YAKEEN 2.0 NEET 2024

- Subject – Physical Chemistry
- Chapter – Ionic Equilibrium

Lecture No.- 1

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Topics to be Covered

- Topic: Revision of Last Class
- Topic: Concepts of Acids & Bases
- Topic: Ostwald Dilution Law
- Topic: Test no 26

Rules 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.

Rules 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 !!!

Revision Of Last Class

$A(g) \rightleftharpoons B(g) + C(g)$

Le-Chatelier's Principle

① effect of Conc.

if Conc. of reactant inc ⇒ eq. shift forward sn

——— dec. ⇒ ——— backward sn

——— Product inc. ⇒ ———))))

——— dec. ⇒ ——— forward sn.

② effect of Temp.

exothermic sn ΔH = (−)ve

$A(g) \underset{\text{Heat absorb}}{\overset{\text{Heat release}}{\rightleftharpoons}} B(g) + C(g)$

T inc. ⇒ eq. shift backward sn

T dec. ⇒ forward sn

if we T ↑ / T ↓

endothermic sn ΔH = (+)ve

& vice-versa.

effect of P or Vol.

P↑ or V↓ ⇒ eq. shift towards less no. of gaseous moles

P↓ or V↑ ⇒ ~~~~~~~~~~ greater ~~~~~~~~~~

effect of Catalyst

effect of addition of Inert gas

(a) at Constt. Volume no effect

(b) at Constt. Pressure. ⇒ V↑ ∴ eq. shift towards greater no. of gaseous moles

Various Concept of Acids & Bases

Arhenius Concept of Acids & Bases

#IIT

Arhenius acid :- substance which gives H^+ ion (Proton) or H_3O^+ ion (Hydronium ion)

in water

for ex :- HCl, HNO_3, H_2SO_4 etc.

$HCl + H_2O \longrightarrow H^+$ or $H_3O^+ + Cl^-$

H_2O ↓

Dielectric Constt. High $\simeq 80$

$HNO_3 + H_2O \longrightarrow H^+$ or $H_3O^+ + NO_3^-$

Arhenius base :- substance which gives OH^- ion (Hydroxide ion) in water

for ex :- $NaOH$, KOH, $Ca(OH)_2$

$NaOH + H_2O \longrightarrow Na^+ + OH^-$

#MFT

Limitations of Arrhenius Concept:

↓

it Cannot explain Concept of Acid & base when solvent is not water.

Bronsted Acid

Bronsted acid :-

Substance which is capable of giving H^+ ion.

for ex:- HCl, HSO_4^-, H_2CO_3, HCO_3^-, H_2SO_4,

Bronsted Base :- substance which can accept H^+ ion

for ex:- Cl^-, NO_3^-, HSO_4^-,

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① **Bronsted Concept** :-

Conjugate acid (C.A.) $\underset{+H^+}{\overset{-H^+}{\rightleftharpoons}}$ Conjugate Base (C.B.)

$HCl \underset{+H^+}{\overset{-H^+}{\rightleftharpoons}} Cl^-$

(C.A.) (C.B.)

② **Amphiprotic species** :- species which can donate as well as accept H^+ ion :- (it can act as both acid as well as base)

$H_2SO_4 \underset{(C.B.)}{\overset{+H^+}{\rightleftharpoons}} \underset{(C.A.)}{HSO_4^-} \overset{-H^+}{\rightleftharpoons} \underset{(C.B.)}{SO_4^{2-}}$ ✓

(C.A.)

Bronsted Base

Limitations of Bronsted Concept

↓

this Concept is applicable only when species is capable of accept or donate H^+ ion.

Questions

#Q. Conjugate base of Bronsted acids H_2O and HF are:

A H_3O^+ and H_2F^+, respectively

B OH^- and H_2F^+, respectively

C H_3O^+ and F^-, respectively

D OH^- and F^-, respectively

Questions

#Q. Which one of the following species cannot act as both Bronsted acid and base?

A H_2O

B $HCO_3^{\ominus}$

C $HSO_4^{\ominus}$

D $NH_2^{\ominus}$

Lewis Acid

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Lewis acid ÷ substance which can accept lone pair of electron

