**Candle “Design it” Lab**

**Introduction background:** Combustion is a chemical reaction in which a substance is combined with oxygen.  This reaction gives off energy in the form of heat and light.  In this investigation the substance that is combining with oxygen is different kinds of candle wax.  You will observe the burning of three different candles and take measurements to compare a variable that your group is going to test.  You will first need to design your lab and decide what variable you will test.  After testing, you will need to gather and graph data.  You then need to analyze and compare the energy characteristics of the two different candles.  *So when choosing your variable keep in mind that you need to be able to relate your variable to energy characteristics of that fuel source.*

**Purpose:** To observe and compare the energy characteristics of three different fuel sources. Attempt to determine which one is best.

**Problem**: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Hypothesis**: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Materials:** (may not all be used)

* Three candles - each a different type of wax(fuel)
* Ruler
* Matches
* white cloth
* balance
* beaker
* Cup of water for extinguishing matches
* stopwatch
* saucer plate

**Procedure**: (*At least* 6 steps, no more than two sentences on each step)

Number the Steps

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**Data:**

Set up tables and graphs

**Analysis:** Choose *seven* Analysis questions, and answer them. You MUST have graphs - So you must do #1 plus six more.

1. Graph the data.  You will produce 2 graphs for each candle. (Ex: candle height vs. time, and mass vs. time)

2. For each graph, which is the dependent variable? The independent variable?

3. Using your graphs, estimate a data point on the graph that wasn’t measured, and one that would fall to the right of your data points.  (Identify both x and y values)

4. Calculate the rate of burning in terms of height or mass vs. time for each candle between five points. (So five answers for each candle)

5. Calculate the average burning rate in terms of height or mass vs time for each candle.

6. Do the candles burn at a constant rate or different rates? How do you know this?

7. Calculate how long it would take each candle to burn 50% of its fuel?

8. Calculate how long it would take each candle to completely burn out?

9. What is the role of the wick in the candle?

10. In what ways, if any, did the candles differ in their combustion behavior? What factors do you think played a role in these results?

11. Why does the flame diminish when the burning candle is covered with a beaker?

12. Why do you think you are not told which candle type(fuel source) is what before you do the lab?

13. Did your findings support your hypothesis? How do you know?

**Conclusion**: (Answer the questions in complete sentences as your conclusion paragraph)

(1) State your findings, explain what you set out to do.  Refer to the problem and your hypothesis.

(2) Hypothesize why the rates varied.

(3) How can your findings be related to energy in biofuels vs. fossil fuels?

(4) Comparing the rates of burning the three candles what conclusions can you draw about energy content and consumption in terms of the Law of Conservation of Mass. What are the products of combustion?

(Adapted from Kathy Daniels’ candle lab)