X'. The electrochemical equivalent of 'X' in grams is

A. m

B. $m \times 10^3$

C. $m \times 10^{-3}$

D. $0.1m$

Answer: B

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EXERCISE -1 (C.W.) BATTERIES

1. On electrolysing K_2SO_4 solution using inert electrodes, $1.68L(STP)$ of gases was obtained. How many moles of MnO_4^- could be reduced to Mn^{2+} by the same quantity of electricity?

A. 0.02

B. 0.15

C. 0.2

D. 0.1

Answer: A

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2. In which of the following cells reactants are not contained within the cell but are continuously supplied from external source?

A. Fuel cell

B. Dry cell

C. Lithium battery

D. Lead storage battery

Answer: A

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EXERCISE -1 (C.W.) CORROSION & PASSIVITY

1. Zins corrodes in

A. 2 M alkaline solution

B. 2 M acid solution

C. 2 M Neutral salt solution

D. All of the above

Answer: B

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2. Iron rod is immersed in Kcl solution such that half its length is exposed to air and the other half immersed in KCl solution. The part corroded is

A. Part of the rod exposed to air

B. Part of the rod immersed in KCl solution

C. Both 1 & 2

D. None of the above

Answer: B

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3. The factors that promote electrochemical corrosion are

A. The nature of the impurity metal with which the metal under consideration is associated

B. The concentration of O_2 in contact with the surface of the metal

C. Highly conducting solutions

D. All

Answer: D

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EXERCISE -1 (H.W) ELECTROCHEMICAL SERIES & EMF

1. If a salt bridge is not used between two half cells, voltage

A. Drops to zero

B. Does not change

C. Increase gradually

D. Increases rapidly

Answer: A

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2. Consider a voltaic cell based on these half - cell reactions

$Ag^{+}(aq) + e^{-} \rightarrow Ag(s) : E^{\circ} = +0.80V$

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

identify the anode and give the voltage of this cell under standard condition.

A. $Ag : E^{\circ}_{\text{cell}} = 0.40V$

B. $Ag : E^{\circ}_{\text{cell}} = 2.00V$

C. $Cd : E^{\circ}_{\text{cell}} = 1.20V$

D. $Cd : E^{\circ}_{\text{cell}} = 2.00V$

Answer: A

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3. The reaction, $\frac{1}{2}H_2(g) + AgCl(s)H^+(aq) + Cl^-(aq) + Ag(s).$

Occurs in the galvanic cell :

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

B. $Pt, H_2(g)|HCl(sol)||AgNO_3(sol)|Ag$

C. $Pt, H_2\ \_\ (g)|HCl(sol)||AgCl(s)|Ag$

D. $H_2)(g)|HCl(sol)||AgCl(s)|Ag$

Answer: C

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EXERCISE -1 (H.W) NERNST EQUATION

1. The EMF of the cell $Ni\ |\ Ni^{2+}$ (0.01M)

$Cl^-(0.01M)\,/\,Cl_2$, pt is__ V if the SRP of nickel and chlorine electrodes

are -0.25 and $+1.36V$ respectively

A. $+1.61$

B. -1.61

C. $+1.79$

D. -1.79

Answer: C

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2. The potential of hydrogen electrode having a pH=10 is

A. 0.59 V

B. zero volts

C. -0.59 V

D. none

Answer: C

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3. The oxidation potential of $0.05MH_2SO_4$ 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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EXERCISE -1 (H.W) ELECTOLYTIC CONDUCTANCE

1. With increase in temperature the electrical conduction of metallic conductor

A. increases

B. decreases

C. remains the same

D. changes irregularly

Answer: B

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2. The equivalent conductance of a 1 N solution of an electrolyte is nearly:

A. 10^3 times its specific conductance

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

C. 100 times its specific conductance

D. The same as its specific conductance

Answer: A

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3. The specific conductances of four electrolytes in $ohm^{-1}cm^{-1}$ are given below. Which one offers higher resistance to passage of electric current?

A. 7.0×10^{-5}

B. 9.2×10^{-9}

C. 6.0×10^{-7}

D. 4.0×10^{-8}

Answer: B

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4. The variation of equivalent conductance of a weak electrolyte with $(concentration)^{1/2}$ is represented as

A. 

B. 

C. 

D. 

Answer: A

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5. The variation of equivalent conductance of a weak electrolyte with $(concentration)^{1/2}$ is represented as

A. 

B. 

C. 

D. 

Answer: A

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6. Equivalent conductance of 1M CH_3COOH is $10 ohm^{-1}cm^2\text{equiv}^{-1}$ and that at inifinite dilution is 200 $ohm^{-1}cm^2\text{equiv}^{-1}$. Hence, % ionisation of CH_3COOJ is:

A. 0.05

B. 0.02

C. 0.04

D. 0.01

Answer: A

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7. if $\wedge_c$ of NH_4OH is $11.5\Omega^{-1}cm^2mol^{-1}$, its degree of dissociation would be

(Given. $\lambda^{\infty}_{NH_4^+} = 73.4\Omega^{-1}cm^2mol^{-1}$ and $\lambda^{\infty}_{OH^-} = 197.6\Omega^{-1}cm^2mol^{-1}$)

A. 0.157

B. 0.058

C. 0.424

D. 0.0848

Answer: C

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8. The value of Λ_{eq}^{∞} for NH_4Cl, $NaOH$ and $NaCl$ are 149.74, 248.1 and $126.4\Omega^{-1}cm^2 \text{ equiv}^{-1}$. The value of Λ_{eq}^{∞} 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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9. The molar conductance of HCl, NaCl and CH_3COONa are 426,12 6 and 91 $\Omega^{-1}cm^2\text{mol}^{-1}$ respectively. The molar c onductance for CH_3COOH is

A. $561\Omega^1cm^2mol^{-1}$

B. $391\Omega^{-1}cm^2mol^{-1}$

C. $261\Omega^{-1}cm^2mol^{-1}$

D. $612\Omega^{-1}cm^2mol^{-1}$

Answer: B

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EXERCISE -1 (H.W) ELECTROLYSIS

1. The passage of current through a solution of certain electrolyte results in the evolution of H_2(g) at cathode and Cl_2(g) at anode. The electrolytic solution is :

A. water

B. H_2SO_4

C. Aqueous NaCl

D. Aqueous $CuCl_3$

Answer: C

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2. The reaction taking place at the anode when a dilute aqueous solution of $CuSO_4$ is electrolysed using inert Pt electrodes.

A. $2SO_4^{2-} \rightarrow S_2O_4^{2-} + 2e^-$

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

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

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

Answer: C

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3. In the electrolysis of $NiSO_4$ using Nickel electrodes the reaction that takes place at anode is

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

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

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

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

Answer: D

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EXERCISE -1 (H.W) FARADAY.S LAWS AND APPLICATIONS

1. The amount of electricity that can deposit 108g of silver from silver nitrate solution is

A. Faraday

B. 1 Ampere

C. 1 Coulomb

D. None

Answer: A

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2. Number of Faradays required to convert 1 mol of $Cr_2O_7^{2-}$ into Cr^{3+} ions is :

A. 3F

B. 3 coulomb

C. 6F

D. $2 \times 6.023 \times 10^{23} e^{-}$

Answer: C

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3. One ampere of current is passed for 9650 seconds through molten $AlCl_3$ What is the weight in grams of Al deposited at cathode? (Atomic weight of $Al = 27$)

A. 0.9

B. 9

C. 0.09

D. 90

Answer: A

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4. On passing a current through molten KCl 19.5 g of K is deposited. The amount of Al deposited by the same quantity of electricity if passed through molten $AlCl_3$ is

A. 4.5 g

B. 9.0 g

C. 13.5 g

D. 27 g

Answer: A

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EXERCISE -1 (H.W) BATTERIES

1. Number of Faradays involved in the net reaction of Lead accumulator is

A. 1

B. 0.5

C. 2

D. Cannot be predicted

Answer: C

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EXERCISE -1 (H.W) CORROSION & PASSIVITY

1. Iron rod is dipped in concentrated HNO_3 After some time the iron rod dipped in $AgNO_3$ solution. Ag is not displace by Iron. This is because

A. SRP of silver is less than iron

B. Iron and silver have same lattice structure

C. Iron becomes passive

D. All the above

Answer: C

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2. What is the percentage of carbon in pig iron and cast iron ?

