lec 9 summary :

We said that $KW = [OH^-] \cdot [H_3O^+] = 10^{-14}$
"Water constant dissociation"

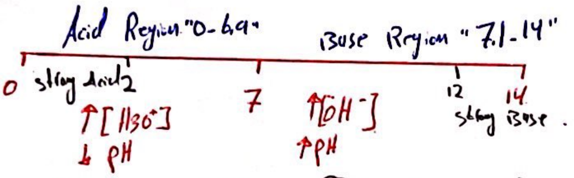
→ For strong Acid → $[Acid] = [H_3O^+]$
↳ then $pH = -\log[H_3O^+] < 7$

→ For Weak Acid → $[Acid] \neq [H_3O^+]$
↳ We use $Ka = \frac{[H_3O^+]^2}{[Acid]}$
↳ then $pH = -\log[H_3O^+] < 7$

For Base → strong → $[Base] = [OH^-]$
↳ then $KW = [H_3O^+][OH^-]$
↳ then $pH = -\log[H_3O^+] > 7$

↳ Weak → $[Base] \neq [OH^-]$
↳ We use $Kb = \frac{[OH^-]^2}{[Base]}$
↳ then $KW = \frac{10^{-14}}{[OH^-]} = [H_3O^+]$
↳ then $pH = -\log[H_3O^+]$

① pH :



Notes :

① pH Urine → Female → more Acidic "5" ; male → more Basic "8"

② pH Saliva → differ b/w people ≈ 6.6 ; healthy ≈ 6.6 ; Not healthy pH < 6.6 → Treatment

③ the blood plazma = 7.4 "Weak base" ✓
④ the pancreatic fluid = "7.8 - 8" Weak base. ✓

⇒ pH it is "Log" Scale. for ex : less 3 units → "1000 times"
(that's due to → $pH = -\log[H_3O^+]$.)
more than 3 units "$\frac{1}{1000}$ times"

How to calculate "determine" pH : ① by indicator → ① litmus paper "Not accurate" (Not exact value)
Base → Blue
Acid → Pink "Red"
② universal one.

② pH meter "↑ Accurate" → exact value.

the solutions of excersis in slides : $pH = -\log[H_3O^+]$

① 0.01 M HCl → $[HCl] = [H_3O^+]$ → strong Acid
$pH = -\log[0.01] = 2$ ✓

② 0.01 N H_2SO_4 → $N = M * n$ ⇒ $M = 0.005$ → $[H_2SO_4] = [H_3O^+]$ → strong Acid.
$pH = -\log(0.005) = 2.3$ ✓

③ 0.01 N NaOH → $M = 0.01 = [OH^-]$ → strong Base.
↳ $K.W = 10^{-14} = 0.01 * [H_3O^+] = 10^{-12}$
$pH = -\log(10^{-12}) = 12$ ✓

④ 10^{-11} HCl → Wrong → that's due to [HCl] must be > 10^{-7} ✓

⑤ 0.1 CH_3COOH → Weak Acid
$1.8 * 10^{-5} = Ka = \frac{[H_3O^+]^2}{[CH_3COOH] = 0.1}$ ⇒ $[H_3O^+] = 1.34 * 10^{-3}$ ⇒ $pH = -\log(1.34 * 10^{-3})$
$= 2.872$ ✓

Henderson-Hasselbalch equation : $pH = pKa + \log\frac{[conj\ Base]}{[Acid]}$

⇒ When [conj Base] = [Acid] "50% is dissociated"
pH = pKa → Constant Value
depends on the Ratio b/w Acid and it's conj Base.

if pH > pKa → [conj Base] > [Acid]
if pH = pKa → [conj Base] = [Acid]
if pH < pKa → [conj Base] < [Acid]
⇒ V. Imp.

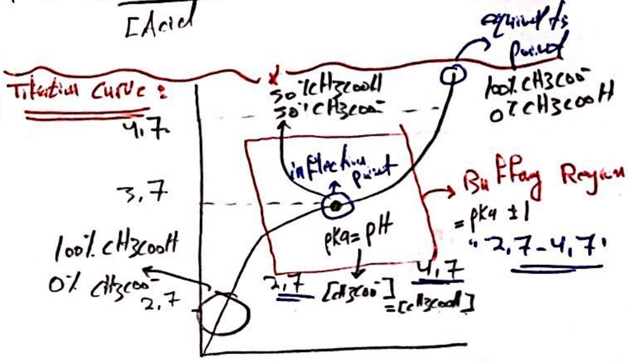
Buffer solution : ★

Resists changing in pH. "When we add amount of strong Acid or Base"
↳ Weak Acid + conj Base. ex : $H_2PO_4^- + HPO_4^{-2}$

ملاحظة كثير مهمة ماخذ Buffer للحوض والقواعد القوية

④ Best buffering Region when pH = pKa
depends on $\frac{[conj\ Base]}{[Acid]}$

Titration Curve :



CH_3COOH → monoprotic → 1 inflection point, 1 equivalent point (OH^-)

→ to determine which Acid is strong
↳ We look to the amount of pKa → more pKa ↳ Weak Acid.

the solutions of excersis :

① $Ka = \frac{[H_3O^+][NaF]}{[HF]}$ ⇒ $3.5 * 10^{-4} = \frac{[H_3O^+][0.12]}{[0.1]}$
$[H_3O^+] = 2.92 * 10^{-4}$
$pH = -\log(2.92 * 10^{-4}) = 3.54$

② $Ka = [H_3O^+] = 3.5 * 10^{-4}$
pH = 3.45

↑ HCl → $[HCl] = [H_3O^+] = 0.02$
pH = 2
pH will ↓ → because we add HCl.

③ $pH = pKa + \log\frac{[conj\ Base\ salt]}{[Acid\ alcohol]}$ ⇒ $3.86 + \log\frac{0.25}{0.75} = 3.38$

thx