Burning Fossil Fuels for Energy

Phenomenon: Schools, homes, neighborhoods, and communities need energy which can harm the environment.

Driving question: Where does energy come from?

Energy use and production are a critical part of our modern world. In this lab, we will model burning fossil fuels in a closed and open system and make connections to the Earth. This lab aims to investigate the impact of burning fossil fuels as an energy source on Earth.

Students will observe burning a solid hydrocarbon (candle formulae) in this lab.

Lesson Objectives

- Students will model the conservation of mass.
- Students will model energy usage in closed and open systems.

Standards

HS-PS1-7 Use mathematical representations to support the claim that atoms and mass are conserved during chemical reactions.

CCC
Energy and Matter

The total amount of energy and matter in closed systems is conserved. (HS-PS1-7)

Materials

- 12-16 500 mL beakers (glass) or mason jars, 2 for each group of 3-4 students.
- 12-16 Tea candles, 2 for each group
- 2 Long matches/group or Flint striker
- 1 Digital or triple beam scale per group

Lab Procedure

1. Gather the necessary materials to create a model of the phenomenon.
2. Mass each tea candle and record the mass in grams on the table in the before column.
3. Mass each mason jar or beaker and record the mass on the table.

4. Place one tea candle inside each mason jar or 500 mL beaker.
5. Light the candle inside each mason jar or beaker using a long match or flint striker.
6. Place cheesecloth (coffee filter) over the opening of glass containers.
7. Replace the collar on one of the Mason jars. Alternatively, place a rubber band around the top of the beaker to hold the cheesecloth (coffee filter) in place. Leave the other mason jar uncovered.
8. Record your observations for 6 minutes, and note the color of the glass every 2 minutes in the table below.

Mass of Candle and Mason Jar

Candle	Before Burning (mass in grams)	After Burning (mass in grams)	Mass Difference (mass in grams)
Open System			
Closed System			
Difference between the systems			

Mason Jar (beaker)	Before Burning (mass in grams)	After Burning (mass in grams)	Mass Difference (mass in grams)
Open System			
Closed System			

Observations

Time in Seconds	120 seconds	240 seconds	360 seconds
Open system			
Closed system			

1. Is burning a candle a physical or chemical change? How can you tell? Explain your answer in complete sentences.

Conclusion Questions

Answer each question in complete sentences.

1. What is needed to make paper burn? Why?

2. What did you notice on the inside surfaces of the jar(s)? Was there a difference between the open and closed systems? Why or why not?

3. What has been produced?

4. What gas must have been produced? Where did it come from?

5. What is the purpose of the wick in the candle?

6. When ignited, does the wick burn or only the wax? Explain your response. How do you know?

7. The law of conservation of mass states that mass cannot be created or destroyed. Explain this in terms of the mass of the candle before and after burning.

8. As in our model, if the candle is burnt in a closed system, would the whole system (jar and the contents) change mass? Explain why and how you know.

9. For combustion reactions to occur, what components are needed?

10. What are the products of combustion reactions?

11. What source(s) of energy could replace burning fossil fuels?