Key

Limiting Reatants and Theoretical Yield

1) **$2\ Al + 3\ S \rightarrow Al_2S_3$**

a. What is the limiting reactant if 3 moles of Al react with 3 moles of S? Which reactant is in excess?

$\frac{3\ mol\ Al}{2\ Al} \left| \frac{1\ Al_2S_3}{} \right. = 1.5\ mol\ Al_2S_3$ $\qquad$ $\frac{3\ mol\ S}{3\ S} \left| \frac{1\ Al_2S_3}{} \right. = 1\ mol\ Al_2S_3$

S is limiting produces less product so Al is excess

b. How many grams (theoretical yield) of aluminum sulfide can form?

$\frac{3\ mol\ S}{3\ S} \left| \frac{1\ Al_2S_3}{1\ mol\ Al_2S_3} \right| \frac{150.14\ g\ Al_2S_3}{} = 150.14\ g\ Al_2S_3$

2) **$2NaBr + 2H_2SO_4 + MnO_2 \rightarrow Br_2 + MnSO_4 + 2\ H_2O + Na_2SO_4$**

a. What is the limiting reactant when 2.10g of NaBr and 9.42 g of H_2SO_4 react? Which reactant is in excess? NaBr $\qquad$ H_2SO_4

$\frac{2.10\ g\ NaBr}{102.89\ g\ NaBr} \left| \frac{1\ mol\ NaBr}{2\ NaBr} \right| \frac{1\ Br_2}{} = \frac{.010\ mol\ Br_2}{} \left| \frac{159.8\ g\ Br_2}{1\ mol\ Br_2} \right. = 1.63\ g\ Br_2$

$\frac{9.42\ g\ H_2SO_4}{98\ g\ H_2SO_4} \left| \frac{1\ mol\ H_2SO_4}{2\ H_2SO_4} \right| \frac{1\ Br_2}{} = \frac{.048\ mol\ Br_2}{} \left| \frac{159.8\ g\ Br_2}{1\ mol\ Br_2} \right. = 7.67\ g\ Br_2$

b. What is the theoretical yield of bromine could be produced ?

3) a. If 4.44 grams of CaO are mixed with 7.77 grams of water, how many grams(theoretical yield) of calcium hydroxide form? (You will need to write the balanced equation first; HINT: synthesis reaction) then (HINT, HINT: Determine which reactant is the limiting)

$CaO + H_2O \rightarrow Ca(OH)_2$

$\frac{7.77\ g\ H_2O}{18.02\ g\ H_2O} \left| \frac{1\ mol\ H_2O}{1\ H_2O} \right| \frac{1\ Ca(OH)_2}{} = \frac{.432\ mol\ Ca(OH)_2}{} \left| \frac{74\ g\ Ca(OH)_2}{1\ mol\ Ca(OH)_2} \right. = 31.9\ g\ Ca(OH)_2$

$\frac{4.44\ g\ CaO}{56\ g\ CaO} \left| \frac{1\ mol\ CaO}{1\ CaO} \right| \frac{1\ Ca(OH)_2}{} = \frac{.0792\ mol\ Ca(OH)_2}{} \left| \frac{74\ g\ Ca(OH)_2}{1\ mol\ Ca(OH)_2} \right. = 5.86\ g\ Ca(OH)_2$

b. How much of the excess reactant remains after reaction is complete?

LR → ER

$\frac{4.44\ g\ CaO}{56\ g\ CaO} \left| \frac{1\ mol\ CaO}{1\ CaO} \right| \frac{1\ H_2O}{} \left| \frac{18\ g\ H_2O}{1\ mol\ H_2O} \right. = 1.43\ g\ H_2O$ ← used

$7.77 - 1.43\ g = 6.34\ g\ H_2O$ excess

have $\qquad$ used