# DPP - Daily Practice Problems

Name : _____ Date : _____

Start Time : _____ End Time : _____

# CHEMISTRY 33

**SYLLABUS : ElectroChemistry I :** Electrolytes and Electrolysis, Faraday's law of electrolysis, Conductors & Conductance

**Max. Marks : 120** **Time : 60 min.**

**GENERAL INSTRUCTIONS**

- The Daily Practice Problem Sheet contains 30 MCQ's. For each question only one option is correct. Darken the correct circle/ bubble in the Response Grid provided on each page.
- You have to evaluate your Response Grids yourself with the help of solution booklet.
- Each correct answer will get you 4 marks and 1 mark shall be deduced for each incorrect answer. No mark will be given/ deducted if no bubble is filled. Keep a timer in front of you and stop immediately at the end of 60 min.
- The sheet follows a particular syllabus. Do not attempt the sheet before you have completed your preparation for that syllabus. Refer syllabus sheet in the starting of the book for the syllabus of all the DPP sheets.
- After completing the sheet check your answers with the solution booklet and complete the Result Grid. Finally spend time to analyse your performance and revise the areas which emerge out as weak in your evaluation.

**DIRECTIONS (Q.1-Q.21) : There are 21 multiple choice questions. Each question has 4 choices (a), (b), (c) and (d), out of which ONLY ONE choice is correct.**

**Q.1** Which one of the following metals could not be obtained on electrolysis of aqueous solution of its salts?

(a) Ag (b) Mg

(c) Cu (d) Cr

**Q.2** On the electrolysis of aqueous solution of sodium sulphate on cathode we get

(a) Na (b) $H_2$

(b) $SO_2$ (d) $SO_3$

**Q.3** A solution of sodium sulphate in water is electrolysed using inert electrodes. The products of the cathode and anode are respectively

(a) $H_2, O_2$ (b) $O_2, H_2$

(c) $O_2$, Na (d) $O_2, SO_2$

**Q.4** The amount of ion discharged during electrolysis is not directly proportional to

(a) Resistance

(b) Time

(c) Current

(d) Chemical equivalent of the ion

| RESPONSE GRID | 1. ⓐⓑⓒⓓ | 2. ⓐⓑⓒⓓ | 3. ⓐⓑⓒⓓ | 4. ⓐⓑⓒⓓ |
|---|---|---|---|---|

*Space for Rough Work*

**Q.5** The passage of current liberates $H_2$ at cathode and $Cl_2$ at anode. The solution is
(a) Copper chloride in water (b) NaCl in water
(c) $H_2SO_4$ (d) water

**Q.6** Degree of ionisation of a solution depends upon
(a) Temperature
(b) Nature of the electrolyte
(c) Nature of the solvent
(d) None of these

**Q.7** Which of the following is not a non electrolyte?
(a) Acetic acid (b) Glucose
(c) Ethanol (d) Urea

**Q.8** When 9.65 coulombs of electricity is passed through a solution of silver nitrate (atomic weight of Ag = 107.87 taking as 108) the amount of silver deposited is
(a) 10.8 mg (b) 5.4 mg
(c) 16.2 mg (d) 21.2 mg

**Q.9** An apparatus used for the measurement of quantity of electricity is known as a
(a) Calorimeter (b) Cathetometer
(c) Coulometer (d) Colorimeter

**Q.10** On passing one faraday of electricity through the electrolytic cells containing $Ag^+$, $Ni^{2+}$ and $Cr^{+3}$ ions solution, the deposited Ag (At. wt. = 108), Ni (At. wt. = 59) and Cr (At.wt.= 52) is

| | Ag | Ni | Cr |
|---|---|---|---|
| (a) | 108 gm | 29.5 gm | 17.3 gm |
| (b) | 108 gm | 59.0 gm | 52.0 gm |
| (c) | 108.0 gm | 108.0 gm | 108.0 gm |
| (d) | 108 gm | 117.5 gm | 166.0 gm |

**Q.11** The platinum electrodes were immersed in a solution of cupric sulphate and electric current is passed through the solution. After some time it was found that colour of copper sulphate disappeared with evolution of gas at the electrode. The colourless solution contains
(a) Platinum sulphate (b) Copper hydroxide
(c) Copper sulphate (d) Sulphuric acid

**Q.12** In electrolysis of a fused salt, the weight of the deposit on an electrode will not depend on
(a) Temperature of the bath
(b) Current intensity
(c) Electrochemical equivalent of ions
(d) Time for electrolysis

