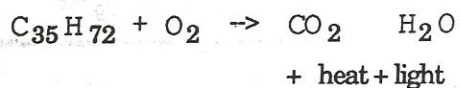


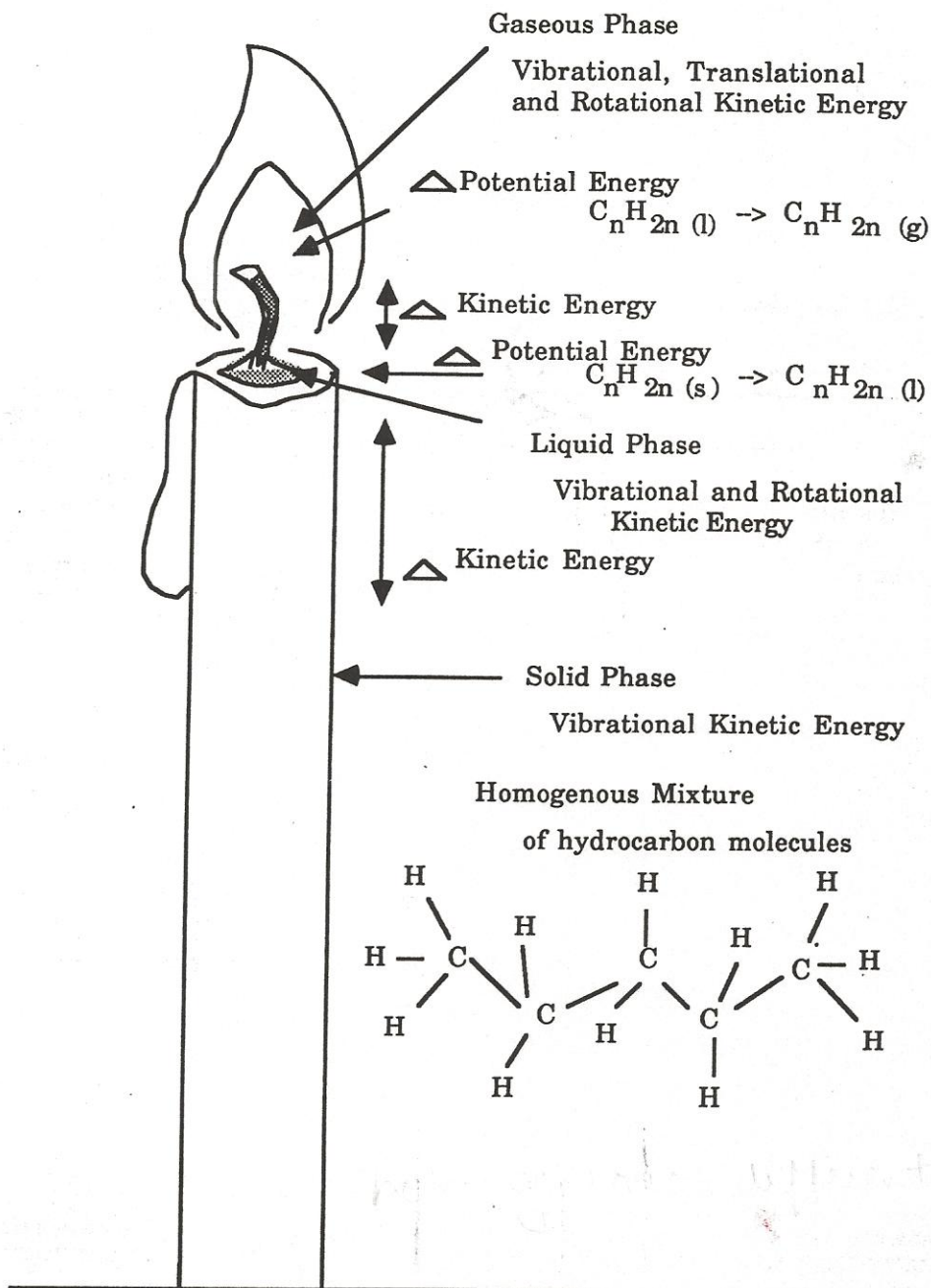
**Figure A5-1. Physical and Chemical Changes of a Burning Candle**

**Chemical Changes**



**Physical Changes**

Heterogenous Mixture of Gases  
 $\text{N}_2, \text{O}_2, \text{CO}_2, \text{H}_2\text{O}$





# Acids (A Real Eyesore)



A dramatic demonstration showing how quickly acids can damage eye tissue.

