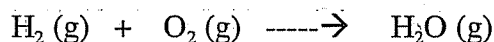


Stoichiometry: (Mass Relationships in Reactions)

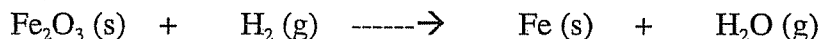
The mole to mole ratio in which substance react and are formed is called the stoichiometric ratio.

1. The balanced coefficients in a chemical equation give the mole to mole ratios in which substances react and are formed. Balance the following equation:



- a) If 2 molecules of H_2 react with 1 molecule of O_2 , _____ molecules of H_2O will be formed.
- b) If 4 molecules of H_2 react with 2 molecules of O_2 , _____ molecules of H_2O will be formed?
- c) To make 8 molecules of H_2O , _____ molecules of H_2 and _____ molecules of O_2 are required.
- d) If 12.04×10^{23} molecules of H_2 react with 6.02×10^{23} molecules of O_2 , _____ molecules of H_2O will be formed.
- e) If 4 moles of H_2 react with 2 moles of O_2 , _____ moles of H_2O will be formed.

2. This reaction is used to reduce iron from iron(III) oxide, and iron ore. Balance and answer the following questions:



- a) If 2 moles of Fe_2O_3 react with excess H_2 , _____ moles of Fe will be produced.
- b) If 4 moles of Fe_2O_3 react with excess H_2 , _____ moles of Fe will be produced.
- c) If 2 moles of Fe_2O_3 react with excess H_2 , _____ moles of H_2O will be produced.
- d) If 1.5 moles of Fe_2O_3 react with excess H_2 , _____ moles of Fe will be produced
- e) How many moles of Fe will be produced from 4.5 moles of H_2 reacting with Fe_2O_3 ?
- f) How many grams of Fe will be produced from 80.0 grams of Fe_2O_3 reacting with H_2 ?

3. Calculating the number of grams of product produced give you the **theoretical yield**. The theoretical yield is the amount of product that you should get assuming that everything goes perfectly in the lab and every atom is recovered. The percent yield is the ratio of the **experimental yield** (what was actually obtained) and the theoretical yield (what should have been obtained).

$$\text{Percent yield} = \frac{\text{experimental yield}}{\text{Theoretical yield}} \times 100\%$$

What would be the percent yield if a student recovered 6.5 grams of product in the lab, and theoretically should have made 7.2 grams?

4. Fertilizer factories produce ammonia (NH_3) by reacting hydrogen gas with nitrogen gas at high temperatures. If the plant uses 1 kg of nitrogen and has an experimental yield of 1.05 kg. Calculate the theoretical yield and the % yield for the factory.