

## EXPERIMENT 3

# Extinguishing a Flame by Changing the Gas



### Purpose

To explore how fuel burns in the presence of oxygen, but not in the presence of carbon dioxide.

### Material

Box of short birthday candles.

Small bottle of vinegar.

Container of baking powder.

Clean glass jar that is taller than a birthday candle.

Tablespoon.

Package of matches.

Small piece of modeling dough.

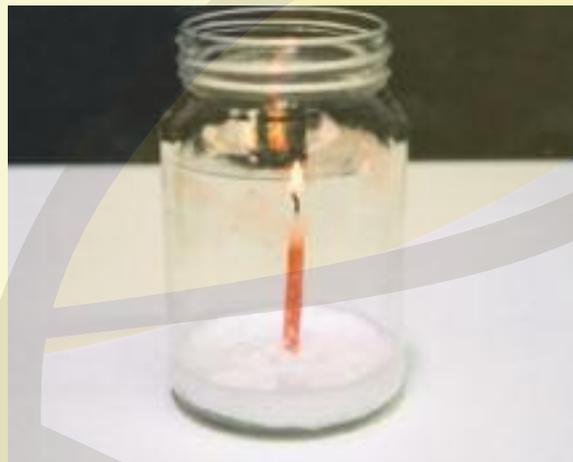
### Presentation

- This experiment can be presented to a small group of students or the entire class.
- Place all of the necessary material on a table.

- Explain to the students that this experiment will demonstrate that fuel burns in the presence of oxygen, but not in the presence of carbon dioxide.

**SAFETY NOTE:** Instruct the students on using matches and fire safely.

- Place the jar on a table with the small piece of modeling dough pressed firmly onto the inside bottom center of the jar.



- Remove one birthday candle from the box and place the candle upright into the modeling dough inside the jar.
- Carefully sprinkle a tablespoon of baking powder inside the jar, all around the candle. Spread the baking powder out evenly.
- Remove a match from the package of matches and carefully light the birthday candle inside the jar.



- Slowly and gently pour a small amount of vinegar into the jar. Add just enough vinegar so that the baking powder makes popping and fizzling sounds.
- Allow the mixture to sit for a short time and observe the candle flame.
- Ask the students to record their observations and conclusions.

### Observations and conclusions

- The candle burns for a short time and then goes out.
- The earth's atmosphere is made up of various gases including oxygen, nitrogen, and carbon dioxide.

- Oxygen and nitrogen are light in weight. Oxygen has another important feature — it helps fires to burn.
- Carbon dioxide is heavier than the other gases and it does not allow objects to burn in its presence.
- When the vinegar is added to the baking powder, the two substances react with one another. That reaction produces carbon dioxide gas, which is heavier than oxygen. Because it is heavier, the carbon dioxide fills the jar from the bottom, effectively pushing out the lighter oxygen. When enough carbon dioxide gas is produced it fills the jar and eventually reaches the flame. Because fuel (the candle) cannot burn in the presence of carbon dioxide, it forces the flame to go out. The flame dies because it no longer has oxygen to burn.
- The same principle is applied in fire extinguishers that are filled with compressed carbon dioxide gas. These extinguishers work by smothering a fire and forcing it to go out by robbing the fire of oxygen.