Name: _____ Date:_____ Block:_____

Unit 1: What is fire? How do we control it?

Part 2: Wick or Wax- What is burning?

Prelab question:What is a common material used to make a wick? How is a wick connected to a combustion reaction?

Choose group roles for this lab. You can decide to continue to group roles or switch them up.

Group Role	Description	Name of Group Member
Manager/safety engineer	Keeps everyone on task within the time frame given and ensures all voices are heard. Ensures teams are following safety expectations.	
Technician	Gathers supplies and facilitates performance of procedures. Returns supplies and ensures the area is cleaned.	
Spokesperson	Shares group findings to the larger class when needed or asks questions to the facilitator if needed	
Reader	Reads passages and questions to keep everyone on the same page	

SAFETY: You will be working with fire and heated surfaces.

- Wear goggles at all times.
- Hair tied back and no baggy clothes
- Hot glass looks the same as cold glass! Wear heat resistant gloves when touching glassware used with the candles.
- Extinguish the candle when not actively making observations.

What provides fuel for the flame - the wick or the wax? What is actually burning?

Testable Question 4: What is the effect of removing the wax from the candle on the candle's ability to burn?

Hypothesis: If the wax is removed from the candle then…

because…

Procedure:
Let's use the plain cotton string as a control to gain more insight into how the candle burns.

1. Cut a 1 cm length of cotton string (found on the back counter).
2. Fill the pie pan with water to cover the bottom.
3. Hold one end of the string with a forceps and light the other end with a lighter. Make sure the string stays upright similar to a candle wick.
4. Record how many seconds it takes for the string to burn completely. (can use wall clock or a watch)

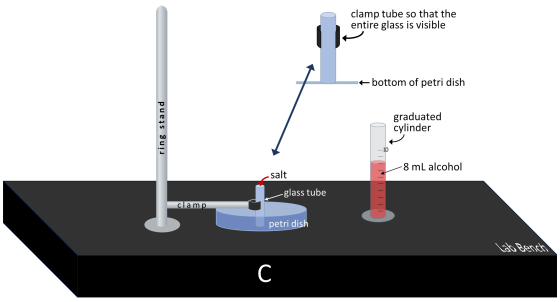
Analysis: What is the length of your cotton wick on the candle? Which takes longer to burn, the plain string or the wick? Is there much of a difference? Was your hypothesis correct? Can you think of why this is the case?

TEACHER DEMO: How does a wick work? Why does the flame not burn all the way down to the bottom of the wick?
Testable question 5: What is the impact of using different materials for the wick on the fire?

1. Look at the burning candle. Record the approximate distance between the bottom of the flame and the wax (eyeball it, record in cm).

You can see that the wax does not touch the flame, yet wax is the major fuel of the candle. How is this possible? To help you answer this question, do the following demonstration:

1. Get a small glass tube and secure it onto a ring stand clamp, having it sit vertically on the glass of a dry petri dish (**SEE illustration C**).



2. Carefully fill the entire glass rod with sodium chloride (table salt) using a small spatula. Do this slowly so you do not spill salt. If you spill a little, don't worry about it.
3. Once filled, poke the top of the salt column to make sure the salt is packed well. If not, add more salt. When the tube is completely filled, do the following control experiment: bring a lit match to the top of the tube, and touch the salt for 2-3 seconds.
4. Record your observations.

Observations

5. Use a graduated cylinder to measure 8 mL of alcohol, C_2H_6O , with red food coloring. Note that alcohol is very flammable--be careful.
6. While closely observing the tube with salt, pour the alcohol into the dish around the tube of salt, and continue to closely observe the tube for 60+ seconds.
7. Record your observations.

8. Once the red color is completely all the way to the top of the glass tube, light a match and touch it to the top of the tube.
9. Record your observations below.

Provide a possible explanation for the above observations.

Testable questions 6?Where is combustion actually taking place? What is actually burning?

Part A: A closer look at the flame- what is burning?

