9: Standardizing Bases

- Using NaOH
- CO_2 interference in bases
- Wt % calculation

Sodium Hydroxide (NaOH)

- Solid pellets or flakes
- Very hygroscopic
  - Solid always contains water
  - Cannot be used as primary standard
  - Must standardize solutions

Sodium Hydroxide (NaOH)

- In solution, reacts with dissolved CO_2

$$CO_2\,(aq) + H_2O\,(l) \rightleftharpoons 2H^+\,(aq) + CO_3^{2-}\,(aq)$$

$$H^+\,(aq) + OH^-\,(aq) \rightarrow H_2O\,(l)$$

$$2Na^+\,(aq) + CO_3^{2-}\,(aq) \rightarrow Na_2CO_3\,(s)$$

- Na+ AND OH- consumed
- White precipitate forms

Using NaOH Solutions

- Boil water to remove CO_2 first
- Store in air-tight container
- Plastic is preferred
  - NaOH slowly etches glass
  - Na_2CO_3 will seize glass stopper
- Must periodically re-standardize
- Make standards from concentrated solutions

Lab 9 Today's Titrant: NaOH

Needed: 500 mL of 0.025M
0.5 L × 0.025 mol/L = 0.0125 mol NaOH

$$\text{wt \%} \times \text{density} \times 1/\text{MW} \times \text{Vol} = \text{Moles}$$

$$0.5\ \frac{(g_{solute})}{(g_{soln})} \times 1.5\ \frac{(g_{soln})}{(mL_{soln})} \times 1/40.0\ \frac{(mol_{solute})}{(g_{solute})} \times \text{Vol}\ (mL_{soln}) = 0.0125\ \text{mol}\ (mol_{solute})$$

Vol = 0.67 mL of 50% NaOH 1 L soln

Lab 9 Today's Standard

Potassium hydrogen phthalate (KHPh)

$$NaOH + KHC_8H_4O_4 \longrightarrow H_2O + KNaC_8H_4O_4$$

Notice:

1 mole NaOH : 1 mole $KHC_8H_4O_4$

Lab 9 Today's Standard

Potassium hydrogen phthalate (KHPh)

$$NaOH + KHC_8H_4O_4 \longrightarrow H_2O + KNaC_8H_4O_4$$

Needed: Mass of KHPh to react with ~25 mL of 0.025 M NaOH

25 mL × 0.025 mol/L = 0.625 mmol NaOH

$$0.625 \text{ mmol NaOH} \times \frac{1 \text{ mol KHPh}}{1 \text{ mol NaOH}} = 0.625 \text{ mmol KHPh}$$

0.625 mmol KHPh × 204.22 g/mol = 127 mg = 0.13 g

Lab 9 Today's Titration

- Potassium hydrogen phthalate
  - Solid acid analyte; Primary Standard
  - Acid solution will NOT have CO_2
- Sodium hydroxide titrant
  - Boil water first to remove CO_2
- **NO** boiling at end point
- Phenolphthalein endpoint

Lab 10a: Steel Sample Prep

$$\text{total mass} \times \text{wt \%} = \text{mass of component}$$

Find mass of steel containing 4mg Mn if wt% of Mn in steel is 0.6%

$$\text{Mass of steel} \times 0.006 = 4 \text{ mg}$$
$$\text{Mass of steel} = 4 \text{ mg}/0.006 = 667 \text{ mg}$$
$$\approx 0.67 \text{ g}$$