**Unit 6 – Chemical Calculations Notes**

**Introduction**

**✓** How do manufacturers know how to make enough of their desired products?

Watch the following videos:

“How Do Airbags Work” <https://www.youtube.com/watch?v=ysGS-_6E80s>

“How far can an Airbag Launch a Football?” <https://www.youtube.com/watch?v=fgLfhInA6-c>

**✓** What can happen if they use too much starting material (reactants)?

**✓** What can happen if they use to little starting material (reactants)?

**Learning Target:**

I will be able to:

**Stoichiometry – Chemical Calculations**

**mole ratio:**

In chemical calculations, are used to convert between a to .

Look at the balanced equation for production of ammonia:

N2(*g*) + 3H2(*g*) → 2NH3(*g*)

Three different mole ratios can be derived from this balanced equation.

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**Mole to Mole Calculations**

In the mole ratio below, ***W*** is the , wanted quantity and ***G*** is the .

The values of ***a*** and ***b*** are the from the .

The general solution for a mole-mole problem is given by:

x =

**Calculating Moles of a Product**

**Problem:** How many moles of NH3 are produced when **0.60 mol of nitrogen** reacts with hydrogen?

**N2**(*g*) + 3H2(*g*) → **2NH3**(*g*)

x =

**Mass-Mass Calculations**

In the laboratory the is usually determined by .

If we know the of a reactant or product, then the mass of .

If a given sample ( ) is measured in grams, it can be by using the .

The from the can be used to calculate the .

If it is the that needs to be determined, the number of moles of the unknown can be .

**Steps for Solving a Mass-Mass Problem**

Change the **mass of *G*** to **moles of *G*** (mass *G* → mol *G*) by using the **molar mass of *G****.*

x =

Change the **moles of G** to **moles of W** (mol G → mol W ) by using the **mole ratio from the balanced equation**.

x =

Change the **moles of *W*** to **grams of *W*** (mol *W* → mass *W* ) by using the **molar mass of *W***.

x =

Another way to represent the steps for doing mole-mass and mass-mole stoichiometric calculations is shown here:

For a problem, the **first** conversion is skipped.

For a problem, the **last** conversion is skipped.



**Calculating the Mass of a Product**

**Calculate the number of grams of NH3** produced by the reaction of **5.40 g of hydrogen** with an excess of nitrogen. The balanced equation is:

N2(g) + **3H2**(g) → **2NH3**(g)

x x x =

 given quantity change given unit to moles mole ratio change moles to grams

**Other Stoichiometric Calculations**

In a typical stoichiometric problem:

1. The given quantity is .
2. Then, the is used to calculate the .
3. Finally, the moles are converted to related to the unit mole, .

The mole-mass relationship gives you two conversion factors.

and

Summary of steps for typical stoichiometric problems:



**✓** How many molecules of oxygen are produced when 29.2 g of H2O is decomposed by electrolysis?

2H2O 🠆 2H2 + O2

x x x =

**Volume to Volume Calculations**

 and combine to form the brown gas , which contributes to .

**✓** How many liters of nitrogen dioxide are produced when 34 L of oxygen react with an excess of nitrogen monoxide? Assume conditions are at STP.

2NO(*g*) + O2(*g*) → 2NO2(*g*)

x x x =

**The Mole and Quantifying Matter**

 from the balanced equation are used to calculate the amount of a in a chemical reaction from a given amount of .

**Stoichiometry – Chemical Calculations**

Determining the amount of chemicals needed to create a specific volume of a gas for an air bag: