

Name: _____ Period: _____ Date: _____ EN _____

BOILING WATER IN A PAPER CUP?!?

Introduction: In this activity you will put a paper cup $\frac{3}{4}$ full of water in an open Bunsen burner flame and see what happens. As you know water boils; no big surprise. But paper burns!?! As the diligent scientist that you are, you will also record data to gain insight into this phenomenon. You will record both the quantitative temperature of the water and your qualitative (subjective) observations of the water, and the cup in the data table.

Materials

- Paper cup
- Water
- Bunsen burner
- Striker
- Ring stand to fit paper cup
- Stopwatch

Prelab Questions:

1. On a molecular level, what is temperature measuring?

2. Write a prediction describing what you will think will happen to the water, the cup and the flame as the experiment progresses.

3. Explain what quantitative means in the introductory paragraph.

4. Explain what qualitative means in the introductory paragraph.

Set up: Set up your experimental apparatus as demonstrated by your teacher and assign the following four roles to members of your lab group. Do not light your Bunsen burner until your teacher OK's your set up.

- Bunsen Burner Keeper: This person is good at lighting the Bunsen burner. As the experiment proceeds, the burner may go out and need to be relit. Remember; close the air intake before trying to light it.
- Time Keeper: The time keeper will call out each interval for the thermometer keeper and the data recorder.
- Thermometer Keeper: this person must hold the thermometer with tongs provided and call out the temperature of the water when told by the time keeper. Stir the cup as you go to keep the temperature even throughout the cup.
- Data Keeper: this person will record the qualitative and subjective data on the data sheet provided at the intervals specified.

Procedure:

1. Ignition: get the Bunsen burner ready by lighting it and opening the air intake to get a hot, blue flame but record your first data point before sliding it under the apparatus.
2. Begin Heating: Slide the Bunsen burner under the cup, begin timing, and begin recording data. Your instructor will let you know when you may stop the experiment.
3. Clean up the lab station as directed by your instructor
4. Copy the Data: Everyone will need to copy the data onto their own data sheet.
5. Graph the Data: You will now make what is called a phase change diagram which is a graph showing how the temperature of a substance changes as a constant heat is applied. On your graph paper, put time on the x-axis and temperature on the y-axis. Don't forget, all graphs need labeled axes (with units) and a title.
6. Look for patterns in the data: identify as many patterns as you can find in the phase change diagram.

Conclusion Questions:

1. What is the law of conservation of energy? It is possible for energy from the Bunsen burner flame to simply disappear as if it never existed?

2. When the water was boiling, where did the energy from the Bunsen burner go? (Answer in terms of the kinetic energy and intermolecular forces between water molecules).

3. Is the boiling water hot enough to catch paper on fire?

4. Why didn't the paper cup burn below the water line?

5. Why is water often called a "heat sink"?

6. Why is it important that it takes so much energy to change water into a gas?
