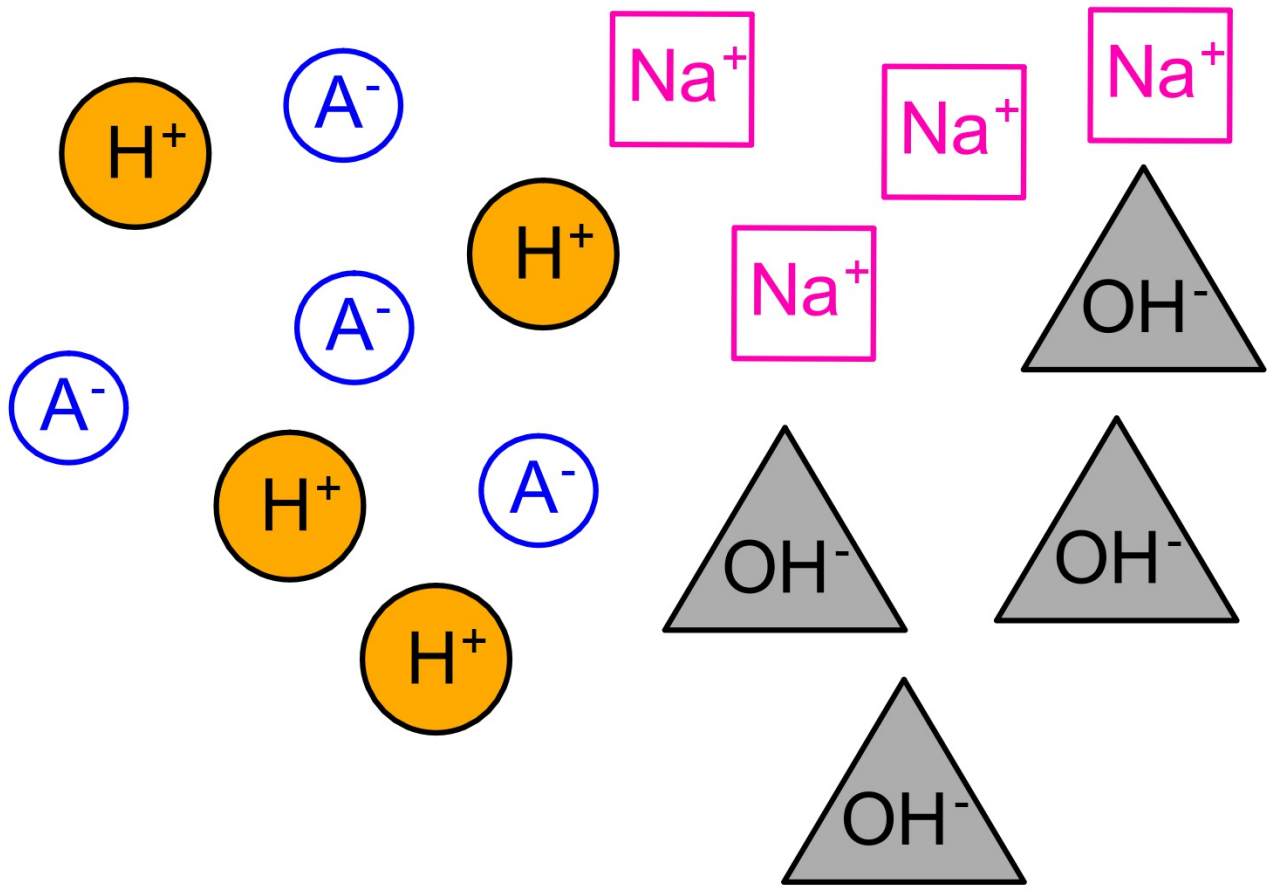
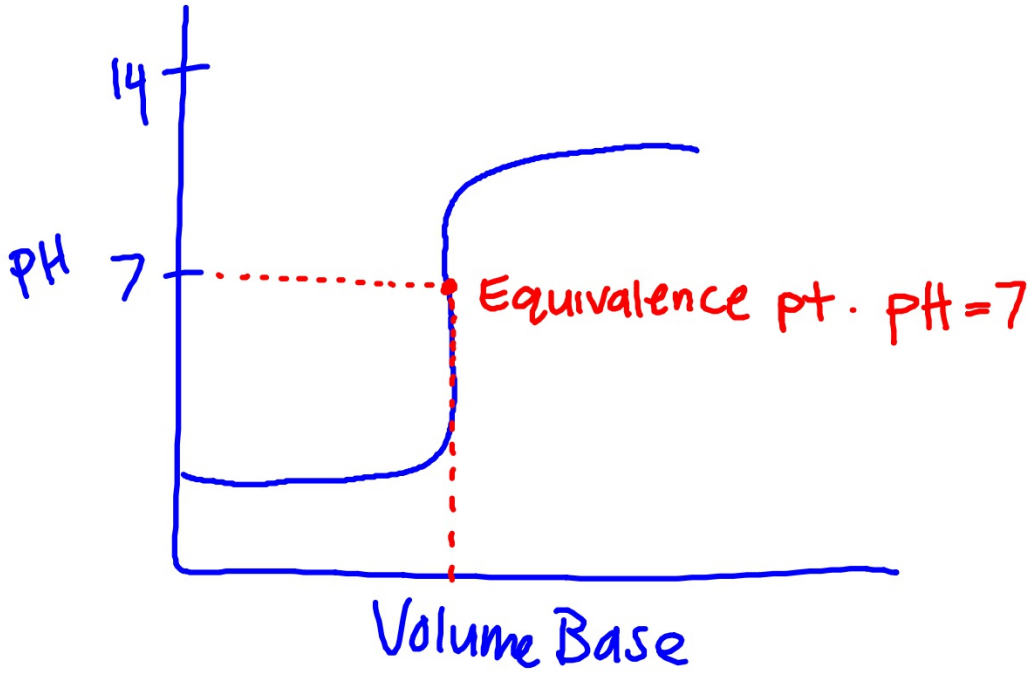
Particles in Solution	Description	How to Calculate pH	pH
Before Titration Begins (acid only)			
½ Equivalence Point			
At Equivalence Point			
Beyond Equivalence Point			