**Q.13** Total charge on 1 mole of a monovalent metal ion is equal to
(a) $9.65\times10^{4}$ Coulomb (b) $6.28\times10^{18}$ Coulomb
(c) $1.6\times10^{-19}$ Coulomb (d) None of these

**Q.14** When 96500 coulomb of electricity is passed through a copper sulphate solution, the amount of copper deposited will be
(a) 0.25 mol (b) 0.50 mol
(c) 1.00 mol (d) 2.00 mol

**Q.15** In infinite dilutions, the equivalent conductances of $Ba^{2+}$ and $Cl^-$ are 127 and 76 $ohm^{-1}\ cm^2\ eqvt^{-1}$. The equivalent conductivity of $BaCl_2$ at indefinite dilution is
(a) 101.5 (b) 139.5
(c) 203.5 (d) 279.5

**Q.16** Conductivity (unit Siemen's) is directly proportional to area of the vessel and the concentration of the solution in it and is inversely proportional to the length of the vessel then the unit of the constant of proportionality is
(a) Sm $mol^{-1}$ (b) $Sm^2\ mol^{-1}$
(c) $S^{-2}m^2$ mol (d) $S^2m^2\ mol^{-2}$

**Q.17** Conductivity of a strong electrolyte
(a) Increases on dilution
(b) Does not change considerably on dilution
(c) Decreases on dilution
(d) Depends on density

**Q.18** Given l / a= 0.5 $cm^{-1}$, R = 50 ohm, N = 1.0. The equivalent conductance of the electrolytic cell is
(a) 10 $ohm^{-1}\ cm^2\ (gm\ eq)^{-1}$
(b) 20 $ohm^{-1}\ cm^2\ (gm\ eq)^{-1}$
(c) 300 $ohm^{-1}\ cm^2\ (gmeq)^{-1}$
(d) 100 $ohm^{-1}\ cm^2\ (gmeq)^{-1}$

**RESPONSE GRID**

| | | | | |
|---|---|---|---|---|
| 5. ⓐⓑⓒⓓ | 6. ⓐⓑⓒⓓ | 7. ⓐⓑⓒⓓ | 8. ⓐⓑⓒⓓ | 9. ⓐⓑⓒⓓ |
| 10. ⓐⓑⓒⓓ | 11. ⓐⓑⓒⓓ | 12. ⓐⓑⓒⓓ | 13. ⓐⓑⓒⓓ | 14. ⓐⓑⓒⓓ |
| 15. ⓐⓑⓒⓓ | 16. ⓐⓑⓒⓓ | 17. ⓐⓑⓒⓓ | 18. ⓐⓑⓒⓓ | |

*Space for Rough Work*

**Q.19** Which one is not a conductor of electricity?
(a) NaCl (aqueous) (b) NaCl (solid)
(c) NaCl (molten) (d) Ag metal

**Q.20** If equivalent conductance of 1M benzoic acid is 12.8ohm$^{-1}$ cm$^2$ (g.eq)$^{-1}$ and if the conductance of benzoate ion and $H^+$ ion are 42 and 288.42 ohm$^{-1}$ cm$^2$ (g.eq)$^{-1}$ respectively. Its degree of dissociation is
(a) 39% (b) 3.9%
(c) 0.35% (d) 0.039%

**Q.21** The unit ohm$^{-1}$ is used for
(a) Molar conductivity
(b) Equivalent conductivity
(c) Specific conductivity
(d) Conductivity

**DIRECTIONS (Q.22-Q.24) : In the following questions, more than one of the answers given are correct. Select the correct answers and mark it according to the following codes:**

**Codes :**
**(a)** 1, 2 and 3 are correct **(b)** 1 and 2 are correct
**(c)** 2 and 4 are correct **(d)** 1 and 3 are correct

**Q.22** Which of the following will conduct electricity in aqueous solution ?
(1) Copper sulphate (2) Zinc nitrate
(3) Common salt (4) Sugar

**Q.23** Which of the following statements are incorrect ?
(1) Quantity of charge carried by one mole of electrons is called one faraday
(2) The equivalent conductance at infinite dilution of a weak acid such as HF can be determined by measurement on very dilute HF solutions
(3) The specific conductance of an electrolyte solution decreases with increase in dilution
(4) The equivalent conductance at infinite dilution of a weak acid such as HF is an undefined quantity

