**Ch. 9.1-9.3 Lecture Guide**

**H. Chemistry**

9.1

* **Review:**
  + Atoms are neither \_\_\_\_\_\_\_\_\_\_\_\_ nor \_\_\_\_\_\_\_\_\_\_\_\_\_ in a chemical reaction, they are only \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.
  + A \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ equation has the same number of each type of atom on both sides of a chemical equation.

**Ex) Information Conveyed by a Balanced Equation for the Production of Methanol**

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| --- | --- | --- |
| **CO (g) +** | **2H2 (g) →** | **CH3OH (l)** |
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9.2

* **Mole-Mole Relationships**
  + We can use a balanced chemical equation to predict the moles of products that a given number of moles of reactants will yield.
    - Ex) The following chemical reaction is the decomposition of 2 moles of water:
      * 2H2O (l) → 2H2 (g) + O­2 (g)
      * 2 moles of water → 2 moles of hydrogen gas + 1 mole of oxygen gas
  + **Question:** How many moles of hydrogen and oxygen gas would be produced from 4 moles of water?
    - Step 1: Multiply the entire equation by 2 to get 4 moles of water.
  + **Question:** How many moles of hydrogen and oxygen gas would be produced from 5.8 moles of water?
    - Step 1: Divide the entire equation by 2 to get a 1 in front of water.
    - Step 2: Multiply the entire equation by 5.8 to 5.8 moles of water.
* **Mole Ratios**
  + Ex) Methane burns in oxygen to form carbon dioxide and water according to the balanced equation: CH4 (g) + 2O2 (g) → CO2 (g) + 2 H2O (g). What number of moles of oxygen gas is required to react with 7.4 moles of methane?
    - Step 1: Create a conversion factor (mole ratio) using the original balanced chemical equation.
    - Step 2: Convert from moles of methane to moles of oxygen.

9.3

* **Mass Calculations**
  + In chemistry, we count by weighing. We know that 2 moles of oxygen atoms weighs approximately 32.00 grams. So how can we determine the amount of one chemical necessary to react with another chemical **in grams?**
  + Ex) For the balanced chemical equation: 2Al (s) + 3I2 (s) → 2AlI3 (s), what mass of I2 is necessary to react exactly with 35.0 g of aluminum?
    - Step 1: Set up a mole ratio of Al to I2 using the original balanced chemical equation.
    - Step 2: Therefore:
      * Moles of Al present x = Moles of I2 required
    - Step 3: Calculate the number of moles of Al present.

* + - Step 4: Calculate the number of moles of I2 required.

* + - Step 5 Calculate the number of grams of I2 required.
* This process of using a chemical equation to calculate the relative masses of reactants and products involved in a reaction is called **stoichiometry**.
  + Ex) Propane, C3H8, when used in fuel, reacts with oxygen to produce carbon dioxide and water according to the following unbalanced equation:

C3H8 (g) + O2 (g) → CO2 (g) + H2O (g)

What mass of carbon dioxide is produced when 96.1 g of propane reacts with sufficient oxygen?

* + - Step 1: Balance the chemical equation.
    - Step 2: Set up a mole ratio of C3H8 to CO­2 using the balanced equation.
    - Step 3: Therefore:
    - Step 4: Calculate the number of moles of C3H8.
    - Step 5: Calculate the number of moles of CO2 produced.
    - Step 6: Calculate the number of grams of CO­2 produced.
  + Calculate the mass of water formed by the complete reaction of 48.05 g of C3H8.
* **Comparing Two Reactions**
  + Ex) Baking soda, NaHCO3, is often used as an antacid. The balanced equation for this reaction is: NaHCO3 (s) + HCl (aq) → NaCl (aq) + H2O (l) + CO2 (g). Milk of magnesia, Mg(OH)2, is also used as an antacid. The balanced equation for this reaction is: Mg(OH)2 + 2HCl (aq) → 2H2O (l) + MgCl2 (aq). Which antacid can consume the most stomach acid, 1.00 g of NaHCO3 or 1.00 g of Mg(OH)2?
    - Step 1: Calculate the molar mass of NaHCO3.
    - Step 2: Determine the moles of NaHCO3
    - Step 3: Determine the moles of HCl neutralized by NaHCO3 using mole ratio.
    - Step 4: Calculate the molar mass of Mg(OH)2.
    - Step 5: Determine the moles of Mg(OH)2.
    - Step 6: Determine the moles of HCl neutralized by Mg(OH)2 using mole ratio.
    - Which antacid neutralizes more HCl?
* Homework: Pg. 269-270, q. 12, 16, 30, 32