CHEMISTRY

BOOKS - ARIHANT PUBLICATION

ELECTROCHEMISTRY

Sample Question Part 1

1. An aqueous solution of copper sulphate, $CuSO_4$ was electrolysed between platinum electrodes using a current of 0.1287 A for 50 min.

[Given atomic mass of Cu = 63. 5 g mol^{-1}]

(i) Write the cathodic reaction.

(ii) Calculate

(a) electric charge passed during electrolysis.

(b) mass of copper deposited at the cathode.

[Given, 1 F = 96500 C mol^{-1}]

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2. Find the number of coulombs required for conversion of one mole of MnO_4^- to one mole of Mn^{2+}.

A. 96500

B. 95600

C. 96500×5

D. 96599×7

Answer:

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3. The amount of Cu deposited whenever a current can deposit 10.8g of Ag from silver nitrate solution is passed through $CuSO_4$ solution.

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Sample Question Part Ii

1. The electrical resistance of a column of 0.05 M NaOH solution of diameter 1 cm and length 50 cm is 5.55 $\times 10^3 \Omega$. Calculate its resistivity, conductivity and molar conductivity.

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2. Calculate Λ° for acetic acid,

Given that, $\Lambda^\circ_{(HCl)}$ = 426 S $cm^2 \text{mol}^{-1}$

$\Lambda^\circ_{(NaCl)}$ = 126 S $cm^2 \text{mol}^{-1}$

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

Recall Kohlrausch's law to find the conductance of weak electrolyte.

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3. Conductivity of 0.00241 M acetic acid solution is $7.896 \times 10^{-5} Scm^{-1}$. Calculate its molar conductivity in this solution. If Λ°_m for acetic acid be

390.5 S $cm^2 mol^{-1}$, what would be its dissociation constant?

(i) First , find molar conductivity using the formula„

$$\Lambda_m = \frac{K \times 1000}{C}$$

(ii) Then find degree of dissociation (α) and dissociation constant (K_a)

by using formula $\alpha = \frac{\Lambda_m}{\Lambda_m^\circ}$ and $K_a = \frac{C\alpha^2}{1-\alpha}$ respectively.

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Sample Question Part Iii

1. Write the Nernst equation for the electrode reaction.

$$M^{n+}(aq) + ne^- \rightarrow M(s)$$

$$E = E^\circ - \frac{2.303RT}{nF} \log \frac{[M]}{[M^{n+}]}$$

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2. Calculate the emf of the following cell at $25^\circ C$

$$Fe|Fe^{\circ +}(0.001M)||H^+(0.01M)||H_2(g)(1\text{bar})|Pt(s)$$

$E^{\circ}_{(Fe^{\circ+}/Fe)} = -0.44V, E^{\circ}_{(H^+/H_2)} = 0.00V$

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3. Calculate the equilibrium constant for the reaction.

$Fe(s) + Cd^{2+}(aq) \Leftrightarrow Fe^{2+}(aq) + Cd(s)$

[Given, $E^{\circ}_{Cd^{2+}/Cd} = -0.40V, E^{\circ}_{Fe^{2+}/Fe} = -0.44V$]

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4. Calculate the cell emf and $\Delta_r G^{\circ}$ for the cell reation at $25^{\circ}C$.

$Zn(s)|Zn^{\circ+}(0.1M)||Cd^{2+}(0.01M)|Cd(s)$

Given, $E^{\circ}_{Zn^{2+}/Zn} = -0.763V,$

$E^{\circ}_{Cd^{2+}/Cd} = -0.403V$

1F = 96500 C mol^{-1}

R = 8.314 $JK^{-1}\text{mol}^{-1}$],

Find $E^{\circ}_{\text{cell}} = E^{\circ}_{\text{cathode}} - E^{\circ}_{\text{anode}}$ then $\Delta_r G^{\circ}$ by using formula,

$\Delta_r G^{\circ} = -nFE^{\circ}_{\text{cell}}$

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Questions For Practice Part 1 Conductor Electrolytes And Their Dissociation Electrolysis Its Law And Applications Multiple Choice Type Questions

1. Reaction taking place at the cathode during electrolysis can be classified as

A. dissociation

B. oxidation

C. reduction

D. None of the above

Answer: B

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2. Find the number of coulombs required for conversion of one mole of MnO_4^- to one mole of Mn^{2+}.

A. 96500

B. 95600×3

C. 96500×5

D. 96599×7

Answer: c

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3. Two different electrolytic cells filled with molten $Cu(NO_3)_2$ and molten $Al(NO_3)_2$, respectively are connected in series. When electricity is passed 2.7g Al is deposited on electrode. Calculate the weight of Cu deposited on cathode.

[Cu = 63.5, Al = 27.0 g mol^{-1}]

A. 190.5g

B. 9.525g

C. 63.5g

D. 31.75g

Answer: b

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4. Consider the following statements,

I $Q = lt$

II. Charge is required for reduction or reduction depends on the stoichiometry of electrode reaction.

III. Charge on 1 electron $= 1.6021 \times 10^{-19} C$

IV. Charge on one mole of electron $= 1.6021 \times 10^{-19} C$

V. Quantity of electricity is Coulomb.

VI. 1F = 96500 C mol^{-1}.

Which of the statement (s) given above is / are incorrect ? Choose the correct option.

A. I and II

B. II and III

C. IV and V

D. VI and I

Answer: c

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Questions For Practice Part 1 Conductor Electrolytes And Their Dissociation Electrolysis Its Law And Applications Very Short Answer Type Questions

1. Give the different between metallic and electrolytic conductions?

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2. Define electrolytes? Give it's classification based on the extent of ionisation.

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3. Electrode is connected to negative terminal of the battery while _____ electrode is connected to positive terminals of battery.

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4. What is obtained at cathode during electrolysis of aqueous . NaCl solution?

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5. How much charge is required for the reduction of 1 mole of Cu^{2+} to Cu?

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6. Calculate the total charge in a mole of electron.

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7. Give the relationship between chemical equivalent and electrochemical equivalent of an element?

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8. Write two applications of electrolysis.

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Questions For Practice Part 1 Conductor Electrolytes And Their Dissociation Electrolysis Its Law And Applications Short Answer Type I Questions

1. Explain, why sodium metal can't be obtained by the electrolysis of aqueous NaCl solution.

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2. Match Column I with Column II.

Column I	Column II
(a) One Faraday	(i) 6.24×10^{18} electrons
(b) Chemical equivalent mass	(ii) 96500 Coulombs
(c) One Coulomb	(iii) ECE (Z) $\times$ 96500
(d) Anode	(iv) Reduction
	(v) Oxidation

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3. Consider the reaction,

$Cr_2O_7^{2-} + 14H^+ + 6e^- \rightarrow 2Cr^{3+} + 7H_2O$

What is the quantity of electricity in coulombs needed to reduce 1 mole of $Cr_2O_7^{2-}$?

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4. What is the amount of charge required to carry out the conversion of 1 mole of Al^{3+} ions to Al according to the following reaction ?

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

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5. How much charge is required for the following reduction 1 mole of Al^{3+} to Al ?

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6. If a current of 0.5 A flows through a metallic wire for 2h, then how many electrons would flow through the wire?

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

(i) 20.0 g of Ca from molten $CaCl_2$?

(ii) 40.0 g of Al from molten Al_2O_3 ?

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8. A current of 1.70 A is passed through 300.0 mL of 0.160 M solution of $ZnSO_4$ for 230s with a current efficiency of 90 per cent. Find out the molarity of Zn^{2+} after the deposition of zinc. Assume the volume of the solution to remain constant during electrolysis.

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Questions For Practice Part 1 Conductor Electrolytes And Their Dissociation Electrolysis Its Law And Applications Short Answer Type Ii Questions

1. Calculate the amount of acetic acid present in one litre, having degree of dissociation equal 1% and $K_a = 1.8 \times 10^{-5}$.

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2. Write note on Faraday's second law of electrolysis

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

(i) 1 mole of H_2O to O_2 ?

(ii) 1 mole of FeO to Fe_2O_3 ?

