Name: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Date: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Lab Partner: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Period: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**LAB \_\_\_\_\_\_: WATER HEATING CURVE**

**Safety:** Because you will be heating glassware, you must wear your \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

 **Experimental Question:** What happens to the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ of water as it changes phase from ice to liquid water to gas (steam)?

**Hypothesis: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**Procedure:**

 1. Fill a 400 mL beaker with ice. Add just enough tap water to cover the ice.

2. Suspend the thermometer as deep in the ice water as possible without the bulb touching the bottom or sides.

3. Record the beginning temperature of the ice water. Put the beaker on the hot plate and start the timer.

4. Read and record the temperature after each minute. You may wish to graph the points as you read them.

5. When the water is above 90°C and has been boiling for 5 minutes, you may stop recording and shut off the burner.

6. Allow the beaker and water to cool in place.

**References:**

****

**Data Table:**

|  |  |  |
| --- | --- | --- |
| **Minute** | **Quantitative**  | **Qualitative**  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |

**Data:**

Attach your data table and graph. Label your heating curve graph like we did in your notes. Be sure to include labels for: ice melting, water warming, and water boiling.

**Conclusions:**

1. What temperature did your ice melt at? Explain how you know.
2. What temperature did your water boil at? Explain how you know.
3. Was heat gained or released during the phase changes?
4. How much heat was gained/released (circle one) when 400g of ice melted into liquid water?

 SHOW WORK:

1. How much heat was gained/released (circle one) when 400g of liquid water vaporized?

SHOW WORK:

1. If you were adding thermal energy the whole time, why did you have periods where your temperature did not change much? (What was the thermal energy doing during those time periods?)



5. Look at this graph of a waxy material called Lauric Acid. At what temperature does Lauric acid change from a solid to a liquid? \_\_\_\_\_\_\_\_\_\_\_\_ Describe why you chose this temperature from the graph.

Warm seas, big waves destroying Arctic ice faster than expected

By Scientific American, adapted by Newsela staff on 05.05.15 Word Count 697

A ship makes its way through Arctic ice. Photo: Pixabay / tpsdave Ice covers much of the Arctic Ocean, the chilly waters near the North Pole. As the global temperature has increased, however, some of the ice has begun to melt. With less ice floating in the water, scientists have discovered that huge waves are rolling through the arctic waters. The waves were discovered by accident. In May 2010, researcher Aleksey Marchenko and a group of students set out on the Barents Sea, just south of the Arctic Ocean. Marchenko made this trip every year.

**Cracks In The Ice** Near the edges, the ice is composed of pieces loosely drifting on the water. Farther inside, however, there are huge chunks that form a nearly solid mass. Marchenko’s ship can usually pick its way slowly through it. In previous years, the chunks of ice were solid enough to camp on. By Scientific American, adapted by Newsela staff on 05.05.15 Word Count 697 This trip turned out to be different. On May 2, the ship sailed east and moored next to a large chunk of ice around 50 miles from the small island of Hopen. Marchenko prepared to lead his class out onto the ice. “We were ready to go but when I went out, I discovered many cracks around,” he remembers. He decided to move the ship deeper into the ice for safety. The farther in he went, he thought, the more stable the ice would become. As they pushed forward, however, the ship encountered small waves, and then bigger ones. Soon, the waves broke up the ice around the ship into thousands of smaller pieces.

 **Looking Up At Tall Waves** Within an hour, Marchenko and his team witnessed a wave that was about 13 feet high. The boat's navigation system ultimately recorded waves more than 20 feet in height, the largest ever measured in icy waters. “And we could see even bigger waves higher than the deck of the ship — 30 feet or more,” Marchenko says. Marchenko later gave his measurements to Clarence Collins and his coworkers at the U.S. Naval Research Laboratory (NRL) in Mississippi. Collins analyzed the measurements to try to figure out how such big waves made it so far into the ice. He found that the ice near the outer edge of the pack absorbed some of the energy of arriving waves. At the same time, the outer layer of ice focused the remaining energy into pulses that could lift the ice pack as the waves rolled beneath. The rise and fall strained ice to the breaking point. Once broken, the smaller ice chunks allowed the largest waves to pass through and attack solid ice farther in.

**Waves Destroy Ice Quickly** The ice went from blocking almost all the wave energy to none at all within just one hour. The process happened so fast, in fact, that Collins calculated waves were destroying the ice at a rate of over 10 miles of ice an hour. Scientists had never imagined that Arctic waves could break up ice so quickly. Historically, the waves in these regions were small. So much of the oceans was covered with ice that there was little open space where storms could whip up big waves. Climate change has brought milder winters, warmer sea temperatures and bigger storms. This is a dangerous combination. Warmer temperatures lead to less ice and more open seas. This lets waves then build up energy in open water and then crash into the arctic ice, breaking it up and clearing even more open water.

**Could Spell Disaster** The presence of large, powerful waves in these areas makes navigating them more dangerous. The speed and ferocity of the waves makes it impossible to know in advance when they are coming. That could spell disaster for sailors, oil companies and native communities who are unprepared for large waves or rely on sea ice to protect them. Wildlife like polar bears and walruses that rely on abundant sea ice to survive are also in danger. Collins does not expect the record waves that Marchenko observed in 2010 to remain a record for long. As waves break up ice, the Arctic seas will become more open, and as a result, waves will become even stronger. For the Arctic Ocean, there are stormy times ahead.



1. What does the temperature do when the phase is changing?
2. Where does that energy go?
3. If ice is changing into water what will happen to the temperature?
4. When will we see a rise in the ocean temperatures?
5. How does this relate to the article you just read?