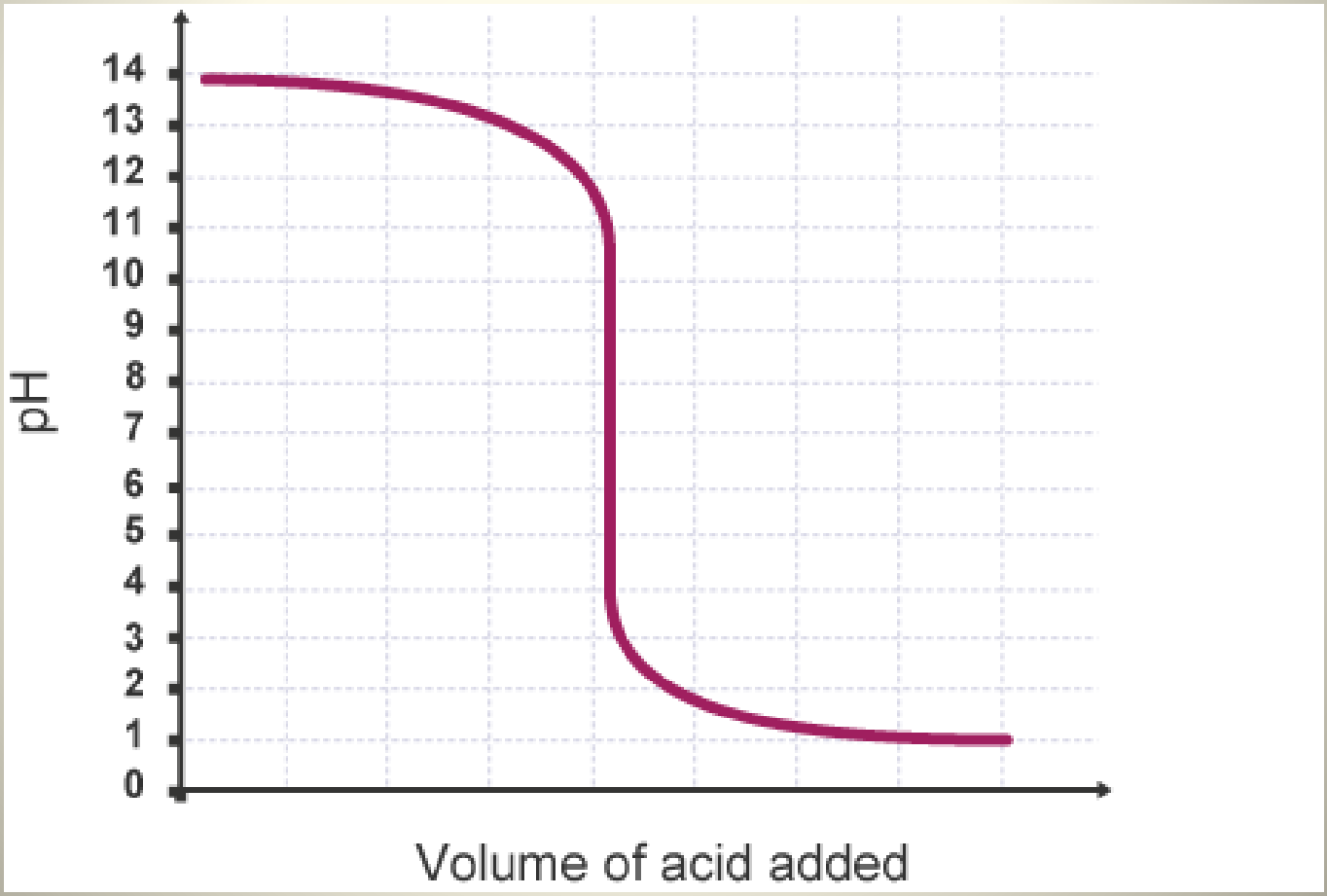
18.3 Acid-Base Titrations

What can you tell me about this graph? Features/sections of the graph?