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4. A solution of $Ni(NO_3)_2$ is electrolysed between platinum electrodes using a current of 5A for 20 min. What mass of Ni is deposited at the cathode?

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5. Silver is electrolytically deposited on a metallic vessel of total surface area $900cm^2$ by passing a current of 0.5A for 2h. Calculate the thickness of silver deposited . Given, density of silver $= 10.5gcm^{-1}$. Atomic mass of silver = 108u, F = 96500 C mol^{-1}

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Questions For Practice Part 1 Conductor Electrolytes And Their Dissociation Electrolysis Its Law And Applications Long Answer Type Questions

1. Predict the products of electrolysis in each of the following ?

An aqueous solution of $AgNO_3$ with silver electrodes.

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2. Predict the products of electrolysis in each of the following ?

An aqueous solution of $AgNO_3$ with Platinum electrodes.

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3. Predict the products of electrolysis in each of the following ?

A dilute solution of H_2SO_4 with platinum electrodes.

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4. Predict the products of electrolysis in each of the following ?

An aqueous solution of $CuCl_2$ with platinum electrodes.

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5. State and explain Faraday's laws of electrolysis. When a current of 24A strength is passed through $AgNO_3$ solution for 10 min 16 grams of silver is deposited . Find out the electrochemical equivalent of silver.

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6. State and explain Faraday's law of electrolysis. When a current of 1.5 amperes strength is passed through a solution of a salt of a metal (atomic mass = 112) for 15 min , 0.783 g of the metal is deposited. Find out the valency of the metal.

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7. State and explain Faraday's law of electrolysis. 0.2964g of copper was deposited on passing a current of 0.5 ampere for 30 minutes through copper sulphate solution. What is the atomic mass of copper ?

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8. Three electrolytic cells A,B and C containing solutions of zinc sulphate, silver nitrate and copper sulphate, respectively are connected in series. A steady current of 1.5 A was passed through them until 1.45g of silver deposited at the cathode of cell B. How long did the current flow? What mass of copper and zinc were deposited in the concerned cells? (Atomic mass of Ag= 108, Zn = 65.4, Cu = 63.5)

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Questions For Assessment Part 1 Conductors Electrolytes And Their Dissociation Electrolysis Its Laws And Applications Multiple Choice Type Questions

1. Electrolysis of dilute aqueous NaCl solution was carried out by passing 10mA current. The time required to liberate 0.01 mole of H_2 gas at the cathode is (1F = 96500 C mol^{-1})

A. 9.65×10^4 s

B. $19.3 \times 10^4 s$

C. $28.95 \times 10^4 s$

D. $38.6 \times 10^4 s$

Answer: B

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2. How many Coulomb of electricity are required for the oxidation of one mole of water to dioxygen?

A. 9.65×10^4 C

B. $1.93 \times 10^4 C$

C. $1.93 \times 10^5 C$

D. $19.3 \times 10^5 C$

Answer: c

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3. How many Faradays of electricity are required to deposit 10 g of calcium from molten calcium chloride using inert electrodes ? (Molar mass of calcium $= 40 g \text{mol}^{-1}$)

A. 0.5F

B. 1F

C. 0.25F

D. 2F

Answer: a

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Questions For Assessment Part 1 Very Short Answer Types Questions

1. The electrical conduction of metallic conductors ..... with decrease in temperature.

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2. The process of decomposition of an electrolyte in solution or in the fused state by passing electricity is called .....

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3. Define degree of dissociation.

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4. Explain the process of electrolysis.

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5. State and explain Faraday's 1st law of electrolysis.

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6. How much charge is required for the reduction of 1 mole of Cu^{2+} to Cu?

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7. From the value of a Faraday (96500 C) and Avogadro number $\left(6.023 \times 10^{23}\right)$, calculate the coulomb charge on an electron.

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Questions For Assessment Part 1 Short Answer Types I Questions

1. How many grams of silver could be plated out on a serving tray by electrolysis of a solution containing silver in $+1$ oxidation state for a period of 8.0 h at a current of 8.46 A ? What is the area of the tray if the thickness of the silver plating is 0.00254 cm? Density of silver is $10.5g/cm^3$.

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Questions For Assessment Part 1 Short Answer Types Ii Questions

1. Electric current is passed through two cells A and B in series. Cell A contains aqueous solution of Ag_2SO_4 and platinum electrodes. Cell B contains aqueous solution of $CuSO_4$ and copper electrodes. The current is passed till 1.6g of oxygen is liberated at the anode in cell A. Calculate the quantities of copper and silver deposited at the cathode of the two cells.

[Atomic mass, O = 16, Cu 63.5, Ag = 108]

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2. Calculate the strength of the current required to deposit 1.2 g of magnesium from molten $MgCl_2$ in 1h.

[1F = 96500 C mol^{-1}, Atomic mass of Mg = 24.0]

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3. An electric current of 0.15 A is passed through 500mL of 0.15 M copper sulphate solution. How much time is required to deposit all the copper?

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4. In the process of electrolysis of CrO_3, the following reaction occurs.

$CrO_3(aq) + 6H^+ + 6e^- \rightarrow Cr(s) + 3H_2O$

Calculate

(i) amount of chromium deposited when 24,000 C of charge passed.

(ii) time required to deposit 1.5g chromium using 12.5A current. (Atomic mass of Cr = 52)

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Questions For Assessment Part 1 Long Answer Types Questions

1. Write the reactions taking place at anode and cathode in case of

(a) inert electrodes (b) Ag electrodes.

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2. How much time is required for 1.5 g Ag to deposit when 1.50 A current is passed through an electrolytic cell containing $AgNO_3$ solution with inert electrodes?

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3. Two electrolytic cells containing silver nitrate solution and dilute sulphuric acid were connected in a series. A steady current of 2.5 A was

passed through them till 1.078 g of silver was deposited (Ag = 107.8 g / mol)

(a) How much electricity was consumed?

(b) What is the weight of oxygen gas liberated during the reaction?

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4. How many moles of Hg will be produced by electrolysing 1.0 M $Hg(NO_3)_2$ solution with a current of 2.00 A for 3 hours ?

$[Hg(NO_3)_2 = 200.6g/\text{mol}]$

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5. State Ostwald dilution law? Derive the relationship between degree of dissociation and concentration of weak electrolyte.

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6. Define super conductors.

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7. The ionisation constant of 0.01 M solution of phenol is 1.0×10^{-10} . What will be its degree of ionisation of the solution which is also 0.01 M in sodium phenolate ?

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Questions For Practice Part Ii Conductivity Of Solution And Kohlrausch S Law Multiple Choice Type Questions

1. $\Omega^{-1}cm^{-1}$ is the unit of

A. specific conductance

B. equivalent conductance

C. cell constant

D. molar conductance

Answer: A

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2. The equivalent conductiviy of a solution containing 2.54 g of $CuSO_4$ per L is $91.0\Omega^{-1}cm^{-1}$ or . 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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3. Which of the statement about solutions 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 temperature.

Answer: c

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4. The molar conductivities of KCl, NaCl and KNO_3 are 152,128 and 111 S $cm^2 \text{mol}^{-1}$, respectively. What is the molar conductivity of $NaNO_3$?

A. 101 S $cm^2 \text{mol}^{-1}$

B. 87 S $cm^2 \text{mol}^{-1}$

C. $-101 S cm^2 \text{mol}^{-1}$

D. $-391 Scm^2 \text{mol}^{-1}$

Answer: b

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Questions For Practice Part Ii Conductivity Of Solution And Kohlrausch S Law Very Short Answer Type Questions

1. What is the unit of molar conductance ?

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2. The unit of equivalent conductance is

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3. Write the unit of cell constant.

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4. If specific conductivity of $N/50$ KCl solution at 298 K is 0.002765 $\Omega^{-1}cm^{-1}$ and resistance of a cell contaning this solution is 100Ω, calculate the cell constant.

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5. The conductivity of 0.20 M solution of KCl at 298 K is 0.248S cm^{-1} . Calculate its molar conductivity.

