**Name: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Heat of Fusion and Vaporization Lab upload full lab**

Guiding Question: Is more heat needed to melt ice or to boil water?

Pre-Lab Questions:

1. Remember: when calculating ΔT, calculate Final - initial temperatures.

If you cooled 85.0 g of water from 55.0°C to 2.0°C, what amount of heat would be lost?

1. What does the negative indicate in the previous answer?
2. A cup of warm water weighs 100.0 g. You add some ice to it and after the ice melts in the cup, the cup of water weighs 143.0 g. What **mass** of ice melted?
3. If a student determined that it took 19,750 J of energy to melt the ice in the question above, what is the student’s experimental value for the heat of fusion (heat required to melt a substance) of ice in joules/gram?

Procedure for Heat of Fusion of Ice: In this part we will focus on how much heat was transferred from warm water into ice to melt it. The warm water’s heat can be calculated using q=mcΔT.

1. Mass a foam cup and record.
2. Add approximately 75.0mL of **warm** water to your cup and find the total mass.
3. Measure and record the initial temperature of the **warm** water.
4. Add 3-4 ice cubes to your water and mix carefully with the thermometer.
5. Continue mixing until the temperature drops to within 1°C of the melting point of water.
6. Measure and record the final temperature of the mixture
7. **Remove any unmelted ice.**
8. Remass the cup of water and record.

**Heat of Fusion of Ice**

|  | Measurement with units |
| --- | --- |
| Mass of foam cup |  |
| Mass of foam cup and water |  |
| Mass of water |  |
| Initial temperature of warm water |  |
| Final temperature of melted ice and water mixture |  |
| Final mass of cup, water, and melted ice |  |

Analysis Questions:

1. Calculate the heat lost by the warm water when the water changes temperature.
2. We make the assumption that the energy the warm water loses is the same amount of energy provided to the ice melting. What are some problems with that assumption?
3. Calculate the mass of the ice that melted.
4. Calculate the experimental ∆Hf (Heat of Fusion) in Joules per gram (J/g) for the ice that melted.
5. The accepted value of Heat of Fusion is on your reference table B. Calculate the percent error.

Procedure for The Heat of Vaporization of Water: We assume that both beakers are identical and that the hot plate distributes heat evenly to both beakers. Therefore, we know that the heat energy gained by both beakers is identical. But how that heat is used is quite different. The 5.0mL beaker has less particles and can heat and vaporize much faster than the 100.0mL of water. We will track the temperature change of the 100.0mL of water since it will constantly be present to record (whereas the 5.0mL will change to gas which has a different specific heat).

1. Add 5.0mL of water to a small beaker using a graduated cylinder.
2. Add 100.0mL of water to a larger beaker.
3. Place both beakers on the same hot plate.
4. Measure and record the temperature of the 100.0mL of water in the large beaker **when the 5.0mL in beaker 1 begins to boil.**
5. Measure and record the final temperature of the 100.0mL of water in the large beaker **when the 5.0mL in beaker 1 is completely vaporized.**
6. Immediately remove the little beaker from the hot plate and unplug the hot plate.

**Heat of Vaporization of Water**

|  | Measurement with units |
| --- | --- |
| Temperature of the 100.0 mL water sample (when the 5mL started to boil) |  |
| Final temperature of the 100.0 mL water sample (when the 5mL was completely vaporized) |  |

Analysis Questions:

1. Calculate the heat absorbed by the 100.0 mL sample of water.
2. How much energy was absorbed by the 5.0 mL sample of water?
3. The energy absorbed by the 5.0 mL sample of water completely vaporized the water. Use this information to calculate the heat of vaporization of water, ∆Hv, in joules per gram.
4. The accepted value for the Heat of Vaporization of water is on Table B. Calculate the % error.
5. Answer the guiding question of this lab: Is more heat needed to melt ice or boil water?

1. Sketch the heating curve of water, labeling the regions that indicate the heat of fusion and the heat of vaporization.







**Use the table below to answer questions below.**

|  | Heat of Vaporization (J/g) | Heat of Fusion (J/g) |
| --- | --- | --- |
| Water | 2260 | 334 |
| Carbon Dioxide | 364 | 205 |
| Propane | 558 | 80 |

1. How is the heat of vaporization of carbon dioxide different from that of water? What might account for this difference?
2. For water, propane, and carbon dioxide, compare the heat of fusion to the heat of vaporization. What patterns do you see? Do you think these patterns hold true for other substances as well? Why might this pattern exist?