A. An electrochemical reaction (galvanic cell) is formed in which Fe acts as anode and cathode is where O_2 is reduced.

B. Electrons flow from anode to cathode though the metal while ions flow through the water droplets

C. Dissolved O_2 oxidises Fe^{+2} to Fe^{3+} before it is deposited as rust $(Fe_2O_3H_2O)$

D. All of the above take place

Answer: D

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3. Which of the following is correct regarding mechanical passivity

A. Visible metal oxide film is formed

B. Visible metal oxide film prevents dissociation of metal

C. Fe, Mn and Pb exhibit mechanical passivity

D. All the above

Answer: D

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4. Zn acts as sacrifical or cathodic protect iont to prevent rusting of iron because

A. E_{OP}° of $Zn < E_{OP}^{\circ}$ of Fe

B. E_{OP}° of $Zn > E_{OP}^{\circ}$ of Fe

C. E_{OP}° of $Zn = E_{OP}^{\circ}$ of Fe

D. Zn is cheaper than iron

Answer: B

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EXERCISE -II (C.W) ELECTRO CHEMICAL SERIES & EMF

1. The hydrogen electrode potential depends on

A. Nature of metal used as anode

B. The p^H of the solution

C. Both nature of the metal used as anode and the p^H of the solution

D. Nature of the metal used as cathode and the p^H of the solution.

Answer: D

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2. The following reaction is non-spontaneous

A. $Zn + 2H^+ \rightarrow Zn^{+2} + H_2$

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

C. $Zn + Cu^{2+} \rightarrow Zn^{2+} + Cu$

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

Answer: B

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3. The cell reaction of a cell is

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

if the standard reduction potential of Mg and Cu are -2.37 V and +0.34 V respectively The emf of the cell is

A. $+2.03$ V

B. -2.03 V

C. $+2.71V$

D. $-2.71V$

Answer: C

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4. The standard reducution potentials of $Zn^{2+}|Zn, Cu^{2+}|Cu$ and $Ag^{+}|Ag$ are respectively $-0.76, 0.34$ and $0.8V$. The following cells were constructed.

$Zn|Zn^{2+}||Cu^{2+}|Cu$

$Zn \mid Zn^{2+}||Ag^{+}|Ag$

$Cu \mid Cu^{2+}||Ag^{+}|Ag$

What is the correct order E^{0}_{cell} of these cell?

A. $b > c > a$

B. $b > c > c$

C. $a > b > c$

D. $c > a > b$

Answer: B

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5. 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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6. For the Daniel Cell involving the cell reaction $Zn_{(s)} + Cu^{+2}_{(aq)} \Leftrightarrow Zn^{+2}_{(aq)} + Cu_{(s)}$ the standard free energies of formation of $Zn_{(s)}, Cu_{(s)}, Cu^{+2}_{(aq)}$ and $Zn^{+2}_{(aq)}$ are 0, 0, 64.4 KJ/Mole and -154.0 KJ/Mole, respectively. Calculate the standard EMF of the cell

A. 2.13 volts

B. 1.13 volts

C. 2.26 volts

D. 3.42 volts

Answer: B

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

A. The spoon will get coated with aluminium

B. An alloy of copper and aluminium is formed

C. The solution becomes blue

D. There is no reaction.

Answer: D

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8. In the Daniel cell which change increases the cell EMF

A. Increase in the concentration of $ZnSO_4$

B. Increase in the dilution of $ZnSO_4$

C. Decreasing the concentration of $CuSO_4$

D. Increasing the dilution of $CuSO_4$

Answer: B

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9. The chemical reaction

$2AgCl_{(\text{fused})} + H_{2(g)} \rightarrow 2HCl_{(aq)} + 2Ag_{(s)}$

taking place in a galvanic cell is represented by the notation

A. $Pt(s)|H_2(g).1\text{bar}|1MKCl_{aq}|AgCl_s|Ag_s$

B. $Pt_s|H_2(g).1\text{bar}|1MHCl_{aq}|1MAg^+(aq)|Ag_s$

C. $Pt(s)|H_2(g).1\text{bar}|1MHCl_{aq}|AgCl_{\text{fused}}|Ag_s$

D. $Pt_s|H_2(g).1\text{bar}|1MHCl_{aq}\ |\ Ag_s|AgCl_s$

Answer: C

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10. 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 electrod is in combination with NHE, Cu electrode is the anod

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 is correct

B. all are correct

C. all are incorrect

D. both b and c correct

Answer: C

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EXERCISE -II (C.W) NERNST EQUATION

1. If the solution of the $CuSO_4$ in which copper rod is immersed is diluted to 10 times, the electrode potential :

A. Increases by 0.295 V

B. Decreases by 0.0295 V

C. Increases by 0.059 V

D. Decreases by 0.059 V

Answer: B

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2. The standard reduction potential of $Zn^{2+} \mid Zn$ and $Cu^{2+} \mid Cu$ are $-0.76V$ and $+0.34$ V respectively. What is the cell e.m.f (in V) of the following cell?

$\left(\frac{RT}{F} = 0.059\right)$

$Zn / Zn^{2+} \quad (0.05M) / Cu^{2+} (0.005M) / Cu$

A. 1.1295

B. 1.0705

C. 1.1

D. 1.041

Answer: B

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3. $E^0_{Zn^{2+}/Zn} = -0.76V$ The EMF of the cell $Zn/Zn^{2+}_{(1M)}||HCl(pH=2) \mid H_{(2(1\text{ atm})}, Pt$ is

A. 0.878 V

B. 0.642 V

C. -0.878 V

D. 0.701 V

Answer: B

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

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

When the concentration of $ZNSO_4$ is $1.0M$ and that of $CuSO_4$ is $0.01M$, the emf changed to E_2. What is the relationship between E_1 and $E(2)$?

A. $E_1 > E_2$

B. $E_1 < E_2$

C. $E_1 = E_2$

D. $E_2 = 0 \neq E_1$

Answer: A

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5. Given that $E_{H_2O\,|\,H_2\,|\,Pt}$ =0 at 298K. The pressure of H_2 gas would be

A. 10^{-7} atm

B. 10^{-14} atm

C. 10^{-10} atm

D. 10^{-12} atm

Answer: B

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6. The standard cell potential for the cell

$Zn\left|Zn^{2+}(1M)\right|\left|Cu^{2+}(1M)\right|Cu$

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

and $E^{\circ}_{Zn^{2+}/Zn} = -0.76V$ is

A. 

B. 

C. 

D. 

Answer: B

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7. In the electrochemical cell

$H_2(g), 1\,\text{atm}\left|H^{+}(1M)\right|\left|Cu^{2+}(1M)\right|Cu(s)$, which one of the following statements is true?

A. H_2 is cathode, Cu is anode

B. Oxidation occurs at Cu electrode

C. Reduction occurs at H_2 electrode

D. H_2 is anode, Cu is cathode

Answer: D

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8. The potential of the cell containing two hydrogen electrodes as represented below Pt, $H_{2(g)}\left|H^+\left(10^{-6}M\right)\right||H^+\left(10^{-4}M\right)\left|H_{2(g)}\right., Pt$ at 298 K is

A. -0.118 V

B. -0.0591 V

C. 0.118 V

D. 0.0591

Answer: C

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9. The emf of the cell,

$Zn|Zn^{2+}(0.01M)||Fe^{2+}(0.001M)|Fe$

at 298 K is 0.2905 then the value of equilibrium constant for the cell reaction is:

A. $\frac{0.32}{0.0295}$

B. $\frac{0.32}{0.0295}$

C. $\frac{0.26}{0.0295}$

D. $\frac{0.26}{0.0591}$

Answer: B

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10. For the given cell reaction of an electrochemical cell, the change in free energy at a given temperature is a function of $Cu^{2+}(C_1aq) + Zn(s) \rightarrow Zn^{2+}(C_2aq) + Cu(s)$

A. nFE°

B. $-nFE^{\circ}$

C. E°/nF

D. $-E^{\circ}$

Answer: B

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EXERCISE -II (C.W) ELECTOLYTIC CONDUCTANCE

1. A conductance cell was filled with a 0.02 M KCl solution which has a specific conductance of $2.768 \times 10^{-3} ohm^{-1} cm^{-1}$. If its resistance is 82.4 ohm at 25° C the cell constant is:

A. $0.2182 cm^{-1}$

B. $0.2281 cm^{-1}$

C. $0.2821 cm^{-1}$

D. $0.2381 cm^{-1}$

Answer: B

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2. The equivalent conductivity of a solution containing 2.45 g of $CuSO_4$ per litre, is $91.0 \Omega^{-1} cm^2 eq^{-1}$. Its conductivity would be

A. $1.45 \times 10^{-1} \Omega^{-1} cm^{-1}$

B. $2.17 \times 10^{-3} \Omega^{-1} cm^{-1}$

C. $2.90 \times 10^{-3} \Omega^{-1} cm^2$

D. $2.9 \times 10^{-3} \Omega^{-1} cm^{-1}$

Answer: D

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3. Equivalent conductance (Λ) vs concentration graphs are given for some electrolytes X,Y and Z. Hence, X, Y and Z are

A. $NiSO_4, KCl, CH_3COOH$

B. $KCl, NiSO_4, CH_3COOH$

C. $KCl, CH_3COOH, NiSO_4$

D. $CH_3COOH, NiSO_4, KCl$

Answer: B

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4. The resistance of 0.5 N solution of an electroolyte in a conductivity cell was found to be 45 ohms. If the electrodes in the cell are 2.2 cm apart

and have an area of $3.8cm^2$ then the equivalent conductance (in Scm^2eq^{-1}) of a solution is