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6. The molar conductance. . . . . with increase in concentration.

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7. Suggest a way to determine the Λ_m° value of water.

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Questions For Practice Part Ii Conductivity Of Solution And Kohlrausch S Law Short Answer Type I Questions

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

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2. Define the molar conductance.

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3. State Kohlrausch's law. Discuss with an example .

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4. Write two applications of electrolysis.

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5. The conductivity of 0.001 M actic acid is $4 \times 10^{-5} S/cm$. Calculate the dissociation constant acetic acid, if molar conductivity at infinite dilution for acetic acid is 390 S $cm^2/$ mol.

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Questions For Practice Part Ii Conductivity Of Solution And Kohlrausch S Law Short Answer Type Ii Questions

1. The resistance of a conductivity cell when filled with 0.05M solution of an electrolyte x is 100 Ω at $40^{\circ}C$. The same conductivity cell filled with 0.01M solution of electrolyte y has a resistance of 50Ω. The conductivity of 0.05 M solution of electrolyte x is $1.0 \times 10^{-4} Scm^{-1}$. Calculate

(i) cell constant

(ii) conductivity of 0.01 M solution

(iii) molar conductivity of 0.01 M solution

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2. Equivalent conductance at infinite dilution of NH_4CI, NaOH and NaCl are 129.8, 217.4 and 108.45 mho cm^2 gm equivalent-' respectively.Calculate the equivalent conductance of HN_4OH at infinite dilution.

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3. From the following molar conductivities at infinite dilution.

Λ_m° for $Ba(OH)_2 = 457.6\Omega^{-1}cm^2\text{mol}^{-1}$

Λ_m° for $BaCl_2 = 240.6\Omega^{-1}cm^2\text{mol}^{-1}$

Λ_m° for $NH_4Cl = 129.8\Omega^{-1}cm^2\text{mol}^{-1}$

Calculate Λ_m° for NH_4OH.

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

Given, $\lambda^\circ\left(H^+\right) = 349.6Scm^2\text{mol}^{-1}$

and $\lambda^\circ\left(HCOO^-\right) = 54.6Scm^2\text{mol}^{-1}$

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5. Conductivity of 2.5×10^{-4} M methonoic acid is 5.25×10^{-5} S cm^{-1} . Calculate its molar Condcutivity and degree of dissociation. Given : $\lambda^\circ\left(H^+ = 349.5\right.$ S $cm^2\text{mol}^{-1}$ and $\lambda^\circ\left(HCOO^-\right)$ = 50.5 S $cm^2\text{mol}^{-1}$.

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Questions For Practice Part Ii Conductivity Of Solution And Kohlrausch S Law Long Answer Type Questions

1. Define the equivalent conductance and specific conductance.

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2. Discuss the effect of dilution on these conductance of an electrolyte .

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3. The specific conductance of a decinormal solution of NaCl equals to $0.0092\Omega^{-1}cm^{-1}$. If ionic conductance of Na^{+} and Cl^{-} ions are 43.0 and 65.0 Ω^{-1} respectively.

Calculate the degree of dissociation of NaCl solution.

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4. Define conductivity and molar conductivity for the solution of an electrolyte . Discuss their variation with concentration.

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5. Conductivity of 0.00241M acetic acid is $7.896 \times 10^{-5} Scm^{-1}$. Calculate its molar condcutivity. If Λ_m° acetic acid is 390.5 S $cm^2 \mathrm{mol}^{-1}$, what is its dissociation constant?

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Questions For Assessment Part Ii Condcutivity Of Solutions And Kohlrousch S Law Multiple Choice Type Questions

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

A. 371.44

B. 271.44

C. 71.44

D. None of these

Answer: B

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2. The specific conductance (κ) of an electrolyte of 0.1 N concentration is related to equivalent conductance (Λe) by the following formula

A. $\Lambda e = \kappa$

B. $\Lambda e = 10\kappa$

C. $\Lambda e = 100\kappa$

D. $\Lambda e = 10000\kappa$

Answer: d

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Questions For Assessment Part Ii Condcutivity Of Solutions And Kohlrousch S Law Very Short Answer Type Questions

1. Express the relation among the conductivity of a solution in the cell, the cell constant and resistance of solution in the cell.

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2. List the factors on which conductivity of electrolyte depends.

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3. The limiting value for weak electrolytes can be obtained by using . . . . . law.

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Questions For Assessment Part Ii Condcutivity Of Solutions And Kohlrousch S Law Short Answer Type I Questions

1. Which of the following solutions has larger molar conductance ?

(i) 0.08 M solution having conductivity equal to $2.0 \times 10^{-2} \Omega^{-1} cm^{-1}$.

(ii) 0.10 M solution having resistivity equal to 58 Ω cm.

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2. Conductivity of two electrolyte solutions A and B each having a concentration of 0.1 M are $8.5 \times 10^{-2} Scm^{-1}$ and $4.1 \times 10^{-4} Scm^{-1}$, respectively. Which of the two offers less resistance to the flow of current ?

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3. Calculate the degree of dissociation of acetic acid at 298 K , given that $\Lambda_m(CH_3COOH) = 11.7 Scm^2 \text{mol}^{-1}$

$\Lambda_m^\circ\left(CH_3COO^-\right) = 40.9 Scm^2\text{mol}^{-1}$

$\Lambda_{m(H^+)}^\circ = 349.1 Scm^2\text{mol}^{-1}$

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4. The Λ_m° values for NaCl and KCl are 126.5 and 149.9 $\Omega^{-1}cm^2\text{mol}^{-1}$ respectively. The ionic conductance of Na^+ at infinite dilution is 50.1 $\Omega^{-1}cm^2\text{mol}^{-1}$. Calculate the ionic conductance at infinite dilution for potassium ion $\left(K^+\right)$.

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5. The conductivity of 0.20 M solution of KCl at 298 K is 0.248S cm^{-1} . Calculate its molar conductivity.

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Questions For Assessment Part Ii Condcutivity Of Solutions And Kohlrousch S Law Short Answer Type Ii Questions

1. From the following molar conductivities at infinite dilution.

Λ_m° for $Ba(OH)_2 = 457.6\Omega^{-1}cm^2\text{mol}^{-1}$

Λ_m° for $BaCl_2 = 240.6\Omega^{-1}cm^2\text{mol}^{-1}$

Λ_m° for $NH_4Cl = 129.8\Omega^{-1}cm^2\text{mol}^{-1}$

Calculate Λ_m° for NH_4OH.

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2. What is the principle behind calculating molar conductivity of weak electrolytes?

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3. Give two applications of Kohlraush's law

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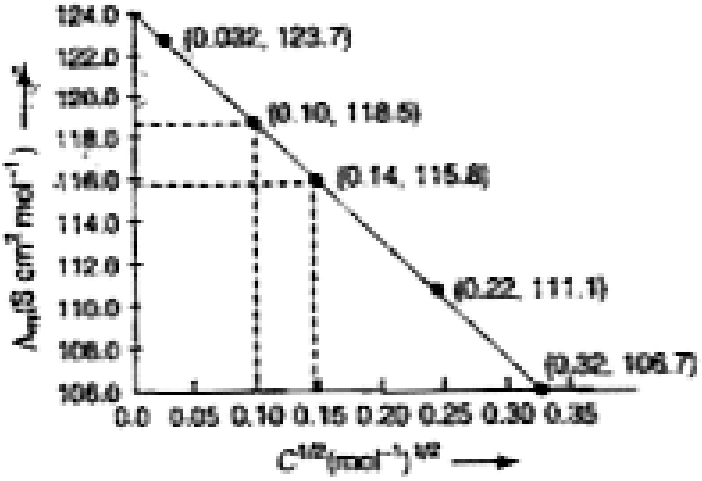
Questions For Assessment Part Ii Condcutivity Of Solutions And Kohlrousch S Law Long Answer Type Questions

1. The following curve is obtained when molar conductivity, Λ_m is plotted against the square root of concentration . $C^{1/2}$ along y and x - axis, respectively for the two electrolytes X and Y.



