

## N39

Weak Acid	Formula of the acid	Example of a salt of the weak acid
Hydrofluoric	HF	KF – Potassium fluoride
Formic	HCOOH	KHCOO – Potassium formate
Benzoic	C <sub>6</sub> H <sub>5</sub> COOH	NaC <sub>6</sub> H <sub>5</sub> COO – Sodium benzoate
Acetic	CH <sub>3</sub> COOH	NaH <sub>3</sub> COO – Sodium acetate
Carbonic	H <sub>2</sub> CO <sub>3</sub>	NaHCO <sub>3</sub> - Sodium bicarbonate
Propanoic	HC <sub>3</sub> H <sub>5</sub> O <sub>2</sub>	NaC <sub>3</sub> H <sub>5</sub> O <sub>2</sub> - Sodium propanoate
Hydrocyanic	HCN	KCN - potassium cyanide

Weak Base	Formula of the base	Example of a salt of the weak acid
Ammonia	NH <sub>3</sub>	NH <sub>4</sub> Cl - ammonium chloride
Methylamine	CH <sub>3</sub> NH <sub>2</sub>	CH <sub>3</sub> NH <sub>3</sub> Cl – methylammonium chloride
Ethylamine	C <sub>2</sub> H <sub>5</sub> NH <sub>2</sub>	C <sub>2</sub> H <sub>5</sub> NH <sub>3</sub> NO <sub>3</sub> - ethylammonium nitrate
Aniline	C <sub>6</sub> H <sub>5</sub> NH <sub>2</sub>	C <sub>6</sub> H <sub>5</sub> NH <sub>3</sub> Cl – aniline hydrochloride
Pyridine	C <sub>5</sub> H <sub>5</sub> N	C <sub>5</sub> H <sub>5</sub> NHCl – pyridine hydrochloride

### Henderson-Hasselbalch Equation

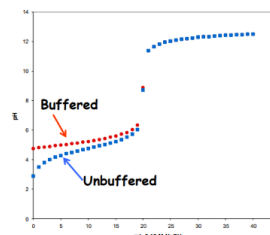
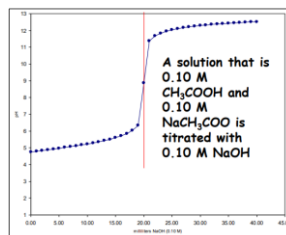
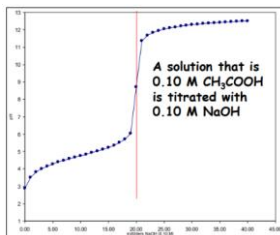
$$pH = pK_a + \log\left(\frac{A^-}{HA}\right) = pK_a + \log\left(\frac{[Base]}{[Acid]}\right)$$

$$pOH = pK_b + \log\left(\frac{BH^+}{B}\right) = pK_b + \log\left(\frac{[Acid]}{[Base]}\right)$$

$$pK_a = -\log(K_a) \quad \text{Just like } pH = -\log[H^+]$$

$$pK_b = -\log(K_b)$$

The acids or bases may be conjugates from the salt!



### Other ways to think about He-Ha

Acid with a buffer:

$$pH = pK_a + \log\left(\frac{[salt]}{[Acid]}\right) = pK_a + \log\left(\frac{[conj. Base]}{[Acid]}\right)$$

Base with a buffer:

$$pOH = pK_b + \log\left(\frac{[salt]}{[Base]}\right) = pK_b + \log\left(\frac{[conj. Acid]}{[Base]}\right)$$

### Another good equation

Rearrange your Law of Mass Action:

$$K_a = \frac{[H^+][A^-]}{[HA]} \rightarrow [H^+] = K_a \frac{[HA]}{[A^-]} \rightarrow = K_a \frac{[Acid]}{[conj. Base]}$$

$$K_b = \frac{[BH^+][OH^-]}{[B]} \rightarrow [OH^-] = K_b \frac{[B]}{[BH^+]} \rightarrow = K_b \frac{[Base]}{[conj. Acid]}$$

### Suggestions...

Pick a method and stick to it. They all have pros and cons.

- Ice tables
  - Pro = familiar
  - Con = takes forever, lots of steps
- He-Ha
  - Pro = fast, on the AP eq. sheet
  - Con = Have to recognize to use it, not always solving for pH
- Rearranging Law of Mass Action
  - Pro = simple
  - Con = Have to recognize to use it, extra step to get to pH or pOH

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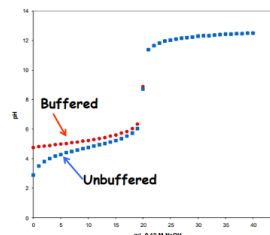
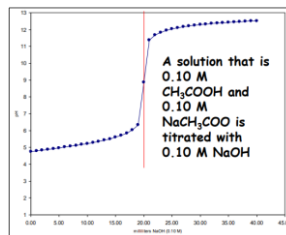
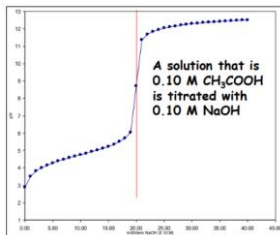
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