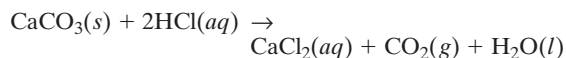


carbon dioxide, and water according to the following equation:



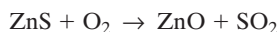
- What mass of HCl will be needed to produce 5.00×10^3 kg of CaCl_2 ?
 - What mass of CO_2 could be produced from the reaction of 750 g of CaCO_3 ?
- 197.** The fuel used to power the booster rockets on the space shuttle is a mixture of aluminum metal and ammonium perchlorate. The following balanced equation represents the reaction of these two ingredients:
- $$3\text{Al}(s) + 3\text{NH}_4\text{ClO}_4(s) \rightarrow \text{Al}_2\text{O}_3(s) + \text{AlCl}_3(g) + 3\text{NO}(g) + 6\text{H}_2\text{O}(g)$$
- If 1.50×10^5 g of Al react, what mass of NH_4ClO_4 , in grams, is required?
 - If aluminum reacts with 620 kg of NH_4ClO_4 , what mass of nitrogen monoxide is produced?
- 198.** Phosphoric acid is typically produced by the action of sulfuric acid on rock that has a high content of calcium phosphate according to the following equation:
- $$3\text{H}_2\text{SO}_4 + \text{Ca}_3(\text{PO}_4)_2 + 6\text{H}_2\text{O} \rightarrow 3[\text{CaSO}_4 \cdot 2\text{H}_2\text{O}] + 2\text{H}_3\text{PO}_4$$
- If 2.50×10^5 kg of H_2SO_4 react, how many moles of H_3PO_4 can be made?
 - What mass of calcium sulfate dihydrate is produced by the reaction of 400. kg of calcium phosphate?
 - If the rock being used contains 78.8% $\text{Ca}_3(\text{PO}_4)_2$, how many metric tons of H_3PO_4 can be produced from 68 metric tons of rock?
- 199.** Rusting of iron occurs in the presence of moisture according to the following equation:
- $$4\text{Fe}(s) + 3\text{O}_2(g) \rightarrow 2\text{Fe}_2\text{O}_3(s)$$
- Suppose that 3.19% of a heap of steel scrap with a mass of 1650 kg rusts in a year. What mass will the heap have after one year of rusting?

Limiting Reactants: Chap. 9, Sec. 3

- 200.** Aluminum oxidizes according to the following equation:
- $$4\text{Al} + 3\text{O}_2 \rightarrow 2\text{Al}_2\text{O}_3$$
- Powdered Al (0.048 mol) is placed into a container containing 0.030 mol O_2 . What is the limiting reactant?
- 201.** A process by which zirconium metal can be produced from the mineral zirconium(IV) orthosilicate, ZrSiO_4 , starts by reacting it with chlorine gas to form zirconium(IV) chloride:
- $$\text{ZrSiO}_4 + 2\text{Cl}_2 \rightarrow \text{ZrCl}_4 + \text{SiO}_2 + \text{O}_2$$
- What mass of ZrCl_4 can be produced if 862 g of ZrSiO_4 and 950. g of Cl_2 are available? You must first determine the limiting reactant.

Mixed Review

- 202.** Heating zinc sulfide in the presence of oxygen yields the following:



If 1.72 mol of ZnS is heated in the presence of 3.04 mol of O_2 , which reactant will be used up? Balance the equation first.

- 203.** Use the following equation for the oxidation of aluminum in the following problems:
- $$4\text{Al} + 3\text{O}_2 \rightarrow 2\text{Al}_2\text{O}_3$$
- Which reactant is limiting if 0.32 mol Al and 0.26 mol O_2 are available?
 - How many moles of Al_2O_3 are formed from the reaction of 6.38×10^{-3} mol of O_2 and 9.15×10^{-3} mol of Al?
 - If 3.17 g of Al and 2.55 g of O_2 are available, which reactant is limiting?
- 204.** In the production of copper from ore containing copper(II) sulfide, the ore is first roasted to change it to the oxide according to the following equation:
- $$2\text{CuS} + 3\text{O}_2 \rightarrow 2\text{CuO} + 2\text{SO}_2$$
- If 100 g of CuS and 56 g of O_2 are available, which reactant is limiting?
 - What mass of CuO can be formed from the reaction of 18.7 g of CuS and 12.0 g of O_2 ?
- 205.** A reaction such as the one shown here is often used to demonstrate a single-displacement reaction:
- $$3\text{CuSO}_4(aq) + 2\text{Fe}(s) \rightarrow 3\text{Cu}(s) + \text{Fe}_2(\text{SO}_4)_3(aq)$$
- If you place 0.092 mol of iron filings in a solution containing 0.158 mol of CuSO_4 , what is the limiting reactant? How many moles of Cu will be formed?
- 206.** In the reaction $\text{BaCO}_3 + 2\text{HNO}_3 \rightarrow \text{Ba}(\text{NO}_3)_2 + \text{CO}_2 + \text{H}_2\text{O}$, what mass of $\text{Ba}(\text{NO}_3)_2$ can be formed by combining 55 g BaCO_3 and 26 g HNO_3 ?
- 207.** Bromine replaces iodine in magnesium iodide by the following process:
- $$\text{MgI}_2 + \text{Br}_2 \rightarrow \text{MgBr}_2 + \text{I}_2$$
- Which is the excess reactant when 560 g of MgI_2 and 360 g of Br_2 react, and what mass remains?
 - What mass of I_2 is formed in the same process?
- 208.** Nickel replaces silver from silver nitrate in solution according to the following equation:
- $$2\text{AgNO}_3 + \text{Ni} \rightarrow 2\text{Ag} + \text{Ni}(\text{NO}_3)_2$$
- If you have 22.9 g of Ni and 112 g of AgNO_3 , which reactant is in excess?
 - What mass of nickel(II) nitrate would be produced given the quantities above?
- 209.** Carbon disulfide, CS_2 , is an important industrial substance. Its fumes can burn explosively in air to form sulfur dioxide and carbon dioxide:
- $$\text{CS}_2(g) + \text{O}_2(g) \rightarrow \text{SO}_2(g) + \text{CO}_2(g)$$
- If 1.60 mol of CS_2 burns with 5.60 mol of O_2 , how many moles of the excess reactant will still be present when the reaction is over?
- 210.** Although poisonous, mercury compounds were once used to kill bacteria in wounds and on the skin. One was called “ammoniated mercury” and is made from mercury(II) chloride according to the following equation:
- $$\text{HgCl}_2(aq) + 2\text{NH}_3(aq) \rightarrow \text{Hg}(\text{NH}_2)\text{Cl}(s) + \text{NH}_4\text{Cl}(aq)$$