(i) What can you say about the nature of these two electrolytes?

(ii) Account for the increase in Λ_m for the electrolytes X and Y with dilution.

(iii) Determine Λ_m^{∞} for these electrolytes.

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Questions For Practice Part Iii Electrolchemical Cells And Series Nernst Equations Batteries And Corrosion Multiple Choice Type Questions

1. If the E°_{cell} for a given reaction has a negative value, then which of the following gives the correct relationships for the values of ΔG° and K_{eq} ?

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

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

C. $\Delta G^{\circ} < 0, K < 1$

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

Answer: A

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2. The electrode potential for

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

$Cu^{+}(aq) + e^{-} \rightarrow Cu(s)$ are $+0.15V$ and $+$ 0.50 V respectively. The value of $E^{\circ}_{Cu^{2+}/Cu}$ will be

A. $0.150V$

B. 0.500 V

C. 0.325 V

D. 0.650V

Answer: c

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3. During discharging of lead storage battery which electrolyte is consumed?

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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4. Galvanic cell is a device in which

A. chemical energy is converted into electrical energy

B. electrical energy is converted into chemical energy

C. chemical energy is seen in the form of heat

D. thermal energy from an outside source is used to derive the cell reaction.

Answer: a

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Questions For Practice Part Iii Electrolchemical Cells And Series Nernst Equations Batteries And Corrosion Very Short Answer Type Questions

1. In the electrochemical cell, oxidation takes place at . . . . . .

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2. The cations on reaching ..... gain electrons and from neutral atoms , which get ..... on the cathode.

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3. What is the standard electrode potential of hydrogen electrode?

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4. Represent the galvanic cell in which the reaction, $Zn(s) + Cu^{2+}(aq) \rightarrow Zn^{2+}(aq) + Cu(s)$ take place.

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5. Write the Nernst equation for electrode reaction.

$M^{n+}(aq) + ne^- \rightarrow M(s)$

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6. Under what condition,

$E_{\text{cell}} = 0$ or $\Delta G = 0$?

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7. Can E°_{cell} or ΔrG° for cell reaction ever be equal to zero?

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8. If a reaction has an equilibrium constant $K < 1$, is E° positive or negative? What is the value of K, when $E^{\circ} = 0V$?

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9. Why does a dry cell become dead after a long time even if it has not been used ?

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10. Unlike dry cell, the mercury cell has a constant cell potential throughout its useful life. Why?

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11. Write the cell reaction of a lead storage battery when it is discharged. How does the density of the electroyte change when the battery is discharged ?

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12. Suggest two materials other than H_2 that can be used as fuels in fuel cell.

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13. What advantage do the fuel cells have over primary and secondary batteries?

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14. Arrange the following metals in the order in which they displace each other from the solution of their salts.

Al, Cu, Fe, Mg and Zn

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15. Rusting of iron is quicker in saline water than in ordinary water. Give reason.

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16. Why does an alkaline medium inhibit the rusting of iron?

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17. Why rusting of iron pipe can be prevented by joining it with a piece of magnesium?

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Questions For Practice Part Iii Electrolchemical Cells And Series Nernst Equations Batteries And Corrosion Short Answer Type I Questions

1. What is galvanic cell? Give an example.

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2. What is electrode potential ? Write the expression for the emf of a cell in terms of oxidation potential.

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

Watch Video Solution

4. Calculate the emf of the cell in which the following reaction takes place,

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

Given that $E^{\circ}_{\text{cell}} = 1.05V$

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5. The standard electrode potential (E°) for Daniel cell is $+1.1V$. Calculate, the ΔG° for the reaction,

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

$1F = 96500 C \text{mol}^{-1}$)

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6. Calculate the standard emf of the cell having the cell reaction.

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

$E^{\circ}_{Zn\,/\,Zn^{2+}} = 0.76V, E^{\circ}_{Co\,/\,Co^{2+}} = 0.25V$

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7. Represent the cell and calculate the Standard e.m.f. of the cell having following cell reaction:

$2Cr(s) + 3Cd^{2+}(aq) \rightarrow 2Cr^{3+}(aq) + 3Cd(s) E^0 Cr^{3+}/Cr = -0.73 vo <$

and $E^0 Cd^{2+}/Cd = -0.40$ volt

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8. Predict whether we can store $CuSO_4$ solution in a zinc vessel from the following data. Show your calculation.

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

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

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9. Mention the reactions occuring at (i) anode (ii) cathode, during working of a mercury cell. Why does the voltage of a mercury cell remain constant during its operation?

Watch Video Solution

10. Write the chemistry of recharging the lead storage battery, highlighting all the materials that are involved during recharging .

Watch Video Solution

11. Explain why $CuSO_4$ solution cannot be stored in Zn vessel ?

Watch Video Solution

12. Can you store copper sulphate solution in a zinc pot?

Watch Video Solution

13. Given the standard electrode potentials,

$K^+/K = -2.93V, Ag^{2+}/Ag = 0.80V$

$Hg^{2+}/Hg = 0.79V, Mg^{2+}/Mg = -2.37V, Cr^{3+}/Cr = -0.74V$

Arrange these metals in their increasing order of reducing power.

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14. The chemistry of corrosion of iron is essentially an electrochemical phenomenon. Explain the reactions occurring during the corrosion of iron in the atmosphere.

Watch Video Solution

Questions For Practice Part Iii Electrolchemical Cells And Series Nernst Equations Batteries And Corrosion Short Answer Type Ii Questions

1. Derive the Nernst equation of electrode potential at 25° C for the electrode reaction.

$M^{+}(aq) + ne \Leftrightarrow M(s)$

Watch Video Solution

2. Calculate the emf of the following cell at $25^{\circ}C$

$Ag(s)\left|Ag^{+}\left(10^{-3}M\right)\right|\left|Cu^{2+}\left(10^{-1}M\right)\right|Cu(s)$

Given, $E^{\circ}_{\text{cell}} = +0.46V$ and $\log 10^{n} = n$.

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3. Find the stability constant of the complex $\left[Zn(NH_3)_4\right]^{2+}$ formed in the reaction,

$Zn^{2+} + 4NH_3 \Leftrightarrow \left[Zn(NH_3)_4\right]^{2+}$

Given that, $E^{\circ}_{Zn^{2+}/Zn} = -0.76V$ and $E^{\circ}_{\left[Zn(NH_3)_4\right]^{2+}/Zn,4NH_3} = -1.03V$

Watch Video Solution

4. 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 E° and ΔG° for the reaction.

(Given, $E^\circ_{Ag^+/Ag} = +0.80V$, $E^\circ_{Zn^{2+}/Zn} = -0.76V$)

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5. The cell in which the following reaction occurs,

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

has $E^\circ_{\text{cell}} = 0.236V$ at 298K , calculate the standard Gibbs energy and the equilibrium constant of the cell reaction.

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6. Write the Nernst equation and emf of the following cell at 298 K.

(i) $Mg(s)\left|Mg^{2+}(0.001M)\right|\left|Cu^{2+}(0.0001M)\right|Cu(s)$

(ii) $Fe(s)\left|Fe^{2+}(0.001M)\right|\left|H^+(1M)\right|H_2(g)(1\text{bar}) \mid Pt(s)$

Given that, $E^\circ_{Mg^{2+}/Mg} = -2.36V$,

$E^\circ_{Cu^{2+}Cu} = 0.34V$, $E^\circ_{Fe^{2+}Fe} = -0.44V$

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7. During the discharge of a lead storage battery, the density of sulphuric acid fell from 1.294 to 1.139g / mL. Sulphuric acid of density 1.294 g / mL is 39% H_2SO_4 by weight and that of density 1.139g / mL is 20% H_2SO_4 by weight. The battery holds 3.5 L of the acid and the volume remained practically constant during the discharge. Calculate the number of ampere-hours for which the battery must have been used. The discharging reactions are

$Pb + SO_4^{2-} \rightarrow PbSO_4 + 2e^-$ (chargining)

$PbO_2 + 4H^+ + SO_4^{2-} + 2e^- \rightarrow PbSO_4 + 2H_2O$ (dischargining)

Watch Video Solution

8. What is corrosion ? What are the factors which affect corrosion? CO_2 is always present in natural water.

Explain its effect (increases, stops or no effect on rusting of iron.

