CHEMISTRY

BOOKS - BITSAT GUIDE

ELECTROCHEMISTRY

Practice Exercise

1. Twoelectrodes are fitted in conductance cell 1.5 cm apart while the area of cross-section of each electrode is $0.75cm^2$. The cell constant is

A. $1.125cm^{-1}$

B. $0.5cm^{-1}$

C. $2.0cm^{-1}$

D. $0.2cm^{-1}$

Answer: C

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2. Conductivity (unit siemens) is directly propotional to area of the vessel and the concentration of the solution it and is inversely proportional to the length of the vessel then the unit of constant of proportionality is

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

B. Sm^2mol^{-1}

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

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

Answer: B

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

A. 0.01 M NaCl

B. 0.05 M NaCl

C. 0.005 M NaCl

D. 0.02 M NaCl

Answer: C

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4. The resistance of 0.1 N solution of a salt is found to be $2.5 \times 10^3 \Omega$. The equivalent conductance of the solution is (Cell

constant $= 1.15 cm^{-1}$)

A. $4.6 ohm^{-1} cm^2 \text{ equiv}^{-1}$

B. $5.6 ohm^{-1} cm^2 \text{ equive}^{-1}$

C. $6.6 ohm^{-1} cm^2 \text{ equiv}^{-1}$

D. $7.6 ohm^{-1} cm^2 \text{ equiv}^{-1}$

Answer: A

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5. 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. $2.9 \times 10^{-3} \Omega^{-1} cm^{-1}$

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

C. $2.4 \times 10^{-3} \Omega^{-1} cm^{-1}$

D. $3.6 \times 10^{-3} \Omega^{-1} cm^{-1}$

Answer: A

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6. Point out the correct statement.

A. Equivalent conductance decreases with dilution

B. Specific conductance increases with dilution

C. Specific conductance decreases with dilution

D. Equivalent conductance increases with increase in concentration

Answer: C

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7. The equivalent conductance of solution is ..... .

[If cell constant is $1.25cm^{-1}$ and resistance of $N/10$ solution is $2.5 \times 10^3\Omega$].

A. $2.5\Omega^{-1}cm^2 \text{ equiv}^{-1}$

B. $2.5\Omega^{-1}cm^{-2} \text{ equiv}^{-1}$

C. $50\Omega^{-1}cm^2 \text{ equiv}^{-1}$

D. $5.0\Omega^{-1}cm^2 \text{ equiv}^{-1}$

Answer: D

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8. The increase in the molar conductivity of acetic acid with dilution is due to

A. decrease in interionic forces

B. increase in degree of ionisation

C. increase in self ionisation of water

D. None of the above

Answer: B

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9. The increase in the molar conductivity of HCl with dilution is due to

A. increase in the self ionisation of water

B. decrease in the self ionisation of water

C. decrease in the interionic forces

D. None of the above

Answer: C

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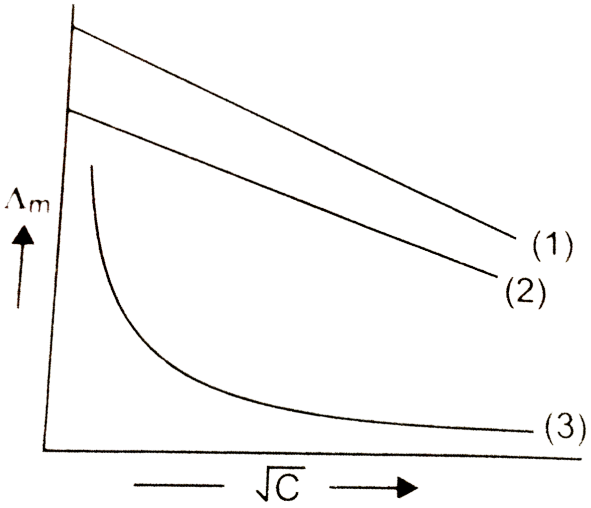
10. Molar conductance Λ_m is plotted against $\sqrt{C}$ (mol litre^{-1}) for three electrolytes $(NaCl, HCl, NH_4OH)$



which of the following is correct ?

