

9.4 Acids and Bases in Action

Sulfuric acid is probably the world's most important industrial chemical. About 25 000 000 t are produced annually.

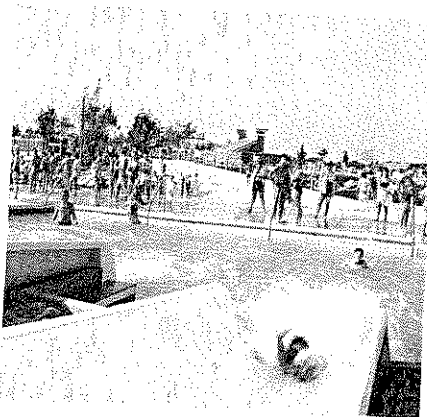


Fig. 13 Hydrochloric acid, HCl , is used in the manufacture of many drugs and for cleaning mortar from bricks. Here it is used to control the amount of acid in swimming pools.

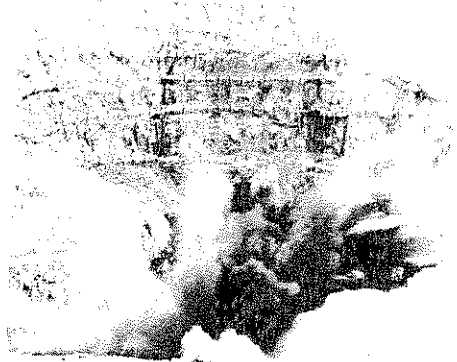


Fig. 14 Nitric acid, HNO_3 , is used in the manufacture of explosives such as TNT. It is also the active ingredient for etching plates.

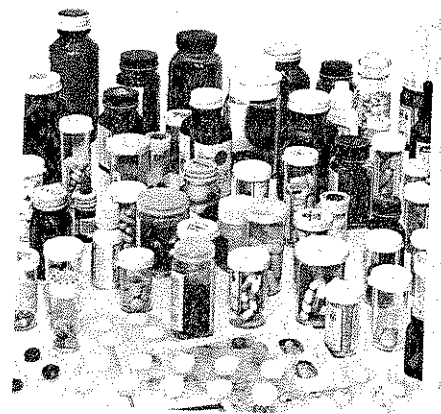


Fig. 15 Sulfuric acid, H_2SO_4 , is a most important chemical—being used to make dyes, drugs, detergents and explosives. It is an ingredient in car batteries.



Fig. 16 Phosphoric acid, H_3PO_4 , is an ingredient in cola drinks and rust removers, and is used in the manufacture of fertilizers.



Fig. 17 Ammonium hydroxide, NH_4OH , is the household ammonia used for various cleaning purposes.



Fig. 18 Sodium hydroxide, NaOH , commonly known as caustic soda, is used in the manufacture of soap, rayon, and paper.

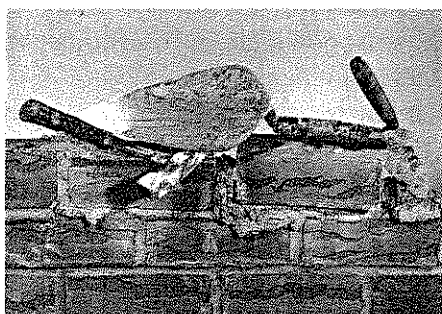


Fig. 19 Calcium hydroxide, $\text{Ca}(\text{OH})_2$, is the slaked lime used to make mortar and plaster for buildings.

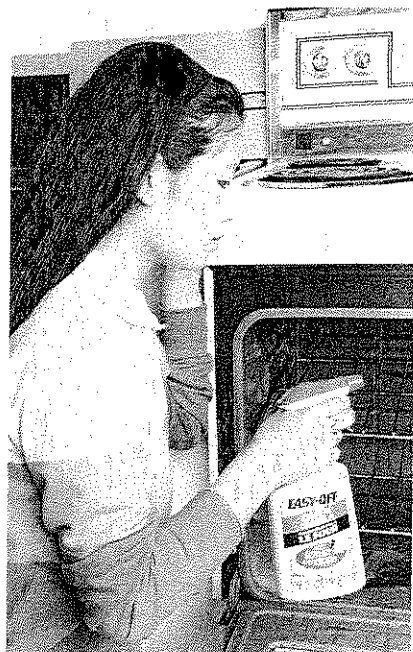


Fig. 20 Potassium hydroxide, KOH , commonly known as caustic potash, is used to make soft soap. It is also the active ingredient in oven cleaners.



Fig. 21 Aluminum hydroxide, $\text{Al}(\text{OH})_3$, is used in the manufacture of glass



Figure 8.24 When diluting acid, always add the acid to the water—never the reverse. Rubber gloves, a lab coat, and safety goggles or a face shield protect against acid splashes.

Diluting Concentrated Acids

The acids that you use in your investigations are bought as concentrated standard solutions. Sulfuric acid is usually bought as an 18 mol/L solution. Hydrochloric acid is usually bought as a 12 mol/L solution. These acids are far too dangerous for you to use at these concentrations. Your teacher dilutes concentrated acids, following a procedure that minimizes the hazards involved.

Concentrated acids should be diluted in a fume hood because breathing in the fumes causes acid to form in air passages and lungs. Rubber gloves must be used to protect the hands. A lab coat is needed to protect clothing. Even small splashes of a concentrated acid will form holes in fabric. Safety goggles, or even a full-face shield, are essential.

Mixing a strong, concentrated acid with water is a very exothermic process. A concentrated acid is denser than water. Therefore, when it is poured into water, it sinks into the solution and mixes with the solution. The heat that is generated is spread throughout the solution. This is the only safe way to mix an acid and water. If you added water to a concentrated acid, the water would float on top of the solution. The heat generated at the acid-water layer could easily boil the solution and splatter highly corrosive liquid. The sudden heat generated at the acid-water boundary could crack the glassware and lead to a very dangerous spill. Figure 8.24 illustrates safety precautions needed to dilute a strong acid.

Diluting Concentrated Acids

1. Why don't we use acids in the concentration in which they are bought?
2. Where should they be diluted? Why?
3. What does exothermic mean?
4. What happens when a concentrated acid is placed in water? Why? What happens to the heat that is produced?
5. What happens when water is added to acid?
6. What could the heat that is generated do? (3 things)
7. So, which is the safe way to dilute acids? (Remember A & W ;)