# YAKEEN NEET 2.0

## 2026

## Electrochemistry

**Physical Chemistry** | **Lecture -11**

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# Topics to be covered

1. Kohlrausch law
2. Degree of dissociation ( $\alpha$ )
3. Home work from modules

## Rule to Attend Class

1. Always sit in a peaceful environment with headphone and be ready with your copy and pen.
2. Never ever attend a class from in between or don't join a live class in the middle of the chapter.
3. Make sure to revise the last class before attending the next class & always complete your home work along with DPP.
4. Never ever engage in chat whether live or recorded on the topic which is not being discussed in current class as by doing so u can be blocked by the admin team or your subscription can be cancelled.

## Rule to Attend Class

5. Try to make maximum notes during the class if something is left then u can use the notes pdf after the class to complete the remaining class.
6. Always ask your doubts in doubt section to get answer from faculty. Before asking any doubt please check whether same doubt has been asked by someone or not.
7. Don't watch the videos in high speed if you want to understand better.


There is one big flaw in your Preparation that's
name is Backlog ? What do we say to Backlog ?
NOT TODAY !!!

# Variation of Conductivity ($k$) with Dilution

Total ions Vol.
600 ions 200ml
1800 1800

# MIT

$k \propto \frac{n}{V\uparrow}$

- **Strong Electrolytes:-** $\alpha = 1$

$V\uparrow$ $C\downarrow$ $K\downarrow$ as no. of ions in 1ml dec.

Weak electrolytes $\rightarrow \alpha < 1$

$V\uparrow$ $C\downarrow$ $\alpha\uparrow$ $\therefore$ Total ions $\uparrow$ but ions in 1ml dec.

