

# RED SUNSET

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### MATERIALS NEEDED:

Beaker, 2000-mL  
Water  
Sodium thiosulfate,  $\text{Na}_2\text{S}_2\text{O}_3$ , approx. 10 g  
Stirring rod  
Hydrochloric acid, HCl, 1 M, 100 mL  
Mask for overhead projector  
Overhead projector (Note: Projector must have light located below the glass on projector surface.)  
Optional: music

### SAFETY PRECAUTIONS:

Wear safety goggles or glasses

The dilute hydrochloric acid used in this experiment is mildly corrosive. In the event of skin contact, wash well with water.

### DISPOSAL:

This procedure generates colloidal sulfur. Dispose of the solution according to local regulation.

### PROCEDURE:

Cover the glass of an overhead projector with a sheet of paper with a circular hole in it approximately 3.5 to 5.0 cm in diameter.

Using a 2000 mL beaker, add 1500 mL water and 10 g sodium thiosulfate,  $\text{Na}_2\text{S}_2\text{O}_3$ , to 1500 mL water. Stir until dissolved.

Place the beaker over the hole in the paper covering the overhead projector, turn on the light and center the beaker and hole on the screen or wall.

Add 50 to 100 mL 1 M hydrochloric acid, HCl, to the beaker. Stir (Note: the rate of the reaction will vary with the amount of HCl added.)

Observe the changes of the light beam as it passes through the liquid and the color of the projected light spot on the wall or screen.

Vary rate by changing amount of hydrochloric acid.

### EXPLANATION:

The sodium thiosulfate decomposes in acid solution to produce colloidal sulfur. As the reaction proceeds, the beam of light can be seen as it passes through the solution. This is known as the Tyndall effect.

As the concentration of the colloidal sulfur increases in the solution, the shorter wavelength light (blue) is scattered while the longer wavelengths (red) passes through. Thus, the projected light beam becomes more red in color. Eventually, the concentration of the colloidal sulfur becomes so great that no light is transmitted.

This process simulates the effect of the sun rising or setting. When the sun is low on the horizon, relative to the observer, the molecules of "air" along with the particulate matter in the air scatters the light allowing the longer wavelengths to be transmitted and producing a red color. Generally, the colors in the sunset are more pronounced due to accumulated particulate matter generated by automobiles, trucks, and industry during the day.

#### **UTILIZATION AND VARIATIONS:**

Mount cutouts of palm trees, city skylines, trees, snowmen, etc... over the hole in the paper to produce special effects. Use appropriate music for the special effects (*i.e.*, Hawaiian music with palm trees, Christmas music with evergreens and snowmen, etc...).

#### **REFERENCE**

I first saw this version of this demonstration presented by one of the teacher-participants at an ICE workshop at the University of Northern Colorado in Greeley, Colorado.