

5. 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 ?
6. 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?
7. 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?
8. Carbon disulfide, CS_2 , is an important industrial substance. Its fumes can burn explosively in air to form sulfur dioxide and carbon dioxide.
- $$\text{CS}_2(\text{g}) + \text{O}_2(\text{g}) \rightarrow \text{SO}_2(\text{g}) + \text{CO}_2(\text{g})$$
- 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?
9. 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:
- $$\text{HgCl}_2(\text{aq}) + 2\text{NH}_3(\text{aq}) \rightarrow \text{Hg}(\text{NH}_2)\text{Cl}(\text{s}) + \text{NH}_4\text{Cl}(\text{aq})$$
- What mass of $\text{Hg}(\text{NH}_2)\text{Cl}$ could be produced from 0.91 g of HgCl_2 assuming plenty of ammonia is available?
 - What mass of $\text{Hg}(\text{NH}_2)\text{Cl}$ could be produced from 0.91 g of HgCl_2 and 0.15 g of NH_3 in solution?
10. Aluminum chips are sometimes added to sodium hydroxide-based drain cleaners because they react to generate hydrogen gas which bubbles and helps loosen material in the drain. The equation follows.
- $$\text{Al}(\text{s}) + \text{NaOH}(\text{aq}) + \text{H}_2\text{O}(\text{l}) \rightarrow \text{NaAlO}_2(\text{aq}) + \text{H}_2(\text{g})$$
- Balance the equation.
 - How many moles of H_2 can be generated from 0.57 mol Al and 0.37 mol NaOH in excess water?
 - Which reactant should be limiting in order for the mixture to be most effective as a drain cleaner? Explain your choice.
11. Copper is changed to copper(II) ions by nitric acid according to the following equation:
- $$4\text{HNO}_3 + \text{Cu} \rightarrow \text{Cu}(\text{NO}_3)_2 + 2\text{NO}_2 + 2\text{H}_2\text{O}$$
- How many moles each of HNO_3 and Cu must react in order to produce 0.0845 mol of NO_2 ?
 - If 5.94 g of Cu and 23.23 g of HNO_3 are combined, which reactant is in excess?
12. One industrial process for producing nitric acid begins with the following reaction:
- $$4\text{NH}_3 + 5\text{O}_2 \rightarrow 4\text{NO} + 6\text{H}_2\text{O}$$
- If 2.90 mol NH_3 and 3.75 mol O_2 are available, how many moles of each product are formed?
 - Which reactant is limiting if 4.20×10^4 g of NH_3 and 1.31×10^5 g of O_2 are available?
 - What mass of NO is formed in the reaction of 869 kg of NH_3 and 2480 kg O_2 ?
13. Acetaldehyde CH_3CHO is manufactured by the reaction of ethanol with copper(II) oxide according to the following equation:
- $$\text{CH}_3\text{CH}_2\text{OH} + \text{CuO} \rightarrow \text{CH}_3\text{CHO} + \text{H}_2\text{O} + \text{Cu}$$
- What mass of acetaldehyde can be produced by the reaction between 620 g of ethanol and 1020 g of CuO? What mass of which reactant will be left over?
14. Hydrogen bromide can be produced by a reaction among bromine, sulfur dioxide, and water as follows.
- $$\text{SO}_2 + \text{Br}_2 + \text{H}_2\text{O} \rightarrow 2\text{HBr} + \text{H}_2\text{SO}_4$$
- If 250 g of SO_2 and 650 g of Br_2 react in the presence of excess water, what mass of HBr will be formed?
15. Sulfur dioxide can be produced in the laboratory by the reaction of hydrochloric acid and a sulfite salt such as sodium sulfite.
- $$\text{Na}_2\text{SO}_3 + 2\text{HCl} \rightarrow 2\text{NaCl} + \text{SO}_2 + \text{H}_2\text{O}$$
- What mass of SO_2 can be made from 25.0 g of Na_2SO_3 and 22.0 g of HCl?
16. The rare-earth metal terbium is produced from terbium(III) fluoride and calcium metal by the following single replacement reaction:
- $$2\text{TbF}_3 + 3\text{Ca} \rightarrow 3\text{CaF}_2 + 2\text{Tb}$$
- Given 27.5 g of TbF_3 and 6.96 g of Ca, how many grams of terbium could be produced?
 - How many grams of the excess reactant is left over?