A. 25.73

B. 15.75

C. 30.75

D. 35.75

Answer: A

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EXERCISE -II (C.W) KOHLRAUSCH.S LAW AND APPLICATIONS

1. The ionic mobilities of the cation and the aniom of a salt A_2B are 140 and 80 $ohm^{-1}cm^2eq^{-1}$ respectively. The equivlent conductivity of salt at infinite dilution is (in $ohm^{-1}cm^2eq^{-1}$):

A. 160

B. 220

C. 440

D. 360

Answer: B

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2. The mathematical expression for law of independent migration of ions is given by

A. $\Lambda = \lambda_m^\circ - BE^{1/2}$

B. $\Lambda_0 = F(U_+ \mid U_-)$

C. $\Lambda_m^\circ = V_+ ? + V_-$

D. $\frac{\Lambda_0}{\Lambda_m} = \frac{1}{\Lambda_m^0} + \frac{\lambda_m c}{K_a(\Lambda_m^\circ)^2}$

Answer: C

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3. The molar ionic conductance at infinite dilution of Ag^+ is $61.92 \times 10^{-4} Smd^{-1}m^2$ at $25^\circ C$ the ionic mobility of Ag^+ will be

A. 6.4×10^{-8}

B. 6.192

C. 6.192×10^{-4}

D. 3.2×10^{-4}

Answer: A

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4. The specific conductance of saturated solution os silver chloride is $k\left(ohm^{-1}cm^{-1}\right)$. The limiting ionic conductance of Ag^+ and Cl^- ions are x and y respectively. The solubility of AgCl in gram liter^{-1} is : (Molar mass of $AgCl = 143.5\text{g mol}^{-1}$)

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

B. $\frac{k}{x+y} \times 143.5$

C. $\frac{k \times 1000 \times 143.5}{x+y}$

D. $\frac{x+y}{k} \times \frac{1000}{143.5}$

Answer: C

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5. At $25^{\circ}C$, the ionic mobility of CH_3COO^-, H^+ are respectively 4.1×10^{-4}, 3.63×10^{-3}cm/sec. The conductivity of $0.01\text{M}\ \text{CH}_3COOH$ is $5 \times 10^{-5}\ \text{S.cm}^{-1}$. Dissociation constant of CH_3COOH is

A. 1.34×10^{-4}

B. 3×10^{-4}

C. 3×10^{-5}

D. 3×10^{-6}

Answer: A

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EXERCISE -II (C.W) ELECTROLYSIS

1. In the process of electrolysis using acive metal electrodes the wieght of cathode and anode.

A. Increases, decreases

B. Decreases, decreases

C. Increases, increases

D. Decreases, increases

Answer: A

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2. The passage of current through a solution of certain electroylte results in the formation of hydrogen at anode the soltuion is

A. Aqueous HCl

B. Fused CaH_2

C. sulphuric acid in water

D. K_2SO_4 (Aq)

Answer: B

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3. During the electrolysis of aqueous solution of sodium chloride, pH of the electrolyte

A. Remains constant

B. Gradually increases

C. Gradually decreases

D. Decreases first and then increases.

Answer: B

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4. Which of the following statements are correct?

a) The electrolysis of aquious NaCl produces hydrogen gas at cathode and chlorine gas at anode,

b) The electrolysis of a $CuSO_4$ solution using Pt electrodes causes the liberation of O_2 at the anode and the deposition of copper at the cathode.

c) Oxygen and hydrogen are produced at the anode and cathode during the electrolysis of dilute aqueous solution of H_2SO_4

d) All electrolytic reactions are redox reactions

A. Only a is correct

B. a,b are correct

C. a,d are correct

D. a,b,c and d are correct

Answer: D

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EXERCISE -II (C.W) FARADAY.S LAWS AND APPLICATIONS

1. A copper voltameter, a solver voltameter and a water voltamenter are connected in series and current is passed for some time. The ratio of the number of moles of copper, silver and hydrogen formed at the cathode is

A. $2:1:1$

B. $1:1:1$

C. $1:2:1$

D. $1:2:2$

Answer: C

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2. How many faradys are required to reduce one mole of $Cr_2O_7^{-2} \rightarrow Cr^{+3}$?

A. 3F

B. 3 coulomb

C. 6F

D. $2 \times 6.023 \times 10^{23} e^{-1}$

Answer: C

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3. The ratio of mass of hydrogen and megnesium deopisted by the same amount of electricity from H_2SO_4 and $MgSO_4$ is

A. $1:8$

B. $1:12$

C. $1:16$

D. $1:32$

Answer: B

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4. In a gydrogen - oxygen fuel cell, 67.2 litre of H_2 at S.T.P is used in 5 min. What is the average current produced?

A. 549.4 amp

B. 643.33 amp

C. 965 amp

D. 1930 amp

Answer: D

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5. An electric current is passed through a copper voltmeter and a water voltameter connected in series. If the copper voltameter now weights 16 mg less, hydrogen liberated at the cathode of the water voltmeter measures at STP about

A. 4.0 ml

B. 5.6 ml

C. 6.4 ml

D. 8.4 ml

Answer: B

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6. A quantity of electrcity required to reduce 12.3 g of nitrobenzene to aniline arising $50\,\%$ current efficiency is

A. 115800C

B. 579000C

C. 231600C

D. 289500C

Answer: A

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7. 9.65 amp of current was passed for one hour through Daniel cell. The loss of mass of zinc anode is

A. 11.76g

B. 1.176g

C. 5.88g

D. 2.94g

Answer: A

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8. The electrochemical equivalent of two substanes are E_1 and E_2. The current that flows to deposit their equal amount at the cathodes in the same time must be in the ratio of

A. $E_1 : E_2$

B. $E_2 : E_1$

C. $E_1 : E_2 - E_1$

D. $E_1 X E_2 : E_1 + E_2$

Answer: B

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9. How long will a current of 1 ampere take for complete deposition of copper from 1 litre of $1NCuSO_4.5H_2O$ solution ?

A. 96500 sec

B. $2 \times 96500\,\text{sec}$

C. $\left[\frac{96500}{2}\right]\text{sec}$

D. $\left[\frac{96500}{4}\right]\text{sec}$

Answer: A

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10. One faraday of electericity is passed separately through one litre of one molar aqueous soltion of I) $AgNO_3$, ii) $SnCl_4$ and iii) $CuSO_4$. The number of moles of Ag, Sn and Cu deposited at cathode are respectively

A. 1.0, 0.25, 0.5

B. 1.0, 0.5, 0.25

C. 0.5, 1.0, 0.25

D. 0.25, 0.5, 1.0

Answer: A

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11. $0.05M$ aqueous solution of NaCl is electrolysed. If a current of strength 0.5amp is used for 193sec. The final concentration of Na^+ ions in the electrolyte will be (volume of solution will be constant)

A. 0.05M

B. 0.049M

C. 0.051M

D. 0.04M

Answer: A

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12. Which one of the following could not be liberated from a suitable electrolyte by the passage of 0.25 faraday of electricity through that electrolyte

A. 0.25 mole of Ag

B. 16gm of Cu

C. 2gm of $O_2(g)$

D. 2.8ltrs of H_2 at STP

Answer: B

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13. What is the time (in sec) required for depositing all the silver present in $125mL$ of $1MAgNO_3$ solution by passing a current of $241.25A$? $(1F = 96500C)$

A. 10

B. 50

C. 1000

D. 100

Answer: B

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14. The charge required for the oxidation of one mole of Mn_3O_4 to MnO_4^{2-} in alkaliine medium is (assume $100\,\%$ current efficiency):

A. 10/3F

B. 6F

C. 10F

D. 4F

Answer: C

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15. The density of copper is 8 gm/cc. Number of coulombs required to plate an area of 10 cm x 10 cm on both sides to a thickness of 10^{-2} cm

using $CuSO_4$ solution as electrolyte is (Atomic weight of Cu - 64g)

A. 48250

B. 24125

C. 95500

D. 10000

Answer: A

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16. The same quantity of electricity is passed through 0.1 M H_2SO_4 and 0.1 M HCl. The amounts of H_2 obtained at the cathodes are in the ratio

A. $1:1$

B. $2:1$

C. $1:2$

D. $3:1$

Answer: A

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17. Which of the following reactions occur at the cathode during the charging of lead storage battery ?