18.4.1

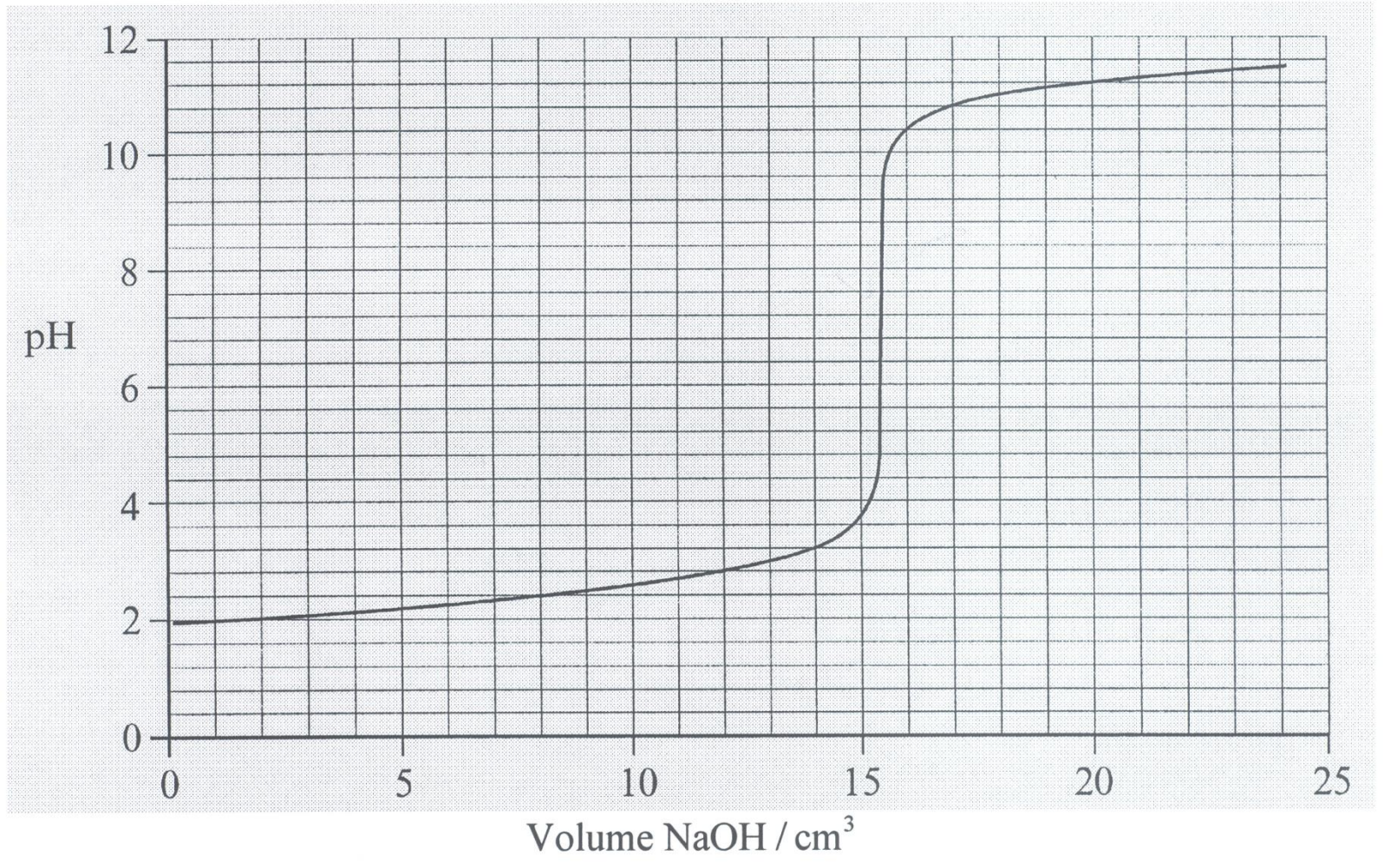
- Sketch the general shapes of graphs of pH against volume for titrations involving strong and weak acids and bases and explain their important features.

Sketch a graph

- Strong acid titrated with a strong base
  - .100 M strong monoprotic acid (HCl)
  - .100 M strong base (NaOH)

