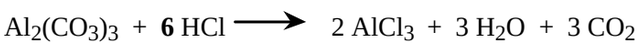
Chapter 3 Review Problem Answers

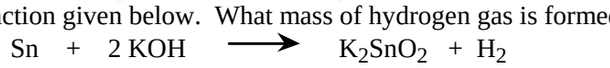
1. Balance the following equation:



$Al_2(CO_3)_3 + \mathbf{6}\ HCl \longrightarrow 2\ AlCl_3 + 3\ H_2O + 3\ CO_2$

The coefficient in front of the reactant hydrochloric acid is **6**.

2. A mixture containing 59.35 (0.500 mol) g of tin and 14.03 (0.25 mol) g of potassium hydroxide is allowed to react according to the reaction given below. What mass of hydrogen gas is formed?



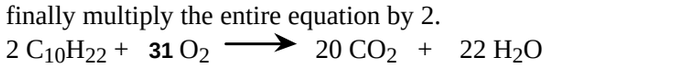
$Sn + 2\ KOH \longrightarrow K_2SnO_2 + H_2$

Limiting Reactant

$0.25\ mol\ KOH \times \frac{1\ mol\ H_2}{2KOH} = 0.125\ mol\ H_2 \times \frac{2.016\ g\ H_2}{1\ mol\ H_2} = \mathbf{0.252\ g\ H_2}$

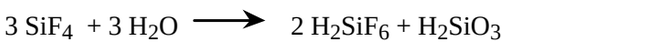
3. What is the coefficient in front of O_2 when the equation below is balanced? **31**

$C_{10}H_{22} + \frac{31}{2}\ O_2 \longrightarrow 10\ CO_2 + 11\ H_2O$ First balance C and H, then balance O using a fraction for the coefficient, finally multiply the entire equation by 2.



$2\ C_{10}H_{22} + \mathbf{31}\ O_2 \longrightarrow 20\ CO_2 + 22\ H_2O$

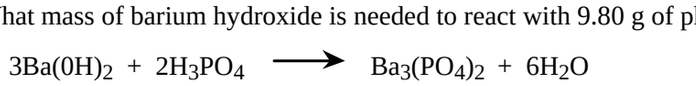
4. How many moles of H_2SiF_6 will be produced when 6.00 mol of H_20 are consumed?



$3\ SiF_4 + 3\ H_2O \longrightarrow 2\ H_2SiF_6 + H_2SiO_3$

$6.00\ mol\ H_20 \times \frac{2\ mol\ H_2SiF_6}{3\ mol\ H_2O} = \mathbf{4.00\ mol\ H_2SiF_6}$

5. What mass of barium hydroxide is needed to react with 9.80 g of phosphoric acid?



$3Ba(0H)_2 + 2H_3PO_4 \longrightarrow Ba_3(PO_4)_2 + 6H_2O$

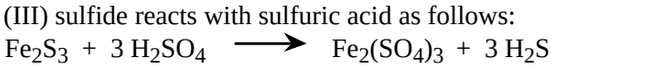
$9.80\ g\ H_3PO_4 \times \frac{1\ mol\ H_3PO_4}{98\ g\ H_3PO_4} \times \frac{3\ mol\ Ba(0H)_2}{2\ mol\ H_3PO_4} \times \frac{171.3\ g\ Ba(0H)_2}{1\ mol\ Ba(0H)_2} = \mathbf{25.7\ g\ Ba(0H)_2}$

6. How many moles of oxygen are consumed when 2.50 mol of propane are combusted?

$C_3H_8 + 5\ O_2 \longrightarrow 3CO_2 + 4H_2O$

$2.50\ mol\ C_3H_8 \times \frac{5\ mol\ O_2}{1\ mol\ C_3H_8} = \mathbf{12.5\ mol\ O_2}$