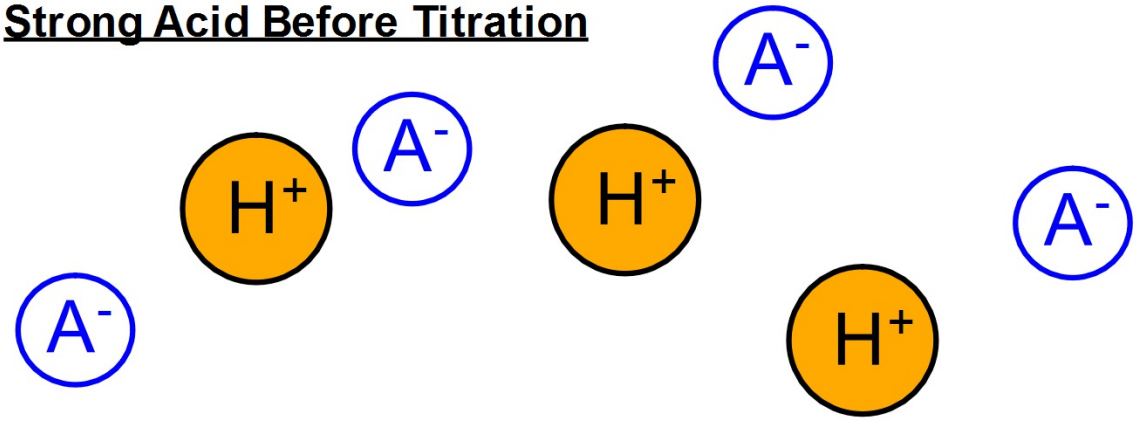


Strong Acid with Strong Base Titration

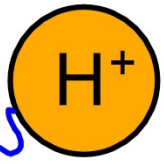
Indicator: Bromothymol Blue



Strong Acid Before Titration



- Strong acid completely dissociates into H+ and A-

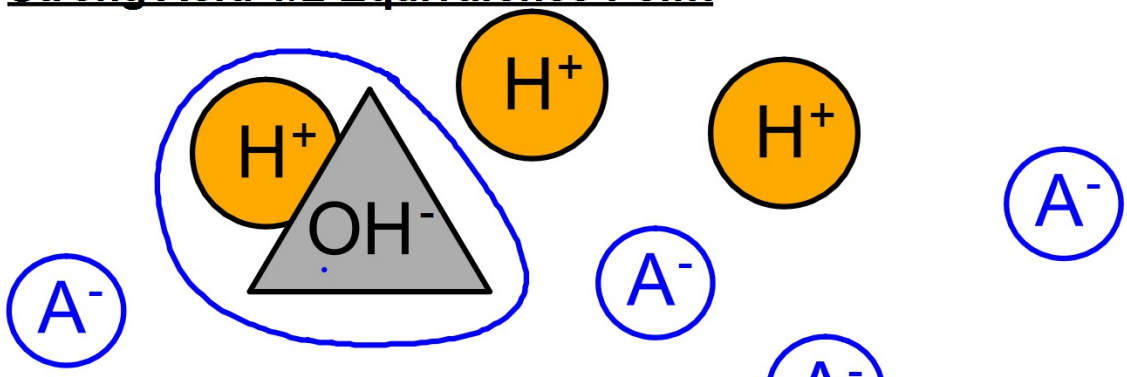


- use the molarity of the strong acid as [H+]

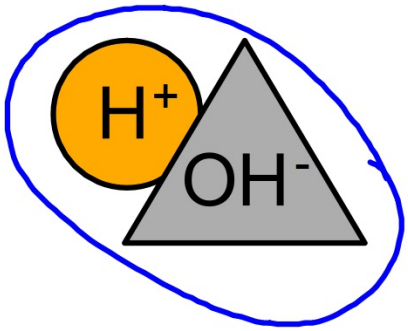
$pH = -\log[H^+]$

- Acidic pH < 7

Strong Acid 1/2 Equivalence Point



- ½ H^+ ions are neutralized w/ OH^- forming H_2O. H^+ still present.