Watch Video Solution

Questions For Practice Part Iii Electrolchemical Cells And Series Nernst Equations Batteries And Corrosion Long Answer Type Questions

1. Describe the construction and working of Daniell cell.

The following reaction occurs in a cell

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

Write the electrode reaction and find out the emf of the cell. Given

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

$CO(s) \rightarrow Co^{2+}(aq), E^{\circ} = 0.28V$

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2. Calculate the half-cell potential at 298 K for the reaction $Cu^{2+}(aq) + 2e^{-} \rightarrow Cu(s)$ where $\left[Cu^{2+}\right]$ is 5.0 M and E° is $+$ 0.34 V

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3. Explain how rusting of iron is envisaged as setting up of an electrochemical cell?

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Questions For Assessment Part Iii Electrolchemical Cells And Series Nernst Equations Batteries And Corrosion Multiple Choice Type Questions

1. E° values of Mg^{2+}/Mg is -2.37V, of Zn^{2+}/Zn is -0.76V and Fe^{2+}/Fe is -0.44V.

Which of the following statement is correct ?

A. Zn will reduce Fe^{2+}

B. Zn will reduce Mg^{2+}

C. Mg oxidises Fe

D. Zn oxidises Fe

Answer: d

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2. Write the chemistry of recharging the lead storage battery, highlighting all the materials that are involved during recharging .

A. $PbSO_4$ on anode is reduced to Pb

B. $PbSO_4$ on cathode is reduced to Pb

C. $PbSO_4$ on cathode is oxidised to Pb

D. $PbSO_4$ on anode is oxidised to PbO_2

Answer: a

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Questions For Assessment Part Iii Electrolchemical Cells And Series Nernst Equations Batteries And Corrosion Very Short Answer Type Questions

1. Write the cell representation for the galvanic cell used for measuring standard electrode potential of iron having $E^{\circ}_{Fe^{2+}/Fe} = -0.44V$

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2. Differentiate between emf and potential difference.

Watch Video Solution

3. What does the negative sign in the expression $E^{\circ}_{Zn^{2+}/Zn} = -0.76V$ mean ?

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4. What is a battery?

Watch Video Solution

5. What is a primary cell? Given one example.

Watch Video Solution

6. Mention the uses of mercury cell.

Watch Video Solution

7. What is the advantage of nickel-cadmium cell over lead-storage battery?

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8. List the advantages of using $H_2 - O_2$ fuel cell over ordinary cell.

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Questions For Assessment Part Iii Electrolchemical Cells And Series Nernst Equations Batteries And Corrosion Short Answer Type I Questions

1. Formulate the galvanic cell in which the following reaction takes place.

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

(i) Which one of its electrodes is negatively charged ?

(ii) The reaction taking place at each of its electrode.

(iii) The carriers of current within this cell.

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2. Calculate the emf for the given cell at $25^{\circ}C$.

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

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

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3. Two half reactions of an electrochemical cell are given below :

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

$Sn^{2+}(aq) \rightarrow Sn^{4+}(aq) + 2e^-, E^\circ = -0.15V$

Construct the redox equation from the standard potential of the cell and predict, if the reaction is reactant favoured or product favoured.

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4. What is a nickel -cadmium cell? State its one merit and one demerit over lead storage cell. Write the overall reaction that occurs during discharging of this cell.

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5. Give an example of a fuel cell and write the cathode and anode reactions for it.

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6. A lead-storage cell can act both as galvanic and electrolyte cells. Explain.

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Questions For Assessment Part Iii Electrolchemical Cells And Series Nernst Equations Batteries And Corrosion Short Answer Type Ii Questions

1. Calculate the potential for half-cell containing 0.10 M $K_2Cr_2O_7$ (aq), 0.20 M $Cr^{3+}(aq)$ and $1.0 \times 10^{-4} MH^+(aq)$. The half- cell reaction is $Cr_2O_7^{2-}(aq) + 14H^+(aq) + 6e^- \rightarrow 2Cr^{3+}(aq) + 7H_2O(l)$ and the standard electrode potential is given as $E^\circ = 1.33V$.

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2. Calculate the standard cell potential of a galvanic cell in which the following reaction takes place $2Cr(s) + 3Cd^{2+}(aq) \rightarrow 2Cr^{3+}(aq) + 3Cd(s)$

Calculate $\Delta_r G^\circ$ and equilibrium constant K of the above reaction at $25^\circ C$.

[Given,

$E^\circ_{Cr^{3+}/Cr} = -0.74V, E^\circ_{Cd^{2+}/Cd} = -0.40V, 1F = 96500C\text{mol}^{-1}$]

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3. For a cell :

$Ag(s)|AgNO_3(0.01M)||AgNO_3(1.0M)|Ag(s)$

(i) Calculate the emf of the cell at $25^\circ C$

(ii) Write the net cell reaction.

(iii) Will the cell generate emf when two concentration become equal ?

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4. Give the half-cell and net cell reactions in the following batteries.

(i) Leclanche cell

(ii) Nickel-metal hydride battery

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Questions For Assessment Part Iii Electrolchemical Cells And Series Nernst Equations Batteries And Corrosion Long Answer Type Questions

1. Write the Nernst equation and emf of the following cells at 298K.

(i) $Sn(s)\left|Sn^{2+}(0.050M)\right|\left|H^{+}(0.020M)\right|H_2(g, 1\text{bar}) \mid Pt(s)$

(ii) $Pt(s)|Br_2(l)|Br^{-}(0.010M)\left|\left|H^{+}(0.030M)\right|H_2(g, 1\text{bar})\right|Pt(s)$

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2. Iron may be protected from rusting by coating with zinc or tin. By referring to the data given below, explain why zinc protect iron more effectively than tin?

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

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

$Sn^{2+} + 2e^{-} \rightarrow Sn, E^{\circ} = -0.14V$

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Odisha Bureau S Textbook Solutions Multiple Choice Type Questions

1. The electric charge for electrode deposition of the gram equivalent of a substance is

A. one ampere for one second

B. 96500 Coulombs

C. charge on one mole of electrons

D. one ampere for one hour

Answer: B

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2. Which is the strongest reducing agent?

A. Zn(s)

B. Cr(s)

C. $H_2(g)$

D. $Fe^{2+}(aq)$

Answer: a

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3. Faraday's law of electrolysis are related to

A. the atomic number of cation

B. the atomic number of anion

C. equivalent mass of electrolyte

D. speed of the cation

Answer: c

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4. Molten sodium chloride conducts electricity due to the presence of . . . . . .

A. free electrons

B. free ions

C. free molecules

D. atoms of sodium and chlorine

Answer: b

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5. The unit of specific conductance is . . . . . .

A. Ohm

B. $\text{Ohm}^{-1}cm^{-1}$

C. Coulomb

D. Faraday

Answer: b

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6. The electrode at which the electrons flow into an electrolyte is . . . . . .

A. anode

B. metal

C. cathode

D. solid

Answer: c

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7. The charge (in Coulombs) on the Na^+ ion is . . . . . .

A. 96500

B. $4.8 \times 10^{+19}$

C. 4.8×10^{-19}

D. 1.6×10^{-19}

Answer: d

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8. 96500 Coulomb will deposite . . . . . of metal.

A. one electrochemical equivalent

B. one g

C. one g equivalent

D. one g molecular mass

Answer: c

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9. Which one of the following is a weak electrolyte?

A. Sodium chloride

B. Copper sulphate

C. Acetic acid

D. Hydrogen Chloride

Answer: c

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10. . . . . . is an example of strong electrolye.

A. Ammonium hydroxide

B. Acetic acid

C. Sodium acetate

D. Sodium chloride

Answer: d

Watch Video Solution

11. Which is the strongest reducing agent?

A. Zn(s)

B. Cu(s)

C. $H_2(g)$

D. $Fe^{2+}(aq)$

Answer: a

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12. The unit of cell constant is . . . . . .