**Q.24** Which of the following statements are applicable to electrolytic conductors ?
(1) Greater will be the polarity of solvent, more will be the conductivity
(2) Ions are responsible for carrying the current
(3) Show a positive temperature coefficient for conductance
(4) On increasing temperature conduction decreases

**DIRECTIONS (Q.25-Q.27) : Read the passage given below and answer the questions that follows :**

The molar conductance of NaCl varies with the concentration as shown in the following table.

| Molar concentration of NaCl | Molar conductance in ohm$^{-1}$cm$^2$mole$^{-1}$ |
|---|---|
| $4 \times 10^{-4}$ | 107 |
| $9 \times 10^{-4}$ | 97 |
| $16 \times 10^{-4}$ | 87 |

All values follows the equations $\lambda_m^C = \lambda_m^\infty - b\sqrt{C}$

where $\lambda_m^C$ = molar specific conductance, $\lambda_m^\infty$ = molar specific conductance at infinite dilution, C = molar concentration.

When a certain conductivity cell (C) was filled with $25 \times 10^{-4}$ (M) NaCl solution. The resistance of the cell was found to be 1000 ohm. At infinite dilution, conductance of $Cl^-$ and $SO_4^{-2}$ are 80 ohm$^{-1}$cm$^2$mole$^{-1}$ and 160ohm$^{-1}$cm$^2$mole$^{-1}$ respectively.

**Q.25** What is the molar conductance of NaCl at infinite dilution?
(a) 147 ohm$^{-1}$ cm$^2$ mole$^{-1}$
(b) 107 ohm$^{-1}$ cm$^2$ mole$^{-1}$
(c) 127 ohm$^{-1}$ cm$^2$ mole$^{-1}$
(d) 157 ohm$^{-1}$ cm$^2$ mole$^{-1}$

**Q.26** What is the cell constant of the conductivity cell (C) ?
(a) 0.385 cm$^{-1}$ (b) 3.85 cm$^{-1}$
(c) 38.5 cm$^{-1}$ (d) 0.1925 cm$^{-1}$

**Q.27** If the cell (C) is filled with $5 \times 10^{-3}$ (N) $Na_2SO_4$ the observed resistance was 400 ohm. What is the molar conductance of $Na_2SO_4$?
(a) 19.25 ohm$^{-1}$ cm$^2$ mole$^{-1}$
(b) 96.25 ohm$^{-1}$ cm$^2$ mole$^{-1}$
(c) 385 ohm$^{-1}$ cm$^2$ mole$^{-1}$
(d) 192.5 ohm$^{-1}$ cm$^2$ mole$^{-1}$

| RESPONSE GRID | | | | | |
|---|---|---|---|---|---|
| | 19. ⓐⓑⓒⓓ | 20. ⓐⓑⓒⓓ | 21. ⓐⓑⓒⓓ | 22. ⓐⓑⓒⓓ | 23. ⓐⓑⓒⓓ |
| | 24. ⓐⓑⓒⓓ | 25. ⓐⓑⓒⓓ | 26. ⓐⓑⓒⓓ | 27. ⓐⓑⓒⓓ | |

*Space for Rough Work*

**DIRECTIONS (Q. 28-Q.30) : Each of these questions contains two statements: Statement-1 (Assertion) and Statement-2 (Reason). Each of these questions has four alternative choices, only one of which is the correct answer. You have to select the correct choice.**

(a) Statement-1 is True, Statement-2 is True; Statement-2 is a correct explanation for Statement-1.

(b) Statement-1 is True, Statement-2 is True; Statement-2 is NOT a correct explanation for Statement-1.

(c) Statement -1 is False, Statement-2 is True.

(d) Statement -1 is True, Statement-2 is False.

**Q.28** **Statement -1:** Electrical conductivity of copper increases with increase in temperature.

**Statement -2:** The electrical conductivity of metals is due to the motion of electrons.

**Q.29** **Statement -1:** If $\lambda^{\bullet}_{Na^+} + \lambda^{\circ}_{Cl^-}$ are molar limiting conductivity of the sodium and chloride ions respectively, then the limiting molar conducting for sodium chloride is given by the equation : $\Lambda^{\circ}_{NaCl} = \lambda^{\bullet}_{Na^+} + \lambda^{\bullet}_{Cl^-}$ .

**Statement -2:** This is according to Kohlrausch law of independent migration of ions.

**Q.30** **Statement -1:** One coulomb of electric charge deposits weight equal to the electrochemical equivalent of the substance.

