Practice Sheet Stoichiometry key

1. Ammonia (NH3) and oxygen gas react to form nitrogen and water.

4 NH3(g) + 3 O2(g) 🡪 2 N2(g) + 6 H2O(g)

* 1. .How many moles of oxygen gas are required to completely react with 8.24 moles of ammonia?

$$?mol O\_{2}=8.24 mol NH\_{3}×\frac{3 mol O\_{2}}{4 mol NH\_{3} }=6.18 mol O\_{2}$$

* 1. Calculate the mass of nitrogen gas that will be formed from the reaction of 3.97 grams of ammonia with excess oxygen gas?

$$?g N\_{2}=3.97 g NH\_{3}×\frac{1 mol NH\_{3}}{17.03 g NH\_{3}} ×\frac{2 mol N\_{2}}{4 mol NH\_{3}}×\frac{28.02 gN\_{2} }{1 mol N\_{2}}=3.27 g N\_{2}$$

* 1. How many molecules of water will result from the reaction of 4.51 moles of oxygen gas with excel ammonia?

$$?molecule H\_{2}O=4.51 mol ×\frac{6 mol H\_{2}O}{3 mol O\_{2} }×\frac{6.022×10^{23}molecule H\_{2}O}{1 mol H\_{2}O}=6.43×10^{24}molecule H\_{2}O$$

* 1. If 6.00 g of ammonia and 6.00 g of oxygen gas are put into a reaction vessel and allowed to react, how many grams of nitrogen gas will result?

$$?g N\_{2}=6.00 g NH\_{3}×\frac{1 mol NH\_{3}}{17.03 g NH\_{3}} ×\frac{2 mol N\_{2}}{4 mol NH\_{3}}×\frac{28.02 gN\_{2} }{1 mol N\_{2}}=4.94 g N\_{2}$$

$$?g N\_{2}=6.00 g O\_{2}×\frac{1 mol O\_{2}}{32.00 g O\_{2}} ×\frac{2 mol N\_{2}}{3 mol O\_{2}}×\frac{28.02 gN\_{2} }{1 mol N\_{2}}=3.50 g N\_{2}$$

* 1. If 3.34 g of nitrogen gas are recovered from the reaction in part d above, what is the percent yield of the reaction?

$$\% yield=\left(\frac{actual mass}{theoretical mass}\right)×100\%=\left(\frac{3.34 g N\_{2}}{3.50 g N\_{2}}\right)×100\%=95.4\% yield$$

1. Given the following balanced equation, answer the questions below:

4 Al*(s)* + 3 O2*(g)* 🡪 2 Al2O3*(s)*

* 1. How many formula units of Al2O3 will be produced by the reaction of 18 molecules of O2 with excess Al?

$$?units Al\_{2}O\_{3}=18 molec O\_{2}×\frac{2 units Al\_{2}O\_{3} }{3 molec O\_{2}}=12 units Al\_{2}O\_{3}$$

* 1. How many moles of O2 are required to react with 8.36 moles of aluminum?

$$?mol O\_{2}=8.36 mol Al×\frac{3 mol O\_{2}}{4 mol Al}=6.27 mol O\_{2} $$

* 1. How many grams of aluminum oxide will be formed by the reaction of 5.99 g of Al with excess O2?

$$?g Al\_{2}O\_{3}=5.99 g Al×\frac{1 mol Al}{26.98 g Al}×\frac{2 mol Al\_{2}O\_{3}}{4 mol Al}×\frac{101.96 g Al\_{2}O\_{3}}{1 mol Al\_{2}O\_{3}}=11.3 g Al\_{2}O\_{3} $$

* 1. How many molecules of oxygen gas (O2) are required to make 24.8 grams of Al2O3?

$$?molec O\_{2}=24.8 g Al\_{2}O\_{3}×\frac{1 mol Al\_{2}O\_{3}}{101.96 g Al\_{2}O\_{3}}×\frac{3 mol O\_{2} }{2 mol Al\_{2}O\_{3}}×\frac{6.02×10^{23}molec O\_{2}}{1 mol O\_{2}}=2.20×10^{23}molec O\_{2} $$

* 1. If 70.0 grams of aluminum oxide are formed from the reaction of 40.0 grams of aluminum and 40.0 grams of oxygen gas, what is the percent yield?

$$?g Al\_{2}O\_{3}=40.0 g Al×\frac{1 mol Al}{26.98 g Al}×\frac{2 mol Al\_{2}O\_{3}}{4 mol Al}×\frac{101.96 g Al\_{2}O\_{3}}{1 mol Al\_{2}O\_{3}}=75.6 g Al\_{2}O\_{3}$$

$$?g Al\_{2}O\_{3}=40.0 g O\_{2}×\frac{1 mol O\_{2}}{16.00 g O\_{2}}×\frac{2 mol Al\_{2}O\_{3}}{3 mol O\_{2}}×\frac{101.96 g Al\_{2}O\_{3}}{1 mol Al\_{2}O\_{3}}=85.0 g Al\_{2}O\_{3}$$

$$\% yield=\left(\frac{70.0 g Al\_{2}O\_{3} }{75.6 g Al\_{2}O\_{3}}\right)×100=92.6\% Al\_{2}O\_{3}$$