**15.1 Calculations Based on Amount of a Reactant or Product.**

Given the amount of one substance in a chemical equation, the amounts of all other substances can be calculated, provided the equation is balanced.

 **Mass-mass Stoichiometry**

The following steps outline the process:

* Step 1: Write a balanced equation.
* Step 2: Calculate the amount (in mol) of the substance with the known mass

$$n= \frac{m}{M}$$

* Step 3: Use the mole ratio to calculate the amount (in mol) of the required substance
* Step 4: Calculate mass required

$$m=n ×M$$

Remember: To calculate the amount, in mol, it’s mass must be given in grams.

**Worked Examples**

1. **Iron rusts slowly in air and water. Using the equation for rusting, what is the mass of iron oxide when 120 g of iron reacts completely in air?**

**Step 1: 4Fe(s) + 3O2(g)  2Fe2O3(s)**

1. **A phosphorus manufacturer is to extract 1.00 tonnes of phosphorus per day by the process given in the equation:**

**2Ca3(PO4)2(s) + 6SiO2(s) + 10C(s) P4(s) + 10CO(g) + 6CaSiO3(s)**

**Calculate the mass required daily of: a) calcium phosphate and b) silicon dioxide**

**Stoichiometry Involving Solutions.**

The amount of reactant present in a solution can be determined from the volume of the solution used, and its concentration, by using the relationship:

 ***n*(mol) = *c* (mol L-1) x *V* (L)**

**Worked examples**

1. **Precipitation reactions occur when two solutions containing soluble reactants are mixed together to produce an insoluble product. This product is collected as a precipitate. What mass of barium sulfate is produced when 100 mL of a 1.52 M solution of barium nitrate reacts completely with a sodium sulfate solution?**

**Step 1: Write a balanced equation.**

1. **What volume of 0.100 M sulfuric acid reacts completely with 17.8 mL of 0.150 M potassium hydroxide?**

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