Lab 5. Physics of Moisture

1. Latent Heat of Fusion

Purpose

You will observe the "latent heat" of changing the phase of a substance.

Materials

ice, sauce pan, hot plate, thermometer, stirrer (a spoon works well), clock or timer

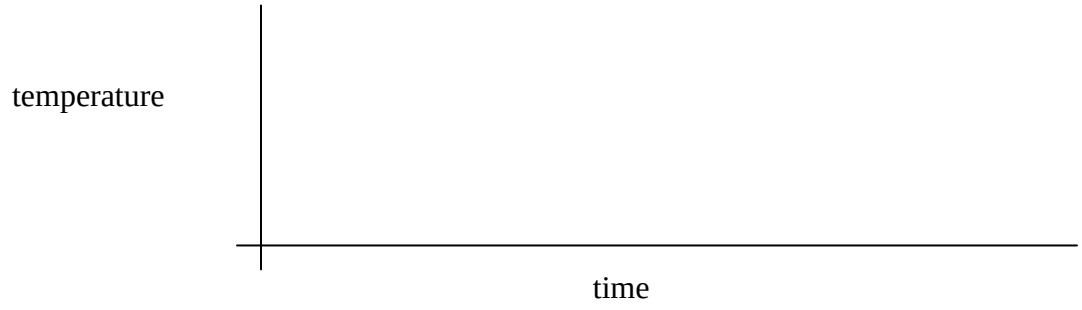
Overview

When ice melts to become liquid water, more is going on than simply a rise in its temperature! Any time a substance changes its phase, it absorbs or releases heat, but it does not always change its temperature in the process. This may sound incredible, but you will observe the consequences of this behavior in this activity.

You will heat ice until it melts and finally boils, recording the temperature of the sample at regular intervals.

Procedure

1. Predict: If you constantly heat a sample of ice on a hot plate, how will its temperature change as it melts, heats up, and finally boils? Sketch a graph of what you expect the temperature to be during that time.



1. Pack a beaker with snow. Add a little water so that the bottom of the beaker is completely covered with liquid. Place a thermometer in the beaker and allow its reading to stabilize. Record the temperature in the table.

3. Place the beaker on the hot plate and turn the hot plate to a high setting. (Some hot plates are touchy. If it turns off during this activity, turn its setting down until it clicks back on again.)

4. Stir the contents of the beaker continuously and well. Measure the temperature of the contents every 10 s and record in the table. Continue measuring for at least one minute after the water is boiling vigorously. If you run out of room in the table, continue your measurements on another sheet of paper.

5. Also record in the blanks below the table the time at which all the ice was melted and the time at which the water began to boil.

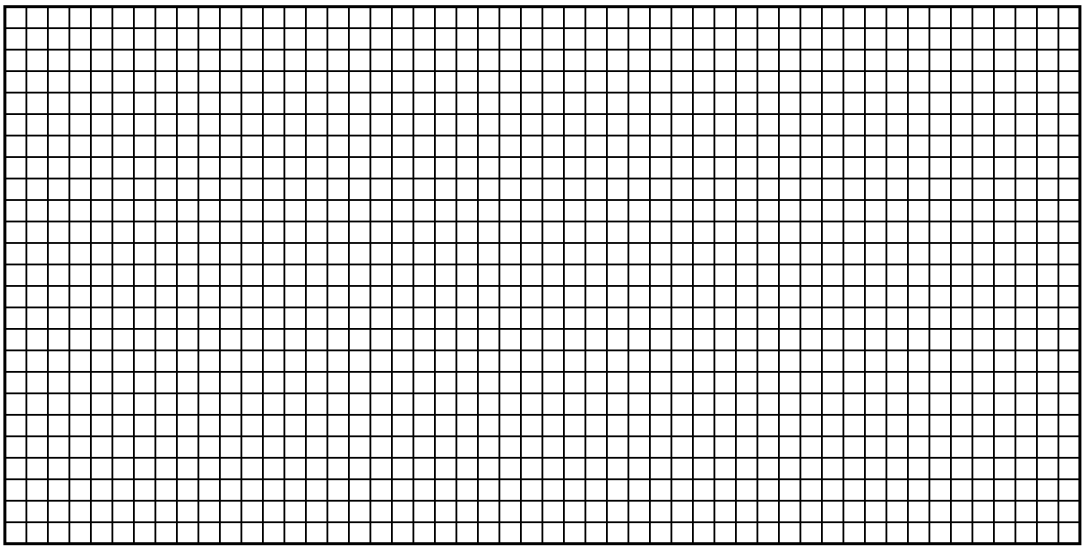
Heating-temperature measurements

time (s)	temp (°C)	time (s)	temp (°C)	time (s)	temp (°C)	time (s)	temp (°C)

Time ice completely melted: _____

Time boiling started: _____

6. Graph your results below. Scale your graph to us at least half of each axis. Label the axes.



Questions

1. Was the temperature progress as you predicted?

2. Does the temperature of the sample always rise if heat is added to it?

2. Sensing Latent Heats

This activity does not take much time at all.

Purpose

You will feel. rather than simply measure, the latent heat of vaporization of water.

Materials

Water, lidded bucket with hole in lid, cloths

Procedure

Evaporation

Wet your hand. Allot it to air-dry. What do you feel as your hand dries?

Condensation

1. When your hands are dry, feel the outside of the bucket. Does the bucket feel warmer, cooler, or about the same temperature as the room air?

2. Now, with one hand, reach inside the bucket through the hole in the lid. Does the bucket feel warmer, cooler, or about the same temperature as the room air?

3. Explain the temperature sensations in both cases.

3 Cloud in a Bottle

Purpose

You will explore the conditions needed to condense water vapor to the liquid.

Materials

basketball pump, hose, rubber stopper, 2-L PETE bottle, warm water, matches

Overview

In the vapor phase, water molecules are separated from each other. In the liquid, the molecules are all in close contact. There is a big difference between how the molecules behave and interact in the two phases. How do they make the change? Are there certain conditions that make it easier than others?

Procedure

Because this activity involves gases under pressure and small objects that may fly through the air, *all members* of a group working on this activity MUST WEAR SAFETY GOGGLES. True, goggles are neither comfortable nor stylish. But it's all fun and games…until somebody loses an eye.

1. Pour some warm water into the 2-L bottle. Cover the mouth of the bottle. Shake and swirl the bottle for a few seconds. Pour out the water.

2. If it is not already assembled, connect the pump to the rubber stopper so that air expelled from the pump comes out through the narrow end of the stopper. Place the stopper securely in the mouth of the bottle. It is best if one person holds the stopper in the mouth of the bottle and another operates the pump.

3. Pump a few strokes of air into the bottle until the bottle becomes hard. Wait 30 seconds for the temperature to equilibrate. *Gently* release the pressure by releasing the stopper. What do you see inside the bottle?

4. Light a match. When its phosphor has burned down, blow it out. Drop the smoldering match into the bottle.

5. Connect the pump to the bottle as before. Pump a few strokes of air into the bottle until the bottle becomes hard. Wait ten seconds for the temperature to equilibrate. Gently release the pressure by releasing the stopper. What do you see inside the bottle?

6. Connect the pump to the bottle once again. Pump a few strokes of air into the bottle until the bottle becomes hard. What do you see inside the bottle now?

7. Repeat a few more times until you think you understand what is happening.

Remove the burnt match from the bottle and clean up any water or other debris from your table.