

PHOSPHORESCENCE

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MATERIALS NEEDED:

matchbook
coin, such as a quarter (U.S. 25¢ or equivalent)

SAFETY PRECAUTIONS:

Wear safety goggles or glasses
This experiment presents a fire risk. A fire extinguisher should be available.

DISPOSAL:

There are no disposal hazards in this experiment.

EXPERIMENTAL PROCEDURE:

Take the matchbook and peel off approximately one-half of the striking surface for the matches. Some paper backing will come with it.

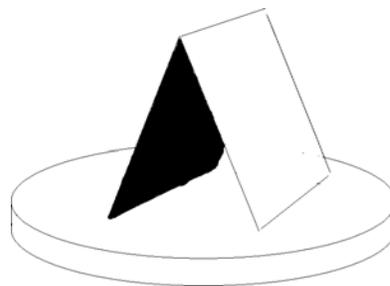
Fold the piece of the striking surface in half so that the dark material is inside. The open it up and stand it on the coin so it stands like a small tent.

Take a match from the matchbook and light it. Use the match to ignite the piece of paper on the coin.

After the paper on the coin is finished burning, discard the ash. There should be a dark yellow to brown-black spot on the coin.

Make sure your hand is clean and dry. Rub your forefinger over the brown-black spot. Extinguish the room lights. Gently rub you forefinger and thumb then separate them. What do you observe? Turn on the room lights and rub your forefinger and thumb together. What do you observe?

If you do not observe any results, repeat the experiment.



EXPLANATION:

Phosphorus has two allotropic forms, red phosphorus and white phosphorus. White phosphorus is reactive with oxygen in the air, slowly oxidizing at room temperature and igniting at temperatures of 35-45°C. Red phosphorus does not ignite until the temperature reaches about 250°C.

The striking section of the matchbook contains red phosphorus. When the piece of the striking section is burned, the phosphorus vaporizes and some condenses on the cool surface of the coin in the form of white phosphorus. When you rub your fingers together, fresh phosphorus is exposed to the air and it burns forming phosphorus oxides, P_4O_6 and P_4O_{10} . Oils, present in the skin, mix with the phosphorus and provide for a uniform exposure of the phosphorus to the air. The energy of the slow oxidation reaction produces the greenish glow or phosphorescence.