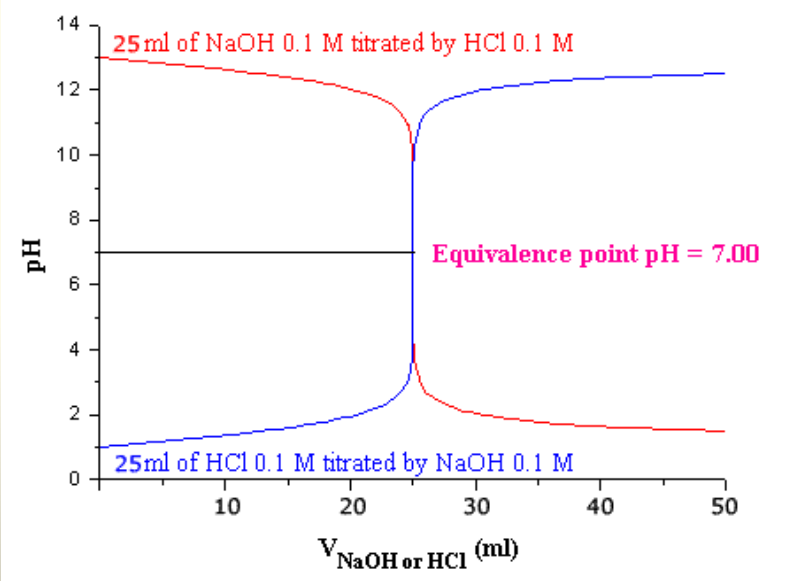
Strong Acid with Strong Base

Initial Concentration of Acid?



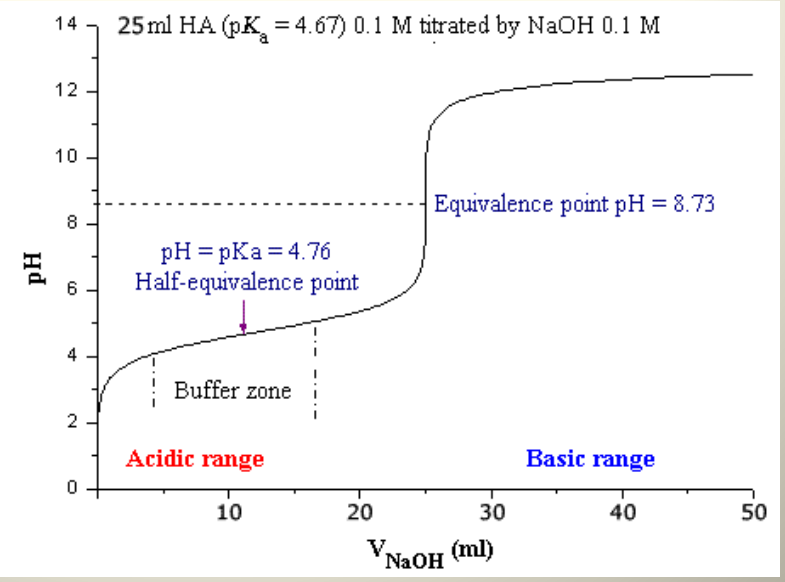
Important Features

- **Equivalence Point:** amount of acid = amount of base (aka point of inflection)
  - Point where the acid (or base) is just neutralized
  - What happens to the pH here and why?



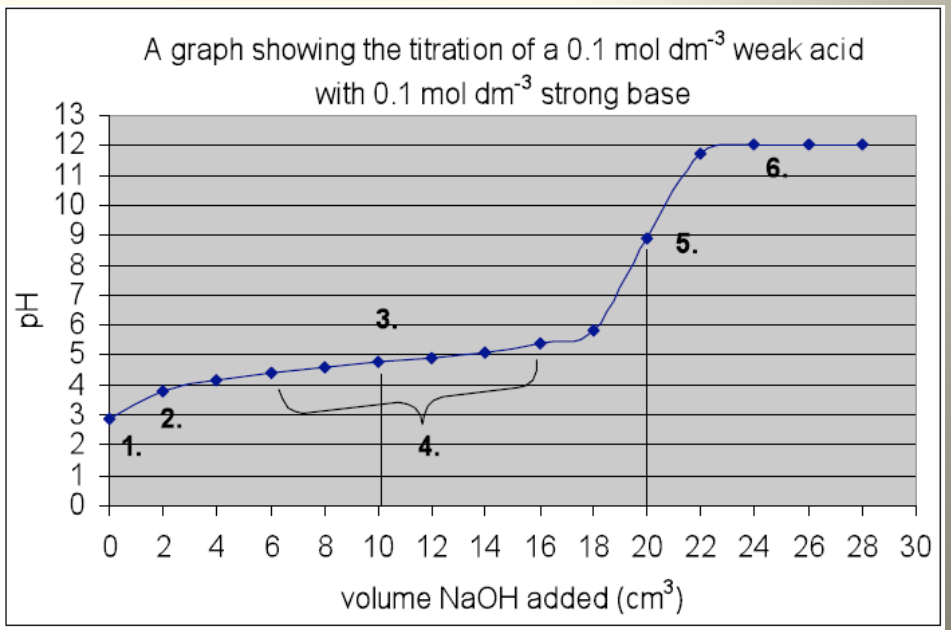
Important Features

- **Buffer Region:** ½ equivalence point
  - When there is ½ of the base (or acid) needed to neutralize the acid. Very little change in pH
  - [HCl] = [NaCl]
  - $pH_{solution}$ = pk_a of the acid (+/- 1 pk_a of the acid)