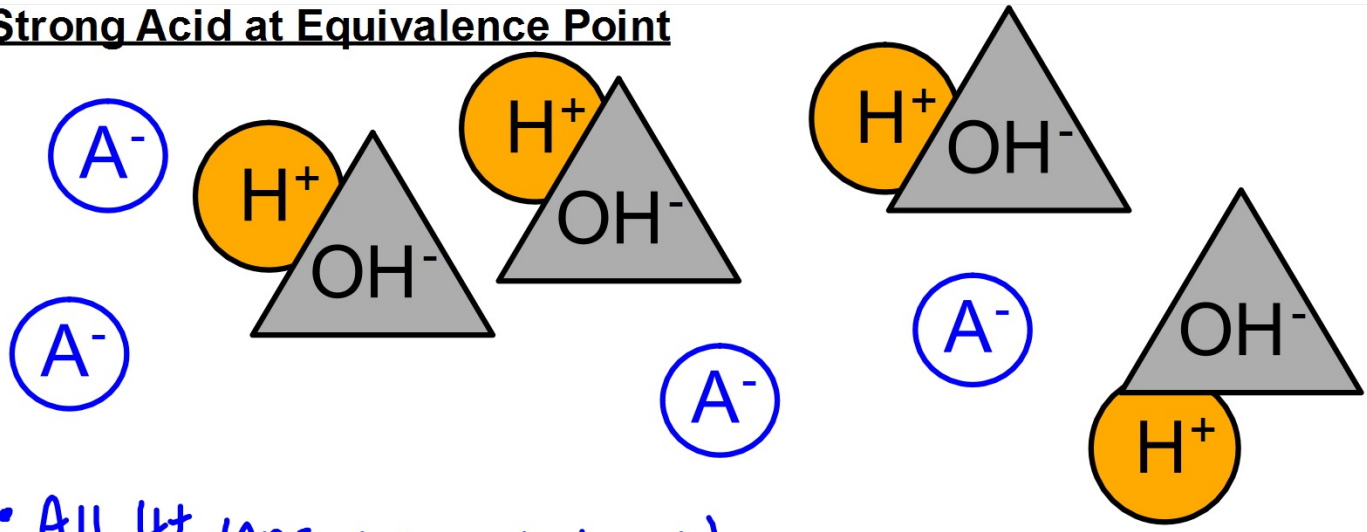


- Find $[H^+] = \frac{\text{mol } H^+}{V_T}$

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

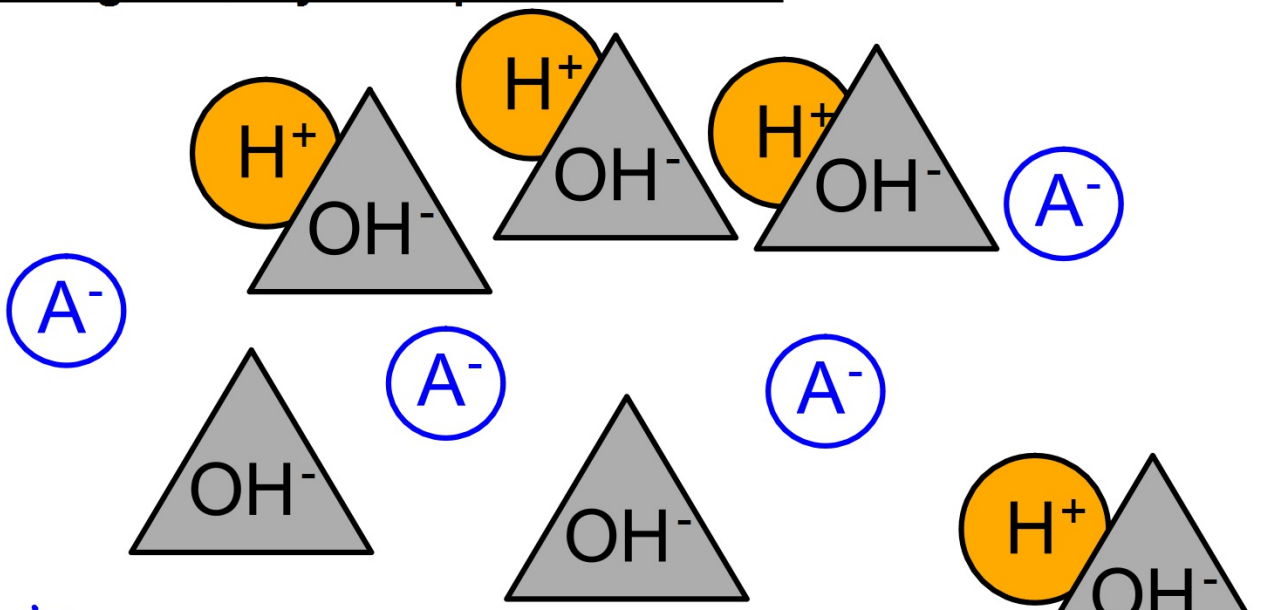
- Acidic $pH < 7$ (slightly higher than initial pH)

Strong Acid at Equivalence Point