$K \rightarrow$ Current ions in 1 ml

$K \leftarrow$ 3 ✓ 1 ml

$\downarrow K \leftarrow$ 1 ✓ 1 ml

# Kohlrausch's Law


$xA^{y+}$ | $yB^{x-}$

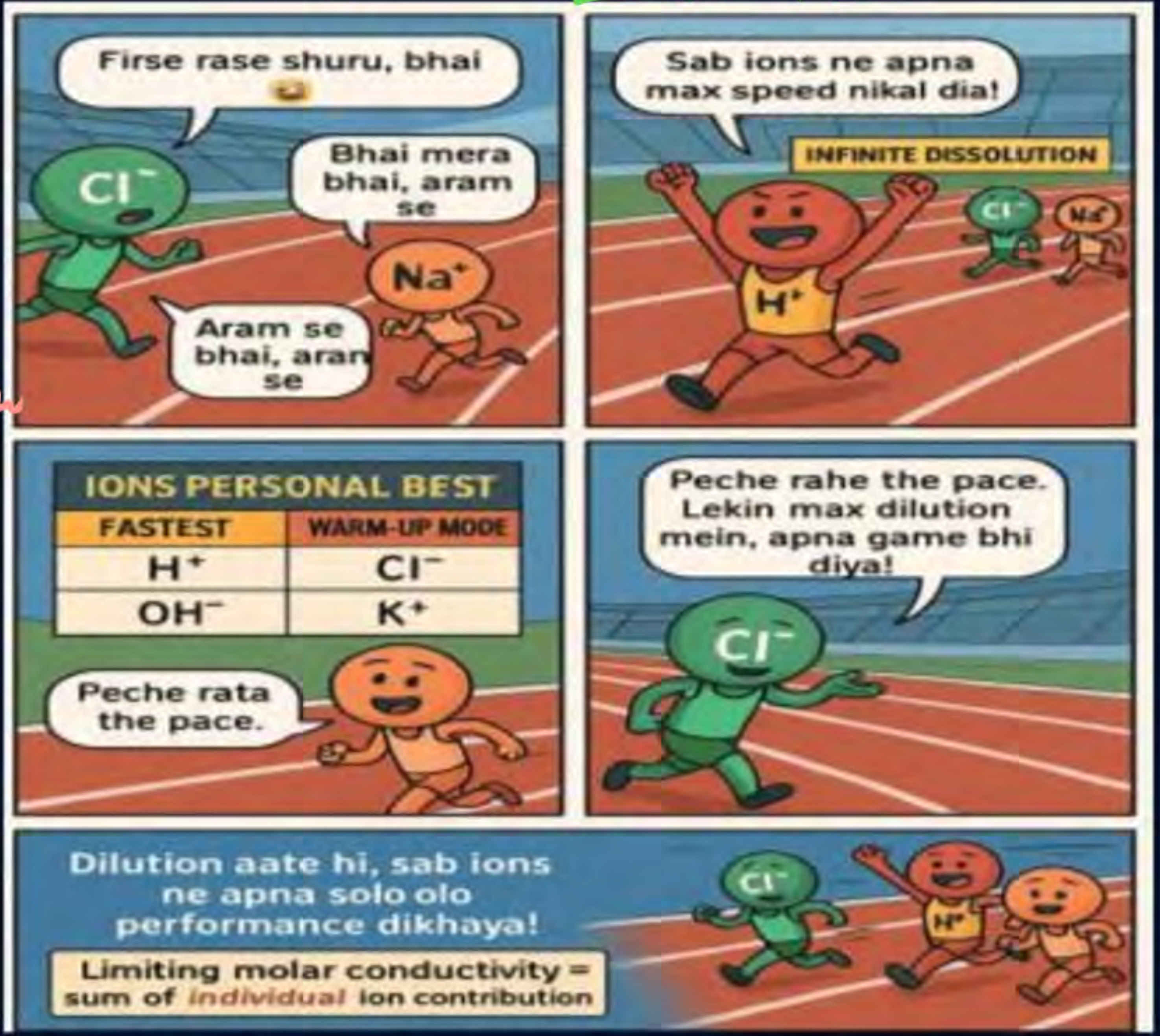
$+xy$ | $-yx = 0$

$\Lambda_m^\infty$ is equal to sum of limiting ionic conductivity of cation & anion each multiplied by no. of ions in 1 formula unit.

#IMP

$$A_xB_y + H_2O \longrightarrow xA^{y+} + yB^{x-}$$

$$\Lambda^\infty_{m\,A_xB_y} = x\,\lambda^\infty_{A^{y+}} + y\,\lambda^\infty_{B^{x-}}$$



$$\overset{\infty}{\Lambda}_{NaCl} = 1\,\overset{\infty}{\lambda}_{Na^+} + 1\,\overset{\infty}{\lambda}_{Cl^-}$$

$x = 1$
$y = 1$

$$\overset{\infty}{\Lambda}_{M\,BaCl_2} = 1\,\overset{\infty}{\lambda}_{Ba^{2+}} + 2\,\overset{\infty}{\lambda}_{Cl^-}$$

$x = 1$
$y = 2$

$$\overset{\infty}{\Lambda}_{M\,CH_3COONa} = 1\,\overset{\infty}{\lambda}_{CH_3COO^-} + 1\,\overset{\infty}{\lambda}_{Na^+}$$

$x = 1$
$y = 1$

$$\overset{\infty}{\Lambda}_{M\,CH_3COOH} = \overset{\infty}{\lambda}_{CH_3COO^-} + \overset{\infty}{\lambda}_{H^+}$$

$$= \overset{\infty}{\Lambda}_{M\,CH_3COONa} + \overset{\infty}{\Lambda}_{M\,HCl} - \overset{\infty}{\Lambda}_{M\,NaCl}$$

$$= \overset{\infty}{\lambda}_{CH_3COO^-} + \cancel{\overset{\infty}{\lambda}_{Na^+}} + \overset{\infty}{\lambda}_{H^+} + \cancel{\overset{\infty}{\lambda}_{Cl^-}} - \cancel{\overset{\infty}{\lambda}_{Na^+}} - \cancel{\overset{\infty}{\lambda}_{Cl^-}}$$

$$\overset{\infty}{\Lambda}_{Ba(OH)_2} = \overset{\infty}{\lambda}_{Ba^{2+}} + 2\,\overset{\infty}{\lambda}_{OH^-}$$

