APPLICATION *Chemical Industry*

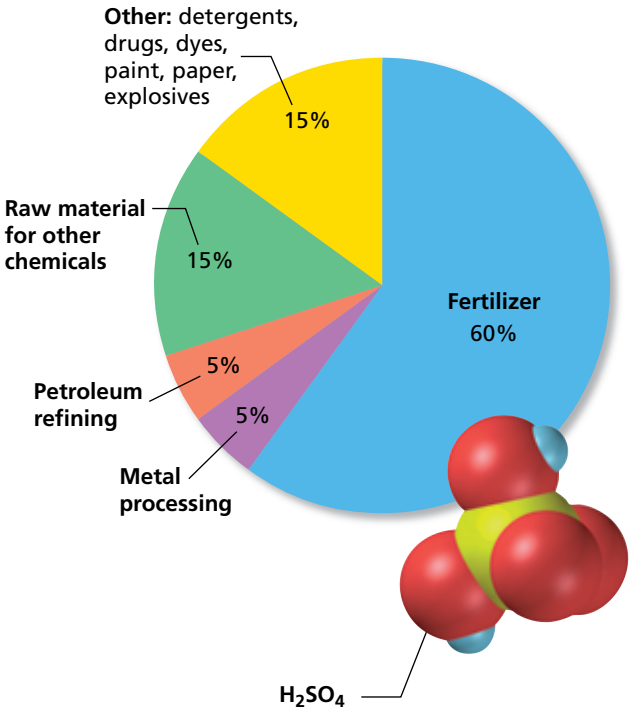
Sulfuric Acid

Sulfuric acid is the so-called "king of chemicals" because it is produced in the largest volume in the United States. It is produced by the contact process. This process starts with the production of SO_2 by burning sulfur or roasting iron pyrite, FeS_2. The purified sulfur dioxide is mixed with air and passed through hot iron pipes containing a catalyst. The contact between the catalyst, SO_2, and O_2 produces sulfur trioxide, SO_3, and gives the contact process its name. SO_3 is dissolved in concentrated H_2SO_4 to produce pyrosulfuric acid, $H_2S_2O_7$.

$$SO_3(g) + H_2SO_4(aq) \longrightarrow H_2S_2O_7(aq)$$

The pyrosulfuric acid is then diluted with water to produce sulfuric acid.

$$H_2S_2O_7(aq) + H_2O(l) \longrightarrow 2H_2SO_4(aq)$$



Important uses of the U.S. supply of sulfuric acid

Properties and Uses of Sulfuric Acid

Concentrated sulfuric acid is a good oxidizing agent. During the oxidation process, sulfur is reduced from +6 to +4 or –2. The change in oxidation state for a reaction depends on the concentration of the acid and on the nature of the reducing agent used in the reaction.

Sulfuric acid is also an important dehydrating agent. Gases that do not react with H_2SO_4 can be dried by being bubbled through concentrated sulfuric acid. Organic compounds, like sucrose, are dehydrated to leave carbon, as shown by the following reaction.

$$C_{12}H_{22}O_{11}(s) + 11H_2SO_4(aq) \longrightarrow 12C(s) + 11H_2SO_4{\cdot}H_2O(l)$$

The decomposition of sucrose proceeds rapidly, as shown in Figure 17 on page 737.

About 60% of the sulfuric acid produced in this country is used to make superphosphate, which is a mixture of phosphate compounds used in fertilizers.

TABLE 7B Top Ten Chemicals Produced in the U.S.

Rank	Chemical	Physical state	Formula
1	sulfuric acid	*l*	H_2SO_4
2	nitrogen	*g*	N_2
3	oxygen	*g*	O_2
4	ethylene	*g*	C_2H_4
5	calcium oxide (lime)	*s*	CaO
6	ammonia	*g*	NH_3
7	phosphoric acid	*l*	H_3PO_4
8	sodium hydroxide	*s*	NaOH
9	propylene	*g*	C_3H_6
10	chlorine	*g*	Cl_2