Name: _____ Date:_____ Block:_____

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

Part 1:What makes a Fire start or go out?

Candle Lab

We have looked at a fire scene and discussed the power and history of fire. Use this background knowledge to question, discover, and explore fire in a controlled environment to understand what makes fire…well fire!.

Prelab:

1. Fire Scene Wonders
   a. In the box below- how would you describe the major categories from our individual wonders about the fire that classmates recorded in the class padlet?

2. You watched a candle burn. Draw what you observed. Include:
   a. Labels
   b. Types of matter that might transform in or out
   c. Types of energy that might transfer in or out

Note: A candle is an OPEN SYSTEM. This means energy and matter can move into and out of the system freely.

3. Using a large sheet of paper, gather in your lab group and your lab station and create a consensus group model.

Reference: *The Chemical History of a Candle* by Michael Faraday, 1860. This lab is based on experiments done by Michael Faraday to understand what is occurring in the burning of a candle.

> There is not a law under which any part of the universe is governed which does not come into play, and is touched upon, in the chemistry of a candle. Michael Faraday, 1860

Choose group roles for this lab.

Group Role	Description	Name of Group Member
Manager	Keeps everyone on task within the time frame given and ensures all voices are heard.	
Technician	Gathers supplies and facilitates performance of procedures	
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.

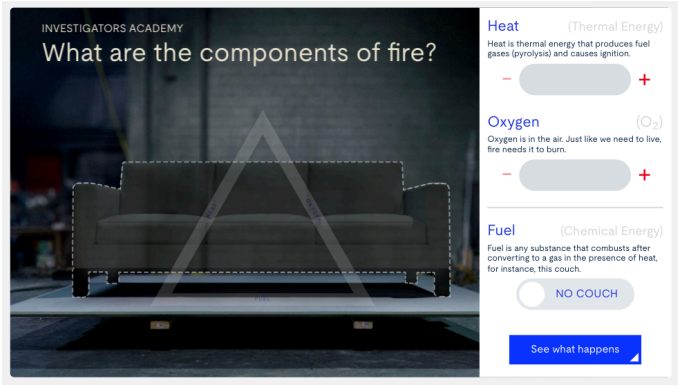
Notes:

Part 1: Fire Investigator Academy- What is Fire?

What are the Components of Fire interactive: Go to this website: https://tinyurl.com/fireXL1

Scroll to the interactive showing a sofa/couch on fire (middle of page). See picture to the right.

Change the settings to observe for what and how much of each component is needed to ignite and sustain a fire. Record your data in the table below.



Name of Table: _____

Trial	Component(s)	Setting tested	Observations & Explanation: What did you observe and how can you explain it?
1	Heat		
	Oxygen		
	Fuel		
2			
3			
4			
5			

Analyze the data you collected. What can you say about fire and what it needs to burn (or combust)?

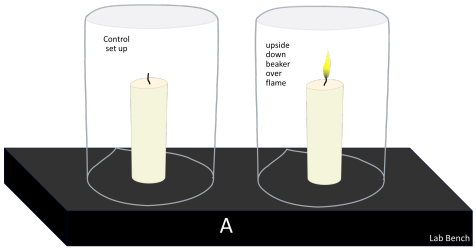
Your turn:

Testable Question 1: What is the effect of reducing the flame's access to the surrounding air on the reaction?

Hypothesis: If the flame's access to the surrounding air is reduced, then…

because…

Procedure:

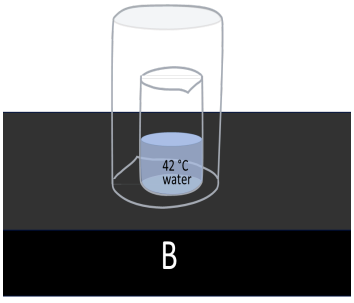


1. Select a dry beaker large enough to fit over the lit candle without the flame touching the glass (600 mL or 1000 mL beaker is good).
2. Turn it upside down over an **unlit** candle on the lab bench and leave it there, *make sure it is completely dry*. Now, as in **illustration A**, place the beaker over a **lit** candle.
3. Immediately start to observe the inside surface of the glass for 50-60+ seconds. You should see two substances forming on the inside surface of the glass. For the next few questions, we will focus on the clear substance.

A) What substances do you think these might be? (hint: what does it look like? Pick up the beaker and touch/wipe them with your finger, if that helps.)

B) Was your hypothesis correct? Why do you think this is?

** If you are not sure what the clear substance is, do the following to help you figure it out: put 40 mL tap water in a 50 mL beaker, heat the water on a hot plate to 43 °C (use a thermometer). Then put the beaker with heated water on the lab bench, and put a larger dry beaker, 150 or 250 mL, upside down over it (SEE **illustration B**). What do you observe happening on the inside surface of the larger beaker (give it 60-90 seconds)? What state is that substance on the inside surface of the beaker a solid, liquid, or gas? What state was it before it got to the glass (after it left the 43 °C liquid water)?



C). For the glass over the flame, was the substance on the inside surface a solid, liquid, or gas? Where did it come from?

D) The first beaker over the unlit candle from the Procedure (**illustration A**) is called a *control*. A control is something to compare your experimental results with to help you analyze your results. Did anything form on the inside surface of the control beaker while it was sitting on the lab bench? Use your answer to help you with the following: Where do you think the clear substance came from in the beaker over the lit candle from this experiment? What is your evidence?

E) It took a bit of time for the substance to form on the beaker's surface (the beaker on the lit candle). Did you *see* this substance before it formed on the surface? You are welcome to perform this experiment again to help answer this question. Think about your answer to C above what phase, solid, liquid, or gas, do you think the substance was in *before* it formed on the surface of the beaker. Was there a phase change when it came in contact with the beaker? From what to what? Use your answer here to help you answer the previous question, D. Go back and edit your answer to D if you can now give a better answer.

CHALLENGE QUESTION:
As your group finishes- Contemplate this next level question:

How would your observations change in the procedure above if you used a different size(s) beaker/jars? Write a testable question, a hypothesis, and explain how you would collect the data to represent the different sizes. If time permits…give it a go!

Wait for teacher instructions to proceed to the next testable question. Work on the challenge above!

Testable Question 2: What happens to the flame when we limit the fuel?

Hypothesis: If the flame's access to fuel is reduced, then…

because…

Procedure:

1. Obtain a piece of foil from your instructor.
2. Place slit in foil around the wick between the flame and the wax at the top of the candle.
3. Observe what happens to the flame.

A) Explain what happened.

B) Was your hypothesis correct? Why do you think this is?

Testable Question 3: What happens to the flame if heat is removed?

Hypothesis: If heat is removed from the flame, then…

because…

Heat always moves from a warmer object to a cooler object (think about holding a cup of hot chocolate in the winter and where the heat is moving.)

How could we draw/model heat?

Procedure:

1. Light the candle on fire.
2. Place the cold screwdriver next to the flame.

A) Explain what happened.

B) Was your hypothesis correct? Why do you think this is?

Notes: