8. **Determine the limiting reactant if you begin with 75.0 grams of each reactant.**

$$2\ Al(OH)_3 + 3\ H_2SO_4 \rightarrow 1\ Al_2(SO_4)_3 + 6\ H_2O$$

$$\frac{75.0\ g\ Al(OH)_3}{1}\left|\frac{1\ mole\ Al(OH)_3}{78\ g\ Al(OH)_3}\right|\frac{1\ mole\ Al_2(SO_4)_3}{2\ mole\ Al(OH)_3}\left|\frac{342\ g\ \ Al_2(SO_4)_3}{1\ mole\ Al_2(SO_4)_3}\right| = 164\ g\ Al_2(SO_4)_3$$

Limiting Reactant

$$\frac{75.0\ g\ H_2SO_4}{1}\left|\frac{1\ mole\ H_2SO_4}{98\ g\ H_2SO_4}\right|\frac{1\ mole\ Al_2(SO_4)_3}{3\ mole\ H_2SO_4}\left|\frac{342\ g\ \ Al_2(SO_4)_3}{1\ mole\ Al_2(SO_4)_3}\right| = 87.2\ g\ Al_2(SO_4)_3$$

$$\frac{75.0\ g\ Al(OH)_3}{1}\left|\frac{1\ mole\ Al(OH)_3}{78\ g\ Al(OH)_3}\right|\frac{6\ mole\ H_2O}{2\ mole\ Al(OH)_3}\left|\frac{18\ g\ \ H_2O}{1\ mole\ H_2O}\right| = 51.9\ g\ H_2O$$

Limiting Reactant

$$\frac{75.0\ g\ H_2SO_4}{1}\left|\frac{1\ mole\ H_2SO_4}{98\ g\ H_2SO_4}\right|\frac{6\ mole\ H_2O}{3\ mole\ H_2SO_4}\left|\frac{18\ g\ \ H_2O}{1\ mole\ H_2O}\right| = 27.6\ g\ H_2O$$

9. **What is the theoretical yield of the neutralization reaction above?**

$87.2\ g\ Al_2(SO_4)_3$ or $27.6\ g\ H_2O$

10. **A student performed this reaction in the lab and collected 66.3 grams of aluminum sulfate and 21.9 grams of water. Based on the theoretical yield you found in Problem #2, what is the student's percent yield?**

$$\frac{66.3\ g\ Al_2(SO_4)_3}{87.2\ g\ Al_2(SO_4)_3} \times 100 = 76.0\ \%$$

$$\frac{21.9\ g\ H_2O}{27.6\ g\ H_2O} \times 100 = 79.3\ \%$$

Extra Credit: Calculate the amount of excess reactant leftover. (Worth 10 points)

$$\frac{75.0\ g\ H_2SO_4}{1}\left|\frac{1\ mole\ H_2SO_4}{98\ g\ H_2SO_4}\right|\frac{2\ mole\ Al(OH)_3}{3\ mole\ H_2SO_4}\left|\frac{78\ g\ Al(OH)_3}{1\ mole\ Al(OH)_3}\right| = 39.8\ g\ Al(OH)_3$$

$$75\ grams\ \ Al(OH)_3 - 39.8\ grams\ Al(OH)_3 = 35.2\ grams\ Al(OH)_3\ leftover$$