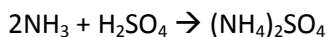
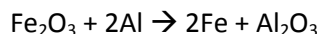


Stoichiometry Problems

1. How many moles of ammonium sulfate can be made from the reaction of 30.0 mol of NH₃ with H₂SO₄ according to the following equation:



2. In a very violent reaction called a thermite reaction, aluminum metal reacts with Iron(III) oxide to form iron metal and aluminum oxide according to the following equation:



- What mass of Al will react with 150. g of Fe₂O₃?
 - If .905 Al₂O₃ mol is produced in the reaction, what mass of Fe is produced?
 - How many mol of Fe₂O₃ will react with 99.0 g of Al?
3. How many grams of hydrogen are needed to react with 1.40 g of nitrogen to produce ammonia?
4. What mass of sulfuric acid is required to completely react with 1.27 g of potassium hydroxide?
5. Ammonium hydrogen phosphate, (NH₄)₂HPO₄ is made from reacting phosphoric acid with ammonia.
- Write the formula for the reaction.
 - If 10.00 g of ammonia react, how many mol of fertilizer will be produced?
 - What mass of ammonia will react with 2800 kg of phosphoric acid?
6. The following reaction shows the synthesis of zinc citrate, an ingredient in toothpaste:
- $$3\text{ZnCO}_3 + 2\text{C}_6\text{H}_8\text{O}_7 \rightarrow \text{Zn}_3(\text{C}_6\text{H}_5\text{O}_7)_2 + 3\text{H}_2\text{O} + 3\text{CO}_2$$
- How many mol of ZnCO₃ are needed to produce 30.0 mol of zinc citrate?
 - What quantities in kilograms, of water and carbon dioxide are produced from 500. mol of C₆H₈O₇?
7. Methyl butanoate is made from reacting butanoic acid with methanol in the following reaction:
- $$\text{C}_3\text{H}_7\text{COOH} + \text{CH}_3\text{OH} \rightarrow \text{C}_3\text{H}_7\text{COOCH}_3 + \text{H}_2\text{O}$$
- What mass of methyl butanoate is produced from the reaction of 52.5 g of butanoic acid?
 - What mass of water is produced from the reaction of 5800. g of methanol?
- 8.
- $$2\text{NH}_4\text{NO}_3 \rightarrow 2\text{N}_2 + \text{O}_2 + 4\text{H}_2\text{O}$$
- How many moles of nitrogen gas are produced when 36.0 g of ammonium nitrate reacts?
 - If 7.35 mol of water are produced in this reaction, what mass of ammonium nitrate reacted?
9. 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 potassium nitrate produced?
10. A car battery produces electrical energy with the following chemical reaction:
- $$\text{Pb} + \text{PbO}_2 + 2\text{H}_2\text{SO}_4 \rightarrow 2\text{PbSO}_4 + 2\text{H}_2\text{O}$$
- If the battery loses .34 kg of lead in this reaction, how many mol of lead(II) sulfate are produced?
11. In a space shuttle, the carbon dioxide 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 carbon dioxide daily. What mass of water will be produced when this amount reacts with LiOH? The other product is lithium carbonate.

12. Water is sometimes removed from products of a reaction by placing them in a closed container with excess tetraphosphorus decoxide. The water reacts to make phosphoric acid.
- What mass of water can be absorbed by 100. g of tetraphosphorus decoxide?
 - If 614 mol of water are absorbed, how many grams of phosphoric acid are produced?
13. Ethanol, C₂H₅OH, is considered a clean fuel because it burns in oxygen and only produces carbon dioxide and water. If 95.0 g of water are produced during the combustion of ethanol, how many grams of ethanol were present at the beginning of the reaction?
14. Sulfur dioxide reacts with oxygen and rain water to produce sulfuric acid, acid rain. If 50.0 g of sulfur dioxide react, how many grams of sulfuric acid can be produced?
15. When heated, sodium bicarbonate, NaHCO₃, decomposes into sodium carbonate and carbon dioxide. If 5.00 g of sodium bicarbonate decompose, what is the mass of the carbon dioxide produced?
16. A reaction between hydrazine, N₂H₄ and dinitrogen tetroxide has been used to launch rockets into space. The reaction produces nitrogen gas and water vapor.
- Write the balanced equation for this reaction.
 - What is the mol ratio of hydrazine and nitrogen gas?
 - How many mol of nitrogen are produced from 20 kmol of hydrazine?
 - How many grams of water are made when 450. kg of dinitrogen tetroxide are consumed?
17. How many moles of oxygen are produced from the decomposition of 517.84 g of mercury (II) oxide?
18. Iron (III) chloride 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 chlorine gas?
19. Sodium sulfide and cadmium nitrate undergo a double replacement reaction. What is the mass in mg of cadmium sulfide that can be made from 5.00 mg of sodium sulfide?
20. Potassium permanganate and glycerin react explosively according to the following reaction:
- $$14\text{KMnO}_4 + 4\text{C}_3\text{H}_5(\text{OH})_3 \rightarrow 7\text{K}_2\text{CO}_3 + 7\text{Mn}_2\text{O}_3 + 5\text{CO}_2 + 16\text{H}_2\text{O}$$
- How many moles of carbon dioxide can be produced from 4.44 mol of KMnO₄?
 - If 5.21 g of H₂O are produced, how many moles of glycerin were used?