A. $\begin{matrix} I & II & III \\ NaCl & HCl & NH_4OH \end{matrix}$

B. $\begin{matrix} I & II & III \\ HCl & NaCl & NH_4OH \end{matrix}$

C. $\begin{matrix} I & II & III \\ NH_4OH & NaCl & HCl \end{matrix}$

D. $\begin{matrix} I & II & III \\ NH_4OH & HCl & NaCl \end{matrix}$

Answer: B

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11. The plot of molar conductance vs $\sqrt{C}$ in strong electrolyte , is

A. circular

B. linear

C. parabolic

D. sinusoidal

Answer: B

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12. The value of Λ_{eq}^{∞} for $NH_4Cl, NaOH$ and $NaCl$ are $149.74, 248.1$ and $126.4\Omega^{-1}cm^2$ equiv^{-1}. The value of Λ_{eq}^{∞} of NH_4OH is

A. $371, 44\Omega cm^2$ equiv^{-1}

B. $271, 44\Omega cm^2$ equiv^{-1}

C. $71, 44\Omega cm^2$ equiv^{-1}

D. data is insufficient to calculate it

Answer: B

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13. The quantity of electricity required to librate 0.1 g equivalent of an element at the electrode is

A. 9650 C

B. 96500 C

C. 965 C

D. 96.5 C

Answer: A

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14. On passing 3 A of electricity for 50 min, 1.8 g of metal deposits. The equivalent mass of metal is

A. 20.5

B. 25.8

C. 19.3

D. 30.7

Answer: C

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15. Ione faraday of electricity will liberate one gram atom of a metal from a solution of

A. $AuCl_3$

B. $CuSO_4$

C. $BaCl_2$

D. KCl

Answer: D

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16. The charge required for the reduction of 1 mole of $Cr_2O_7^{2-}$ ions to Cr^{3+} is

A. 96500 C

B. $2 \times 96500C$

C. $3 \times 96500C$

D. $6 \times 96500C$

Answer: D

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17. On passing 0.1 F of electricity through aluminium chloride, the amount of aluminium meta deposited on cathode is (Atomic weight of $Al = 27$)

A. $0.27g$

B. $0.3g$

C. $0.9g$

D. $2.7g$

Answer: C

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18. The current of 2 A is passed for 5 h through a molten tin salt to deposit 22.2 g tin. What is the oxidation state of tin in salt? [Atomic weight of $Sn = 118.69g$]

A. $+2$

B. $+5$

C. $+3$

D. $+4$

Answer: A

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19. What will be the weight of silver deposited, if $96.5A$ of current is passed into aqueous solution of $AgNO_3$ for 100 s?

A. 1.08 g

B. 10.8 g

C. 108 g

D. 1080 g

Answer: B

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20. A certain amount of current liberates 0.5 g of H_2 in 2.0 h. How many gram(s) of oxygen can be liberated by the same current in the same time?

A. 0.5 g

B. 8.0 g

C. 4.0 g

D. 16.0 g

Answer: C

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21. Pick the odd one out.

A. Daniell cell

B. Voltaic cell

C. Galvanic cell

D. Electrolytic cell

Answer: D

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22. The EMF of a cell is

A. sum of two oxidation potentials

B. sum of two potentials

C. difference of two electrode potentials

D. None of the above

Answer: C

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23. Consider the following reaction,

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

A cell represented above should have emf

A. positive

B. negative

C. zero

D. Cannot be predicted

Answer: B

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24. The standard reduction potential of Pb and Zn electrodes are -0.126 and $-0.763V$ respectively. The cell equation will be

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

B. $Pb^{4+} + 2Zn \rightarrow Pb + 2Zn^{2+}$

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

D. None of the above

Answer: A

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25. Consider the following reaction,

$$\frac{1}{2}H_2(g) + AgCl(s) \rightarrow H^+(aq) + Cl^-(aq) + Ag(s)$$

Above reaction occurs in the galvanic cell

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

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

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

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

Answer: C

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26. When the sample of copper with the zinc impurity is to be purified by electrolysis, the appropriate electrodes are