- All H^+ ions are neutralized by OH^- forming H_2O. Neutral salt in soln.
- Strong Acid + Strong Base = Neutral Salt
- pH = 7 (neutral)

Strong Acid Beyond Equivalence Point



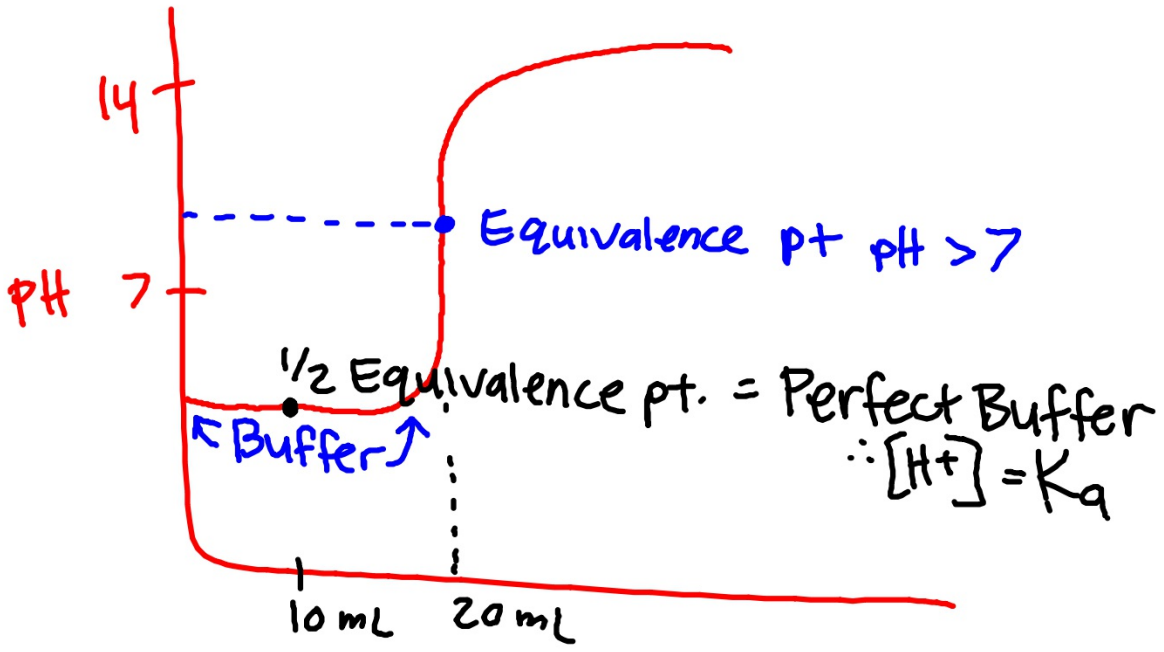
- Excess OH^- in soln. NO H^+ to react with.
- Find $[OH^-] = \frac{\text{mol } OH^-}{V_T}$
- pH > 7 (basic)