A. $Ohm^{-1}cm^2$

B. cm^{-1}

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

D. $Ohm^{-1}cm^2$ / gm. Equiv.

Answer: b

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13. For a redox reaction to proceed in a cell, the emf must be

A. positive

B. negative

C. zero

D. fixed

Answer: a

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14. Moles of aluminium produced by passing six Faraday of electricity is . . . .

A. 2 mol

B. 6 mol

C. 3 mol

D. 1 mol

Answer: a

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15. . . . . grams of chlorine can be prepared by the electrolysis of molten sodium chloride with 10 amperes current passed for 10min.

A. 2.2

B. 4.4

C. 3.8

D. 5

Answer: a

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16. Which of the following type of reactions occur at the anode during electrolysis ?

A. dissociation

B. Substitution

C. Reduction

D. Oxidation

Answer: d

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Odisha Bureau S Textbook Solutions Very Short Answer Type Questions

1. What happens to equivalent conductance when solution is diluted?

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2. What is the amount of substance liberated by the passage of 1 Faraday of electricity?

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3. Define specific conductance of an electrolyte.

Watch Video Solution

4. Define equivalent conductance.

Watch Video Solution

5. Define molar conductance.

Watch Video Solution

6. State Kohlrausch's law. Discuss with an example .

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7. What is the electrode potential?

Watch Video Solution

8. The unit of equivalent conductance is

Watch Video Solution

9. Define electrochemical equivalent.

Watch Video Solution

10. What is the unit of molar conductance ?

Watch Video Solution

11. What is cell constant?

Watch Video Solution

12. What is electromotive force?

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13. In the outside circuit of a cell electron flows from which electrode?

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14. Which gas is liberated at anode due to electrolysis of molten sodium hydride?

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15. Which gas is liberated at cathode due to the electrolysis of aqueous solution of sodium chloride?

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16. What is the unit of emf?

Watch Video Solution

17. What is an electrochemical cell?

Watch Video Solution

18. Define degree of dissociation of an electrolyte?

Watch Video Solution

19. What is the unit of specific conductance?

Watch Video Solution

20. What is the basis on which anode or cathode is identified in a chemical cell?

Watch Video Solution

21. Give the relationship between chemical equivalent and electrochemical equivalent of an element?

Watch Video Solution

22. What is the function of a salt bridge?

Watch Video Solution

23. What happens to the conductance of a solution when temperature is increased ?

Watch Video Solution

24. Oxidation and reduction take place at which of the the electrodes in a cell?

Watch Video Solution

25. What is the emf of a standard hydrogen electrode?

Watch Video Solution

26. What do you meant by strong electrolyte?

Watch Video Solution

27. During electrolysis of aqueous solution of NaCl at which electrode chlorine is liberated.

Watch Video Solution

28. What is the charge in Coulombs on CO_3^{2-} ion?

Watch Video Solution

29. How many Coulombs of electricity are required to produce 20g of calcium from molten $CaCl_2$?

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Watch Video Solution

30. Write the cell representation when Zn electrodes is connected to standard hydrogen electrode.

Watch Video Solution

31. What is the charge in Coulombs on Cu^{2+} ion?

Watch Video Solution

32. In an electrochemical cell, reduction taken place at .....

Watch Video Solution

33. What is the relation between standard emf of a cell and equilibrium constant?

Watch Video Solution

34. One Faraday of electricity will deposit ..... weight of a metal.

Watch Video Solution

35. What is the unit of equivalent conductance ? How does the equivalent conductance vary with dilution?

Watch Video Solution

36. What is the basis on which anode or cathode is identified in a chemical cell?

Watch Video Solution

37. What do you understand by strong and weak electrolytes?

Watch Video Solution

38. How many Coulombs of electricity are required to produce 20g of calcium from molten $CaCl_2$?

Watch Video Solution

39. Represent the cell and calculate the Standard e.m.f. of the cell having following cell reaction:

$2Cr(s) + 3Cd^{2+}(aq) \rightarrow 2Cr^{3+}(aq) + 3Cd(s) E^0 Cr^{3+}/Cr = -0.73 vo <$

and $E^0 Cd^{2+}/Cd = -0.40$ volt

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40. State KohIrausch's law.

Watch Video Solution

41. How many moles of aluminium can be prepared by the electrolysis of molten alumina with a current of six Faradays.

Watch Video Solution

42. Explain why $CuSO_4$ solution cannot be stored in Zn vessel ?

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Odisha Bureau S Textbook Solutions Fill In The Blanks

1. Conductance of a solution . . . . . with dilution.

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2. Amount of substance liberated by the passage of one Coulomb of electricity through an electrolyte is called . . . . . .

Watch Video Solution

3. The more . . . . . the standard reduction potential, the . . . . . is the ability to displace hydrogen from acids.

Watch Video Solution

4. Conduction of electricity in solution is due to . . . . . .

Watch Video Solution

5. At . . . . . electrode in a cell oxidation takes place.

Watch Video Solution

6. In an electrochemical cell, reduction taken place at ..... .

Watch Video Solution

7. In electrochemical cell ..... energy is converted to ..... energy.

Watch Video Solution

8. What is the emf of a standard hydrogen electrode?

Watch Video Solution

9. Zinc has a ..... tendency to lose electrons than copper.

Watch Video Solution

10. In a galvanic cell electron flows from ..... to ..... through the connecting wires.

Watch Video Solution

11. In a galvanic cell the difference between reduction potential of cathode and anode is called. .....

Watch Video Solution

12. An aqueous solution of silver nitrate ..... be stored in a copper vessel.

Watch Video Solution

13. According to electrochemical series zinc is ..... active than iron.

Watch Video Solution

Watch Video Solution

14. Electrolysis of molten sodium hydride liberates . . . . . gas at the . . . . . .

Watch Video Solution

15. Electrochemical equivalents of two metals are in the ratio of their . . . . . .

Watch Video Solution

16. ECE $\times$ . . . . . = Chemical equivalent.

Watch Video Solution

17. Mass of substance liberated at the electrode is directly proportional to . . . . . .

Watch Video Solution

18. On electrolysis of aqueous solution of sodium chloride . . . . . is liberated at cathode.

Watch Video Solution

19. The unit of cell constant is . . . . . .

Watch Video Solution

20. The unit of equivalent conductance is

Watch Video Solution

21. The unit of specific conductance is . . . . . .

Watch Video Solution

22. In a Daniell cell copper vessel serves as . . . . . .

Watch Video Solution

23. In electrochemical series the elements are arranged in order of . . . . . reduction potentials.

Watch Video Solution

24. What is the standard electrode potential of hydrogen electrode?

Watch Video Solution

25. Specific conductance $\times$ . . . . . = Equivalent conductance.

Watch Video Solution

26. What happens to the conductance of a solution when temperature is increased ?

Watch Video Solution

27. In an electrochemical cell, reduction taken place at ……

Watch Video Solution

28. One Faraday of electricity will deposit …… weight of a metal.

Watch Video Solution

29. A current of 0.5 A flowing for 30 min deposits 0.2964g of a metal at the cathode. Calculate the equivalent mass of the metal.

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Odisha Bureau S Textbook Solutions Give Reasons

1. Sodium can not be extracted by the electrolysis of aqueous solution of sodium chloride.

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2. Explain, why $AgNO_3$ solution can't be stored in copper vessel.

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3. Copper sulphate solution can be stored in a zinc vessel.

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4. Blue colour of copper sulphate solution is discharged by dipping an iron rod in it.

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Odisha Bureau S Textbook Solutions Answer The Following

1. What is the difference between a galvanic cell and electrolytic cell?

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2. What is the difference between electrode potential and cell potential?

Watch Video Solution

3. How electrochemical series predicts the feasibility of a reaction?

Watch Video Solution

4. What is the function of a salt bridge?

Watch Video Solution

5. What is the relation between standard emf of a cell and equilibrium constant?

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6. The molar conductance of a solution of $AlCl_3$ in found to be 130 mho $cm^2 \text{mol}^{-1}$ at 298K.