**Statement -2:** One Faraday deposits one mole of the substance.

| RESPONSE GRID | 28.ⓐⓑⓒⓓ | 29.ⓐⓑⓒⓓ | 30.ⓐⓑⓒⓓ |
|---|---|---|---|

| DAILY PRACTICE PROBLEM SHEET 33 - CHEMISTRY | | | |
|---|---|---|---|
| Total Questions | 30 | Total Marks | 120 |
| Attempted | | Correct | |
| Incorrect | | Net Score | |
| Cut-off Score | 36 | Qualifying Score | 64 |
| Success Gap = Net Score – Qualifying Score | | | |
| Net Score = (Correct × 4) – (Incorrect × 1) | | | |

*Space for Rough Work*

# DAILY PRACTICE PROBLEMS

# CHEMISTRY SOLUTIONS

# 33

**1.** (b) The reduction potential of Mg is less than that of water ($E^0 = -0.83V$), hence their ions in the aqueous solution cannot be reduced, instead water will be reduced

$2H_2O + 2e^- \rightarrow H_2 + 2OH^-$

**2.** (b) Water is reduced at the cathode and oxidized at the anode instead of $Na^+$ and $SO_4^{2-}$

Cathode : $2H_2O + 2e^- \rightarrow H_2 + 2OH^-$

Anode : $H_2O \rightarrow 2H^+ + \frac{1}{2}O_2 + 2e^-$.

**3.** (a) At cathode : $2H^+ + 2e^- \rightarrow H_2$,

At anode : $2OH^- \rightarrow H_2O + \frac{1}{2}O_2 + 2e^-$

**4.** (a) $W = ZIt, Q = It$.

**5.** (b) Since discharge potential of water is greater than that of sodium so water is reduced at cathode instead of $Na^+$.

Cathode : $H_2O + e^- \rightarrow \frac{1}{2}H_2 + OH^-$

Anode : $Cl^- \rightarrow \frac{1}{2}Cl_2 + e^-$.

**6.** (b) The degree of ionization depend upon the nature of the solute, the size of the solute molecules and the concentration of the solution.

**7.** (a) The substances whose aqueous solutions allow the passage of electric current and are chemically decomposed, are termed electrolytes. Electrolytic substances are classified as strong or weak according to how readily they dissociate into conducting ions. Acetic acid is a weak electrolyte. Glucose, ethanol and urea are non-electrolytes.

**8.** (a) $W_{Ag} = \frac{E_{Ag} \times Q}{96500} = \frac{108 \times 9.65}{96500} = 1.08 \times 10^{-2}$ gm $= 10.8$ mg

**9.** (c) Cu voltameter or Cu or Ag coulometer are used to detect the amount deposited on an electrode during passage of know $n$ charge through solution.

**10.** (a) Wt. of Ag deposited = Eq. wt. of Ag = 108 gm

Wt. of Ni deposited = Eq. wt. of Ni = 29.5 gm

Wt. of Cr deposited = Eq. wt. of Cr = 17.3 gm

**11.** (d) During electrolysis of $CuSO_4$. $Cu^{2+}$ gets discharged at cathode and $OH^-$ at anode. Thus solution becomes acidic due to excess of $H^+$ and $SO_4^{2-}$ or $H_2SO_4$.

**12.** (a) The amount deposited is directly proportional to current intensity, electrochemical equivalent of ions and the time for electrolysis and is independent of the temperature.

**13.** (a) One mole of monovalent metal ion means charge of N electron i.e. 96500 C or 1 Faraday.

**14.** (b) 31.75 g copper gets deposited at cathode on passing 96500 coulomb charge. We know that 31.75 gm of Cu is equal to 0.5 mole of Cu deposited at cathode on passing 1F of current.

**15.** (b) $\lambda^\infty BaCl_2 = \frac{1}{2}\lambda^\infty Ba^{2+} + \lambda^\infty Cl^- = \frac{127}{2} + 76$

$= 139.5$ ohm$^{-1}$ cm$^2$(g.eq)$^{-1}$

**16.** (b) $C = \frac{K[A]A}{l}, K = \frac{C \times l}{[A]A} = \frac{Sm}{molm^{-3}\, m^2} = Sm^2\, mol^{-1}$

**17.** (b) Strong electrolytes ionize completely at all dilutions and the number of ions does not increase on dilution. A small increase in $\Lambda_m$ value with dilution is due to the weakening of electrostatic attraction between the ions on dilution.