Types of lewis acid :-

→ Incomplete octet

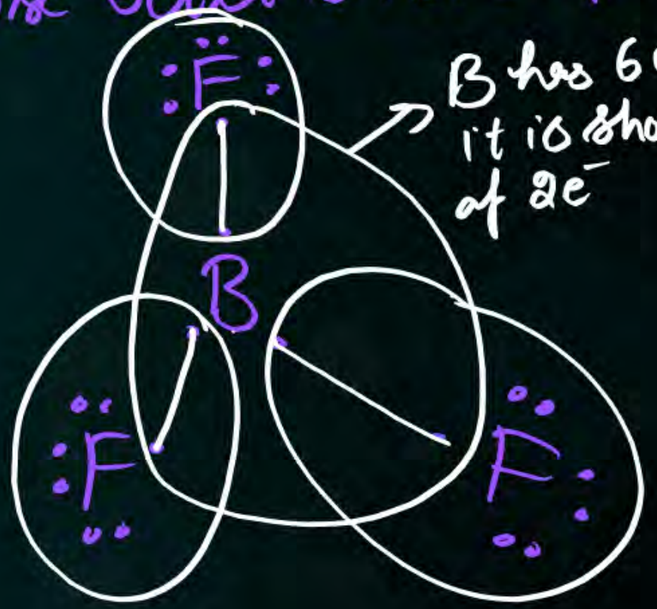
↓

molecule whose octet is not Complete

$BF_3 + F^-$

↓

BF_4^-



→ M C D of delhi

↓ Multiple bond with high E.N. species

↓ d-orbital vacant PCl_5 etc

Cations whose octet is not Complete.

for ex ÷ Cl^+, Br^+, R^+, NO_2^+, H^+ etc

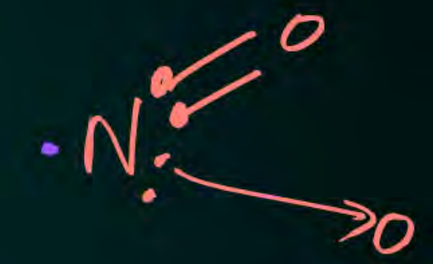
short of 2 $\bar{e}$ it can accept l.p. of $\bar{e}$

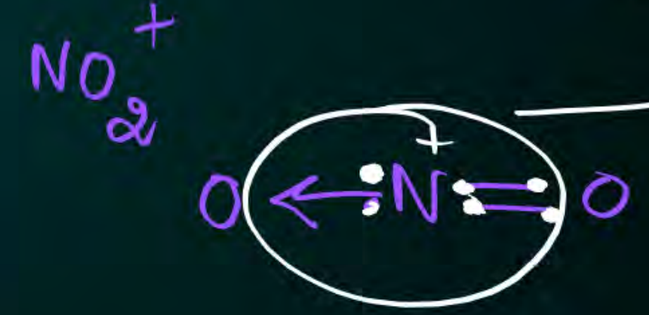
R = alkyl

Alkane − H = Alkyl (R)

$CH_4 - H = -CH_3$ Methyl

$C_2H_6 - H = -C_2H_5$ Ethyl



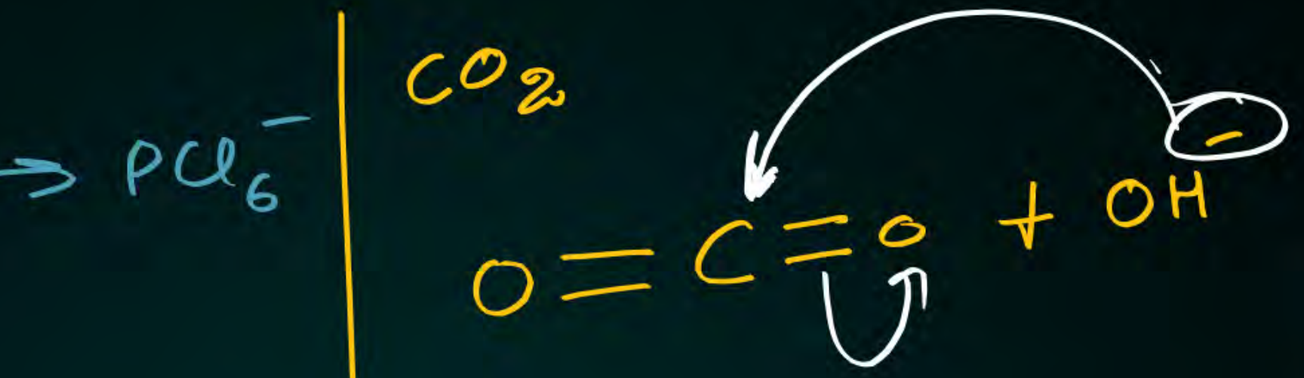


$PCl_5 + Cl^- \longrightarrow PCl_6^-$

PCl_5 → Vacant d-orbital

SiF_4 → Lewis acid

CO_2



$O=C=O + OH^-$

↓

$O=C(OH)-O^-$ (HCO_3^-)

Can NH_4^+ act as lewis acid?

↓ Cannot act as Lewis acid.

Lewis Base

Substance which can donate lone pair of e^-

Types
- Neutral molecule → $:NH_3$, H_2O, etc
- Negatively charged ion → for ex :- Cl^-, Br^-, I^-, NO_2^- etc

Questions

#Q. Which of the following is least likely to behave as Lewis Base?

A $H_2\ddot{O}$

B $:NH_3$

C BF_3

D $OH^{\ominus}$

Electrolyte

Substance which dissociate in water to give ions

$$HCl + H_2O \longrightarrow H^+ + Cl^-$$

$$CH_3COOH + H_2O \rightleftharpoons CH_3COO^- + H^+$$

Strong Electrolyte

Substance which dissociate completely into ions in water.