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

B. $Pb^{2+} + SO_4^{-2} \Rightarrow PbSO_4$

C. $Pb \Rightarrow Pb^{2+} + 2e^-$

D. $PbSO_4(s) + 2H_2O \Rightarrow PbO_2(s) + 4H^+ + SO_4^{-2} + 2e^-$

Answer: A

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18. As lead storage battery is charged

A. lead dioxide dissolves

B. sulphuric acid is regenerated

C. lead electrode becomes coated with lead sulphate

D. the concentration of sulphuric acid decreases

Answer: B

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19. Alkali storage cell is commonly called

A. lead accumulator

B. Edison battery

C. fuel cell

D. Leclanche cell

Answer: B

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20. Galvanized iron sheets are coated with

A. Zn

B. Cr

C. Cu

D. Ni

Answer: A

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

A. Cu

B. Zn

C. Ag

D. Sn

Answer: D

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22. Zinc is used to protect corrosion of iron because

A. $E_{\otimes i}$ of $Zn < E_{\otimes i}$ of iron

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

C. Zn is cheaper than iron

D. Zn is abundantly available

Answer: B

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23. In corrosion of iron

A. electrons flow from anode to cathode through the metal while ions flow through die water droplets

B. an electrochemical cell (galvanic cell) is formed in which Fe acts as anode and cathode were O_2 is reduced

C. dissolved O_2 oxidises Fe^{2+} to Fe^{3+} before it is deposited as rust $(Fe_2O_3.xH_2O)$

D. all of the above takes place

Answer: D

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

A. generate heat

B. emove absorbed oxygen from electrode surfaces

C. produce high purity water

D. create potential difference between the two electrodes

Answer: D

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EXERCISE -II (H.W) ELECTRO CHEMICAL SERIES & EMF

1. E° of $Mg^{2+}||Mg$, $Zn^{2+}||Zn$, and $Fe^{2+}\ |\ |\ Fe$ are -2.37V, -0.76V and -0.44 V respectively. Which of the following is correct?

A. Mg oxidizes Fe

B. Zn oxidizes Fe

C. Zn reduces Mg^{2+}

D. Zn reduces Fe^{+2}

Answer: D

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2. The EMF of the Daniel cell is 1.1V . The external EMF to be applied for the following reaction to take place in it.

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

A. 0.10 V

B. 1.1 V

C. 1.2 V

D. 0.55 V

Answer: C

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3. Given: $Fe_{(s)} \rightarrow Fe^{2+} + 2e^-, E^\circ = +0.44V$

$Pb_{(s)} \rightarrow Pb^{2+} + 2e^-, E^\circ = +0.13V$

$Ag^+ + e^- \rightarrow Ag, E^\circ = +0.8V$

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

Which of the following metal ion will oxidise iron?

A. Ag^{+} only

B. Cu^{2+} only

C. Pb^{+2} only

D. All

Answer: C

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4. If a spoon of copper metal is placed in a solution of ferrous sulphate .

A. Copper will precipitate out

B. Iron will precipitate

C. Cu and Fe will precipitate

D. No reaction takes place

Answer: D

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

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

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6. Standard reduction potential values for the electrodes are given below.

$Mg^{2+}2e^{-} \rightarrow Mg \text{ is } -2.37V$

$Zn^{2+} + 2e^{-} \rightarrow Zn \text{ is } -0.76V$

$Fe^{2+} + 2e^{-} \rightarrow Fe \text{ is } -0.44V$

Which of the following statement is correct

A. Zince will reduce Fe^{2+}

B. Zinc will reduce Mg^{2+}

C. Mg oxidises Fe

D. Zinc oxidises Fe

Answer: A

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7. The life span of a Daniel cell may increased by

A. Large Cu electrode

B. Lowering of $CuSO_4$ concentration

C. Lowering of $ZnSO_4$ concentration

D. Large copper electrode

Answer: C

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8. To the Daniel cell $ZnSO_4$ is added to the left hand side electrode. Then cell emf

A. Increases

B. Decreases

C. Doest not change

D. First increases & then decreases

Answer: B

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9. The reaction, $\frac{1}{2}H_2(g) + AgCl(s) = H^+(a.q) + Cl^-(a.q) + Ag(s)$ occurs in the galvanic cell:

A. $Ag|AgCl_s|KCl_{\text{soln}}|AgNO_{3\,(\text{soln})}|Ag$

B. $Pt, H_2(s)|HCl_{\text{soln}}|AgNO_3(\text{soln}) \mid Ag$

C. $Pt, H_2(g)|HCl_{\text{soln}}|AgCl_s \mid Ag$

D. $Pt, H_2(g)|KCl_{\text{soln}}|AgCl_s \mid Ag$

Answer: C

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EXERCISE -II (H.W) NERNST EQUATION

1. The e.m.f of the cell

$Ni/Ni^{+2}(1M)//Cl^-(1M)Cl_2, Pt$

$\begin{pmatrix} E^\circ Ni^{2+}/Ni = -0.25eV: \\ E^\circ \frac{1}{2}Cl_2/Cl^- = +1.36eV \end{pmatrix}$

A. $-1.11V$

B. 1.11 V

C. -1.61 V

D. 1.61 V

Answer: D

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2. The reduction potential of hydrogen electrode containing a solution of pH=4 is

A. 0.236 V

B. 4.059 V

C. $-0.236V$

D. 3.941 V

Answer: C

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3. The oxidation potential of a hydrogen electrode is related to the pH of the solution by the equation at 25° C

A. $-0.059 \times pH$

B. $0.059 \times pH$

C. $0.059/(pH$

D. $0.059 + pH$

Answer: B

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4. $I_2(s) \mid I^-$(0.1M) half cell is connected to a H^+ (aq)$|H_2$(1 bar)|Pt half celland e.m.f. is found to be 0.7714 V. If $E^\circ_{I_2|I^-}$=0.535 V, find the pH of $H^+ \mid H_2$ half cell.

A. 1

B. 3

C. 5

D. 7

Answer: B

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5. Which one of the following will increase the voltage of the cell ? $(T = 298K)$

$Sn + 2Ag^+ \rightarrow Sn^{2+} + 2Ag.$

A. Increase in the concentration of Sn^{2+} ions

B. increase in the concentration of Ag^+ ions

C. increase in the size of silver rod

D. removal of salt bridge

Answer: B

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6. The standard emf for the cell cell reaction $Zn + Cu^{2+} \rightarrow Zn^{2+} + Cu$ is 1.10 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. 0.110V

C. -1.10 V

D. -0.110 V

Answer: A

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7. The E° at 25°C for the following reaction at the indicated concentrations is 1.50 V. Calculate the ΔG in kJ/mol 25°C :

A. -140.94

B. -295

C. -212

D. -422.83

Answer: D

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8. The cell, $Zn/Zn^{2+}(1M)//Cu^{2+}(1M)/Cu\left(E_{cell}^{\circ}=1.10V\right)$, was allowed to be completely concentration of Zn^{2+} to Cu^{2+} is

A. 37.3

B. 1037.3

C. 9.65×10^{4}

D. antilog (24.04)

Answer: B

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9. Deduce from the following E^{c-} values of half cells, what combination of two half cells would results in a cell with the largest potential?

$I.$	$A + e(-) \rightarrow A^{c-}$	$E^{c-} = -0.24V$
$II.$	$B^{c-} + e^{-} \rightarrow B^{2-}$	$E^{c-} = +1.25V$
$III.$	$C^{c-} + 2e^{-} \rightarrow C^{3-}$	$E^{c-} = -1.25V$
$IV.$	$D + 2e^{c-} \rightarrow D^{2-}$	$E^{c-} = +0.68V$

A. I and IV

B. II and III

C. III and IV

D. I and II

Answer: D

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10. The emf (in V) of a Daniell cell containing 0.1 M $ZnSO_4$ and 0.01 M $CuSO_4$ solutions at their respective electrodes is $\left(E^{\circ}_{Cu^{2+}/Cu} = +0.34V, E^{\circ}_{Zn^{2+}/Zn} = -0.76V\right)$

A. 1.1

B. 1.16

C. 1.13

D. 1.07

Answer: D

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EXERCISE -II (H.W) ELECTROLYTIC CONDUCTANCE

1. The specific conductance of a solution is $0.3568 \ \text{ohm}^{-1}cm^{-1}$ when placed in a cell the conductance is $0.0268 \ \text{ohm}^{-1}$. The cell constant is

A. $1.331 cm^2$

B. $13.31 cm^{-1}$

C. $0665 cm^{-1}$

D. $6.65 cm^{-1}$

Answer: B

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

A. Ionic mobility of H^+ is greater than that of Na^+

B. the dipolie moment of NaCl is greater than that of HCl

C. NaCl is more ionic than HCl

D. HCl is Bronsted acid and NaCl is a salt of a strong acid and strong base

Answer: A

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3. Conductance of 0.1 M KCl (conductiviy = $Xohm^{-1}cm^{-1}$) filled in a conductivity cell is Y ohm^{-1} If the conductance of 0.1 M NaOH filled in the same cell is Z ohm^{-1} the molar conductance of NaOH will be

A. $10^3\frac{XZ}{Y}$

B. $10^4\frac{XZ}{Y}$

C. $10\frac{XZ}{Y}$

D. $0.1\frac{XZ}{Y}$

Answer: B

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EXERCISE -II (H.W) KOHLRAUSCH.S LAW & APPLICATIONS

1. Which of the following represents increasing order of ionic conductance at infinite dilution?

A. $F^- < Cl^- < Br^- < I^-$

B. $I^- < Br^- < F^- < Cl^-$

C. $F^- < Cl^- < I^- < Br^-$

D. $F^- < I^- < Cl^- < Br^-$

Answer: A

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2. The equivalent conductance of two strong electrolytes at infinite dilution in H_2O (where ions move freely through a solution) at $25^\circ C$ are given below:

$A^\circ_{CH_3COONa} = 91.0 Scm^2/\text{equiv}$

$A^\circ_{HCl} = 426.25 cm^2/\text{equiv}$

What additional information/quantity one needs to calculate A° of an aqueous solution of acetic acid?