$$= \overset{\infty}{\Lambda}_{BaSO_4} + 2\,\overset{\infty}{\Lambda}_{NaOH} - \overset{\infty}{\Lambda}_{Na_2SO_4}$$

$$= \overset{\infty}{\lambda}_{Ba^{2+}} + \cancel{\overset{\infty}{\lambda}_{SO_4^{2-}}} + \cancel{2\,\overset{\infty}{\lambda}_{Na^+}} + 2\,\overset{\infty}{\lambda}_{OH^-} - \cancel{2\,\overset{\infty}{\lambda}_{Na^+}} - \cancel{\overset{\infty}{\lambda}_{SO_4^{2-}}}$$

$$1\,NaCl + H_2O \rightarrow 1\,Na^+_{(aq)} + 1\,Cl^-(aq.)$$

1 mole — 1 mole — 1 mole — (a)

1 geq. — 1 geq — 1 geq. — (b)

$$1\,BaCl_2 + H_2O \rightarrow 1\,Ba^{2+}(aq.) + 2\,Cl^-(aq.)$$

1 mole — 1 mole — 2 mole — (c)

1 g-eq. — 1 g-eq — 1 g-eq — (d)

#MIT

$$\overset{\infty}{\Lambda}_N A_x B_y = \overset{\infty}{\lambda}_N A^{y+} + \overset{\infty}{\lambda}_N B^{x-}$$

$$\overset{\infty}{\Lambda}_M A_x B_y = x \overset{\infty}{\lambda}_M A^{y+} + y \overset{\infty}{\lambda}_M B^{x-}$$

QUESTION (AIPMT (Pre.) 2012)

Limiting molar conductivity of $NH_4OH$ (i.e., $\overset{0}{\Lambda}_{m(NH_4OH)}$) is equal to

$\overset{\infty}{\Lambda}_M = \overset{0}{\Lambda}_M$

(A) $\overset{0}{\Lambda}_{m(NH_4Cl)} + \overset{0}{\Lambda}_{m(NaCl)} - \overset{0}{\Lambda}_{m(NaOH)}$

(B) $\overset{0}{\Lambda}_{m(NaOH)} + \overset{0}{\Lambda}_{m(NaCl)} - \overset{0}{\Lambda}_{m(NH_4Cl)}$

(C) $\overset{0}{\Lambda}_{m(NH_4OH)} + \overset{0}{\Lambda}_{m(NH_4Cl)} - \overset{0}{\Lambda}_{m(HCl)}$

(D) $\overset{0}{\Lambda}_{m(NH_4Cl)} + \overset{0}{\Lambda}_{m(NaOH)} - \overset{0}{\Lambda}_{m(NaCl)} = \overset{\infty}{\lambda}_{NH_4^+} + \cancel{\overset{\infty}{\lambda}_{Cl^-}} + \cancel{\overset{\infty}{\lambda}_{Na^+}} + \overset{\infty}{\lambda}_{OH^-} - \cancel{\overset{\infty}{\lambda}_{Na^+}} - \cancel{\overset{\infty}{\lambda}_{Cl^-}}$

## QUESTION (AIPMT (Mains) 2012)

**The molar conductance's of NaCl, HCl and $CH_3COONa$ at infinite dilution are 126.45, 426. 16 and 91ohm$^{-1}$ cm$^2$ mol$^{-1}$ respectively. The molar conductance of $CH_3COOH$ at infinite dilution is**

(A) 201.28 ohm$^{-1}$ cm$^2$ mol$^{-1}$

(B) 390.71 ohm$^{-1}$ cm$^2$ mol$^{-1}$

(C) 698.28 ohm$^{-1}$ cm$^2$ mol$^{-1}$

(D) 540.48 ohm$^{-1}$ cm$^2$ mol$^{-1}$

$$\Lambda^{\infty}_{CH_3COOH} = \Lambda^{\infty}_{CH_3COO^-Na^+} + \Lambda^{\infty}_{HCl} - \Lambda^{\infty}_{NaCl}$$

$$= 91 + 426.16 - 126.45$$

$$= 390.71\ S\,cm^2/mol$$

## QUESTION (AIPMT (Main) 2010)

Which of the following expressions correctly represents the equivalent conductance at infinite dilution of $Al_2(SO_4)_3$. Given that $\lambda^o_{Al^{3+}}$ and $\lambda^o_{SO_4^{2-}}$ are the equivalent conductances at infinite dilution of the respective ions?

