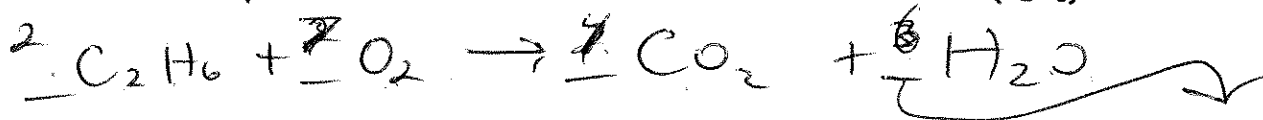


## Mole Ratios

1. a. Write the equation for the reaction of the combustion of ethane ( $C_2H_6$ ).



b. What is the mole ratio of  $O_2$  to  $CO_2$ ?

$$7:4$$

6 moles  
of  $H_2O$

c. What is the mole ratio of  $CO_2$  to  $H_2O$ ?

$$4:6$$

d. How many moles of  $C_2H_6$  are used up when 2.50 moles of  $H_2O$  are produced?

$$2.50 \text{ mol } H_2O \left( \frac{2 \text{ mol } C_2H_6}{6 \text{ mol } H_2O} \right) = 0.83333 \text{ mol } C_2H_6$$

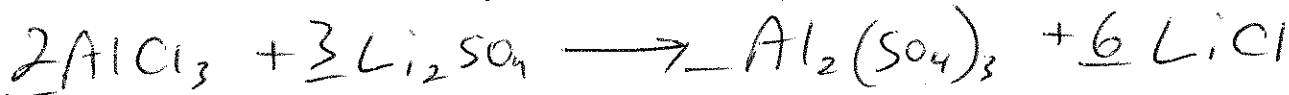
$= 0.833 \text{ mol } C_2H_6$

e. How many moles of  $CO_2$  are produced when 6.89 moles of  $O_2$  are used?

$$6.89 \text{ mol } O_2 \left( \frac{4 \text{ mol } CO_2}{7 \text{ mol } O_2} \right) = 3.937142857 \text{ mol } CO_2$$

$= 3.94 \text{ mol } CO_2$

2. a. Write and balance the equation for the reaction of aluminum chloride and lithium sulfate.



b. What is the mole ratio of aluminum chloride to aluminum sulfate?

$$2:1$$

c. What is the mole ratio of aluminum chloride to lithium sulfate?

$$2:3$$

d. How many moles of aluminum sulfate are produced in a complete reaction of 0.367 moles of lithium sulfate?

$$0.367 \text{ mol } Li_2SO_4 \left( \frac{1 \text{ mol } Al_2(SO_4)_3}{3 \text{ mol } Li_2SO_4} \right) = 0.122333 \text{ mol } Al_2(SO_4)_3$$

$= 0.122 \text{ mol } Al_2(SO_4)_3$

e. How many moles of lithium sulfate are used up when 1.89 moles of lithium chloride react?

$$1.89 \text{ mol } LiCl \left( \frac{3 \text{ mol } Li_2SO_4}{6 \text{ mol } LiCl} \right) = 0.945 \text{ mol } Li_2SO_4$$

$= 0.945 \text{ mol } Li_2SO_4$

f. How many grams of lithium sulfate are in the answer to letter e?

$$0.945 \text{ mol } Li_2SO_4 \left( \frac{109.9 \text{ g } Li_2SO_4}{1 \text{ mol } Li_2SO_4} \right) = 103.8555 \text{ g } Li_2SO_4$$

$= 104 \text{ g } Li_2SO_4$

KEY

Write the balanced equation and solve each of the following:

1. Aluminum metal and hydrogen chloride react to form aluminum chloride and hydrogen gas.



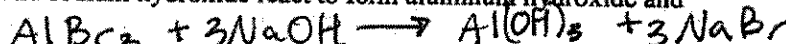
- a. How many moles of aluminum metal are needed to produce 3.33 moles of aluminum chloride?

$$3.33 \text{ mol AlCl}_3 \left( \frac{2 \text{ mol Al}}{2 \text{ mol AlCl}_3} \right) = \boxed{3.33 \text{ mol Al}}$$

- b. How many moles of hydrogen chloride are needed to react with this number of moles of aluminum metal?

$$3.33 \text{ mol Al} \left( \frac{6 \text{ mol HCl}}{2 \text{ mol Al}} \right) = \boxed{9.99 \text{ mol HCl}}$$

2. Aluminum bromide and sodium hydroxide react to form aluminum hydroxide and sodium bromide.



- a. How many moles of sodium bromide can be formed from 1.55 moles of aluminum bromide?

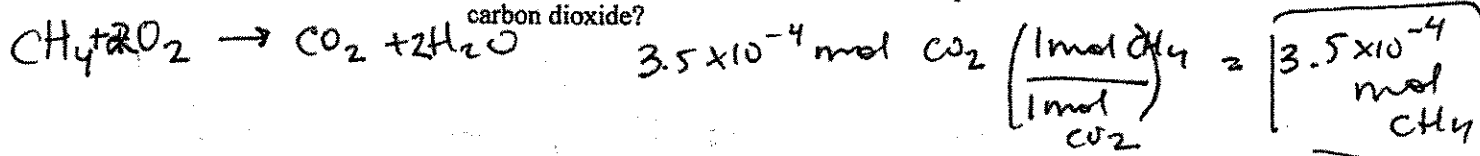
$$1.55 \text{ mol AlBr}_3 \left( \frac{3 \text{ NaBr}}{1 \text{ mol AlBr}_3} \right) = \boxed{4.65 \text{ mol NaBr}}$$

- b. How many moles of aluminum hydroxide may be formed from 4.65 moles of sodium hydroxide?

$$4.65 \text{ mol NaOH} \left( \frac{1 \text{ mol Al(OH)}_3}{3 \text{ mol NaOH}} \right) = \boxed{1.55 \text{ mol Al(OH)}_3}$$

3. Methane gas (carbon tetrahydride) reacts with oxygen by combustion.

- a. How many moles of methane are needed to produce
- $3.5 \times 10^{-4}$
- moles of carbon dioxide?



- b. How many moles of oxygen are needed to react to form the
- $3.5 \times 10^{-4}$
- moles of carbon dioxide?

$$3.5 \times 10^{-4} \text{ mol CO}_2 \left( \frac{2 \text{ mol O}_2}{1 \text{ mol CO}_2} \right) = \boxed{7 \times 10^{-4} \text{ mol O}_2}$$

- c. How many moles of atoms of oxygen would there be in your answer to question #3b?

$$7 \times 10^{-4} \text{ mol O}_2 \left( \frac{6.02 \times 10^{23} \text{ atoms}}{1 \text{ mol}} \right) \left( \frac{2 \text{ O atoms}}{1 \text{ O}_2} \right) = \boxed{8.428 \times 10^{20}}$$