

ChemLab 1

Observation of a Candle

You have seen candles burn, perhaps on a birthday cake. But you probably have never considered the burning of a candle from a chemist's point of view. Michael Faraday, a 19th-century chemist, found much to observe as a candle burns. He wrote a book and gave talks on the subject. In this ChemLab, you will investigate the burning of a candle and the products of combustion.



Problem

What are the requirements for and characteristics of a candle flame? What are the products of the combustion of the candle?

Objectives

- **Observe** a candle flame and perform several tests.
- **Interpret** observations and the results of the tests.

PREPARATION

Materials

large birthday candles
matches
shallow metal dish
25 mL of limewater solution
250-mL beaker
500-mL Erlenmeyer flask
solid rubber stopper to fit the flask
wire gauze square
tongs

Safety Precautions

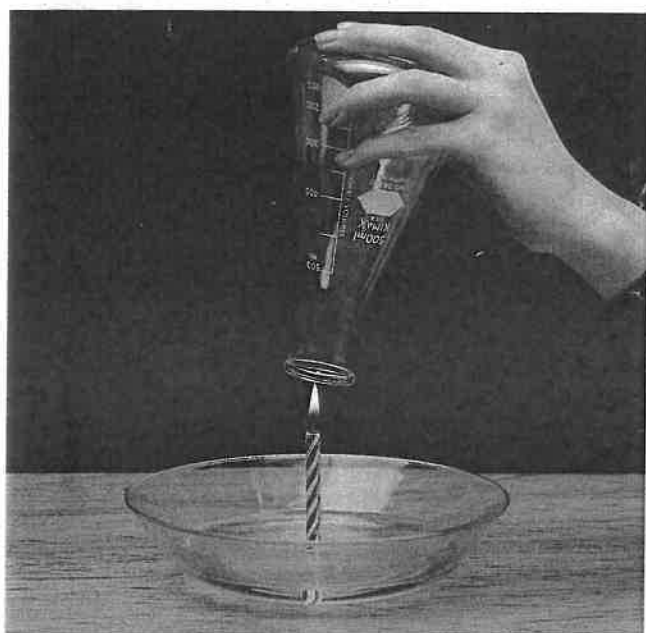


Wear an apron and goggles. Keep all combustible materials, including clothing, away from the match and candle flames. Do not allow the limewater to splash into your eyes. If it does, immediately rinse your eyes for 15 minutes and notify your teacher.

PROCEDURE

1. Light a candle and allow a drop or two of liquid wax to fall into the center of the pan. Press the candle upright onto the melted wax before it can solidify. If the candle burns too low during the following procedures, repeat this step with a new candle.
2. Observe the flame of the burning candle for a few minutes. Try to observe what is burning and where the burning takes place. Observe the different regions of the flame. Make at least eight observations, and record them in a data table like the one shown.
3. Light a second candle and hold the flame about 2 cm to 4 cm to the side of the first candle flame. Gently blow out the first candle flame, then quickly move the flame of the second candle into the smoke from the first flame. Record your observations.
4. Relight the standing candle. With tongs, hold the wire gauze over the flame, perpendicular to the candle. Slowly lower the gauze onto the flame. Do not allow the gauze to touch the candle wax. If the flame goes out, quickly move the wire gauze off to the side. Record your observations.
5. Fill the 250-mL beaker with cold tap water, dry the outside of the beaker, and hold it about 3 cm to 5 cm above the candle flame. Record your observations.

- Pour tap water into the pan or dish to a depth of about 1 cm.
- Quickly lower an Erlenmeyer flask over the candle so that the mouth of the flask is below the surface of the water. Allow the flask to remain in place for approximately one minute. Record your observations.



- Lift the flask out of the water, turn it upright, and add about 25 mL of limewater. Stopper the flask and swirl the solution for approximately one minute. Record your observations. If the solution becomes cloudy or chalky, calcium carbonate was formed, indicating the presence of carbon dioxide in the flask.

ANALYZE AND CONCLUDE

- Classifying** Which changes that you noted in step 2 were physical? Which were chemical?

- Making Inferences** Do your results in step 3 indicate that the candle wax burns as a solid, a liquid, or a vapor? Explain.
- Interpreting Data** One requirement for combustion is the presence of fuel. Interpret your results from steps 4 and 7 to determine the other requirements.
- Interpreting Data** Based upon your analysis of the observations from steps 5 and 8, what are two products of the combustion of the candle?

APPLY AND ASSESS

- Sir Humphry Davy invented a safety lamp for miners in which a flame was surrounded by a wire gauze cylinder. Can you explain the reason why the lamp was constructed in this way?
- What change in water level occurred in procedure 7? Propose an explanation for this change.

DATA AND OBSERVATIONS

| Procedure step | Observations |
|----------------|--------------|
| 2 | |
| 3 | |
| 4 | |
| 5 | |
| 7 | |
| 8 | |