A. Λ° of chloroacetic acid $(ClCH_2COOH)$

B. Λ° of NaCl

C. Λ° of CH_3COOK

D. The limiting equivalent conductance of $H^+\left(\lambda^\circ_{H+}\right)$

Answer: B

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3. The value of $\wedge_m^\infty$ for KCl and KNO_3 are 149.86 and $154.96\Omega^{-1}cm^2mol^{-1}$

Also $\lambda^\infty_{Cl^-}$ is 71.44 $\text{ohm}^{-1}cm^2mol^{-1}$ The value of $\lambda^\infty_{NO_3^-}$ is

A. 76.54 $ohm^{-1}cm^2mol^{-1}$

B. $133.08ohm^{-1}cm^2mol^{-1}$

C. $37.7ohm^{-1}cm^2mol^{-1}$

D. Unpredictable

Answer: A

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4. Specific conductance of 0.1 M CH_3COOH at 25° C is 3.9×10^{-4} $\text{ohm}^{-1}\text{cm}^{-1}$

If $\lambda^\infty\left(H_3O^+\right)$ and $\lambda^\infty\left(CH_3COO^-\right)$ at 25°C are 349.0 and 41.0 $\text{ohm}^-\text{cm}^2\text{mol}^{-1}$ respectively degree of ionisation of CH_3COOH at the given concentration is

A. $1.0\,\%$

B. $4.0\,\%$

C. $5.0\,\%$

D. $2.0\,\%$

Answer: A

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5. At 298 K the molar conductivities at infinite dilution ($\wedge_m^\circ$) of NH_4Cl, KOH and KCl are 152.8, 272.6 and $149.8\ \mathrm{S\ cm^2 mol^{-1}}$ respectively. The $\wedge_m^\circ$ of NH_4OH in $\mathrm{S\ cm^2 mol^{-1}}$ and % dissociation of 0.01 M NH_4OH with $\wedge_m = 25.1\ \mathrm{S\ cm^2 mol^{-1}}$ at the same temperature are

A. 269.6, 9.6

B. 30,84

C. 275.6, 0.91

D. 275.6, 9.1

Answer: D

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6. The equivalent conductances of sodium chloride, hydrochloric acid and sodium acetate at infinite dilution are 126.45, 426.16 and

$91.0 ohm^{-1} cm^2 eq^{-1}$, respectively at $25^\circ C$. Calculate the equivalent conductance of acetic acid at infinite dilution.

A. 80

B. 328

C. 360

D. 408

Answer: C

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EXERCISE -II (H.W) ELECTROLYSIS

1. Two platinum electrodes were immersed in a solution of $CuSO_4$ and electric current was passed through the solution. After some time, it was found that colour of $CuSO_4$ disappeared with evolution of gas at the electrode. The colourless solution contains.

A. Platinum sulphate

B. Copper sulphate

C. Copper hydroxide

D. Sulphuric acid

Answer: C

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2. Which of the following on electrolysis would, not evolve oxygen at the anode ?

A. Dilute H_2SO_4 with Pt electrodes

B. Aqueous silver nitrate using Pt electrodes

C. Aqueous Na_2SO_4 with Pt electrodes

D. 50% of H_2SO_4 with Pt electrodes

Answer: D

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3. In which of the following electrolysis, the composition of electrolyte is expected to remain constant under optimum conditions

A. Aq. $AgNO_3$ solution between Ag electrodes

B. Ag. $CuSO_4$ solution between Pt electrodes

C. Fused NaCl between Pt electrodes

D. Aqueous $AgNO_3$ solution between Pt electrodes.

Answer: A

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4. In the electrolysis of Na_2SO_4 solution using inert electrodes

a) the anodic reaction is

$2H_20 \rightarrow O_{2(g)} + 4e^- + 4H^+$

b) $H_{2(g)}$ and $O_{2(g)}$ is produced in a molar ratio of $2:1$

c) 23 grams of sodium is produced at the cathode

d) The cathode reaction is $Na^+ + e^- \rightarrow Na$

A. a and b are correct

B. c,d are correct

C. Only c is correct

D. All are correct

Answer: A

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EXERCISE -II (H.W) FARADAY.S LAWS & APPLICATIONS

1. How many coulombs of electricity are consumed when a 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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2. The same current if passed through solution of silver nitrate and cupric salt connected in series. If the weights of silver deposited is $1.08g$. Calculate the weight of copper deposited

A. 0.6454 g

B. 6.354 g

C. 0.3177 g

D. 3.177 g

Answer: C

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3. Aluminium oxide may be electrolysed at 1000° C to furnish aluminium metal (Atomic mass = 27 amu, 1 Faraday = 96500 Coulomb). The cathode reaction is $Al^{3+} + 3e^{-} \rightarrow Al$. To prepare 5.12 kg of aluminium metal by this method would require:

A. $5.49 \times 10^{1} C$ electricity

B. 5.49×10^{4} C of electricity

C. 1.83×10^{7} C of electricity

D. 5.49×10^{7} C of electricity

Answer: D

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4. In an electrolytic cell one litre of 1M aqueous solution of MnO_4^- is reduced to MnO_4^{-2} at cathode. How many faradays would be required so

that the solution becomes 0.899 M MnO_4^-

A. 10 Faradays

B. 0.1 Faradays

C. 1.0×10^{-4} Faraday

D. 1×10^{-2} Faraday

Answer: B

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5. Statement -1 : During the electrolysis of water, two faraday of charge will produce a total of 33.6 litre of gases at STP at electrodes.

Statement -2 : In the electrolysis of water, two faraday of charge will produce half mole of H_2 gas and one fourth mole of O_2 gas.

A. b,c

B. a,b,c

C. a,c,d

D. All

Answer: A

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6. On electrolysis of 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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7. Three faradays of electricity are passed through molten Al_2O_3 aqueous solution of $CuSO_4$ and molten $NaCl$ taken in deffernt electrolytic cells. The amout of Al, Cu and Na deposited at the cathodes will be in the ration of .

A. 1 mole: 2 moles: 3 mole

B. 1 mole: 1.5 mole: 3 mole

C. 3 mole: 2 mole: 1 mole

D. 1 mole: 1.5 mole: 2 mole

Answer: B

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8. Number of coulombs of current required to convert completely 1 mole of MnO_4^- ions in acid medium to one mole of Mn^{2+} ions electrolytically is

A. 96500

B. 5×96500

C. 96500×2

D. 96500×6

Answer: B

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9. On passing a current through a molten aluminium chloride for some time, produced 11.2 lit of Cl_2 at NTP at anode, the quantity of aluminium deposited at cathode is

A. 27 grams

B. 18 grams

C. 9 gram

D. 36 gram

Answer: C

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10. A current of 2A passing for 5 hours deposits 22.2 g of tin (at.wt=119), the oxidation state of tin is

A. zero

B. three

C. two

D. four

Answer: C

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11. 1 ampere current is passed for 60 seconds into an electrolytic cell. Number of electrons that, pass through the solution is.

A. 6.0×10^{23}

B. 1.2×10^{24}

C. 37.5×10^{19}

D. 7.48×10^{21}

Answer: C

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12. The number of electrons passing per second through a cross-section of copper wire carrying 10^{-6} ampere:

A. 1.6×10^{-19}

B. 6×10^{-35}

C. 6×10^{-6}

D. 6.24×10^{12}

Answer: D

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13. Zinc reacts with $CuSO_4$ according to the equation $Zn + CuSO_4 \rightarrow ZnSO_4 + Cu$. If excees of zinc is added to 100.0 ml of 0.05 M $CuSO_4$ the amount of copper formed in moles will be

A. 0.05

B. 0.5

C. 0.005

D. 50

Answer: C

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14. Total volume of gases evolved at STP when 36 g of H_2O are completely electrolysed between platinum electrodes

A. 22.4 lit

B. 44.8 lit

C. 33.6 lit

D. 67.2 lit

Answer: D

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15. What is the approximate quantity of electricity in colombs required to deposit all the silver from 250 ml 1M $AgNO_3$ aqueous solution (At.wt of Ag=108)?

A. 96500

B. 24125

C. 48250

D. 12062.5

Answer: B

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16. The change required to deposite 9 g of Al from Al^{3+} solution is (at. Wt. of Al = 27.0) :

A. 4

B. 2

C. 3

D. 1

Answer: A

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EXERCISE -II (H.W) BATTERIES

1. When lead accumulator is charged, it is

A. An electrolytic cell

B. A galvanic cell

C. A Daniel cell

D. None of the above

Answer: A

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2. During the discharge of a lead storage battery, density of H_2SO_4 fall from 1.3 to $1.14g/mL$ Sulphuric acid of density $1.3g/ml$ is 40W % and that of $1.14g/mL$ is 20W% The battery holds two litre of the acid and volume remains practically constant during dicharging. The number of ampere- sec used from the battery is.