$pOH = -\log[OH^-]$

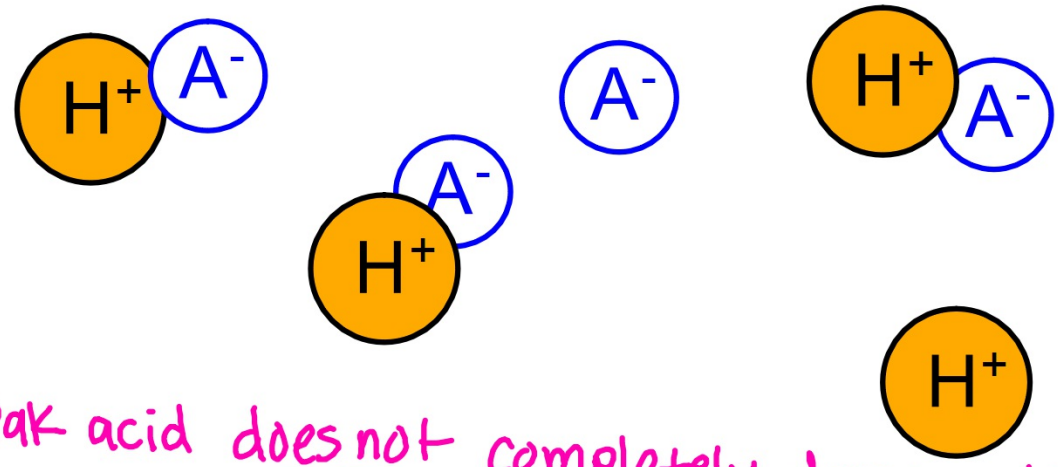
$pH = 14 - pOH$

Weak Acid with Strong Base Titration

Indicator: phenolphthalein

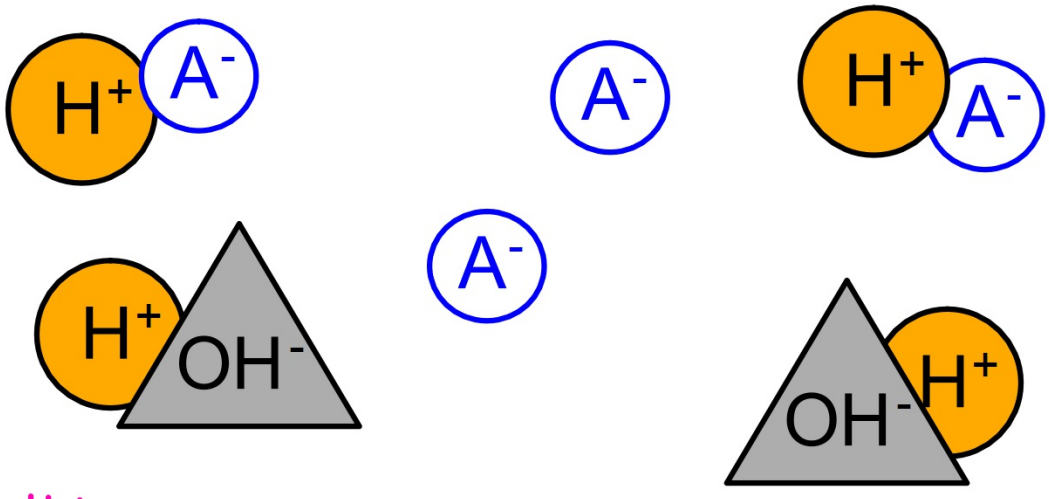


Weak Acid Before Titration



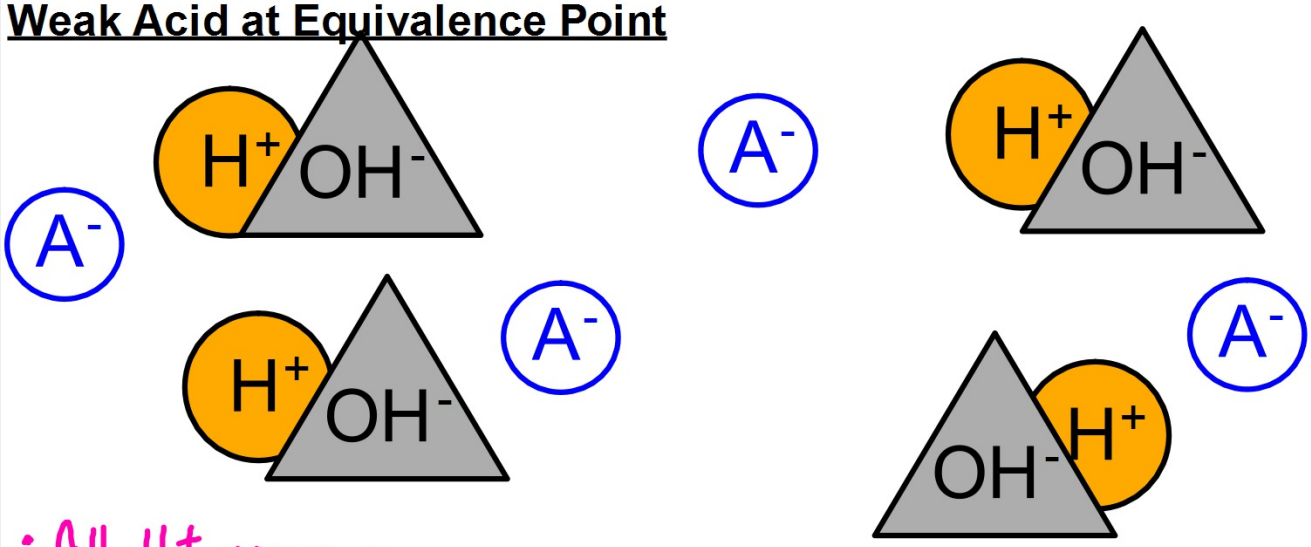
- Weak acid does not completely dissociate. The majority exist as whole molecules, not ions.
