

Chemistry 105 - Fundamental Chemistry

Fall Semester 1997 - Chemical Reactions and Stoichiometry

1) Hydrogen chloride, HCl, can be made conveniently in the laboratory by the reaction of NaCl with sulfuric acid. This reaction yields HCl(g) and Na₂SO₄ as products.

- Write a balanced equation depicting this reaction.
- If 20.9g of NaCl are used, how many grams of H₂SO₄ are required for complete reaction?
- If 20.9g of NaCl are used, and only 5.6 g of HCl are isolated, what is the percent yield of HCl?
- If only 5.6 g of HCl are obtained, how many grams of Na₂SO₄ must also have been formed?

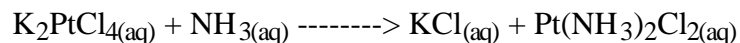
2) In a blast furnace, iron (III) oxide combines with carbon monoxide to produce iron metal and carbon dioxide.

- How many moles of CO are required to give 2.4 moles of Fe? How many grams of CO are required?
- How many grams of CO are required to consume completely 2.0 moles of iron (III) oxide?
- To produce 27.9 kg of Fe, how many kilograms of iron (III) oxide are required?
- If each pound (454 g) of iron (III) oxide produces one-half pound of Fe, what is the percent yield of iron?

3) On April 16, 1947, the S.S. Grandchamp blew up in the harbor of Texas City, Texas, and the explosion set off a chain reaction of explosions and fires that eventually killed 570 people. The original blast was from the explosive decomposition of ammonium nitrate, a compound used as a fertilizer, to give nitrogen, oxygen, and water.

- If a shipload of ammonium nitrate (3.00×10^4 tons) explodes, how many tons of each of the products is formed?
- If the explosion is done on a small scale, and 45.0 g of water was isolated, what was minimum amount of ammonium nitrate present in the beginning?
- Assume the decomposition of ammonium nitrate is not complete. Only 1.0 g of oxygen gas are isolated from 8.0 g of ammonium nitrate. What is the percent yield of oxygen gas.

4) Pt(NH₃)₂Cl₂, called "cisplatin," has recently been found to be effective in treating certain types of cancers. It is synthesized by the following reaction:



With 1.00 g of K₂PtCl₄, how many grams of NH₃ must be used for complete reaction? How many grams of Pt(NH₃)₂Cl₂ will be produced?

5) Ammonia is used throughout the world as a fertilizer and in making nitrogenous plastics and fibers. It is usually manufactured in the Haber process, the direct reaction of nitrogen gas with hydrogen gas (in the presence of other compounds that accelerate the reaction). If you use 280.0 pounds of nitrogen gas, how many pounds of hydrogen gas are required for complete reaction? How many pounds of NH₃ can be produced?