A. $3 \times 96,500$

B. $6 \times 96,500$

C. $9 \times 96,500$

D. $12 \times 96,500$

Answer: B

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3. Efficiency of the following cell is 84%

$A(s) + B_{aq}^{2+} + B(s), \Delta H^{\circ} = -285KJ$

The standard electrode potential of cell will be.

A. 1.20 V

B. 2.40V

C. 1.10 V

D. 1.24 V

Answer: D

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EXERCISE -II (H.W) CORROSION AND PASSIVITY

1. Zinc is used to protect corrosion of iron because

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

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

C. Zn is cheaper than iron

D. Zn is abundantly available

Answer: B

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2. The corrosion of iron object is favoured by

A. presence of H^+ ion

B. Presence of moisture in air

C. Presence of impurities in iron object

D. All of the above

Answer: D

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3. 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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4. A solution of concentration 'C' g equiv/litre has a specific resistance R. The equivalent conductance of the solution is

A. R/C

B. C/R

C. 1000/R

D. 10000 R /C

Answer: C

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5. For the following reaction

$Ag^{+}_{(aq)} + Cl^{-}_{(aq)} \rightarrow AgCl_{(s)}$

Given :

$\Delta G^{\circ}_{f}, AgCl = -112.44\,\text{kJ/mol}, \Delta G^{\circ}_{f} Cl^{-} = -130\,\text{kJ/mol}, \Delta G^{\circ}_{f} Ag^{+} =$

Report your answer by rounding it upto nearest whole number. The K_{sp} of $AgCl$ is $n \times 10^{-10}$. The value of 'n" is .

A. -0.60

B. 0.60 V

C. 6.0 V

D. -6.0 V

Answer: B

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6. At $25^\circ C$, the molar conductances at infinite dilution for the strong electrolytes $NaOH, NaCl$ and $BaCl_2$ are $248 \times 10^{-4}, 126 \times 10^{-4}$ and $280 \times 10^{-$ respectively. $\Lambda_m^\circ Ba(OH)_2$ in $Sm^2 mol^{-1}$

A. 52.4×10^{-4}

B. 216×10^{-4}

C. 402×10^{-4}

D. 524×10^{-4}

Answer: B

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7. How many Faradays are required to reduce $1molofBrO_3^{c-}$ to Br^{c-} in basic medium ?

A. A-2, B-3, C-4, D-1

B. A-4, B-1, C-2, D-4

C. A-3, B-2, C-4, D-1

D. A-4, B-3, C-2, D-1

Answer: B

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	List-I	List-II
A)	Electronic conductors	1) Acectic acid
B)	Electrolytic conductors	2) Solid salts
C)	Non-electrolyte	3) Surose
D)	Weak electrolyte	4) Molten salts

8. The correct match is

A. A-2, B-1, C-3, D-4

B. A-2, B-4, C-3, D-1

C. A-1, B-4, C-3, D-2

D. A-4, B-3, C-2, D-1

Answer: B

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9. The equivalent conductance at infinite dilution of a weak acid such as HF

A. can be determined by extrapolation of measurnments on dilute solutions of HCl, HBr and HI

B. Can be determined by measurnment on very dilute HF solutions.

C. Can be determined from measurnments on dilute solutions of NaF, NaCl and HCl

D. is an undefined quantity

Answer: C

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10. Molar conductane of KCl increases slowly with decrease in concentration because of

A. increase in degree of ionisation

B. increase in total number of current carrying species

C. weaking of interionic attractions and increases in ionic mobilities

D. increase in hydration of ions.

Answer: C

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11. Fused NaCl has less electrical conductance than NaCl in the aqueous solution. This is due to

A. fused NaCl has less number of ions

B. incomplete ionization occurs in the fused state

C. Na^+, Cl^- ions do not move freely in the fused salt

D. Fused NaCl has no ions.

Answer: C

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12. The extent of ionization of weak electrolyte increases

A. with increase in concentration of the solute

B. On addition of excess of water

C. On decreasing the temperature

D. On stirring the solution vigorously

Answer: B

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13. Which of the following statements is correct for an electrolytic solution upon dilution

A. conductivity increases

B. conductivity decreases

C. molar conductance decreases but equivalent conductance increases

D. molar conductance increase while equivalent conductance decreases.

Answer: B

Watch Video Solution

14. The reason for increase in electrical conduction of a weak electrolyte with increase in temperature

A. increase in the number of ions

B. increase in the speed of ions

C. increase in the degree of dissociation of electrolytes

D. all the above

Answer: D

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15. The electrochemical cell stops working after some time because:

A. Electrode potentials of both electrodes becomes zero

B. Electrodes potentials of both electrodes become equal

C. Temperature of the coil increases

D. the reaction starts proceeding in opposite direction

Answer: A

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16. A reversible galvanic cell is connected to an external battery. If the EMF of the battery is less than EMF of the galvanic cell, current

A. does not flow from galvanic cell

B. Flows from the battery into the galvanic cell

C. Flows from the galvanic cell into the battery

D. All the three may take place.

Answer: C

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17. Following are some of the facts about a dry cell

I : It is alos called Leclanche cell

II : It is also called Daniel cell

III : Electrolyte is a moist paste of NH_4Cl and $ZnCl_2$ in starch

IV : Cathodic reaction is

$$2MnO_2(s) + 2NH_4^+(aq) + 2e^-$$

$$\rightarrow Mn_2O_3(s) + 2NH_3(g) + H_2O(l)$$

Select correct facts :

A. I,ii, iii

B. I,iii,iv

C. ii,iii,iv

D. I,iv

Answer: B

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18. Assertion(A) Λ_m for weak electrolytes shows a sharp increase when the electrolytic solution is diluted.

Reason(R) For weak electrolytes degree of dissociation increases with dilution of solution.

A. (a-r) (b-q)(c-q,r)(d-p,s)

B. (a-q)(b-r)(c-q,s)(d-p,r)

C. (a-r)(b-q)(c-q,s)(d-p,r)

D. (a-r)(b-q)(c-p,s)(d-s,r)

Answer: B

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EXERCISE - 3

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

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

The standard EMF of the reaction

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

will be:

A. 1.653 V

B. 1.212 V

C. 0.111 V

D. 0.330 V

Answer: B

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2. A hypothetical elecrochemical cell is shown below:

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

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

A. $A^{\oplus}+e^{-}\Rightarrow A, B^{\oplus}+e^{-}\Rightarrow B$

B. The cell reaction cannot be predicted

C. $A+B^{\oplus}\Rightarrow A^{\oplus}+B$

D. $A^{\oplus}+B\Rightarrow A+B^{\oplus}$

Answer: C

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3. The charge required for the reduction of 1 mol of MnO_4^- to MnO_2 is

A. 1F

B. 2F

C. 5F

D. 6F

Answer: C

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4. If the half-cell reaction $A = E^- \rightarrow A^-$ has a large negative reduction potential, it follows that .

A. A is readily oxidised

B. A is readily reduced

C. A^{approx} is readily oxidised

D. A^{approx} is readiliy reduced

Answer: C

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5. At 20° C, the standard oxidation potential of Zn and Ag in water are:

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

$Ag(s) \rightarrow Ag^+(aq) + E^-, E^o = -0.80V$

The standard EMF of the given reaction is:

$Zn + 2Ag^+ \rightarrow 2AG + Zn^{+2}$

A. $Zn^{2\oplus}(aq) \Rightarrow Ag^{\oplus}(aq) \Rightarrow Zn(s) + Ag(s)$

B. $Zn(s) + 2Ag(s) \Rightarrow Zn^{2\oplus}(aq) + 2Ag^+(aq)$

C. $Zn(s) + 2Ag^{\oplus} \Rightarrow Zn^2(aq) + 2Ag(s)$

D. $Zn^{2+}(aq) + 2Ag^s \Rightarrow 2Ag^+(aq) + Zn(s)$

Answer: C

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6. E° for the electrochemical cell

$Zn(s)|Zn^{2+}1M(Aq.)||Cu^{2+}1M(aq.)|Cu(s)$

is 1.10 V at $25^\circ C$. The equilibrium constant for the cell reaction,

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

Will be :

A. 10^{-37}

B. 10^{37}

C. 10^{-17}

D. 10^{17}

Answer: B

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7. When a lead storage battery is charged:

A. amount of sulphuric acid decreases

B. Sulphuric acid is regenerated

C. Lead oxide dissolves

D. Lead electrode becomes coated with lead sulphate

Answer: B

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8. A current of 96.5 A is passed for 18 min between nickel electrodes in 500 mL solution of $2MNi(NO_3)_2$. The molarity of solution after electrolysis would be:

A. 0.92 M

B. 1.25 M

C. 0.46 M

D. 0.752 M

Answer: A

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9. What is the time (in sec) required for depositing all the silver present in $125mL$ of $1MAgNO_3$ solution by passing a current of $241.25A$? $(1F = 96500C)$

A. 10

B. 50

C. 1000

D. 100

Answer: B

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

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

When the concentration of $ZNSO_4$ is $1.0M$ and that of $CuSO_4$ is $0.01M$, the emf changed to E_2. What is the relationship between E_1 and $E(2)$?

