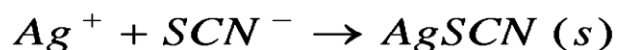
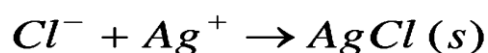


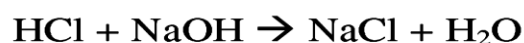
## Back titration :

Back titration is a titration done in reverse; instead of titrating the original sample, a known excess of standard reagent is added to the solution, and the excess is titrated. for example



## Acid And Base titration :

The acid reacts with the base in an aqueous medium , Upon reaching the end point, the number of moles of the acid have reacted with the necessary moles of the base The result is usually water and salt according to the following equation .



$$K = \frac{[H_3O^{+}][OH^{-}]}{[H_2O]^2}$$

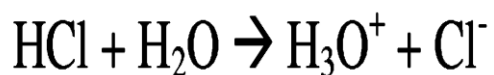
Dissociation constant in 25c:

$$K_w = 1.0 \times 10^{-14}$$

In Pure water  $[H]^{+} = [OH]^{-} = 1.0 \times 10^{-7}$

## Acid-base equilibria in water

When adding the acid or base to the water, both of them will dissolve in the water. If the acid is strong, then it will be completely ionized ... as in the equation.



While a base like ammonia is weak, it is partially ionized



Stability of the base equilibrium

$$K_b = \frac{[\text{NH}_4^+][\text{OH}^-]}{[\text{NH}_3]}$$

## PH-Scale

$$\text{pH} = -\log [\text{H}^+]$$

$$\text{pOH} = -\log [\text{OH}^-]$$

ex. Calculate pH ,pOH for NaOH [  $5 \times 10^{-2}$  ] M sol.

$$[\text{OH}^-] = [5 \times 10^{-2}]$$

$$\text{pOH} = -\log [\text{OH}^-]$$

$$\text{pOH} = -\log [5 \times 10^{-2}]$$

$$\text{pOH} = 1.3$$

$$\text{pH} + \text{pOH} = 14$$

$$\text{pH} + 1.3 = 14$$

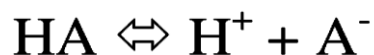
$$\text{pH} = 12.7$$

## Acid and Base strength

### Strong acid and strong base

Strong acid		Strong base	
HCl	Hydrochloric acid	NaOH	Sodium hydroxide
H <sub>2</sub> SO <sub>4</sub>	Sulfuric Acid	Ca(OH) <sub>2</sub>	Calcium hydroxide
HNO <sub>3</sub>	Nitric acid	KOH	Potassium hydroxide

## Weak acid and weak base



The above equation for weak acid thus a stable equilibrium of acid is :

$$K_a = \frac{[\text{H}^+]^2}{C_a}$$

Weak base equation



stable equilibrium of base

$$K_b = \frac{[\text{OH}^-]^2}{C_b}$$

Ex. If the dissociation constant for acetic acid  $1.8 \times 10^{-5}$  calculate PH when acid  
Concentration 0.1 M ?

Sol.

$$K_a = \frac{[\text{H}^+]^2}{C_a}$$

$$1.8 \times 10^{-5} = [\text{H}^+]^2 / 0.1$$

$$[\text{H}^+]^2 = 1.8 \times 10^{-6}$$

$$[\text{H}^+] = 1.3 \times 10^{-3}$$

$$\text{pH} = -\log [\text{H}^+]$$

$$\text{pH} = -\log 1.3 \times 10^{-3}$$

$$\text{pH} = 2.88$$

Weak acid		Weak base	
Hf	hydrofluoric acid	NH <sub>3</sub>	Ammonia
CH <sub>3</sub> COOH	Acetic acid	C <sub>5</sub> H <sub>5</sub> N	Pyridine