Check Worksheet

$$2Ca_3(PO_4)_2 + 6SiO_2 + 10C \rightarrow 6CaSiO_3 + 10CO + P_4$$

16 12 18 10

28 28

$$4H_3BO_3 + \underset{m=?}{\overset{\text{UNKNOWN}}{2NaOH}} \longrightarrow \underset{m=230g}{\overset{\text{KNOWN}}{7H_2O}} + Na_2B_4O_7$$

Step 1: Moles Known

$$230g\ H_2O \times \frac{1\ mol\ H_2O}{18.02\ g\ H_2O} = 12.764\ mol\ H_2O$$

Step 2: Moles Unknown

$$12.764\ mol\ H_2O \times \frac{2\ mol\ NaOH}{7\ mol\ H_2O} = 3.647\ mol\ NaOH$$

Step 3: Mass Unknown

$$3.647\ mol\ NaOH \times \frac{40.00g\ NaOH}{1\ mol\ NaOH} = \boxed{150g\ NaOH}$$

Solution Stoichiometry

SOLUTION STOICHIOMETRY

- the methods used to calculate the quantities of substances in solution.
- involves **molar concentrations and the volumes of solutions**.

Solution Stoichiometry

Solutions of ammonia and phosphoric acid are used to produce ammonium hydrogen phosphate fertilizer. What volume of 14.8 mol/L $NH_{3(aq)}$ is needed for the ammonia to react completely with 10.0 L of 12.9 mol/L $H_3PO_{4(aq)}$ to produce fertilizer?

UNKNOWN KNOWN

$$2NH_{3(aq)} + H_3PO_{4(aq)} \longrightarrow (NH_4)_2HPO_{4(aq)}$$

$V = ?$ $V = 10.0\,L$

$C = 14.8\,mol/L$ $C = 12.9\,mol/L$

Step 1: Moles Known

$$10.0\,\cancel{L\ H_3PO_4} \times \frac{12.9\ mol\ H_3PO_4}{1\ \cancel{L\ H_3PO_4}} = 129\ mol\ H_3PO_4$$

Step 2: Moles Unknown

$$129\ \cancel{mol\ H_3PO_4} \times \frac{2\ mol\ NH_3}{1\ \cancel{mol\ H_3PO_4}} = 258\ mol\ NH_3$$

Step 3: Volume Unknown

$$258\ \cancel{mol\ NH_3} \times \frac{1\ L\ NH_3}{14.8\ \cancel{mol\ NH_3}} = 17.4\,L\ NH_3$$

If 25.00 mL HCl acid with a concentration of 0.1234 M is neutralized by 23.45 mL of NaOH, what is the concentration of the base?

UNKNOWN KNOWN

$$NaOH_{(aq)} + HCl_{(aq)} \longrightarrow NaCl_{(aq)} + H_2O_{(l)}$$

V = 23.45 mL V = 25.00 mL

C = ? C = 0.1234 M

Step 1: Moles Known

$$0.02500\,\text{L HCl} \times \frac{0.1234\,\text{mol HCl}}{1\,\text{L HCl}} = 0.003085\,\text{mol HCl}$$

Step 2: Moles Unknown

$$0.003085\,\text{mol HCl} \times \frac{1\,\text{mol NaOH}}{1\,\text{mol HCl}} = 0.003085\,\text{mol NaOH}$$

Step 3: Concentration Unknown

$$\frac{0.003085\,\text{mol NaOH}}{0.02345\,\text{L NaOH}} = 0.1316\,\text{mol/L NaOH}$$

$$0.003085\,\text{mol NaOH} \times \frac{1}{0.02345\,\text{L}} =$$

Worksheet

1) $H_2SO_{4(aq)} + NH_{3(aq)} \Rightarrow (NH_4)_2SO_{4(aq)}$

2) $Ca(OH)_{2(aq)} + Al_2(SO_4)_{3(aq)}$ $CaSO_{4(s)} + Al(OH)_{3(aq)}$

3) $Na_2CO_{3(aq)} + FeCl_{3(aq)}$ $NaCl_{(aq)} + Fe_2(CO_3)_{3(s)}$

4) $NaOH_{(aq)} + H_3PO_{4(aq)}$ $Na_3PO_{4(aq)} + H_2O_{(l)}$

5) $CuSO_{4(aq)} + Ca(NO_3)_{2(aq)}$ $CaSO_{4(s)} + Cu(NO_3)_{2(aq)}$