What would be its equivalent conductance at the same temperature ?

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Odisha Bureau S Textbook Solutions Short Answer Type I Questions

1. Distinguish between strong electrolytes and weak electrolytes.

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2. Define conductance, specific conductance and equivalent conductance.

Watch Video Solution

3. What are the electrolytic products of fused NaCl? Write equations.

Watch Video Solution

4. What is the difference between electrochemical equivalent and chemical equivalent ?

Watch Video Solution

5. Write notes on

(i) Electroplating

(ii) Electrorefining

(iii) Galvanic cell

(iv) Electrotyping

(v) Electrochemical series.

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6. What are the main difference between electromotive force of cells and cell potential?

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7. Write down the notations of representing cathode, anode, and galvanic cell.

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8. What are reference electrodes ? What is the electrode potential?

Watch Video Solution

9. What are fuel cells? What are its advantages?

Watch Video Solution

10. Write the reasons of corrosion.

Watch Video Solution

11. How metal corrosion is prevented?

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

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13. When a current strength of 965 ampere can deposit 0.9 g of Al metal in 20 sec. What is the efficiency of electrolysis?

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14. Standard oxidation potential of iron electrode is $+0.44$V. Calculate the potential of Fe, $FeSO_4$ (1M) at $25^\circ C$.

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15. What is lead storage battery?

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16. Write the Nernst equation for a half cell reaction.

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17. 1N salt solution surrounding two platinum electrodes, 2.1 cm apart and 6.3 cm^2 in area was found to offer a resistance of 50 ohm. Calculate the equivalent conductance of the solution.

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

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

Calculate the cell potential for the reaction

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

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19. Write down the working of mercury dry cell.

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20. Write down the working of nickel- cadmium cell.

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Odisha Bureau S Textbook Solutions Short Answer Type Ii Questions

1. What happens to pH of NaCl solution after electrolysis and why?

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2. Specific conductance of a 0.12 N solution of electrolyte is $2.4 \times 10^{-2} ohm^{-1} cm^{-1}$. What is the value of its equivalent conductance?

Watch Video Solution

3. What do you understand by electrochemical series? Discuss the importance of electrochemical series.

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4. The equivalent conductance of 0.001N KCl solutin is 147 $ohm^{-1}cm^2gmeq^{-1}$ at $25^\circ C$. Find the specific conductance.

Watch Video Solution

5. The specific conductance of a 0.12N solution of an electrolyte is $2.4 \times 10^{-2}\ ohm^{-1}cm^{-1}$ Calculate its equivalent conductance.

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6. Rusting of iron is quicker in saline water than in ordinary water. Give reason.

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7. An electronic current is passed through two solution (A) $AgNO_3$ and (B) a solution of 10g of blue vitriol in 500 mL of water using platinum electrodes separately. After 30 min it was found that 1.307g Ag was deposited . What is the concentration of Cu^{2+} after electrolysis?

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8. A current of 1.7 A is passed through 300mL of 0.16 M $ZnSO_4$ solution for 230 seconds with a current efficiency of 90%. Find the concentration of divalent zinc in solution.

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9. The standard potential of Ni^{2+}/Ni is -0.236 V. If this electrode is coupled with a hydrogen electrode, the emf of the cell becomes zero. Calculate the pH of the acid used in electrode.

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10. E° values for $Fe^{3+} + 3e \rightarrow Fe$ and $Fe^{2+} + 2e \rightarrow Fe$ are - 0.036V and -0.44V respectively. Calculate the E^{0} and ΔG^{0} for the cell reaction $Fe + 2Fe^{3+} \rightarrow 3Fe^{2+}$.

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11. When salt spread on road to melt ice and snow during winter, corrosion of motor cars is a major problem, justify.

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12. E° of Ag electrode is 0.8 V and solubility product of AgI is 1×10^{-16}. Calculate the potential of Ag electrode at $25^{\circ} C$ in a saturated AgI solution in water.

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Odisha Bureau S Textbook Solutions Long Answer Type Questions

1. State and explain Faraday's laws of electrolysis. How many grams of aluminium can be produced by the electrolysis of molten alumina with a current of 3 amperes for 10 minutes?

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2. Define and explain equivalent conductance and specific conductance. A 0.1 N solution of NaCl has a specific conductance of 0.00119 mho cm^{-1}. Find its equivalent conductance.

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3. Explain the terms

(i) Conductance

(ii) Specific conductance

(iii) Equivalent conductance

(iv) Molar conductance.

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4. State and explain Kohlrausch's law. How can this law be used to find equivalent conductance of acetic acid at infinite dilution?

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5. State and explain Faraday's second law of electrolysis. How does this help in determining equivalent mass of the metal?

Watch Video Solution

6. Write notes on

(i) Electroplating

(ii) Electrorefining

(iii) Galvanic cell

(iv) Electrotyping

(v) Electrochemical series.

Watch Video Solution

7. What is meant by electrode potential? Explain in the half cell reactions of

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

Watch Video Solution

8. Write two applications of electrochemical series.

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9. A current of 0.5 amperes was passed through a solution of silver nitrate for six min. Find the mass of silver deposited.

(Atomic mass of Ag = 108)

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10. The resistance of $N/5$ solution of an electrolyte in a cell was found to be 45 ohm. Calculate the equivalent conductance of the solution if the electrodes in a cell are 2.2 cm apart and have an area of 3.8 equiv. cm.

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11. State and explain Faraday's laws of electrolysis. 0.2015g of copper were deposited by a current of 0.25 A in 45 min. What is the ECE of the copper?

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12. Describe the construction and working of Daniell cell.

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13. Describe the construction and working of Daniell cell.

The following reaction occurs in a cell

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

Write the electrode reaction and find out the emf of the cell. Given

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

$CO(s) \rightarrow Co^{2+}(aq), E^{\circ} = 0.28V$

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14. What are the difference between ionisation and electrolysis? What are strong and weak electrolysis, discuss with example.

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15. Differentiate between emf and potential difference.

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16. Write two applications of electrolysis.

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17. Define equivalent and molar conductance. Give their relationship with specific conductance. How does equivalent conductance vary with increase in temperature?

How many atoms of calcium will be deposited from fused $CaCl_2$ by a current of 25 mA passes for 60 sec?

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18. State and explain equivalent conductance and specific conductance. Calculate the mass of silver deposited when a current of 1A is passed

through $AgNO_3$ solution for 1h. The electrochemical equivalent of silver is 1.21×10^{-3}.

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19. Define and explain specific conductance and equivalent conductance. Why on dilution the specific conductance decreases and equivalent conductance increases?

A 0.1 N solution of sodium acetate has a specific conductance 0.0061 $\text{ohm}^{-1}cm^{-1}$. Calculate the equivalent conductance of the solution.

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20. Calculate the half-cell potential at 298 K for the reaction $Cu^{2+}(aq) + 2e^- \rightarrow Cu(s)$ where $\left[Cu^{2+}\right]$ is 5.0 M and E° is $+$ 0.34 V

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21. State and explain Faraday's laws of electrolysis. 0.2015g of copper were deposited by a current of 0.25 A in 45 min. What is the ECE of the copper?

Watch Video Solution

22. Define equivalent and molar conductance. Give their relationship with specific conductance. How does equivalent conductance vary with increase in temperature?

How many atoms of calcium will be deposited from fused $CaCl_2$ by a current of 25 mA passes for 60 sec?

Watch Video Solution

23. State and explain equivalent conductance and specific conductance. Calculate the mass of silver deposited when a current of 1A is passed through $AgNO_3$ solution for 1h. The electrochemical equivalent of silver is 1.21×10^{-3}.

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24. State and explain Faraday's law of electrolysis. When a current of 1.5 amperes strength is passed through a solution of a salt of a metal (atomic mass = 112) for 15 min , 0.783 g of the metal is deposited. Find out the valency of the metal.

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25. Describe specific and equivalent conductance. How are they related? What is the effect of dilution of them?

