

- c. What mass of ammonia will react with 2800 kg of H_3PO_4 ?
- 181.** The following reaction shows the synthesis of zinc citrate, a ingredient in toothpaste, from zinc carbonate and citric acid:
- $$3\text{ZnCO}_3(s) + 2\text{C}_6\text{H}_8\text{O}_7(aq) \rightarrow \text{Zn}_3(\text{C}_6\text{H}_5\text{O}_7)_2(aq) + 3\text{H}_2\text{O}(l) + 3\text{CO}_2(g)$$
- How many moles of ZnCO_3 and $\text{C}_6\text{H}_8\text{O}_7$ are required to produce 30.0 mol of $\text{Zn}_3(\text{C}_6\text{H}_5\text{O}_7)_2$?
 - What quantities, in kilograms, of H_2O and CO_2 are produced by the reaction of 500. mol of citric acid?
- 182.** Methyl butanoate, an oily substance with a strong fruity fragrance can be made by reacting butanoic acid with methanol according to the following equation:
- $$\text{C}_3\text{H}_7\text{COOH} + \text{CH}_3\text{OH} \rightarrow \text{C}_3\text{H}_7\text{COOCH}_3 + \text{H}_2\text{O}$$
- What mass of methyl butanoate is produced from the reaction of 52.5 g of butanoic acid?
 - In order to purify methyl butanoate, water must be removed. What mass of water is produced from the reaction of 5800. g of methanol?
- 183.** Ammonium nitrate decomposes to yield nitrogen gas, water, and oxygen gas in the following reaction:
- $$2\text{NH}_4\text{NO}_3 \rightarrow 2\text{N}_2 + \text{O}_2 + 4\text{H}_2\text{O}$$
- How many moles of nitrogen gas are produced when 36.0 g of NH_4NO_3 reacts?
 - If 7.35 mol of H_2O are produced in this reaction, what mass of NH_4NO_3 reacted?
- 184.** Lead(II) nitrate reacts with potassium iodide to produce lead(II) iodide and potassium nitrate. If 1.23 mg of lead nitrate are consumed, what is the mass of the potassium nitrate produced?
- 185.** A car battery produces electrical energy with the following chemical reaction:
- $$\text{Pb}(s) + \text{PbO}_2(s) + 2\text{H}_2\text{SO}_4(aq) \rightarrow 2\text{PbSO}_4(s) + 2\text{H}_2\text{O}(l)$$
- If the battery loses 0.34 kg of lead in this reaction, how many moles of lead(II) sulfate are produced?
- 186.** In a space shuttle, the CO_2 that the crew exhales is removed from the air by a reaction within canisters of lithium hydroxide. On average, each astronaut exhales about 20.0 mol of CO_2 daily. What mass of water will be produced when this amount reacts with LiOH ? The other product of the reaction is Li_2CO_3 .
- 187.** Water is sometimes removed from the products of a reaction by placing them in a closed container with excess P_4O_{10} . Water is absorbed by the following reaction:
- $$\text{P}_4\text{O}_{10} + 6\text{H}_2\text{O} \rightarrow 4\text{H}_3\text{PO}_4$$
- What mass of water can be absorbed by 1.00×10^2 g of P_4O_{10} ?
 - If the P_4O_{10} in the container absorbs 0.614 mol of water, what mass of H_3PO_4 is produced?
 - If the mass of the container of P_4O_{10} increases from 56.64 g to 63.70 g, how many moles of water are absorbed?
- 188.** Ethanol, $\text{C}_2\text{H}_5\text{OH}$, is considered a clean fuel because it burns in oxygen to produce carbon dioxide and water with few trace pollutants. If 95.0 g of H_2O are produced during the combustion of ethanol, how many grams of ethanol were present at the beginning of the reaction?
- 189.** Sulfur dioxide is one of the major contributors to acid rain. Sulfur dioxide can react with oxygen and water in the atmosphere to form sulfuric acid, as shown in the following equation:
- $$2\text{H}_2\text{O}(l) + \text{O}_2(g) + 2\text{SO}_2(g) \rightarrow 2\text{H}_2\text{SO}_4(aq)$$
- If 50.0 g of sulfur dioxide from pollutants reacts with water and oxygen found in the air, how many grams of sulfuric acid can be produced? How many grams of oxygen are used in the process?
- 190.** When heated, sodium bicarbonate, NaHCO_3 , decomposes into sodium carbonate, Na_2CO_3 , water, and carbon dioxide. If 5.00 g of NaHCO_3 decomposes, what is the mass of the carbon dioxide produced?
- 191.** A reaction between hydrazine, N_2H_4 , and dinitrogen tetroxide, N_2O_4 , has been used to launch rockets into space. The reaction produces nitrogen gas and water vapor.
- Write a balanced chemical equation for this reaction.
 - What is the mole ratio of N_2O_4 to N_2 ?
 - How many moles of N_2 will be produced if 20 000 mol of N_2H_4 are used by a rocket?
 - How many grams of H_2O are made when 450. kg of N_2O_4 are consumed?
- 192.** Joseph Priestley is credited with the discovery of oxygen. He produced O_2 by heating mercury(II) oxide, HgO , to decompose it into its elements. How many moles of oxygen could Priestley have produced if he had decomposed 517.84 g of mercury oxide?
- 193.** Iron(III) chloride, FeCl_3 , can be made by the reaction of iron with chlorine gas. How much iron, in grams, will be needed to completely react with 58.0 g of Cl_2 ?
- 194.** Sodium sulfide and cadmium nitrate undergo a double-displacement reaction as shown by the following equation:
- $$\text{Na}_2\text{S} + \text{Cd}(\text{NO}_3)_2 \rightarrow 2\text{NaNO}_3 + \text{CdS}$$
- What is the mass, in milligrams, of cadmium sulfide that can be made from 5.00 mg of sodium sulfide?
- 195.** Potassium permanganate and glycerin react explosively according to the following equation:
- $$14\text{KMnO}_4 + 4\text{C}_3\text{H}_5(\text{OH})_3 \rightarrow 7\text{K}_2\text{CO}_3 + 7\text{Mn}_2\text{O}_3 + 5\text{CO}_2 + 16\text{H}_2\text{O}$$
- How many moles of carbon dioxide can be produced from 4.44 mol of KMnO_4 ?
 - If 5.21 g of H_2O are produced, how many moles of glycerin, $\text{C}_3\text{H}_5(\text{OH})_3$, were used?
 - If 3.39 mol of potassium carbonate are made, how many grams of manganese(III) oxide are also made?
 - How many grams of glycerin will be needed to react with 50.0 g of KMnO_4 ? How many grams of CO_2 will be produced in the same reaction?
- 196.** Calcium carbonate found in limestone and marble reacts with hydrochloric acid to form calcium chloride,