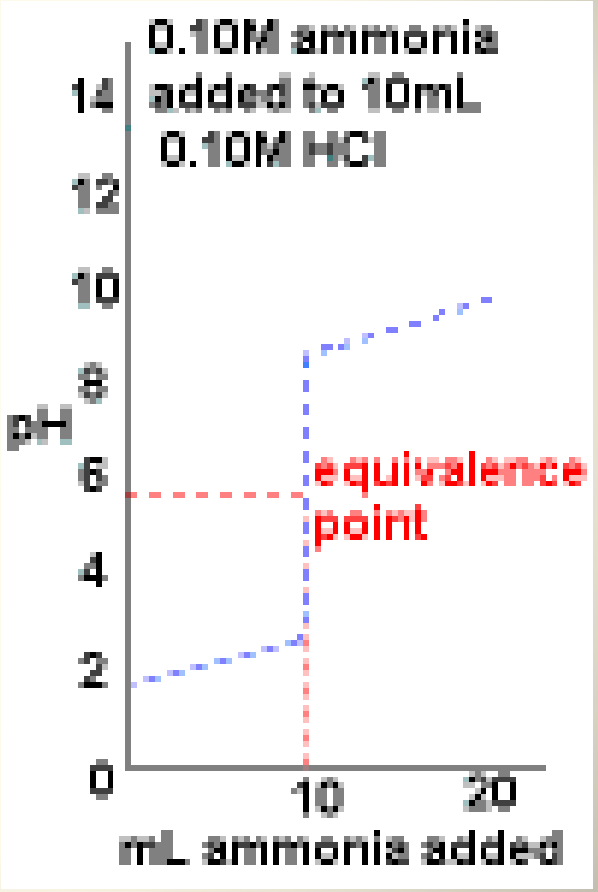
Weak Acid Titrated with Strong Base

- Ethanoic acid with NaOH
- pH at equivalence point?
- Look at the salt formed when all acid neutralized and apply salt hydrolysis!