- Use K_a and ICE to find $[H^+]$
  $pH = -\log[H^+]$
- Acidic ($pH < 7$)

Weak Acid 1/2 Equivalence Point



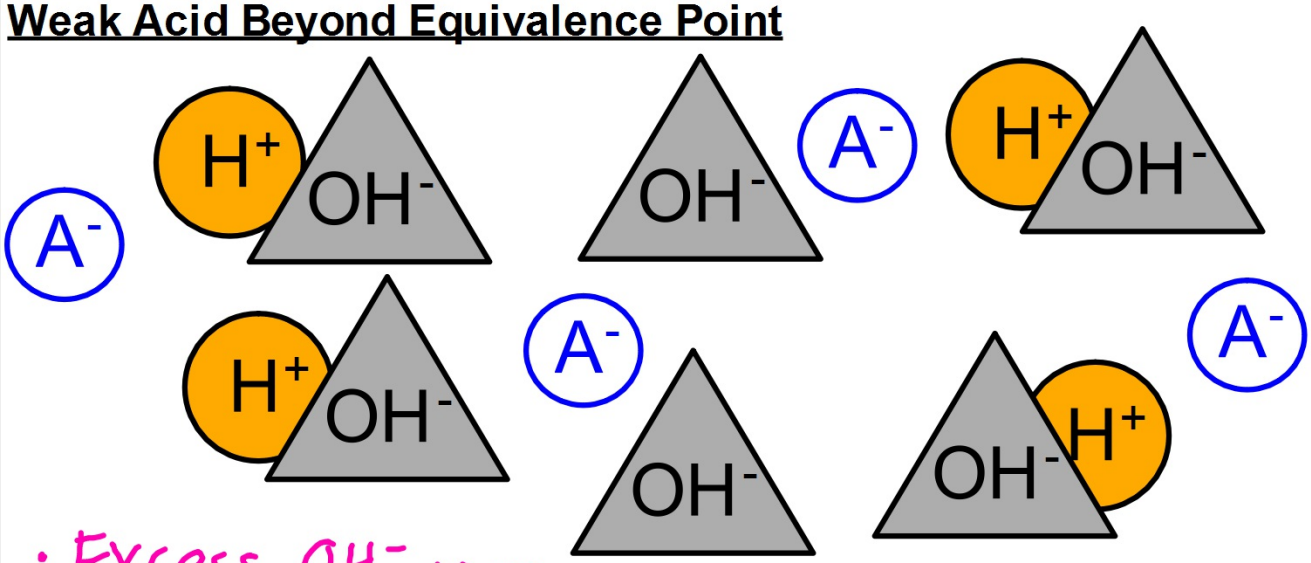
- ½ H^+ ions are neutralized by OH^-, forming H_2O. Equal amounts of HA and A^-.
  ∴ Perfect Buffer
- $[H^+] = K_a\left(\frac{\text{mols HA}}{\text{mols A}^-}\right)$ ∴ $[H^+] = K_a$
- Acidic $pH < 7$