A. $E_1 = E_2$

B. $E_1 = 0 \neq E_2$

C. $E_1 > E_2$

D. $E_1 < E_2$

Answer: C

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11. The reduction electrode potential E of 0.1 M solutoin of M^+ ions $\left(E^\circ_{RP} = -2.36V\right)$ is

A. $-4.82V$

B. $-2.41V$

C. $+2.41V$

D. none of these

Answer: B

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

A. $8.1 \times 10^4 g$

B. $2.4 \times 10^5 g$

C. $1.3 \times 10^4 g$

D. $9.0 \times 10^3 g$

Answer: A

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13. The equivalent conductance of $M/32$ solution of a weak monobasic acid is 6.0 mho $cm^2 eq^{-1}$ and at infinite dilution is 200 mho $cm^2 eq^{-1}$. The

dissociation constant of this acid is:

A. 1.25×10^{-6}

B. 6.25×10^{-4}

C. 1.25×10^{-4}

D. 1.25×10^{-5}

Answer: D

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14. Given:

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

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

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

A. 0.38 V

B. 0.52 V

C. 0.92 V

D. 0.30 V

Answer: B

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15. For the cell $Tl|Tl^{+}(0.001M)||Cu^{2+}(0.01M)|Cu$. E_{cell} at $25^{\circ}C$ is 0.83V, which can be increased:

A. Decreasing $[Ti^{+}]$

B. increasing $[Cu^{2+}]$

C. Increasing $[Ti^{+}]$

D. both 'a' and 'b'

Answer: D

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

A. 89. kJ

B. $-89.0J$

C. $-44.5kJ$

D. $-98.0kJ$

Answer: B

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

A. Increase in ionic mobility of ions

B. 100% ionisation of electrolyte at normal dilution

C. Increase in both the number of ions and ionic mobility of ions.

D. Increase in number of ions

Answer: A

Watch Video Solution

18. The electrode pptenticals for

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

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

are $+0.15V$ and $+0.\ 50V$ repectively. The value of $E^{\circ}_{cu^{2+}/Cu}$ will be.

A. 0.150 V

B. 0.500 V

C. 0.325 V

D. 0.650 V

Answer: C

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

A. $0.18V$

B. $+0.89V$

C. $+1.19V$

D. $+1.83V$

Answer: B

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

A. X gt Y gtZ

B. Y gt Z gt X

C. Y gt X gt Z

D. Z gt X gt Y

Answer: D

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21. If the E_{cell}° for a given reaction has a positive value, then which of the following gives the correct relationship for the values of ΔG° and K_{eq} :-

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

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

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

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

Answer: B

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

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

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

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

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

Answer: D

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

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

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

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

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

Answer: A

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

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

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

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

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

The strongest oxidizing and reducing agents respectively are:

A. Cl_2 and I_2

B. F^2 and I^-

C. Br_2 and Cl^-

D. Cl_2 and Br^-

Answer: B

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25. A button cell used in watched funcations as follwing

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

If half cell potentials are

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

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

The cell potential will be

A. 0.84 V

B. 1.34 V

C. 1.10 V

D. 0.42 V

Answer: C

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

A. 0.118 V

B. 1.18 V

C. 0.059 V

D. 0.59 V

Answer: D

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

A. 9650 C

B. 96.50 C

C. 96500 C

D. $2 \times 96500 C$

Answer: A

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

A. 54.0 g

B. 108.0 g

C. 5.4 g

D. 10.8 g

Answer: B

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

A. electrolytic cel

B. Dynamo

C. Ni-Cd cell

D. Fuel cell

Answer: D

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

A. $2.88Sc\frac{m^2}{m}ol$

B. $11.52Sc\frac{m^2}{m}ol$

C. $0.086Sc\frac{m^2}{m}ol$

D. $28.8Sc\frac{m^2}{m}ol$

Answer: C

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

A. 55 minutes

B. 110 minutes

C. 220 minutes

D. 330 minutes

Answer: B

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

A. 6×10^{23}

B. 6×10^{20}

C. 3.75×10^{20}

D. 7.48×10^{23}

Answer: A

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EXERCISE - IV

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

A. $Pt(s)H_2(g.0.1^-)H^+(aq, 1M)||Cu^{2+}(aq, 1M)Cu||$

B. $Pt(s)H_2O(g, 1^-)H^+(aq, 1M)||Cu^{2+}(aq, 1M)Cu||$

C. $Pt(s)H_2(g.1^-)H^+(aq, 1M)||Cu^{2+}(aq, 1M)Cu||$

D. $Pt(s)H_2(g.\ 1^-)H^+(aq, 1M)||Cu^{2+}(aq.\ , 1M)Cu||$

Answer: C

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

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

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

A. 

B. 

C. 

D. 

Answer: B

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3. Which of the following statement is correct?

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

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

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

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

Answer: C

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

A. Cell potential

B. Cell emf

C. Potential difference

D. Cell voltage

Answer: B

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

A. it does not participate in the cell reaction.

B. it provides surface either for oxidatin or for reduction reaction.

C. it provides surface for conduction of electrons.

D. It provides surface for redox reaction.

Answer: D

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

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

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

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

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

Answer: C

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

A. Conductivity of solution depends upon size of ions.

B. conductivity depends upon viscosity of solution.

C. Conductivity does not depend upon solvation of ions present in solution.

D. Conductivity of solution increases with temperture.

Answer: C

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8. Using tha data given below is reducing potenial.

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

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

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

A. Cl^-

B. Cr

C. Cr^{3+}

D. Mn^{2+}

Answer: B

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9. Which of the following is the strongest oxidising agent ?

A. Cl^-

B. Mn^{2+}

C. MnO_4^-

D. Cr^{3+}

Answer: C

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10. Use the data given in Q.8 and find out the most stable ion in its reduced form.

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

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

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

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

Answer: B

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11. Use the data given in Q.8 and find out the most stable ion in its reduced form.

A. Cl^{-}

B. MnO_4^{-}

C. $Cr_2O_7^{2-}$

D. Mn^{2+}

Answer: D

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12. Use the data given in Q.8 and find out the most stable ion in its reduced form.

A. Cr^{3+}

B. MnO_4^-

C. $Cr_2O_7^{2-}$

D. Mn^{2+}

Answer: D

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13. The quantity of charge required to obtain one mole of aluminium from $Al_2 0_3$ is

A. 1 F

B. 6 F

C. 3F

D. 2 F

Answer: C

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14. The cell constant of a conductivity cell

A. changes with change of electrolyte

B. Changes with change of concentration of electrolyte

C. Changes with temperature of electrolyte

D. Remains constant for a cell.

Answer: D

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15. While charging the lead storage battery:

A. $PbSO_4$ anode is reduced to Pb.

B. $PbSO_4$ cathode is reduced to Pb.

C. $PbSO_4$ cathode is oxidation to Pb.

D. $PbSO_4$ anode is oxidsed to PbO_2

Answer: A

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

A. $\Lambda^{\circ}_{mNH_4OH} + \Lambda^{\circ}_{mNH_4Cl} - \Lambda^{\circ}_{HCl}$

B. $\Lambda^{\circ}_{mNH_4Cl} + \Lambda^{\circ}_{mNaOH} - \Lambda^{\circ}_{NaCl}$

C. $\Lambda^{\circ}_{mNH_4Cl} + \Lambda^{\circ}_{mNaCl} - \Lambda^{\circ}_{NaOH}$

D. $\Lambda^{\circ}_{mNaOH} + \Lambda^{\circ}_{mNaCl} - \Lambda^{\circ}_{NH_4Cl}$

Answer: B

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

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

B. $2H_2O(l) \rightarrow O_2(g) + 4H^+(aq) + 4e^-, E^{\circ}_{\text{cell}} = 1.23V$

C. $H^+_{aq} + e^- \rightarrow \frac{1}{2}H_2(g), E^{\circ}_{\text{cell}} = 0.00V$

D. $Cl(aq) \rightarrow + \frac{1}{2}Cl_2(g) + e^-, E^{-}_{\text{cell}} = 1.36V$

Answer: D

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18. The positive value of the standard electrode potential of Cu^{2+}/Cu indicates that .....

1) This redox couple is a strongest reducing agent than the H^+/H_2 couple.

2) This redox couple is a stronger oxidising agent than H^+/H_2

3) Cu cannot displace H_2 from acid.

4) Cu cannot displaced H_2 from acid.