## Applications

Safety • Eyes • Acids

## Theory

When acids dissolve in water, a considerable amount of heat can be released. Spattering may result if water is added to acid since some of the water will vaporize as it comes into contact with the acid. The greater the acid concentration the greater the risk. To prevent spattering, acids are always added to water. In most cases, since water has a high specific heat capacity it can absorb much of the heat if the mixing is done slowly. Since sulfuric acid is a dehydrator, extreme care must be taken when working with this acid.

A single drop of acid in a person's eye can leave the eye permanently scarred. In the event that a chemical has been accidentally splashed into someone's eyes, the eyes should immediately be flushed with water for a minimum of 15 minutes. Following this, seek help from a physician. Although rinsing the eye may be sufficient, it is good practice to have the eye checked by qualified medical personnel. Prior to conducting any demonstration or experiment, always review safety guidelines for each substance utilized by reading MSDS sheets, labels, etc. Always wear safety goggles to prevent damage to eye tissue. You only have two eyes—they cannot be replaced!

## Materials

|                                                          |                                     |
|----------------------------------------------------------|-------------------------------------|
| Petri dish                                               | Plastic soda bottle, 1-L            |
| Permanent marker                                         | Overhead projector                  |
| Fresh egg white                                          | Distilled water                     |
| Sulfuric acid, conc., $H_2SO_4$ , 10 mL                  | Erlenmeyer flask, 250-mL            |
| Dropper, 2                                               | Beral-type pipet, jumbo             |
| Saturated sodium bicarbonate (baking soda) solution, 1 L | Rubber stopper to fit flask, 2-hole |

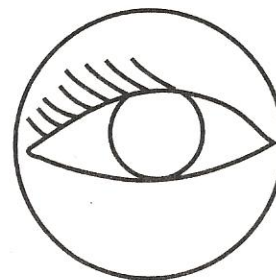
## Safety Precautions

Sulfuric acid is severely corrosive to eyes, skin and other tissues. It is toxic by inhalation and ingestion. Sulfuric acid is extremely hazardous in contact with finely-divided materials, carbides, chlorates, nitrates and other combustible materials. Wear chemical splash goggles, chemical-resistant gloves, and a chemical-resistant apron.

## Preparation

Saturated sodium bicarbonate: Place 10 cm<sup>3</sup> (2 tablespoons) baking soda in a 1-L soda bottle. Top off with water. Secure the cap and shake well.

Use a permanent marker to draw an outline of an eye on the bottom of a Petri dish.



## Demonstration

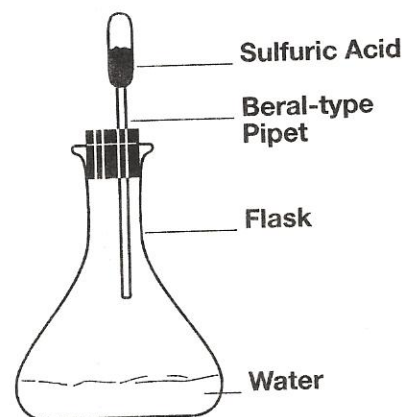
### *Effect of acid on proteins:*

Place the petri dish on an overhead projector. Crack an egg and transfer the egg whites to the petri dish. Compare the transparency of the egg whites to the cornea of an eye. Explain to students that the egg white and human tissue are made of protein. The protein of an eye in particular has a delicate structure that may be easily and permanently damaged. Place a few drops of concentrated sulfuric acid onto the egg white, causing it to immediately turn opaque. Neutralize the acid by adding a few drops of baking soda solution. Point out that although the acid may now be neutralized, the damage has been done.

### *Exothermic dilution of acid:*

Place 5 mL water in a 125-mL Erlenmeyer flask. Insert a jumbo plastic Beral-type pipet into one of the holes of a two-hole rubber stopper and then carefully fill the pipet with concentrated sulfuric acid. Insert the stopper assembly into the flask. Ask a few students to feel the bottom of the flask and describe its temperature. Slowly squirt the acid from the pipet into the water in the flask. Ask the same students to compare the temperature now. The temperature should rise dramatically.

*Note: You must use a 2-hole stopper.*



## Disposal

Neutralize the acid according to Flinn Suggested Disposal Method #24b.

## Reference

Bilash, B.; Gross G.; Koob, J. A Simulated Acid in Your Eye Accident in *A Demo A Day—A Year of Chemical Demonstrations*; Flinn Scientific Inc.: Batavia, IL, 1995; p 10.

Bilash, B. Always Add Acid (AA) in *A Demo A Day—A Year of Physical Science Demonstrations*; Flinn Scientific Inc.: Batavia, IL, 1997; p 56.