Acid-base titrations:

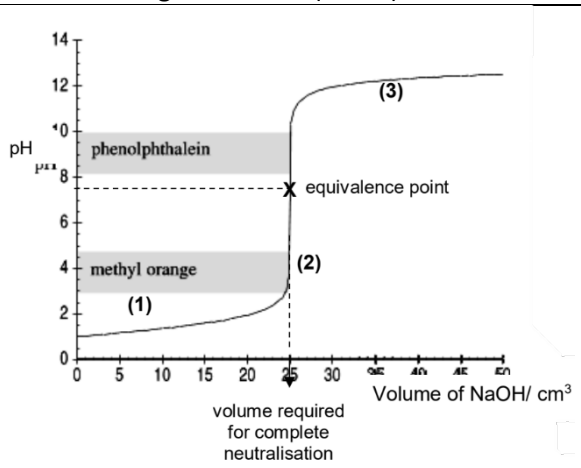
Sketching titration curves

Checklist for titration curve:

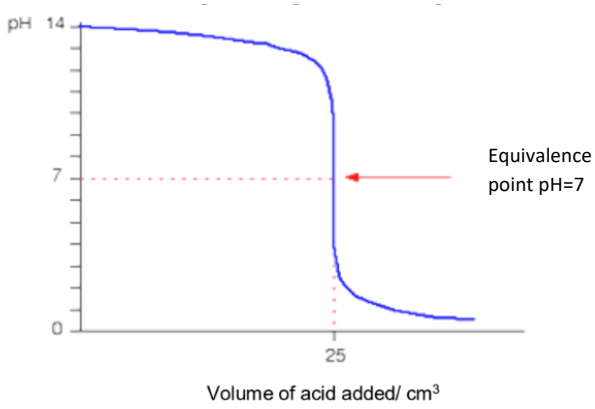
- ✓ Initial pH
- ✓ Buffer region (only required if Qn ask)
- ✓ Point of maximum buffering capacity
- ✓ Equivalence point
- ✓ Final Ph

- Equivalence point is found through extrapoltaiton of linear poriton of parts (1)/(2)/(3) of titration curve ad taking midpoint between intersections)

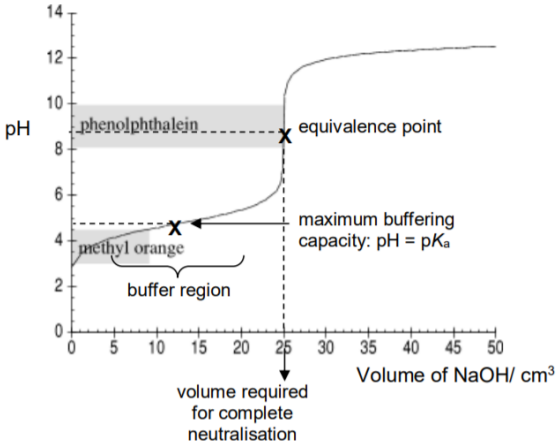
HCl titrated against NaOH (SA-SB)



NaOH titrated against HCl (SB-SA)

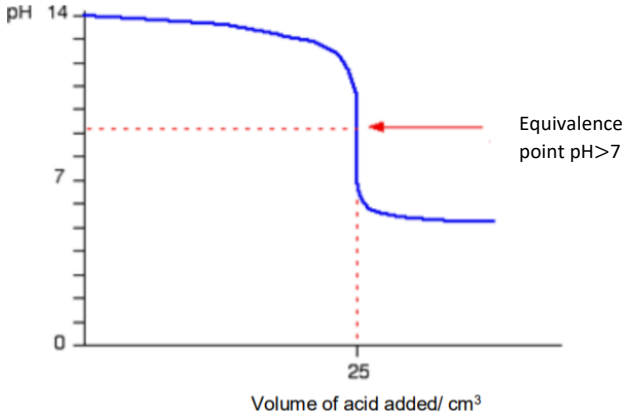


CH3COOH titrated against NaOH (WA-SB)