A. 2 & 4

B. Only 2

C. 3 & 4

D. 1 7 4

Answer: A

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19. Potential for some half cell reactions are given below. On the basis of these mark the correct answer.

(i) $H^+(aq) + e^- \rightarrow \left(\frac{1}{2}\right) H^2(g)\ E^\circ_{cell} = 0.00V$

(ii) $2H_2O(l) \rightarrow O_2(g) + 4H^+(aq) + 4e^-, E_{cell} = 1.23V$

(iii) $2SO_4^{2-}(aq) \rightarrow S_2O_8^{2-}(aq) + 2e^-, E^\circ_{cell} = 1.96V$

A. 2 & 4

B. 1 & 3

C. 1 & 2

D. Only 2

Answer: B

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20. $E^\circ_{\text{cell}} = 1.1V$ for Daniel cell. Which of the following expressions are correct description of state of equilibrium in this cell?

A. 2 & 4

B. 2 & 3

C. 1 & 2

D. Only 2

Answer: B

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21. The product / s of the following reaction is (are)

$$C_2H_5Br + 2Na + CH_3Br \xrightarrow{\text{dry ether}}$$

A. 2 & 4

B. 1 & 3

C. 1 & 2

D. 1 & 4

Answer: B

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22. $\Lambda_m^\circ H_2O$ is equal to

A. 1 & 4

B. 2 & 4

C. 1 & 3

D. 1 & 2

Answer: A

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23. Durinh electrlysis of an aqueous solution of $CuSO_4$ using copper electrodes, if $2.5g$ of Cu is deposited at cathode, tehn at anode

A. 1 & 3

B. 2 & 3

C. 1 & 4

D. 2 & 4

Answer: A

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24. Durinh electrlysis of an aqueous solution of $CuSO_4$ using copper electrodes, if $2.5g$ of Cu is deposited at cathode, tehn at anode

A. 1 & 3

B. 1 & 4

C. 2 & 3

D. 2 & 4

Answer: A

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25. Conductivity k, is equal to .....

1) $\frac{1}{R} \cdot \frac{l}{A}$

2) $\frac{G}{A}$

3) Λ_m

4) $\frac{l}{A}$

A. 1 & 2

B. 2 & 3

C. 3 &4

D. 1 & 4

Answer: A

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26. Molar conductivity of ionic solution depends on.....

1) Temperature

2) Distance between electrodes.

3) Concentration of electrolytes in solution.

4) Surface area of electrodes.

A. 1 & 2

B. 2 & 3

C. 3 & 4

D. 1 & 4

Answer: C

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27. For the given cell, $Mg|Mg^{2+}||Cu^{2+} \mid Cu$

1) Mg is cathode

2) Cu is cathode

3) The cell reaction is $Mg + Cu^{2+} \rightarrow Mg^{2+} + Cu$

4) Cu is the oxidising agent.

A. 1 & 3

B. 1 & 4

C. 2 & 3

D. 2 & 4

Answer: C

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28. 0.2 faraday charge is passed in 1 litre solution containing 0.1 molar Fe^{+3} ions. How many moles of iron get deposited at cathode assuming only iron is reduced in electrolytic process.

$\left(E^0_{Fe^{+3}/Fe^{+2}} = 0.77\text{V}\ \text{E}^0_{Fe^{+2}/Fe} = -0.44V\right)$

A. 0.005 moles

B. 0.033 moles

C. 0.67 moles

D. 0.1 moles

Answer: A

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29. Using electrolytic method, if cost of production of 10L of oxygen at STP is Rs. x, the cost of production of same volume of hydrogen at STP will be:

A. 2x

B. $x/16$

C. $x/32$

D. $x/2$

Answer: D

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30. A copper plate of $10cm \times 10cm$ and 0.1cm thickness is to be placted with silver. If the density of Ag is 10.8g/cc, the number of electrons required for this process is

A. 1 mole

B. 2 moles

C. 0.5 moles

D. 2.5 moles

Answer: A

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31. A lead storage battery containing 5.0 L of 1N H_2SO_4 solution is operated for 9.65×10^5 s with a steady current of 100 mA. Assuming volume of the solution remaining constant, normality of H_2SO_4 will

A. Remains unchanged

B. Increases by 0.20

C. Increase by unity

D. Decrease by 0.40

Answer: D

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32. In electrolytic reduction of a nitroarene with $50\,\%$ current efficiency, 20.50g of the electric charge. The molar mass of the compound is reduced by $2 \times 96500C$ of electric charge. The molar mass of the compound is:

A. $20.50g$

B. 10.25 g

C. 123.000g

D. 61.50 g

Answer: C

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33. The specific conductance at 289 K of AgCl is $1.826 \times 10^{-6} ohm^{-1} cm^{-1}$. The ionic conductance of Ag^{+} and Cl^{-} are 61.92 and 61.92 and 76.36 respectively. What is the solubility of AgCl in water?

A. $1.1 \times 10^{-2} g^{-1}$

B. $1.9 \times 10^{-3} gL^{-1}$

C. $1.3 \times 10^{-5} gL^{-1}$

D. $2.1 \times 10^{-6} gL^{-1}$

Answer: B

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34. Equivalent conductance of 1 M propanoic acid is 10 $ohm^{-1}cm^2eq^{-1}$. pH of the propanpoic acid solution is

A. 7

B. 3.3

C. 1.3

D. 6.8

Answer: C

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35. The specific conductance and equivalent conductance of a saturated solution of $BaSO_4$ are $8 \times 10^{-5} ohm^{-1}cm^{-1}$ and 8000 $ohm^{-1}cm^2\text{equi}^{-1}$ respectively. Hence K_{sp} of $BaSO_4$ is

A. $2.5 \times 10^{-10} M^2$

B. $2.5 \times 10^{-11} M^2$

C. $2.5 \times 10^{-20} M^2$

D. $2.5 \times 10^{-23} M^2$

Answer: B

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36. EMF of an $H_2 - O_2$ fuel cell

A. Is independent of partial pressures of H_2 and O_2

B. Decreases on increasing P_{H_2} and P_{O_2}

C. Increases on increasing P_{H_2} and P_{O_2}

D. Varies with the concentration of OH^- ions in the cathodic and anodic compartments.

Answer: C

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37. `Zn + Cu^(2+) (aq) Reaction quotient, $Q = \frac{[Zn^{2+}]}{[Cu^{2+}]}$ Variation of E_{cell} with log Q is of the type with OA =1.10 V, E_{cell} will be 1.1591 when

A. $[Cu^{++}]/[Zn^{++}] = 0.1$

B. $[Cu^{++}]/[Zn^{++}] = 0.01$

C. $[Zn^{++}]/[Cu^{++}] = 0.01$

D. $[Zn^{++}]/[Cu^{++}] = 0.1$

Answer: C

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38. For the half cell

At pH =3 electrode potential is

A. 1.30 V

B. 1.20 V

C. 1.10 V

D. 1.48 V

Answer: D

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

A. -0.2205 V

B. $+0.2205$ V

C. -0.11 V

D. $+0.11$ V

Answer: A

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40. The reduction potential of a hydrogen electrode at $pH10$ at $298K$ is : $(p = 1$ atm)

A. $p(H_2) = 1atm, \left[H^+\right] = 1M$

B. $p(H_2) = 1atm, \left[H^+\right] = 2M$

C. $p(H_2) = 2atm, \left[H^+\right] = 2M$

D. $p(H_2) = 2.5atm, \left[H^+\right] = 1.5M$

Answer: B

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41. Two weak acid solutions HA_1 and HA_2 with the same concentration and having pK_a values 3 and 5 are placed in contact with hydrogen electrode $(1atm$ and $25^\circ C)$ and are interconnected through a salt bridge. Find the EMF of the cell.

A. 0.079

B. 0.059

C. 0.118

D. 0.029

Answer: B

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42. In a fuel celll, methanol is used as a fuel and O_2 is used as oxidizer. The standard enthalpy of combustion of methanol is -726 kJ mol^{-1}. The standard free energies of formation of $CH_3OH(I), CO_2(g)$ and $H_2O(I)$ are -166.3, -394.4 and -237.1 kJ mol^{-1} respectively.

The standard free energy change of the reaction will be

A. 0.8

B. 0.87

C. 0.97

D. 0.9

Answer: C

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

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

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

A. 4.5 V

B. 3.0 V

C. 2.5 V

D. 5.0 V

Answer: C

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44. For the following reaction

$Ag^{+}_{(aq)} + Cl^{-}_{(aq)} \rightarrow AgCl_{(s)}$

Given :

$\Delta G^{\circ}_{f}, AgCl = -112.44\,\text{kJ/mol}, \Delta G^{\circ}_{f} Cl^{-} = -130\,\text{kJ/mol}, \Delta G^{\circ}_{f} Ag^{+} =$

Report your answer by rounding it upto nearest whole number. The K_{sp} of $AgCl$ is $n \times 10^{-10}$. The value of 'n" is .

A. -0.60 V

B. 0.60 V

C. 6.0 V

D. None

Answer: B

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