	Cathode	Anode
A.	Pure zinc	Pure copper
B.	Cathode	Anode
	Impure zinc	Pure copper
C.	Cathode	Anode
	Impure zinc	Impure sample
D.	Cathode	Anode
	Pure copper	Impure sample

Answer: D

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27. Cu^+ ion is not stable in aqueous solution because because of dispropotionation reaction. E° value of disproportionation of Cu^+ is

$$\left[E^\circ_{Cu^{2+}/Cu^+} = +0.15V, E^\circ_{Cu^{2+}/Cu} = 0.34V\right]$$

A. $-0.38V$

B. $+0.19V$

C. $-0.49V$

D. $+0.38V$

Answer: B

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28. Calculate the emf of the following cell:

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

Given that, $E^{\circ}_{Cu^{2+}/Cu} = 0.34V$, $E^{\circ}_{Ag/Ag^{+}} = -0.80V$

A. 0.046 V

B. 0.46 V

C. 0.57 V

D. $-0.46V$

Answer: B

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29. A cell constituted by two electrondes $A\left(E^{\circ}_{A/A^{+}} = -0.35V\right)$ and $B\left(E^{\circ}_{B/B^{+}} = 0.42V\right)$.

Calculate the emf of the cell.

A. 0.07 V

B. 0.77 V

C. $-0.77V$

D. $-0.07V$

Answer: B

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30. Out of Cu, Ag, Fe and Zn, the metal which can displace all others from their salt solution is

A. Ag

B. Cu

C. Zn

D. Fe

Answer: C

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31. Which of the following solution will turn blue when placed in copper vessel?

A. $AgNO_3$

B. $NaCl$

C. $ZnSO_4$

D. KNO_3

Answer: A

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32. A gas X at 1 atm is bubbled through a solution containing a mixture of $1MY^-$ and $1MZ^-$ at $25^\circ C$. If the order of reduction potentials is $Z > Y > X$, then

A. Y will oxidise X but not Z

B. Y will oxidise Zbut not X

C. Y will oxidies both X and Y

D. Y will reduce both X and Y

Answer: A

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33. Using the standard electrode potential, find out the pair between which redox reaction is not feasible. E° values :

$Fe^{3+}/Fe^{2+} = +0.77, I_2/I^- = +0.54V$

$Cu^{2+}/Cu = +0.34V, Ag^+/Ag = +0.80V$

A. Fe^{3+} and I^-

B. Ag^+ and Cu

C. Fe^{3+} and Cu

D. Ag^+ and Fe^{3+}

Answer: D

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34. The emf of the cell involving the reaction

$2Ag^+(aq) + H_2(g) \rightarrow 2Ag(s) + 2H^+(aq)$ is $0.080V$.

The standard oxidation potential od silver electrode is

A. 0.80 V

B. 0.40 V

C. $-0.80V$

D. 0.20 V

Answer: C

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35. For a reaction $A(s) + 2B^+(aq) \rightarrow A^{2+}(aq) \rightarrow A^{2+}(aq) + 2B$, K_C has been found to be 10^{12}. The E°_{cell} is 0.354 V

A. 0.354 V

B. 0.708 V

C. 0.0098 V

D. 1.36 V

Answer: A

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36. The value of E_{cell} of hydrogen electrode at $pH = 0$ 298 K and 1 atm, is

A. 0.59 V

B. 0 V

C. $-0.59V$

D. $-0.059V$

Answer: B

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37. The emf of a galvanic cell is positive when free energy change of reaction is

A. > 0

B. < 0

C. $= 0$

D. no relationship of free energy change and emf

Answer: B

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38. What is the value of E° cell in the following reaction?

