

Quantitative Chemistry and Stoichiometry: For every problem you need to balance the equation correctly so that you can use the right mole ratios. If you are given amounts of both reactants, you need to find the limiting reactant. Remember that when gases are involved, there are 22.4 Liters in a mol of any gas at standard temperature and pressure (STP). If the reactions occur in solution the concentration is used as molarity (M) recall that molarity is the number of moles of solute in a liter of solution.

1) Calcium carbonate (CaCO_3) decomposes upon heating, producing calcium oxide and carbon dioxide gas.

- Write a balanced chemical equation for this reaction.
- How many grams of calcium oxide will be produced after 12.25 g of calcium carbonate is completely decomposed? (ans: 6.86 g CaO)
- What volume of carbon dioxide gas is produced from this amount of calcium carbonate, at STP? (ans: 2.94 L)

2) Hydrogen gas and bromine gas react to form hydrogen bromide gas.

- Write a balanced chemical equation for this reaction.
- 3.2 g of hydrogen gas and 9.5 g of bromine gas react. Which is the limiting reagent? (ans: Br_2)
- How many grams of hydrogen bromide gas can be produced using the amounts in (b)? (ans: 9.7 g HBr)
- How many grams of the excess reactant are left unreacted? (ans: 3.1 g)
- What volume of HBr , measured at STP, is produced in (b)? (ans: 2.7 L of HBr)

3) When ammonia gas (NH_3), oxygen gas and methane gas (CH_4) are combined, the products are hydrogen cyanide gas (HCN) and water.

- Write a balanced chemical equation for this reaction.
- Calculate the mass of each product produced when 225 g of oxygen gas is reacted with an excess of the other two reactants. (ans: 253.8 g H_2O and 127 g HCN)
- If the actual yield of the experiment in (b) is 105 g of HCN , calculate the percent yield. (ans: 82.7%)

4) When solutions of potassium iodide and lead (II) nitrate are combined, the products are potassium nitrate and bright yellow lead (II) iodide.

- Write a balanced equation for this reaction, including (aq) and (s).
- Calculate the mass of precipitate produced when 50.0mL of 0.45M potassium iodide solution and 75mL of 0.55M lead (II) nitrate solution are mixed. (ans: 5.2 g PbI_2)
- Calculate the volume of 0.50M potassium iodide required to react completely with 50.0mL of 0.50M lead (II) nitrate (ans: 100 mL)