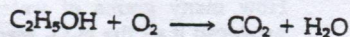


Solve problems **20 to 28 EVEN only**. You must show all work and circle your final answers.

**8-4 to 8-9 Stoichiometric Calculations and Limiting Reactant**

20. \*The alcohol component of gasohol burns according to the unbalanced equation



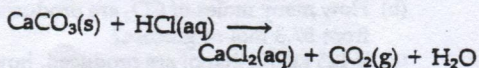
Balance the equation.

- How many moles of oxygen are needed to react with 52.6 g of  $\text{C}_2\text{H}_5\text{OH}$ ?
  - How many grams of oxygen are needed to react with 52.6 g of  $\text{C}_2\text{H}_5\text{OH}$ ?
  - How many grams of  $\text{CO}_2$  are formed when 52.6 g of  $\text{C}_2\text{H}_5\text{OH}$  react?
  - When 52.6 g of  $\text{C}_2\text{H}_5\text{OH}$  and 75.0 g of  $\text{O}_2$  react how many grams of  $\text{CO}_2$  are formed? (limiting reactant problem)
21. Nitrogen dioxide can form nitric acid by reacting with water as shown by the unbalanced equation



Balance the equation.

- How many grams of  $\text{HNO}_3$  can be formed from 50 mol of  $\text{NO}_2$ ?
  - How many grams of  $\text{H}_2\text{O}$  are needed to form 500 g of  $\text{HNO}_3$ ?
  - How many grams of  $\text{NO}_2$  are needed to form 250 g of  $\text{HNO}_3$ ?
  - When 125.0 g of  $\text{NO}_2$  and 95.0 g of water react how many grams of  $\text{HNO}_3$  can be formed? (limiting reactant problem)
22. \*Antacids containing  $\text{CaCO}_3$  react with "stomach acid" according to the equation

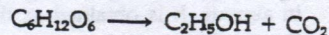


Balance the equation.

- How many grams of  $\text{CO}_2$  can be formed from 500 mg of  $\text{CaCO}_3$ ?
- How many moles of  $\text{HCl}$  are needed to react with 1.00 g of  $\text{CaCO}_3$ ?
- How many grams of  $\text{CaCO}_3$  are needed to produce 1200 mg of calcium ion?

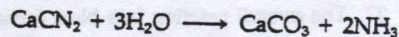
(Some people use  $\text{CaCO}_3$  as a supplemental Ca source.)

- How many grams of  $\text{CO}_2$  can be formed when 9.45 g of  $\text{HCl}$  and 28.4 g of  $\text{CaCO}_3$  react? (limiting reactant problem)
23. The fermentation of glucose to form ethyl alcohol or ethanol occurs according to the unbalanced equation

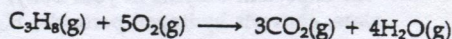


Balance the equation.

- How many grams of  $\text{C}_6\text{H}_{12}\text{O}_6$  are needed to form 500 g of ethyl alcohol?
  - How many moles of  $\text{CO}_2$  are produced when 10.0 g of  $\text{C}_6\text{H}_{12}\text{O}_6$  react?
  - How many grams of  $\text{C}_2\text{H}_5\text{OH}$  can be formed from 1.00 kg of  $\text{C}_6\text{H}_{12}\text{O}_6$ ?
24. \*Calcium cyanamide,  $\text{CaCN}_2$ , is used as a fertilizer. It reacts with water to form  $\text{CaCO}_3$  (which counteracts excess acidity in the soil) and ammonia,  $\text{NH}_3$  (which fertilizes the soil), according to the equation



- How many grams of  $\text{NH}_3$  can be formed from 1.00 mol of  $\text{CaCN}_2$ ?
  - How many grams of water are needed to produce 625 g of  $\text{NH}_3$ ?
  - How many grams of  $\text{CaCN}_2$  are needed to produce 500 kg of  $\text{NH}_3$ ?
  - If the  $\text{CaCN}_2$  used in the reaction is only 70% pure, the rest being inert impurities, how many kilograms of  $\text{NH}_3$  can be formed from 500 kg of impure  $\text{CaCN}_2$ ?
25. Propane undergoes combustion in air:



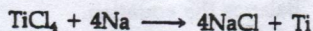
- How many moles of oxygen are needed to react with 12.5 mol of  $\text{C}_3\text{H}_8$ ?
- How many grams of  $\text{C}_3\text{H}_8$  react with 500 g of oxygen?

over →



25)

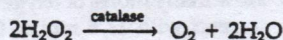
- (c) If a cylinder of propane contains 1.00 kg of  $C_3H_8$ , how many grams of  $CO_2$  are formed when it burns?
- (d) If a sample of impure propane contains 80% propane along with some chemically inert gases, how many grams of oxygen are needed to react with 470 g of the impure propane?
26. \*Titanium metal is used to make relatively lightweight but high-strength alloys used in aircraft. It is obtained as the metal by the reaction



- (a) How many moles of Ti are formed when 5.25 g of Na react?
- (b) How many grams of Ti can be formed from 296 g of  $TiCl_4$ ?
- (c) If you want to produce 10.0 kg of Ti, how many grams of Na are needed?
- (d) How many grams of NaCl are formed when 0.764 g of  $TiCl_4$  react?
- (e) How many grams of titanium can be formed when 500 g of  $TiCl_4$  and 250 g of Na react? (limiting reactant problem)
27. The overall reaction in a blast furnace is

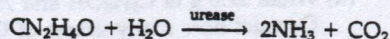


- (a) How many grams of  $Fe_2O_3$  are needed to produce 250 g of Fe?
- (b) How many kilograms of CO are needed to produce 375 kg of Fe?
- (c) If the iron ore is 72%  $Fe_2O_3$ , how many grams of Fe can be formed from 500 g of ore?
- (d) How many kilograms of Fe are formed when  $4.89 \times 10^4$  kg of  $Fe_2O_3$  and 935 kg of CO react? (limiting reactant problem)
28. \*An important enzyme in your body, catalase, converts hydrogen peroxide,  $H_2O_2$ , to oxygen and water.

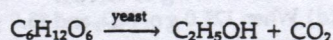


29)

- (a) How many grams of  $H_2O_2$  are converted if  $4.68 \times 10^{-6}$  mol of  $O_2$  are formed?
- (b) A single cell in your body can produce  $4.58 \times 10^{-12}$  g of hydrogen peroxide. How many grams of water will be produced if all the  $H_2O_2$  reacts?
- (c) How many moles of  $H_2O_2$  are required to produce 50 mg of water?
- (d) How many grams of  $O_2$  are formed when  $1.75 \times 10^{-9}$  g of  $H_2O_2$  react?
29. The enzyme urease, isolated from jack beans, catalyzes the decomposition of urea according to the following reaction.



- (a) How many grams of urea are needed to produce 28.35 g of  $NH_3$ ?
- (b) How many moles of water are required to react with 82.9 mg of urea?
- (c) How many grams of  $NH_3$  are produced from 5.50 g of urea?
- (d) How many grams of urea are needed to react with 0.604 g of water?
30. \*Wine can be made by fermenting sugar, such as glucose, by the action of enzymes found in yeast. The fermentation forms ethyl alcohol or ethanol and carbon dioxide.



Balance the equation.

- (a) How many grams of ethanol are produced from 99.5 g of glucose?
- (b) How many moles of  $CO_2$  are produced from 57.3 mol of glucose?
- (c) If 125 kg of ethanol are produced, how many kilograms of carbon dioxide are also produced?
31. An astronaut excretes about  $2.5 \times 10^3$  g of water a day. If lithium oxide is used in the spacecraft to absorb the water, how many kilograms of  $Li_2O$  must be included for a