Check Worksheet

KNOWN

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

$m = 425\,g$ $\quad$ $m = ?$

$$425\,g\ Ca_3(PO_4)_2 \times \frac{1\ mol\ Ca_3(PO_4)_2}{310.18\,g\ Ca_3(PO_4)_2} \times \frac{10\ mol\ CO}{2\ mol\ Ca_3(PO_4)_2} \times \frac{28.01\,g\ CO}{1\ mol\ CO}$$

$$= 192\,g\ CO$$

Solution Stoichiometry

SOLUTION STOICHIOMETRY

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

$$C = \frac{n}{V} \qquad n = C \times V \qquad V = \frac{n}{C}$$

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

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

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

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

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

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

$$V = \frac{n}{C} = \frac{258\ mol}{14.8\ mol/L}$$

① UNKNOWN KNOWN

$H_2SO_{4(aq)} + 2NH_{3(aq)} \longrightarrow (NH_4)_2SO_{4(aq)}$

$V = 50.0\,mL$ $V = 24.4\,mL$

$C = ?$ $C = 2.20\,mol/L$

Step 1: Moles Known

$$0.0244\,L\ NH_3 \times \frac{2.20\,mol\ NH_3}{1\,L\ NH_3} = 0.05368\,mol\ NH_3$$

Step 2: Moles Unknown

$$0.05368\,mol\ NH_3 \times \frac{1\,mol\ H_2SO_4}{2\,mol\ NH_3} = 0.02684\,mol\ H_2SO_4$$

Step 3: Concentration Unknown

$$C = \frac{n}{V} = \frac{0.02684\,mol\ H_2SO_4}{0.0500\,L\ H_2SO_4} = 0.537\,mol/L$$

$$0.02684\,mol\ H_2SO_4 \times \frac{1}{0.0500\,L\ H_2SO_4}$$

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