

NAME

Key

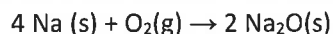
CHEM 1301

Stoichiometry HMWK #10

Print this document 1 page per sheet in portrait orientation. Double sided or single sided are acceptable.

▪ **Moles to Moles**

Use the following reaction to answer the following questions. None of the problems are connected, so don't carry information from one problem to another!



1. For the reaction shown, calculate how many moles of Na_2O are formed when 0.967 moles of Na are reacted in the following reaction.

$$0.967 \text{ mol Na} \left(\frac{2 \text{ mol Na}_2\text{O}}{4 \text{ mol Na}} \right) = \boxed{0.484 \text{ mol Na}_2\text{O}}$$

2. When 2.19 moles of Na are reacted, how many moles of O_2 also react?

$$2.19 \text{ mol Na} \left(\frac{1 \text{ mol O}_2}{4 \text{ mol Na}} \right) = \boxed{0.548 \text{ mol O}_2}$$

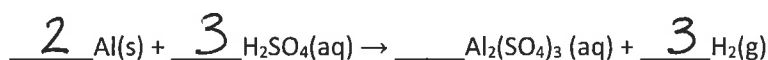
3. If you form 8.6943 mol Na_2O , how many moles of Na and how many moles of O_2 were reacted?

$$8.6943 \text{ mol Na}_2\text{O} \left(\frac{4 \text{ mol Na}}{2 \text{ mol Na}_2\text{O}} \right) = \boxed{17.389 \text{ mol Na}}$$

$$8.6943 \text{ mol Na}_2\text{O} \left(\frac{1 \text{ mol O}_2}{2 \text{ mol Na}_2\text{O}} \right) = \boxed{4.3472 \text{ mol O}_2}$$

▪ **Mass-to-mass Stoichiometry**

Refer to the following reaction to answer the next set of problems. (Balance the reaction before you start!)



1. A) How many grams of aluminum can be reacted using 23.65 g H₂SO₄?

$$23.65 \text{ g H}_2\text{SO}_4 \left(\frac{1 \text{ mol H}_2\text{SO}_4}{98.08 \text{ g H}_2\text{SO}_4} \right) \left(\frac{2 \text{ mol Al}}{3 \text{ mol H}_2\text{SO}_4} \right) \left(\frac{26.96 \text{ g Al}}{1 \text{ mol Al}} \right)$$

$$= 4.334 \text{ g Al}$$

- B) As the reaction in part A progresses, how many grams of H₂ gas are produced?

$$23.65 \text{ g H}_2\text{SO}_4 \left(\frac{1 \text{ mol H}_2\text{SO}_4}{98.08 \text{ g H}_2\text{SO}_4} \right) \left(\frac{3 \text{ mol H}_2}{3 \text{ mol H}_2\text{SO}_4} \right) \left(\frac{2.02 \text{ g H}_2}{1 \text{ mol H}_2} \right)$$

$$= 0.4871 \text{ g H}_2$$

2. In a completely separate setup, I need to make 10.00g Al₂(SO₄)₃. How many grams of Al should I begin the reaction with?

$$10.00 \text{ g Al}_2\text{(SO}_4\text{)}_3 \left(\frac{1 \text{ mol Al}_2\text{(SO}_4\text{)}_3}{342.1 \text{ g Al}_2\text{(SO}_4\text{)}_3} \right) \left(\frac{2 \text{ mol Al}}{1 \text{ mol Al}_2\text{(SO}_4\text{)}_3} \right) \left(\frac{26.96 \text{ g Al}}{1 \text{ mol Al}} \right)$$

