Acid Base Equilbria Summary

Formulas:

- Recall ICE table from chemical equilibria
- Degree of ionization= $\frac{amount\ of\ molecules\ ionised\ at\ equilbirum}{initial\ amount\ of\ molecules}$
- P____ =-lg [____] for pH, pOH, pKa, pKb
- [____] = 10^{-p}—— for pH, Poh

- To find pH from pOH, and vice versa
  pH + pOH = pKw = 14 (25°C)

- Acid and Base dissociation constants
  Ka= $\frac{[H+][A-]}{[HA]}$
  Kb= $\frac{[BH+][OH-]}{[B]}$
- For conjugate acid-base pair
  pKa x pKb = pKw = 14 (25°C)
  Ka x Kb = Kw = 1.00 x 10^{-14} mol^2dm^{-6} (25°C)

- To find pH or pOH, of a buffer solution with Henderson Hasselbalch Equation
  pH = pKa + $\lg\frac{[A-]}{[HA]}$ for <u>acidic</u> buffer solution
  pOH = pKb + $\lg\frac{[BH+]}{[B]}$ for <u>alkaline</u> buffer solution

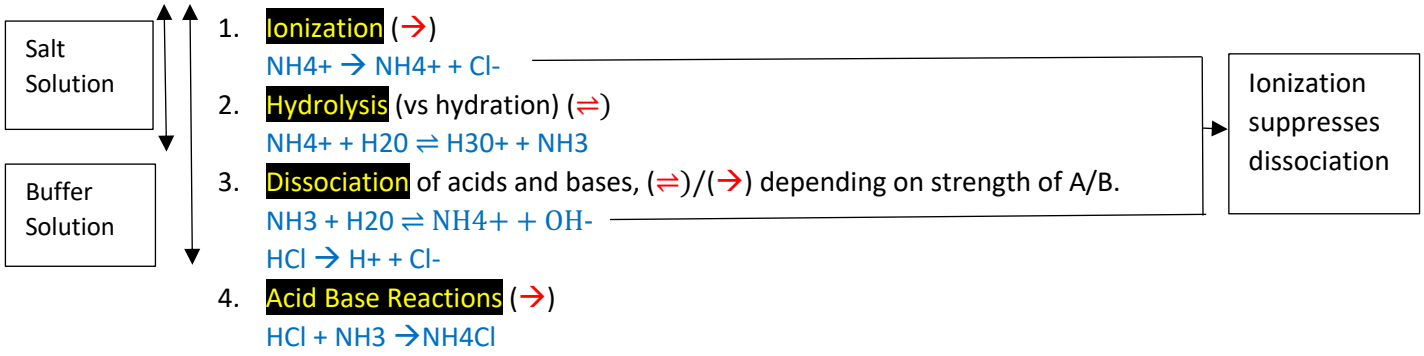
- Maximum buffering capacity
  pH = pKa for <u>acidic</u> buffer solution
  (i.e. **amount of acid= amount of conjugate base formed from acid**, based on Henderson Hasselbalch Equation)
  pOH = pKb for <u>alkaline</u> buffer solution
  (i.e. **amount of base= amount of conjugate acid formed from base**, based on Henderson Hasselbalch Equation)

Note: H+ and H3O+ can be used interchangeably, select based on convenience.

Application:

Titration curves (SA-SB, WA-SB, SA-WB, WA-WB)

Illustrated with an example on $25.0cm^3$ of $0.100moldm^{-3}$ HCl titrated against $0.100moldm^{-3}$ NH3



- ✓ **Identify what is in the solution** at any given point in titration
- ✓ **Calculate concentration of H+/ OH-** by employing formulas

  N.B. Calculations will usually need to analyse amount of chemical species (which is the limiting reagent, which is in excess). Take note to consider changes in volume, as it'll affect concentration.

SA-SB

Straight forward as pure acid base reaction. No salt hydrolysis, no buffer. Analysis of amount of chemical species and calculating concentration will form the bulk of our answer.

WA-SB, SA-WB

Solution contains…	What to do
Pure acid/ base	**Consider strong or weak A/B**. a. If strong A/B, using balanced chemical equation, determine concentration of H+/ OH- ions, pH can be determined. b. If weak A/B, use ICE table along with Ka/Kb.
Excess/ Unreacted SA/SB with salt that is also acidic/ basic in nature after hydrolysis	Only need to consider concentration of H+/OH- of the excess/ unreacted SA/SB. No need to consider the concentration of H+/OH- from salt hydrolysis. N.B. Reason being complete dissociation of the SA/SB will suppress salt hydrolysis.
Pure Salt	Consider which ion(s) hydrolyses (if any), and if they do, construct ICE table and use Ka/Kb,
Buffer/ maximum buffering capacity	Find the resultant concentration of the relevant conjugate acid-base pair species after acid-base reaction, and apply Henderson Hasselbalch Equation.