For Ex.:- $NaCl$, Na_2SO_4 **etc.**

strong electrolyte $\rightarrow \alpha = 1$

Weak Electrolyte

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Substance which do not dissociate completely in water into ions.

Formic acid acetic acid

For Ex.:- $HCOOH$, CH_3COOH, HCN etc.

Weak electrolyte → $\alpha < 1$

NH_4OH (Ammonium hydroxide)

↓

Weak base.

Ostwald Dilution Law

applicable for weak electrolytes $\rightarrow \alpha < 1$

α = degree of dissociation (d.o.d.) = $\frac{\text{no. of moles dissociated}(x)}{\text{no. of moles taken}(C)}$

$x = C\alpha$

$$CH_3COOH_{(aq)} + H_2O_{(l)} \rightleftharpoons CH_3COO^-_{(aq)} + H^+ \text{ or } H_3O^+_{(aq)}$$

	CH_3COOH	H_2O	CH_3COO^-	H^+ or H_3O^+
$t=0$	C		0	0
$t=t$ at eq.	$C-x$		x	x
	$C-C\alpha$		$C\alpha$	$C\alpha$

$$K_C = \frac{[CH_3COO^-][H^+]}{[CH_3COOH][H_2O]}$$

$$K_C[H_2O] = K_a = \frac{[CH_3COO^-][H^+]}{[CH_3COOH]}$$

K_a → Ionisation Constt. of acid
or
Dissociation Constt. of acid

$$K_a = \frac{C\alpha \times C\alpha}{C - C\alpha}$$

$$K_a = \frac{C^{\cancel{2}}\alpha^2}{\cancel{C}(1-\alpha)}$$

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

$$NH_4OH + H_2O \rightleftharpoons NH_4^+ + OH^-$$

C	0	0
$C-x$	x	x
$C-C\alpha$	$C\alpha$	$C\alpha$

$$K_C = \frac{[NH_4^+][OH^-]}{[NH_4OH][H_2O]}$$

$$K_C[H_2O] = K_b = \frac{[NH_4^+][OH^-]}{[NH_4OH]}$$

K_b → Dissociation Constt of base
or
Ionisation Constt of base

$$K_b = \frac{c\alpha \times c\alpha}{c(1-\alpha)}$$

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

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① Ostwald's dilution law

② applicable for weak electrolytes ($\alpha < 1$)
weak acid or weak bases

③ $K_a = \frac{c\alpha^2}{1-\alpha}$] $\rightarrow \alpha > 0.05$
$\leftarrow \frac{K_a}{c} > 25\times10^{-4}$

if $\alpha << 1$
$1-\alpha \approx 1$

$K_a = c\alpha^2$] $\rightarrow \alpha \leq 0.05$
$\frac{K_a}{c} = \alpha^2$ $\leftarrow \frac{K_a}{c} \leq 25\times10^{-4}$

$K_b = \frac{c\alpha^2}{1-\alpha}$] $\rightarrow \alpha > 0.05$
$\leftarrow \frac{K_b}{c} > 25\times10^{-4}$

if $\alpha << 1$
$1-\alpha \approx 1$

$K_b = c\alpha^2$] $\rightarrow \alpha \leq 0.05$
$\frac{K_b}{c} = \alpha^2$ $\leftarrow \frac{K_b}{c} \leq 25\times10^{-4}$

④ % age dissociation $= \alpha \times 100$ ⑤ $\alpha = \sqrt{\frac{K_a}{c}}$ or $\alpha = \sqrt{\frac{K_b}{c}}$

Questions

#Q. Find α for 0.1 M CH_3COOH if $K_a = 18 \times 10^{-9}$.

Ans C = Conc. of weak elec. $= 0.1\,M = 10^{-1}\,M$

$\frac{Ka}{C} = \frac{18 \times 10^{-9}}{10^{-1}} = 18 \times 10^{-8} < 25 \times 10^{-4}$

$\alpha = \sqrt{\frac{Ka}{C}}$

$\alpha = \sqrt{\frac{18 \times 10^{-9}}{10^{-1}}} = \sqrt{18 \times 10^{-8}} = 3\sqrt{2} \times 10^{-4}$

Questions

donate 1 H^+ ion.

#Q. The K_a of a weak monobasic acid is 1×10^{-5}. The percentage of ionization in a decimolar acid solution is:

$C = \frac{1}{10} M = 10^{-1} M$

A 0.1%

B 10%

C 0.5%

D 1%

% age dissociation $= \alpha \times 100 = 10^{-2} \times 100 = 1\%$

$\alpha = \sqrt{\frac{Ka}{C}}$

$\frac{Ka}{C} = \frac{1 \times 10^{-5}}{10^{-1}} = 10^{-4} < .95 \times 10^{-4}$

$\alpha = \sqrt{10^{-4}} = 10^{-2}$

Test no ÷ 26

↓

lec-1 to lec-3 → elec. Revise.

Recorded summary lec → S.O.M.

Home Work from Modules

Exercise-1 → Q 92, Q 95, Q 96, Q 97, Q 98, Q 99, Q 100

Thank You