1. Obtain a small piece of screen from the supply table.
2. Light your candle and allow it to burn for 30 seconds.
3. Using tongs, lower the screen over the flame and hold near the top of the wick. This will absorb some of the heat and reduce the size of the flame so you can see better.
4. Look at the flame from above the screen.
5. Record what you see by the wick. Be sure to include a diagram(with labels) and words.

Part B: What is burning? (read all directions first)

1) To gain EVEN MORE insight into how wax burns, light the candle again. Try to find a spot where there is no wind and the flame is straight and pointing to the ceiling.
2) Using the lighter, bring its flame a couple inches away from the candle flame.
3) One lab partner should blow out the candle and the other partner immediately bring the lit match to 2-3 cm above the wick. What happens?
4) Record your observations.

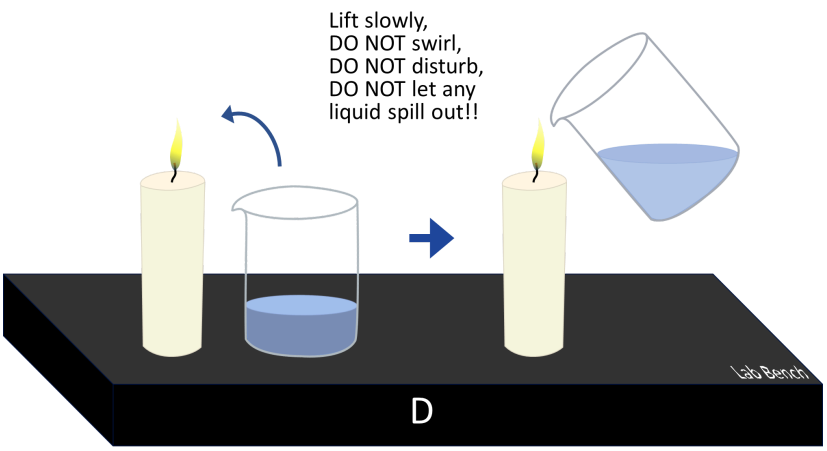
Part C: What is burning?

1. Get a pie pan and place it on the lab bench.
2. Get a long/narrow candle with a straight wick. Break off some of the wick to make it straight if you need to.
3. Hold the lit candle at bottom, bring it 6-8 inches above the pie pan, and turn the candle upside down.
4. Record observations. Be sure to provide reasons as to why this might have happened based on previous portions of the lab.

Reflections: After doing parts A and B and C Above- do you now have more insight into how the wax burns? Think about your results. Record your ideas about how the candle is able to burn wax. Try to record your own ideas below.

Testable question 6: What is the impact of changing the air around the flame on the fire?

1. In your 400 mL beaker, add 4 big scoops of sodium bicarbonate ($NaHCO_3$) using a scoopula (found on the lab table).
2. Set down the beaker an inch away from your candle with the pour spout directed toward the candle (***SEE*** illustration D).
3. Light the candle.
4. With the beaker sitting one inch from the candle, add 30-35 mL of 5% acetic acid (vinegar).
5. Let sit **undisturbed for ~10 seconds**, then slowly and smoothly lift the beaker keeping it upright, then slowly turn the beaker >45° keeping the pour spout 3 cm above and slightly to the side of the candle flame (illustration D). Record your observations.



Note that the reaction of vinegar(acetic acid diluted in water is CH_3COOH) and sodium bicarbonate ($NaHCO_3$) creates water (H_2O) and carbon dioxide (CO_2), which is more dense than air and so it stays in the reaction beaker.

CLEAN UP: Rinse out all glassware thoroughly, put back in your bucket.

6. Record what happened to the CO_2 when you tilted the beaker over the flame.

As a team:Review your candle notes from part 1. In the box below, record the reactants, or molecules that go INTO a Combustion Reaction on the left side of the equation. What are the two products -what COME OUT of the candle you and your lab partners have discovered as a result of this reaction (your lab activities last week and this week can help reveal them).

SUMMATIVE ASSIGNMENT: Update your candle model posters with new information. Use a blue marker to represent new learning. You can clarify what is needed and/or add additional information.