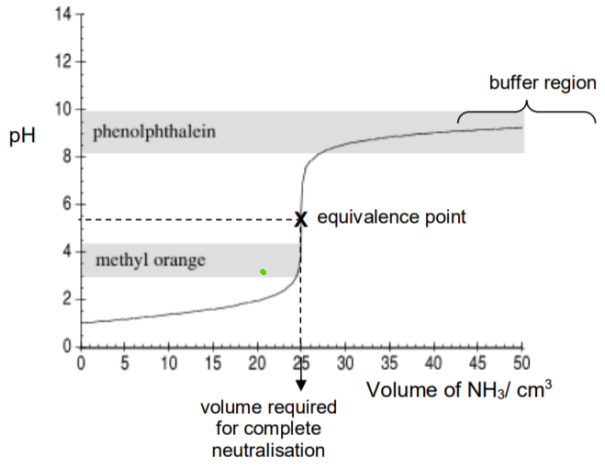
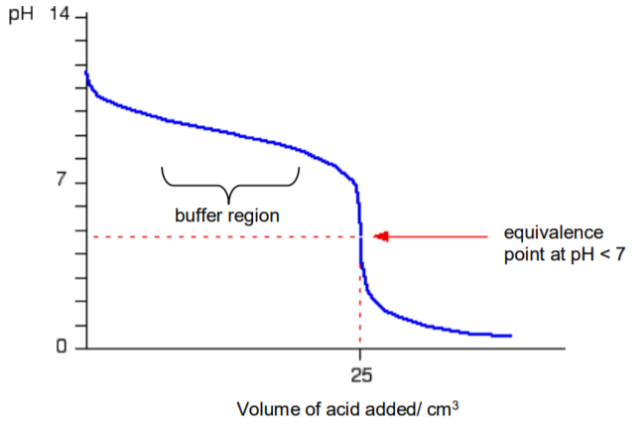
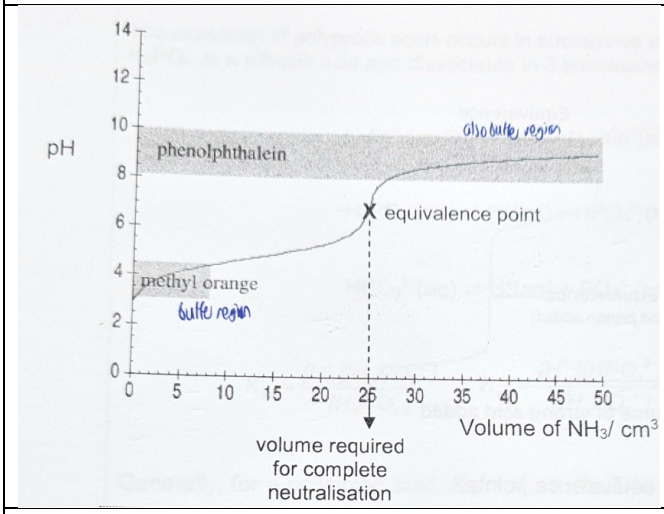
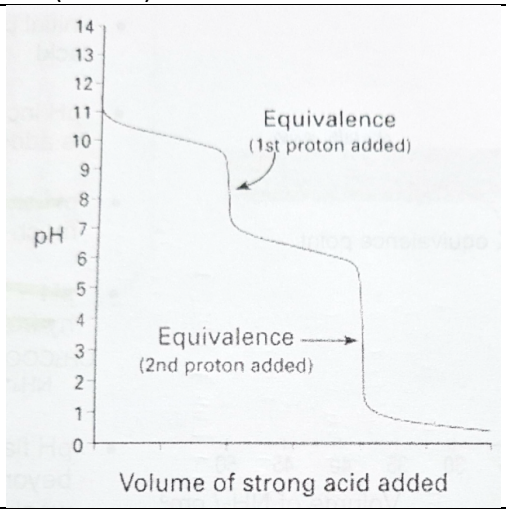
Volume of acid added at the point when maximum buffering capacity is obtained= $12.5cm^3$

NaOH titrated against CH3COOH (SB-WA)



Volume of acid added at the point when maximum buffering capacity is obtained= $50cm^3$

N.B. Notice difference between SA/ WA starting WB/SB starting curve shape.

HCl against NH3 (SA-WB)	NH3 against HCl (WB-SA)
	
CH3COOH titrated against NH3 (WA-WB)	Polyprotic acids and bases: Na2CO3 titrated against HCl (WB-SA)
	

Description:
Curve remain low until equivalence point due to unreacted A/B, flatten out at a high value due to excess A/B.
Buffer region is the entire region between pure WA/WB and pure salt.

Comparison of titration curves involving acids and bases of different strength

	SA against SB	WA against SB	SA against WB	WA against WB
Initial pH	Low due to **strong** A	Relatively high due to **weak** A	Low due to **strong** A	Relatively high due to **weak** A
Buffer solution	-	From unreacted WA and its salt formed	From excess WB and its salt formed	From WA and its salt formed, WB and its salt formed
pH change	**Sharp** change (4-10) due to **one excess drop** of alkali	**Sharp** change (7-10) due to **one excess drop** of alkali → relatively smaller range at relatively higher pH range	**Sharp** change (3-7) due to **one excess drop** of alkali → relatively smaller range at relatively lower pH range	**Less sharp** change due to **one excess drop** of alkali
Indicator	Phenolphthalein/ methyl orange	Phenolphthalein	Phenolphthalein	No appropriate indicator (no sharp pH change)
pH at equivalence point	pH=7 as **salt does not undergo hydrolysis**	pH>7 as **salt undergo hydrolysis to produce OH-**	pH<7 as **salt undergo hydrolysis to produce H+**	pH≈7 as **salt undergo hydrolysis**
Final pH	High due to **strong** B	High due to **strong** B	Relatively low due to **weak** B	Relatively low due to **weak** B

- Analysis will change if (type of A/B) against (type of A/B) is inverted
- Recall: Maximum buffering capacity is when the amount of WA/WB= amount of CB/CA from salt formed (equal amount of conjugate base pair)
- Final pH of solution may not hit 1 or 14. Depends on concentration of H+/OH- present. Calculations can be made using pH/pOH formula.
- Need to be careful when stating volume of acid/ base added at the point when maximum buffering capacity. Depending on which direction of (type of A/B) against (type of A/B) you are looking at, may have to x2, because amount of salt may be fixed at a maximum level already.
- Also have titration curves of polyprotic acid and bases