The specific conductivity of an $N/20$ solution of KCl at 25°C is 0.002765 mho cm^{-1}. If the resistance of the same solution placed in the cell is 2000 ohms, what is the cell constant?

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26. Define and explain specific conductance and equivalent conductance.

A 0.01N solution of NaCl has a specific conductance of 0.001112 $\text{ohm}^{-1}cm^{-1}$. Find its equivalent conductance.

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27. State and explain Faraday's laws of electrolysis. How many grams of chlorine will be produced by the electrolysis of molten sodium chloride with a current of 5.5 A for 25 min?

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Chapter Practice Multpile Choice Type Questions

1. The unit of conductivity is

A. Ω^{-1}

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

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

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

Answer: B

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

A. $6250 Sm^2 \text{mol}^{-1}$

B. $6.25 \times 10^{-4} Sm^2 \text{mol}^{-1}$

C. $625 \times 10^{-4} Sm^2 \text{mol}^{-1}$

D. $62.5 Sm^2 \text{mol}^{-1}$

Answer: b

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3. The standard emf of a galvanic cell involving 2 moles of electrons in its redox reaction is 0.59 V . The equilibrium constant for the redox reaction of the cell is

A. 10^{20}

B. 10^{5}

C. 10

D. 10^{10}

Answer: A::C::D

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4. The potential of the following cell is 0.34 V at $25^{\circ}V$. Calculate the standard reduction potential of the copper half-cell .

$Pt|H_2(1atm)|H^+(1M)\ ||\ |Cu^{2+}(1M)|Cu$

A. $-3.4V$

B. $+3.4V$

C. $-0.34V$

D. $+0.34V$

Answer: decreasing

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5. Which of the following is used widely in the manufature of lead storage battery?

A. Arsenic

B. Lithium

C. Bismuth

D. Antimony

Answer: decreasing

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Chapter Practice Very Short Answer Type Questions

1. In galvanic cell, what is the polarity of anode?

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2. Write the Nernst equation for single electrode potential.

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3. What is the efficiency of a fuel cell? What is the use of a fuel cell?

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4. Suggest a metal that can be used for cathodic protection of iron against rusting.

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5. Write the relationship between cell potential and equilibrium constant.

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6. Write the Nernst equation to calculate the cell potential of $Mg(s)\left|Mg^{2+}(aq)\right| \mid Ag^{+}|Ag.$

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7. What are the products obtained at cathode and anode, when $PbBr_2$ is electrolysed?

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Chapter Practice Short Answer Type I Questions

1. The conductivity of 0.20 M solution of KCl at 298 K is 0.248S cm^{-1} .

Calculate its molar conductivity.

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2. Discuss the product of electrolysis of molten NaCl.

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3. Write the Nernst equation and emf of the following cell at 298K.

$Fe(s)\left|Fe^{2+}(0.001M)\right|\left|H^{+}(1M)\right|H_2(g)(1\text{bar})\mid Pt.$

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4. A solution of $MgSO_4$ is electrolysed for 20 min with a current of 1.5A.

What mass of magnesium is deposited at the cathode?

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5. The potential for the cell below is found to be 0.25V.

$Pt(s)|H_2(g)|H^+(aq),\ 1\ \text{mol}\ /L\ |\ |\ Cu^{2+}$

(aq, C mol $/L$) $|\ Cu(s)$ What is the value of C ?

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6. (i) Why does zinc react with dilute sulphuric acid but copper does not ?

(ii) Why it is not possible to measure the single electrode potential?

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7. The emf of a cell corresponding to the reaction, $Zn(s) + 2H^+(aq) \rightarrow Zn^{2+}(0.1M) + H_2(g, 1atm)$ is 0.28 V at $25^\circ C$. Write the half-cell reaction and calculate the pH of the solution at the hydrogen electrode.

$E^\circ_{Zn^{2+}/Zn} = -0.76V, E^\circ_{H^+/H_2} = 0$

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8. Calculate the cell emf and $\Delta_r G^\circ$ for the cell reation at $25^\circ C$.

$Zn(s)\left|Zn^{\circ+}(0.1M)\right|\left|Cd^{2+}(0.01M)\right|Cd(s)$

Given, $E^\circ_{Zn^{2+}/Zn} = -0.763V$,

$E^\circ_{Cd^{2+}/Cd} = -0.403V$

1F = 96500 C mol^{-1}

R = 8.314 $JK^{-1}\mathrm{mol}^{-1}$],

Find $E^\circ_{\text{cell}} = E^\circ_{\text{cathode}} - E^\circ_{\text{anode}}$ then $\Delta_r G^\circ$ by using formula,

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

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9. Find the equilibrium constant for the reaction,

$Cu^{2+} + \ln^\circ \Leftrightarrow Cu^+ + \ln^{3+}$

Given that, $E_{Cu^{2+}/Cu^+} = 0.15V$,

$E^\circ_{\ln^{2+}/\ln^+} = -0.4V$, $E^\circ_{\ln^{3+}/\ln} = 0.42V$

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10. A current of 3.7 A is passed for 6h between nickel electrodes in 0.5 L of a 2M solution of $Ni(NO_3)_2$. What will be the molarity of solution at the end of electrolysis ?

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Chapter Practice Short Answer Type Ii Questions

1. Calculate the standard cell potentials at $25^\circ C$ for the electrochemical cells, $Zn|Zn^{2+}||$ reference half-cell and reference half-cell $||Cu^{2+}|Cu$, where the reference half-cell is,

(i) SHE

(ii) Ag / AgCl electrode.

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2. Calculate the standard electrode potential of Ni^{2+} | Ni electrode if emf of the cell, $Ni(s)|Ni^{2+}(0.01M)||Cu^{2+}(0.1M)|Cu(s)$ is 0.059 V.

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

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3. Which cell is generally used in hearing aids ? Name the material of the anode, cathode and electrolyte. Write the reactions involved.

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4. How many molecules of chlorine should be deposited from molten sodium chlorine in 1 min by a current of 300 mA?

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5. Calculate the standard free energy change taking place in $H_2 - O_2$ fuel cell in which the following reactions occur.

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

(ii) $2H_2 \rightarrow 4H^+ + 4e^-, \ E^\circ = 0.000V$

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6. Consider the following cell reaction,

$2Fe(s) + O_2(g) + 4H^+(aq) \rightarrow 2Fe^{2+}(aq) + 2H_2O(l), E^\circ = 1.67V$

At $\left[Fe^{2+}\right] = 10^{-3}M, p(O_2) = 0.1$ atm and pH =3.

What is the cell potential at $25^\circ C$?

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7. Degree of dissociation of pure water is 1.9×10^{-9}. Molar ionic conductance of H^+ ions and OH^- ions at infinite dilution are 200 S $cm^2 \text{mol}^{-1}$ and 350 S $c^2 \text{mol}^{-1}$ respectively. What is the molar conductance of water ?

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8. A current of 1.70 A is passed through 300.0 mL of 0.160 M solution of $ZnSO_4$ for 230s with a current efficiency of 90 per cent. Find out the

molarity of Zn^{2+} after the deposition of zinc. Assume the volume of the solution to remain constant during electrolysis.

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Chapter Practice Long Answer Type Questions

1. Discuss the products obtained in electrolysis of aqueous solution of brine.

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2. Find the stability constant of the complex $\left[Zn(NH_3)_4\right]^{2+}$ formed in the reaction,

$Zn^{2+} + 4NH_3 \Leftrightarrow \left[Zn(NH_3)_4\right]^{2+}$

Given that, $E^{\circ}_{Zn^{2+}/Zn} = -0.76V$ and $E^{\circ}_{\left[Zn(NH_3)_4\right]^{2+}/Zn,4NH_3} = -1.03V$

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3. Calculate the equilibrium constant for the reaction. $2Fe^{2+} + 3I^{-} \Leftrightarrow 2Fe^{3+} + I_3^{-}$

The standard reduction potential in acidic condition is 0.78 V and 0.54 V , respectively . For Fe^{3+}/Fe^{2+} and I_3^{-}/I couples.

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