Polyprotic Acids and The pH of Salt Solutions

Polyprotic Acids

- Polyprotic acids involve more than one protonateable (?) proton
- Consider sulfurous acid (H_2SO_3)

$$H_2SO_3 \rightleftharpoons H^+ + HSO_3^- \qquad K_{a1} = 1.7 \times 10^{-2}$$

$$HSO_3^- \rightleftharpoons H^+ + SO_3^{-2} \qquad K_{a2} = 6.4 \times 10^{-8}$$

- Some general observations:
  - The K_a for the first ionization is always higher
    - Why would this be true?
- So long as the K_a values for successive protonations differ by more than 10^3, the pH for polyprotic acids can be satisfactorily found from the first protonation

Salt Solutions

General Principles

- Salts are ionicly bonded substances that can be related back to the product of an acid/base reaction.

$$HCl + NaOH \Rightarrow \boxed{NaCl + H_2O}$$

$$HCl \Rightarrow Cl^- + H_3O^+$$

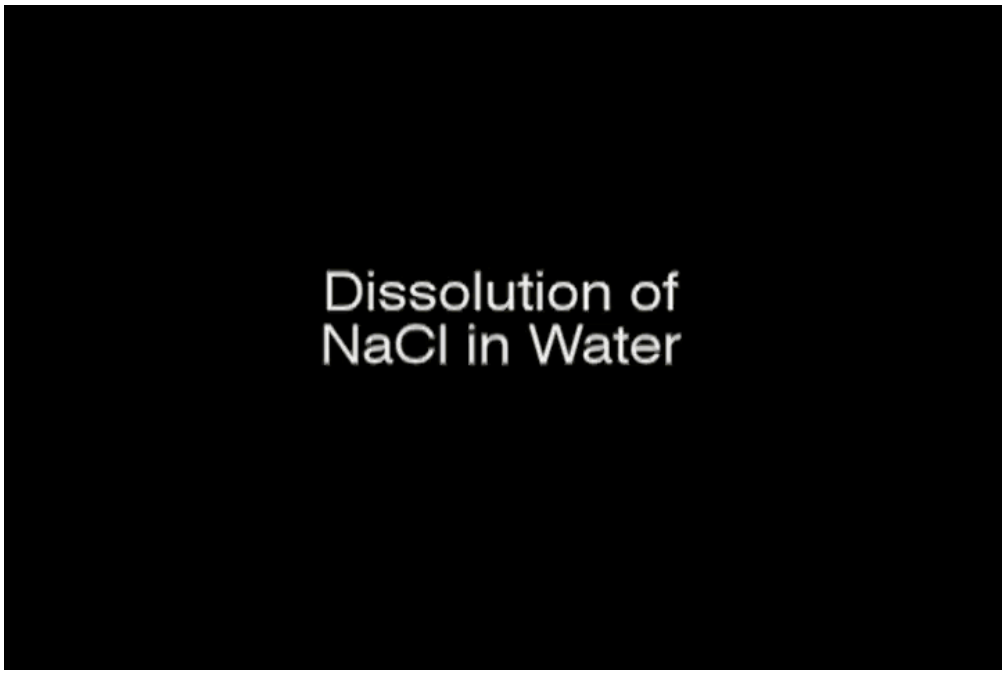
$$NaOH \Rightarrow Na^+ + OH^-$$

$$Na^+ + Cl^- + H_2O \Rightarrow \times$$

NaCl's ions are the *descendants* of a strong acid and a strong base so neither reacts with water and the pH is 7

Solutions & Solubility

The Solution Process



Salt Solutions

Application

- List the following solutions in order of increasing pH;
- A) 0.1 M $Co(ClO_4)_2$
- B) 0.1 M RbCN
- C) 0.1 M $Sr(NO_3)_2$
- D) 0.1 M $KC_2H_3O_2$

Salt Solutions

Application

0.1 M $Co(ClO_4)_2$ 0.1 M RbCN 0.1 M $Sr(NO_3)_2$ 0.1 M $KC_2H_3O_2$

K_a of $HC_2H_3O_2 = 1.8 \times 10^{-5}$

K_a of $HCN = 4.9 \times 10^{-10}$

Salt Solutions

Homework

- 16.83a / 16.87 / 16.88 / 16.91 / 16.92