$Cr\left|Cr^{3+}(0.1M)\right|\left|Fe^{2+}(0.01M)\right|Fe$

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

A. $+0.2606V$

B. $0.5212V$

C. $+01303V$

D. $-0.2606V$

Answer: A

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39. Consider the following reaction,

$Zn(s) + Cu^{2+}(0.1M) \rightarrow Zn^{2+}(1M) + Cu(s)$ above reaction, taking place in a cell, E°_{cell} is $1.10V$. E_{cell} for the cell will be $\left(2.303\frac{RT}{F} = 0.0591\right)$

A. $1.80V$

B. $1.07V$

C. $0.82V$

D. $2.14V$

Answer: B

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40. The Edison storage cell is represented as

$$Fe(s)|FeO(s)|KOH(aq)|Ni_2O_3(s)|Ni(s)$$

the half-cell reactions are

$$Ni_2O_3(s) + H_2O(l) + 2e^- \Leftrightarrow 2NiO(s) + 2OH^-, E^\circ = +0.40V$$

$$FeO(s) + H_2O(l) + 2e^- \Leftrightarrow Fe(s) + 2OH^-, E^\circ = -0.87V$$

What is the maximum amount of electrical energy that can be obtained from one mole of Ni_2O_3?

A. 127 kJ

B. 245.11 kJ

C. 90.71 kJ

D. 122.55 kJ

Answer: B

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41. Consider the following cell reaction

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

$E^\circ_{\text{cell}} = 0.46V$ By boubling the concentration of Cu^{2+}, E_{cell} is

A. doubled

B. halved

C. increases nut less than double

D. decreases by a small fraction

Answer: D

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42. The value of the reaction quotient, Q for the following cell is

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

A. 156

B. 125

C. 1.25×10^{-2}

D. 6.4×10^{-3}

Answer: D

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43. The standard e.m.f of a cell, involving one electron change is found to be 0.591 V at $25^{\circ}C$. The equilibrium constant of the

reaction is : $\left(F = 96,500 C mol^{-1}\right.$: R=8.314 $Jk^{-1}mol^{-1}$

A. 1.0×10^{1}

B. 1.0×10^{5}

C. 1.0×10^{10}

D. 1.0×10^{30}

Answer: C

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44. Hydrogen electrode is placed in the solution whose pH is 10. The potential of this electrode will be

A. $+0.591V$

B. $-0.591V$

C. 0

D. None of these

Answer: B

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45. What is the Gibbs energy of the following reaction?

$Zn(s) + Cu^{2+}(aq) \rightarrow Zn^{2+}(aq) + Cu^{2+}(s), E^{\circ}_{\text{cell}} = 1.1V$

A. $106135.75 Jmol^{-1}$

B. $21227 Jmol^{-1}$

C. $-212.27 kJmol^{-1}$

D. $21227 Jmol^{-1}$

Answer: C

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46. When a lead storage battery is charged, it acts as

A. primary cell

B. galvanic cell

C. concentration cell

D. electrolytic cell

Answer: D

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47. In a hydrogen oxygen uel cell, combustion of hydrogen occurs to

A. Produce high purity water

B. remove adsorbed oxygen from electrode surface

C. generate heat

D. create potential between two electrodes

Answer: D

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48. 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 moisture

D. In air and saline water

Answer: D

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49. On the basis of electrochemical theory of aqueous corrosion, the reaction occurring at the cathode is

A. $O_2(g) + 4H^+(aq) + 4e^- \rightarrow 2H_2O(l)$

B. $H_2(g) + 2OH^-(aq) \rightarrow 2H_2O(l) + 2e^-$

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

D. $Fe^{3+}(aq) + e^- \rightarrow Fe^{2+}(aq)$

Answer: A

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1. A reaction, $Cu^{2+} + 2e^- \rightarrow Cu$ is given. For this reaction, graph between E_{red} versus $\ln[Cu^{2+}]$ is a straight line of intercept 0.34 V, then the electrode oxidation potential of the half-cell $Cu\,/\,Cu^{2+}(0.1M)$ will be

A. 0.34

B. $0.34 + \frac{0.0591}{2}$

C. $-0.34 - \frac{0.0591}{2}$

D. $-0.34 + \frac{0.0591}{2}$

Answer: D

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2. If $E^{\circ}_{Fe^{3+}\,/\,Fe}$ and $E^{\circ}_{Fe^{2+}\,/\,Fe}$ are $-0.36V$ and $0.439V$ respectively, then value of $E^{\circ}_{Fe^{3+}\,/\,Fe^{2+}}$ is