$$\lambda^{\infty}_{N}\, Al_2(SO_4)_3 = \lambda^{\infty}_{N}\, Al^{3+} + \lambda^{\infty}_{N}\, SO_4^{2-}$$

(A) $2\lambda^o_{Al^{3+}} + 3\lambda^o_{SO_4^{2-}}$

(B) $\lambda^o_{Al^{3+}} + \lambda^o_{SO_4^{2-}}$

(C) $(\lambda^o_{Al^{3+}} + \lambda^o_{SO_4^{2-}}) \times 6$

(D) $\frac{1}{3}\lambda^o_{Al^{3+}} + \frac{1}{2}\lambda^o_{SO_4^{2-}}$

QUESTION (WB (JEE) 2013)

$n=2$

$148.2$
$123.6$
$271.8$

$Na^+ \quad K^+ \quad = (COO^-)_2^{2-} \quad C_2O_4$

Equivalent conductivity at infinite dilution for sodium-potassium oxalate $((COO^-)_2Na^+K^+)$ will be [given, molar conductivities of oxalate, $K^+$ and $Na^+$ ions at infinite dilution are 148.2, 50.1, 73.5 S cm$^2$ mol$^{-1}$, respectively]

(A) $271.8\ S\ cm^2\ eq^{-1}$

$$\Lambda^\infty_N (COO^-)_2 Na^+ K^+ = \frac{\Lambda^\infty_M (COO^-)_2 Na^+ K^+}{n} = \frac{271.8}{2} = 135.9\ S\ cm^2/mol$$

(B) $67.95\ S\ cm^2\ eq^{-1}$

(C) $543.6\ S\ cm^2\ eq^{-1}$

$$\Lambda^\infty_M (COO^-)_2 Na^+ K^+ = 148.2 + 50.1 + 73.5$$

$$C_2O_4^{2-} = (COO^-)_2$$

(D) $135.9\ S\ cm^2\ eq^{-1}$

## QUESTION (WB (JEE) 2013)

**The correct order of equivalent conductances at infinite dilution in water at room temperature for $H^+$, $K^+$, $CH_3COO^-$ and $HO^-$ ions is**

$H^+ > OH^-$

(A) $HO^- > H^+ > K^+ > CH_3COO^-$

(B) $H^+ > HO^- > K^+ > CH_3COO^-$

(C) $H^+ > K^+ > HO^- > CH_3COO^-$

(D) $H^+ > K^+ > CH_3COO^- > HO^-$

QUESTION

The ionic conductivity of $Ba^{2+}$ and $Cl^-$ at infinite dilution are 127 and 76 $ohm^{-1}\ cm^2\ eq^{-1}$ respectively. The equivalent conductivity of $BaCl_2$ at infinity dilution (in $ohm^{-1}\ cm^2\ eq^{-1}$) would be:

