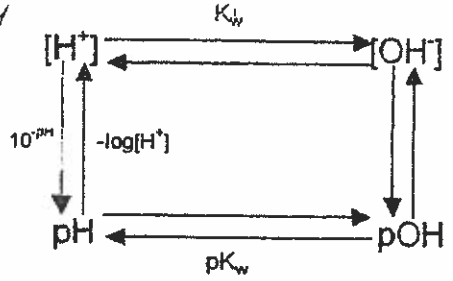
ACID/BASE UNIT

$pH = -\log[H^+]$

$H^+ = 1 \times 10^{-pH}$

$pK_a = -\log K_a$

$K_a = 1 \times 10^{-pK_a}$



$pH + pOH = 14$

pH / pOH / $[H_3O^+]$ / $[OH^-]$

Q. Kind of Question?

One Substance
(e.g.) NH_3, $AlCl_3$, HCl

Q. Kind of Species?

Strong

Acid
(Big 6)
↳ $[H^-] = [HA]$

H_2SO_4 HNO_3
HI $HClO_4$
HBr
HCl

Base
(Soluble OH's)
↳ $[OH^-] = [MOH]$

Group I + II

Weak

Acid
★ Carboxylic (CH_3COOH)
★ All cations except IA + IIA

↳ Use K_a/ICE to find $[H^+]$

$H^+ = \sqrt{[Acid]\,K_a}$

Base
★ Ammonia (NH_3)
★ All anions except bi-ions and conjugate 5

↳ Use K_b/ICE to find $[OH^-]$

$OH^- = \sqrt{[Base]\,K_b}$

Bi-ions

↳ Compare K_a to K_b

$K_b = \frac{K_w}{K_{a\,conj.}}$

Mixture of 2 Substances
(e.g.) NaOH + HCOOH

1st Determine INITIAL CONCENTRATION
↳ (Dilution) $C_f = C_i\left(\frac{V_i}{V_f}\right)$

Buffer
(Weak Conjugate Pair)
(e.g.) $HNO_2 + NaNO_2$
↳ $pH = pK_a + \log \frac{[base]}{[acid]}$
or
$pOH = pK_b + \log \frac{[Acid]}{[Base]}$

2nd

$K_a \cdot K_b = K_w$

Acid + Base Neutralization

3rd

Strong-Strong
↳ Determine excess $[H^+]$ or $[OH^-]$

(e.g.)	HCl	+ NaOH	→ NaCl	+ H_2O
I	0.2	0.1	0	
C	- 0.1	- 0.1	+ 0.1	
F	0.1	0	0.1	

↳ Excess strong acid

Weak-Strong
(e.g.) $CH_3COOH + NaOH$

Equivalent

(e.g.)	CH_3COOH	+ NaOH	→ $NaCH_3COO$	+ H_2O
I	0.1	0.1	0	
C	- 0.1	- 0.1	+ 0.1	
F	0	0	0.1	

One substance: ↑ acidic or basic salt

Excess Weak

↳ Use K_a or K_b ICE

(e.g.)	NH_3	+ HCl	→ NH_4^+	+ Cl^-
I	0.2	0.1	0	0
C	- 0.1	- 0.1	+ 0.1	+ 0.1
F	0.1	0	0.1	0.1

Buffer

↳ $pH = pK_a + \log \frac{[base]}{[acid]}$

$H^+ = \sqrt{[Acid]\,K_a}$

$OH^- = \sqrt{[Base]\,K_b}$

Excess Strong

(e.g.)	CH_3COOH	+ NaOH	→ $NaCH_3COO$	+ H_2O
I	0.1	0.2	0	
C	- 0.1	- 0.1	+ 0.1	
F	0	0.1	0.1	

Excess strong base ↑ ↑ n/a