A. $(-0.036-0.439)V$

B. $[3(-0.36)+2(0.439)]V$

C. $(-0.36-0.439)]V$

D. $[(3-0.36)-2(-0.439)]V$

Answer: D

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

A. $330\Omega^{-1}cm^2$

B. $203\Omega^{-1}cm^2$

C. $139.5\Omega^{-1}cm^2$

D. $51\Omega^{-1}cm^2$

Answer: C

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4. The equilibrium constant (K) for the reaction

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

[Given, $E^\circ_{cell} = 0.46V$]

A. $K_c =$ antilog 15.6

B. $K_c =$ antilog 2.5

C. $K_c =$ antilog 1.5

D. $K_c =$ antilog 12.2

Answer: A

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5. E° for $Fe\,/\,Fe^{2+}$ is $+0.44V$ and E° for $Cu\,/\,Cu^{2+}$ is $-0.32V$. Then, in the cell,

A. Cu oxidises Fe^{2+} ion

B. Cu^{2+} oxidises iron

C. Cu reduces Fe^{2+} ion

D. Cu^{2+} reduces Fe

Answer: B

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6. A curent of 0.5 A when passed through $AgNO_3$ solution for 193 s deposited 0.108 h Ag. The equivalent weight of silver is

A. 108

B. 54

C. 10.8

D. 5.4

Answer: A

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7. When an aqueous solution of sodium chloride is electrolysed using platinum electrodes, the ion discharged at the electrodes are

A. sodium and gydrogen

B. Sodium and chloride

C. hydrogen and chloride

D. hydroxyl and xhloride

Answer: C

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8. When same quantity of electricuty is passed through aqueous $AgNO_3$ and H_2SO_4 solutions connected in series, $5.4 \times 10^{-2} g$ of H_2 is liberated. What is the mass of silver (in grams) deposited? (Equivalent weight of hydrogen $= 1008$, silver $= 108$)

A. 54

B. 0.54

C. 5.4

D. 10.8

Answer: C

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9. When electric current is passed through acidified water for 1930 s, 1120 mL of H_2 gas is collected (at STP) at the cathode. What is the current passed in amperes?

A. 0.05

B. 0.50

C. 5.0

D. 50

Answer: C

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10. Given, standard electrode potentials

$Fe^{2+} + 2e^- \rightarrow Fe, E^\circ = -0.440V$

$Fe^{3+} + 3e^- \rightarrow Fe, E^\circ = -0.036V$

The standarde potential (E°) for

$Fe^{2+} + e^- \rightarrow Fe^{2+}$, is

A. $+0.772V$

B. $-0.772V$

C. $+0.417V$

D. $-0.417V$

Answer: A

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11. The specific conductivity of $0.1NKCl$ solution is $0.0129\Omega^{-1}cm^{-1}$. The resistane of the solution in the cell is 100Ω. The cell constant of the cell will be

A. 1.1

B. 1.29

C. 0.56

D. 2.80

Answer: B

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12. The cathodic reaction of a dry cell is represented as

$2MnO_2(s) + Zn^{2+} + 2e^- \rightarrow ZnMn_2O_4(s)$

If there are 8 g MnO_2 in the cathodic compartment then the

time for which the dry cell will continue to give current of 2 milliampere, is

A. 25.675 day

B. 51.35 day

C. 12.8 day

D. 6.423 day

Answer: B

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13. The standard potential of the reaction $H_2O + e^- \rightarrow \left(\frac{1}{2}\right)H_2 + OH^-$ at 298 K by using $k_w(H_2O) = 10^{-14}$, is:

A. $E^\circ = \frac{RT}{F}\ln K_w$

B. $E^\circ = \frac{RT}{F} \ln \left[p_{H_2}\right]^{1/2} \left[OH^-\right]$

C. $E^\circ = \frac{RT}{F} \ln \frac{\left[p_{H_2}\right]^{1/2}}{\left[H^+\right]}$

D. $E^\circ = -\frac{RT}{F} \ln K_W$

Answer: A

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