**Name:** _____ **Date:** _____ **Period:** _____

**Lab Partner(s):** _____

# Candle Lab

**Introduction**: When a candle is burned, a complex chemical reaction called combustion takes place in which the **wax reacts with oxygen (in air) to produce carbon dioxide gas, water vapor,** and **energy** in the form of heat and light. Wax is also known chemically as paraffin, and it is a mixture of hydrocarbons with a chemical formula of $\mathbf{C_{25}H_{52}}$.

**Purpose**: To burn candle wax (AKA: paraffin) in order to determine the number of moles and molecules converted to other products during the process of combustion and then to calculate the mass of one product formed.

**Materials**:
Candle
Matches
Index card
Balance
Goggles




**Safety**: Goggles **must** be worn at all times without exception due to the fact that you will be working with fire! Be careful of the open flame on the candle, and do not allow clothes and/or hair to come into close proximity of the lit candle. Dispose of used matches in the waste container provided, NOT the trash can; do not throw away the match boxes. No horseplay of any kind will be tolerated! DO NOT MOVE THE BALANCES!!

**Procedure**:

1. Measure the mass of an index card. Record the mass, including all significant figures and the necessary unit, in the appropriate box of the Data Table.
2. Light the candle with a match. Drip a small amount of the wax onto the index card, and immediately stick the base of the candle in the warm wax. Blow out the candle once it is firmly attached to the index card.
3. Measure the mass of the candle and index card together. Record the mass in the appropriate box of the Data Table.
4. Calculate the mass of the candle itself. Record mass in the appropriate box of the Data Table.
5. Using a match, light the candle again, and allow it to burn for *five minutes*. **Important**: DO NOT PLAY WITH THE WAX BECAUSE THIS WILL MESS UP YOUR RESULTS! Place used matches in the waste container provided.
6. At the end of the five-minute burn period, mass the candle and index card, being careful *not to lose any melted wax.*
7. Calculate the mass of the candle that burned during the 5 minutes causing the paraffin to convert (*i.e.*, change) into other products.
8. Remove the candle from the index card and leave the candle and card at the lab station. Matches should remain in the waster container provided. Clean up any spilled wax and wipe off lab table surface.

**Date Table**: Be sure to include units and write measurements and calculations with appropriate number of SF!

| Mass of Index Card (Measured) | Mass of Candle and Index Card (Measured) | Mass of Candle (Calculated) | Mass of Candle and Index Card After Burning 5 Minutes (Measured) | Mass of Candle After Burning 5 Minutes (Calculated) | Mass of Candle Converted To Other Products(Calculated) |
|---|---|---|---|---|---|
| | | | | | |

**Calculations and Post-Lab Questions**

Show ALL work for calculations. Include units and formulas; use correct number of significant figures.

1. Write the combustion reaction for the following: paraffin reacts with oxygen to produce carbon dioxide and water. Remember: A reaction must always be balanced!!! (See introduction for formula of paraffin.)

2. Calculate the molar mass of wax.

   Formula for wax: _____ Molar mass of wax: _____

3. How many moles of wax were in the candle before it was burned? (How much wax, in moles, did you start with?)

4. How many molecules were in the candle before it was burned?

5. How many moles of wax were used up during the burning?

6. How many molecules were used up during the burning?

7. How long would it take to burn 1.0 mole of a candle? (Hint: find minutes/mole and use as the conversion factor)

8. Fossil fuels (coal and fuels containing hydrocarbons) contribute to the greenhouse effect by producing carbon dioxide. What mass of carbon dioxide was produced during the time when your candle burned?

| | | | | | |
|---|---|---|---|---|---|
| g $CO_2$ = | g $C_{25}H_{52}$ | | | | = |
| | | | | | |

9. What two resources are consumed (*used up*) as a candle undergoes combustion? (Look at the equation!)

10. What happened to the atoms of these resources when they were consumed during combustion? In other words, what happened to the atoms of the reactants as they underwent chemical change?

11. If this reaction were allowed to go to completion (*not intentionally stopped after 5 minutes*), what would be the limiting reactant (LR) (*completely used in reaction and causes reaction to stop*)?
    The excess reactant (XR)?

12. If this reaction were to go to completion in a closed container, what would be the limiting reactant and what would be the excess reactant?