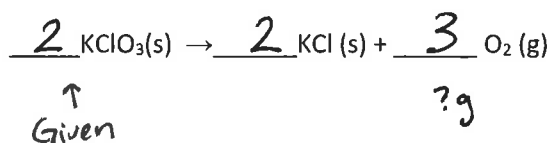
$$= 1.576 \text{ g Al}$$

3. If I begin with 9.72 mol H₂SO₄, how many grams of H₂ can I make?

$$9.72 \text{ mol H}_2\text{SO}_4 \left(\frac{3 \text{ mol H}_2}{3 \text{ mol H}_2\text{SO}_4} \right) \left(\frac{2.02 \text{ g H}_2}{1 \text{ mol H}_2} \right)$$

$$= 19.6 \text{ g H}_2$$

4. For the reaction shown, calculate how many grams of oxygen form when each quantity of reactants completely reacts.



- A) 2.97 g KClO₃

$$2.97 \text{g KClO}_3 \left(\frac{1 \text{ mol KClO}_3}{122.55 \text{g KClO}_3} \right) \left(\frac{3 \text{ mol O}_2}{2 \text{ mol KClO}_3} \right) \left(\frac{32 \text{g O}_2}{1 \text{ mol O}_2} \right) = 1.14 \text{g O}_2$$

- B) 0.7541 g KClO₃

$$0.7541 \text{g KClO}_3 \left(\frac{1 \text{ mol KClO}_3}{122.55 \text{g}} \right) \left(\frac{3 \text{ mol O}_2}{2 \text{ mol KClO}_3} \right) \left(\frac{32 \text{g O}_2}{1 \text{ mol O}_2} \right) = 0.2954 \text{g O}_2$$

- C) 15.69 kg KClO₃ (NOTE THE kg!!)

$$\hookrightarrow 1.569 \times 10^4 \text{g KClO}_3$$

same method as A+B

$$= 6.145 \times 10^3 \text{g O}_2$$

- D) How many grams of KCl will also form when 0.7541g KClO₃ react? (Same mass as Part B)

$$0.7541 \text{g KClO}_3 \left(\frac{1 \text{ mol KClO}_3}{122.55 \text{g}} \right) \left(\frac{2 \text{ mol KCl}}{2 \text{ mol KClO}_3} \right) \left(\frac{74.55 \text{g KCl}}{1 \text{ mol KCl}} \right) = 0.4587 \text{g KCl}$$

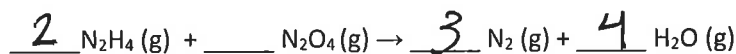
- E) Use your answer for parts B and D to show that you have not violated the Law of Mass Conservation. (Add the masses of the 2 products that you calculated, is this equal to the mass of the reactant you began with?)

$$0.4587 \text{g KCl} + 0.2954 \text{g O}_2 = 0.7541 \text{g KClO}_3$$

P mass = R mass
✓ COM

▪ Theoretical Yield/Percent Yield

1. Consider the reaction below:



A) A reaction initially contains 5.27g of N_2H_4 , and excess N_2O_4 . What is the theoretical yield of N_2 for the reaction?

$$5.27 \text{g N}_2\text{H}_4 \left(\frac{1 \text{ mol N}_2\text{H}_4}{32.06 \text{g}} \right) \left(\frac{3 \text{ mol N}_2}{2 \text{ mol N}_2\text{H}_4} \right) \left(\frac{28.02 \text{g N}_2}{1 \text{ mol N}_2} \right) = \boxed{6.91 \text{ g N}_2}$$

B) You recover 4.95g of N_2 at the end of the reaction. What is the percent yield for the reaction?

$$\frac{4.95 \text{g N}_2}{6.91 \text{g N}_2} \times 100\% = \boxed{71.6\%}$$

2. A scientist calculated that he should make ^{TY} 20.32g of a drug he is synthesizing from a reaction. The known percent yield of the reaction is 64.23%. How much of the drug can he expect to recover at the end of his reaction?

$$64.23\% = \frac{\text{AY}}{\text{TY}} \times 100\%$$

K 20.32g

$$.6423 = \frac{\text{AY}}{20.32\text{g}} \quad \text{AY} = \boxed{13.05 \text{g Drug}}$$

3. A different scientist calculated that she should synthesize 8.54g of her product but only recovers ^{TY} 2.98g of it. What is the percent yield of the reaction?

AY

$$\frac{2.98 \text{g}}{8.54 \text{g}} \times 100 = \boxed{34.9\%}$$