Strong Acid with Weak Base

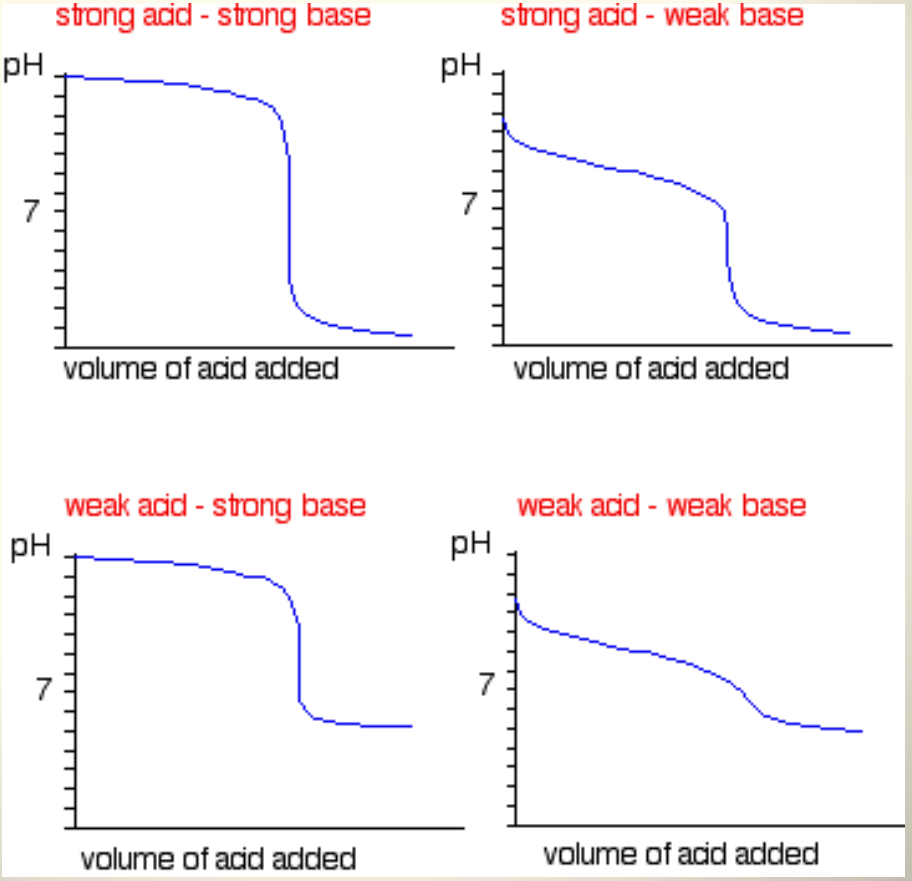
- HCl with Ammonia
  - *no buffer



Weak Acid and Weak Base

- Yuck!
- Conductivity

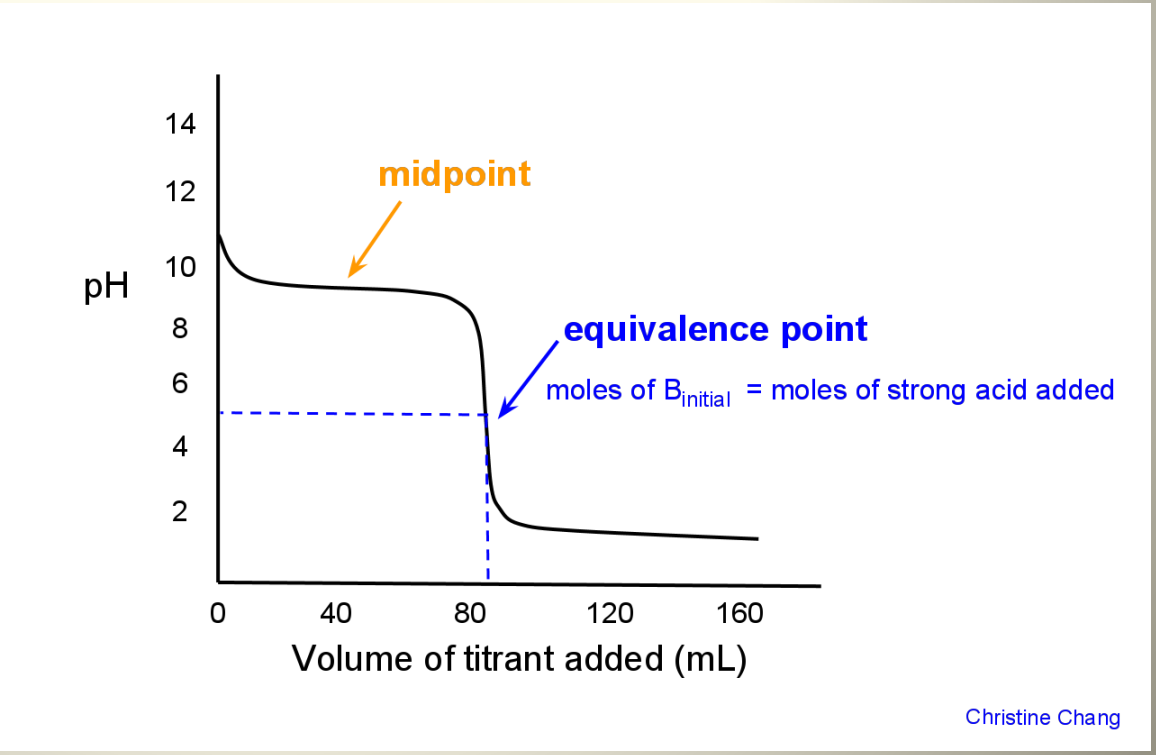
=highest at Equivalence point



Weak Base with Strong Acid

- ½ equivalence point

$pOH = pK_b$



Which types have buffer regions?

- Explain.
- Need excess weak acid and its conjugate base salt.
  - Weak acid titrated with strong base
- Need excess weak base with its conjugate acid salt.
  - Weak base titrated with strong acid.

Practice IB

- The graph below indicates the pH change during the titration of 20.0 cm^3 of 0.100 mol dm^{-3} of $CH_3COOH(aq)$ with 0.100 mol dm^{-3} KOH(aq). From the graph, identify the volume of KOH(aq) and the pH at the equivalence point. (2)

Practice IB

- A 0.10 mol dm^{-3} ammonia solution is placed in a flask and titrated with a 0.10 mol dm^{-3} hydrochloric acid solution.

a) When half the ammonia has been neutralized (the half-equivalence point), the pH of the solution is 9.25. Deduce the relationship between $[NH_3]$ and $[NH_4^+]$ at the half-equivalence point. (1)

b) Determine pK_b and K_b for ammonia based on the pH at the half-equivalence point. (3)

c) Describe the significance of the half-equivalence point in terms of its effectiveness as a buffer. (1)