

Combustion of a Burning Candle- Day 1

Introduction: (write a summary in your lab notebook)

Wildfire has become an increasingly relevant topic in California. Recent wildfires in Santa Rosa and Paradise caused significant destruction to property and loss of life. During the fires, poor air quality could be seen as far away as New York. The first step in understanding the complex nature of wildfire and its impacts is exploring what fire is and how it burns. In this lab, we will examine the process of combustion using a simpler model, the combustion of a candle. We will use the evidence collected during this experiment to make claims about what's consumed and produced during a fire and how a fire burns.

Objectives: (copy in your lab notebook)

- Practice making qualitative and quantitative observations.
- Analyze and interpret data from an experiment.
- Use observations of a burning candle to determine the reactants and products of a combustion reaction.
- Use observations of a burning candle to develop a model for the combustion of a candle.
- Argue for a claim based on evidence.

Prelab: (answer in your lab notebook)

1. Based on what you already know about candles, how do you think they burn? Use pictures, arrows, and labels to create a **model** [diagram] to show your current understanding of how a candle burns. Include things that are not visible also.

Model	Explanation

2. Read the whole lab and list 3 questions you have about the procedure:

- _____
- _____
- _____

3. Guiding Question: How do we identify a gas?

Demo: Watch each demo and record your observations in your lab book. Teacher demo or [Video for all three tests.](#)

1. Splint test- Oxygen gas
2. Splint Test- Hydrogen gas
3. Splint Test- Carbon Dioxide

Test	Observations
Oxygen	
Hydrogen	
Carbon Dioxide	

Result

Procedures:

Part I. Candle Observation

1. If the candle is not already attached to cardboard, use the melted wax to attach it.
2. Creating a heading for "**Candle observations before burning.**" Before lighting the candle, observe it carefully, using your senses: sight, sound, touch, and smell (but not taste). Record your observations. Include at least 2 quantitative and 4 qualitative observations.
3. Create a new heading for "**Observations during burning.**" Light the candle. Observe the candle and flame carefully. Record 2 new quantitative and 4-new qualitative observations in your lab book.



Part II. Experimenting with a Candle

General Directions for Experiments:

For each experiment below, reread the experiment before you begin. Perform the experiment and record detailed observations in your results section. Answer the guiding questions.

A. Guiding Question: What drives combustion in a burning candle?

In experiments 1 to 3, you will figure out the three things that are needed for combustion to happen (candle burn)

Experiment 1:

1. Use a piece of aluminum foil, approximately 3cm by 3cm.
2. Use your pen or pencil tip to punch a tiny hole through the center of the foil. Make the hole about the same diameter as the diameter of the wick.
3. Place the aluminum foil over the wick. Adjust the curve in the aluminum foil strip so that it will slip over the wick, but will curve just above the body of the candle.
4. Light the wick and observe for several minutes. If any wax comes through the aluminum foil, clean the foil and try again.
5. Record observations in your lab book.
6. Repeat this experiment two more times.
7. Record additional observations in your lab book.

**Experiment 2: Guiding Question:**

1. Light a candle and allow it to burn for a minute. Hold a wood splint in the candle flame until it catches fire.
2. Extinguish the candle with a wave of your hand and immediately hold the burning splint about 1cm above the wick in the path of the "smoke" that is being released by the extinguished candle. If nothing happens, try it again, placing the lit splint a little closer to the wick.
3. Record observations in your lab book.
4. Repeat this experiment reversing the roles of the splint and the candle.
5. Record your observations.
6. Can a Candle be relit from a distance? Why or why not?

**Experiment 3:**

1. Light the candle.
2. Invert a clean, dry 400 mL beaker and place it over the candle. The beaker should rest on the benchtop and completely cover the candle. Observe until no more changes are apparent.
3. Lift the beaker off of the candle and place it upright (right side up) on the wire gauze on the lab bench.
Use beaker tongs & be careful — the beaker will be hot!
4. Make sure you observe any residue inside the beaker as well as the flame.
5. Record observations in your lab book.
6. Allow the beaker to cool, and then clean the beaker thoroughly with soap and water using the abrasive side of the sponge.
7. Is Air necessary for the combustion of a candle?



B. Guiding Question: What is produced when a candle burns?

Experiment 4:

1. Light the candle.
2. Lift a clean, dry 250 mL beaker with beaker tongs, and place it over the candle as shown. The base of the beaker should be a few centimeters above the flame of the candle. Hold the beaker at this height until you begin to see material collecting on the bottom of the beaker (~1 min).
3. Lift the beaker off of the candle and place it upright (right side up) on the lab bench on a wire gauze. Be careful — the beaker will be hot!
4. Record your observations. If you would like to repeat the experiment, allow the beaker to cool first.
5. What is produced & How do you know?
6. Wipe off the outside of the beaker when finished to clean it.
7. Repeat holding the beaker upside down over the flame at an angle. Record observations.
8. What is produced & How do you know?



Experiment 5:

1. Hold a clean 125 mL flask upside down.
2. Light a wood splint and put the flame into the flask. Pay attention to the time it takes for the flame to extinguish.
3. Light the candle. Hold a clean 125 mL flask upside down so that the mouth is just above the candle flame. Allow the candle to burn for a full minute. Continue holding the flask upside down and pull it slowly away from the candle. Blow out the candle.
4. Set the flask upside down on the desk and allow to cool (~3-5 mins)
5. Light a wooden splint. Place the lit end of the splint in the flask. Pay attention to the time it takes for the flame to extinguish.
6. Record observations on the report form.



Add Research: How does a fire extinguisher work?