7. Iron (III) sulfide reacts with sulfuric acid as follows:



$Fe_2S_3 + 3\ H_2SO_4 \longrightarrow Fe_2(SO_4)_3 + 3\ H_2S$

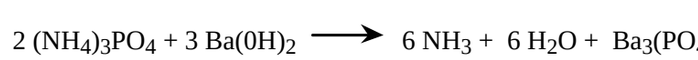
$49.0\ g\ H_2SO_4 \times \frac{1\ mol\ H_2SO_4}{98.08\ g} = 0.500\ mol\ H_2SO_4$ (Limiting Reactant)

$207.9\ g\ Fe_2S_3 \times \frac{1\ mol\ Fe_2S_3}{207.89\ g} = 1.00\ mol\ Fe_2S_3$

$0.500\ mol\ H_2SO_4 \times \frac{3\ mol\ H_2S}{3\ mol\ H_2SO_4} \times \frac{34.08\ g\ H_2S}{1\ mol\ H_2S} = \mathbf{17.0\ g\ H_2S}$

When 49.0 g sulfuric acid reacts with 207.9 g of iron (III) sulfide the limiting reactant is **sulfuric acid** and **17.0 g H_2S**g of hydrogen sulfide will be formed

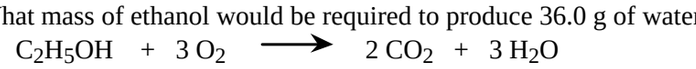
8. What mass (grams) of barium hydroxide would be required to make 15.0 grains of ammonia? (1 g = 15.4 grains)



$2\ (NH_4)_3PO_4 + 3\ Ba(0H)_2 \longrightarrow 6\ NH_3 + 6\ H_2O + Ba_3(PO_4)_2$

$15.0\ NH_3\ grains \times \frac{1\ g}{15.4\ grains} \times \frac{1\ mol\ NH_3}{17.03\ g\ NH_3} \times \frac{3\ mol\ Ba(0H)_2}{6\ mol\ NH_3} \times \frac{171.3\ g}{1\ mol\ Ba(0H)_2} = \mathbf{4.90\ g\ Ba(0H)_2}$

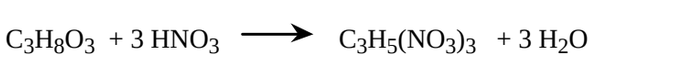
9. What mass of ethanol would be required to produce 36.0 g of water?



$C_2H_5OH + 3\ O_2 \longrightarrow 2\ CO_2 + 3\ H_2O$

$36.0\ g\ H_2O \times \frac{1\ mol\ H_2O}{18.02\ g\ H_2O} \times \frac{1\ mol\ C_2H_5OH}{3\ mo\ H_2O} \times \frac{46.07}{1\ mol\ C_2H_5OH} = \mathbf{30.7\ g\ C_2H_5OH}$

10. The reaction of 9.21 g of glycerin ($C_3H_8O_3$), with an excess of nitric acid resulted in the production of 17.0 g of the explosive, nitroglycerine. What is the percent yield?



$C_3H_8O_3 + 3\ HNO_3 \longrightarrow C_3H_5(NO_3)_3 + 3\ H_2O$

$9.21\ g\ C_3H_8O_3 \times \frac{1\ mol\ C_3H_8O_3}{92.09\ g\ C_3H_8O_3} \times \frac{1\ mol\ C_3H_5(NO_3)_3}{1\ mol\ C_3H_8O_3} \times \frac{227.09\ g\ C_3H_5(NO_3)_3}{1\ mol\ C_3H_5(NO_3)_3} = 22.7\ g\ C_3H_5(NO_3)_3$

(Theoretical Yield)

$\frac{17.0\ g\ C_3H_5(NO_3)_3\ \textbf{(actual yield)}}{22.7\ g\ C_3H_5(NO_3)_3\ \textbf{(Theoretical Yield)}} \times \mathbf{100\% = 74.9\ \%}$