(A) 203

$\Lambda^{\infty}_{N\ BaCl_2} = 127 + 76 = 203\ S\ cm^2\ eq^{-1}$

(B) 279

(C) 101.5

(D) 139.5

## QUESTION (Kerala PMT 2012)

**The electrical properties and their respective SI units are given below. Identify the wrongly matched pair**

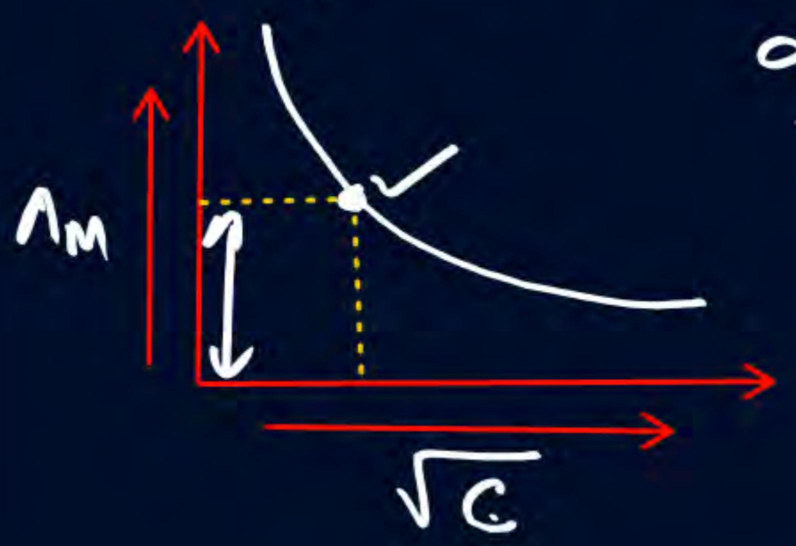
| Electrical Property | SI Unit |
|---|---|
| (A) Specific conductance | $Sm^{-1}$ |
| (B) Conductance | S |
| (C) Equivalent Conductance | $Sm^2$ (gm equiv)$^{-1}$ |
| (D) Molar Conductance | $Sm^2\ mol^{-1}$ |
| (E) Cell Constant | m |

$\frac{l}{a} = \frac{m}{m^2} = m^{-1}$

# Degree of Dissociation (α)

# MIT

$\%age\ \alpha = \alpha \times 100$




$$\alpha = \frac{\Lambda_M^c}{\Lambda_M^\infty}$$

$\Lambda_M^c \leftarrow 20$ ions

$\Lambda_M^\infty \leftarrow 1000$ ions

QUESTION (NEET 2013)

At 25°C molar conductance of 0.1 molar aqueous solution of ammonium hydroxide is 9.54 $ohm^{-1}\ cm^{2}\ mol^{-1}$ and at infinite dilution its molar conductance is 238 $ohm\ cm^{2}\ mol^{-1}$. The degree of ionization of ammonium hydroxide at the same concentration and temperature is:

(A) 40.800%

(B) 2.080%

(C) 20.800%

(D) 4.008% ✓

$C = 0.1M$

$\Lambda_M^c = 9.54\ S\,cm^2/mol$

$\Lambda_M^\infty = 238\ S\,cm^2/mol$

$\alpha = \frac{9.54}{238} \approx \frac{10}{240} \approx 0.04$

$\%age\ \alpha = 0.04 \times 100 \approx 4\%$

# Relation Between Ionisation Constant ( $K_a$ or $K_b$ ) & α

Weak acid.

$\downarrow$

$$K_a = \frac{c\alpha^2}{1-\alpha}$$

Weak base.

$\downarrow$

$$K_b = \frac{c\alpha^2}{1-\alpha}$$

# MIT

$$\boxed{\begin{gathered} K_a \text{ or } K_b = \frac{C \Lambda_M^{c\,2}}{\Lambda_M^{\infty}(\Lambda_M^{\infty} - \Lambda_M^{c})} \\ \text{if } 1-\alpha \approx 1 \; (\alpha \le 0.05) \\ K_a \text{ or } K_b = \frac{C \Lambda_M^{c\,2}}{\Lambda_M^{\infty\,2}} \end{gathered}}$$

Q. for 0.1 M sol$^n$ if $\Lambda^c_M$ $CH_3COOH$ is 20 $S\,cm^2/mol$.
& $\Lambda^\infty_M$ $CH_3COOH$ = 400 $S\,cm^2/mol$. find $K_a$ if $\alpha <<<< 1$

$C = 0.1M$

$$\alpha = \frac{2\cancel{0}}{40\cancel{0}} = \frac{1}{20} = 0.05 = 5 \times 10^{-2}$$

Ans
$$K_a = C\alpha^2$$
$$= 10^{-1}(5 \times 10^{-2})^2$$
$$K_a = 25 \times 10^{-5}$$

# Home work from modules

Prarambh → Q 43, 44, 45, 46, 49, 52, 53, 58

Ans → $\cancel{8}$ → 7

$2 + 3 + 2 = 7$

# THANK YOU