Weak Acid at Equivalence Point



- All H^+ ions are neutralized by OH^-, forming H_2O. Basic salt in H_2O.
  (A^- is the conjugate Base of HA (weak acid))
- $A^- + H_2O \rightleftharpoons HA + OH^-$
  Use K_b and ICE to find $[OH^-]$
  $pOH = -\log[OH^-]$ $\therefore pH = 14 - pOH$
- Basic ($pH > 7$)

Weak Acid Beyond Equivalence Point

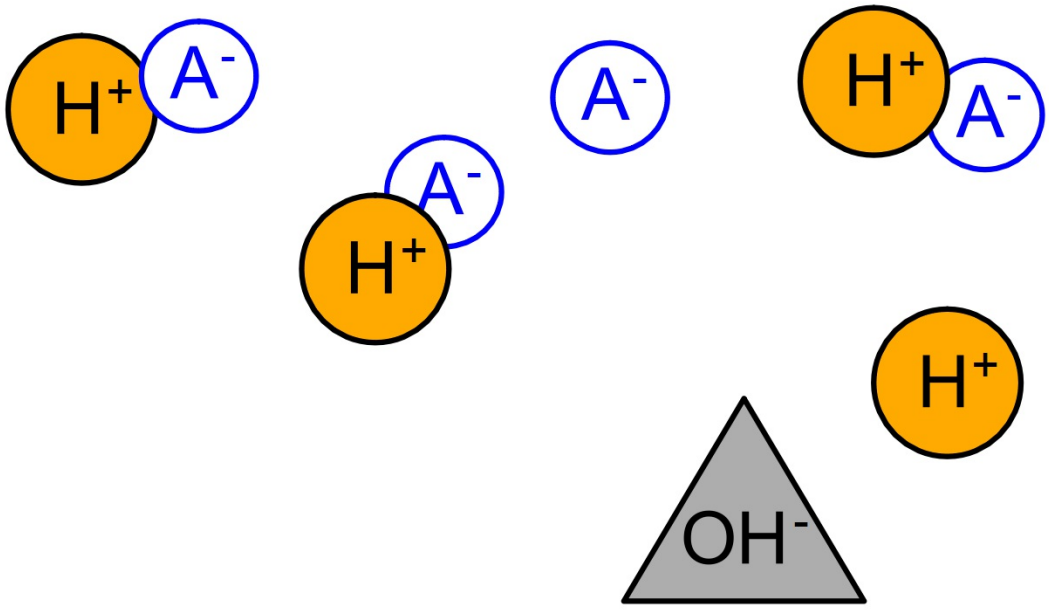


- Excess OH^- ions
- Find $[OH^-] = \frac{\text{mols } OH^-}{V_T}$

$pOH = -\log[OH^-]$

$pH = 14 - pOH$

- Basic ($pH \gg 7$)

Oxygen = red **Hydrogen = yellow** **A^- = green**

Before Titration	½ Equivalence Pt.
At Equiv. Pt	Beyond Eq. Pt.