**18.** (a) $l/a = 0.5$ cm$^{-1}$, $R = 50$ ohm

$$\rho = \frac{Ra}{l} = \frac{50}{0.5} = 100$$

$$\Lambda_m = k \times \frac{1000}{N} = \frac{1}{\rho} \times \frac{1000}{N} = \frac{1}{100} \times \frac{1000}{1}$$

$= 10$ ohm$^{-1}$ cm$^2$ (gm eq)$^{-1}$

**19.** (b) In solid state NaCl does not dissociate into ions so it does not conduct electricity.

**20.** (b) $\Lambda^\infty_{m(C_6H_5COOH)} = \Lambda^\infty_{(C_6H_5COO^-)} + \Lambda^\infty_{(H^+)}$

$= 42 + 288.42 = 330.42$

$$\alpha = \frac{\Lambda_m}{\Lambda_m^\infty} = \frac{12.8}{330.42} = 3.9\%$$

**21.** (d) Conductance $= \frac{1}{\text{resistance}} = \frac{1}{\text{ohm}} = \text{ohm}^{-1}$ or mho

**22.** (a) Copper sulphate, zinc nitrate and common salt forms ions in the aqueous solution. Therefore, they conduct electricity but sugar solution does not form ion; hence does not conduct electricity in solution.

**23.** (c) The number of current carrying particles or ions per ml decrease on dilution and specific conductivity, being the conductance of one centimetre cube of solution, decreases with dilution. Hence statements (1) and (3) are correct.

**24.** (d) In electrolytic conductors, a single stream of electrons flow from cathode to anode.

**For Qs. 25-27**

(i) $\Lambda_m^C = \lambda_m^\infty - b\sqrt{C}$

When $C_1 = 4 \times 10^{-4}$; $\Lambda_m^C = 107$

and when $C_2 = 9 \times 10^{-4}$; $\Lambda_m^C = 97$

So, $107 = \lambda_m^\infty - b \times 2 \times 10^{-2}$ .....(1)

$97 = \lambda_m^\infty - b \times 3 \times 10^{-2}$ .....(2)

$b = 1000$

$\lambda_m^C = \lambda_m^\infty - b\sqrt{C}$

$\lambda_m^\infty = \lambda_m^C + b\sqrt{C} = 107 + 10^3 \times 2 \times 10^{-2}$

$\lambda_m^\infty = 127 \text{ ohm}^{-1}\text{cm}^2\text{mole}^{-1}$

(ii) For $25 \times 10^{-4}$ (M) NaCl

$\lambda_m = \lambda_m^\infty - b\sqrt{C}$

$\lambda_m = 127 - 10^3 (25 \times 10^{-4})^{1/2}$

$\lambda_m = 127 - 10^3 \times 5 \times 10^{-2}$

$\lambda_m = 77$

But $\lambda_m = \frac{K \times 1000}{M}$ ; $K = \left(\frac{\ell}{a}\right)\frac{1}{R}$

$\lambda_m = \left(\frac{\ell}{a}\right)\frac{1}{R} \times \frac{1000}{M}$

$\Lambda_m = (\text{cell constant}) \times \frac{1000}{R \times M}$

$\Rightarrow 77 = (\text{cell constant}) \times \frac{1000}{1000 \times 25 \times 10^{-4}}$

Cell constant $= 77 \times 25 \times 10^{-4} = 0.1925 \text{cm}^{-1}$

(iii) For $Na_2SO_4$

$K = \left(\frac{\ell}{a}\right)\frac{1}{R} = \frac{0.9125}{400} = 4.81 \times 10^{-4} \text{ohm}^{-1}\text{cm}^{-1}$

$\lambda_m = \frac{K \times 1000}{M} = \frac{4.81 \times 10^{-4} \times 1000}{\frac{5}{2} \times 10^{-3}}$

$\lambda_m(Na_2SO_4) = 192.5 \text{ ohm}^{-1}\text{cm}^2\text{mole}^{-1}$

**25. (c) 26. (d) 27. (d)**

**28. (c)** Electrical conductivity of copper decreases with increase in temperature because the metallic conductivity is due to the motion of electrons. On increasing temperature the motion of electron increases which hinder in conductance of current. Hence, here statement -1 is false but the statement -2 is true.

**29. (a)** According to Kohlrausch law, "Limiting molar conductivity of an electrolyte can be represented as the sum of the individual contributions of the anion and cation of the electrolyte".

**30. (d)** One Faraday deposits one gram equivalent of the substance.