Name_____

DATA Nugget

Lake Superior rhythms

Featured scientists: Gena (she/her) and Ali Gephart (she/her), Bayfield High School.
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Research Background:

Gena and Ali are sisters who grew up in Bayfield, Wisconsin on the south shore of Lake Superior. When they were young, they spent many summer days sailing in the Apostle Islands National Lakeshore with their parents and friends. As they relaxed on the beach, they would watch how the lake changed. Even over a short period of time, they would see the landscape change. In just a few hours, a rock that was visible above the water's surface when they arrived would slowly become submerged, only to reappear several hours later.

A sandy Lake Superior shoreline near Bayfield, WI.

In high school, Gena and Ali set out to learn about the geophysical forces acting on Lake Superior. They wanted to investigate why they would sometimes see such dramatic fluctuations in water levels. They also wanted to know why water from rivers and streams would sometimes flow out into the lake, while other times it would flow back into the tributaries.

They learned that large lakes exhibit a phenomenon called a **seiche** (*pronounced saysh*). Like tides, a seiche is a periodic rising and falling of water levels. However, tides and seiches are caused by two different forces. Whereas tides are connected to the sun and moon, seiches are caused by changes in atmospheric pressure and strong winds.

Many atmospheric events can exert force on the water, including storms that come and go, heavy rain, cold fronts blowing through, or the calming of strong winds. You can think of Lake Superior as a giant bathtub, and the seiche is the water sloshing back and forth as it is pushed by a force and then released.

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Gena and Ali realized that the seiche probably explained the water level changes they saw on Lake Superior. They became curious to learn more about the lake's seiche pattern. An atmospheric event can cause the water to slosh from one side of the lake to the other several times. They predicted the seiche would look like a wave pattern as the water comes and goes.

To test their ideas, they decided to investigate how often the water switched directions and how much the water level changed because of the seiche. In other words, they wanted to measure the amplitude and period of the seiche. The **amplitude** is the height of a wave from its midpoint, or equilibrium. The amplitude can be calculated as half of the water level change from its highest and lowest point in a cycle. The length of time it takes to complete one full back-and-forth cycle is called the **period**. You can track the period of the seiche by how much time has passed from one peak to the next peak.

Over their summer break, Gena and Ali started to plan how they could document changes in water levels in their hometown. With permission, Gena and Ali placed a sensor inside a boathouse that was protected from wave action. The sensor measured the distance to the nearest object and was set to collect a data point every six minutes. Gena and Ali placed the sensor so that it faced the surface of the water. That way, it would document changes in the water level throughout time.

The sensor with data recorder on the dock inside a boathouse.

Scientific Question: What is the period and amplitude of the Lake Superior seiche in Bayfield?

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Scientific Data:

Use the data below to answer the scientific question:

Time from launch (hrs)	Distance (m)	Time from launch (hrs), continued	Distance (m), continued
1	0.96	21	1.02
2	1.00	22	0.98
3	1.08	23	0.96
4	1.08	24	0.95
5	1.11	25	0.94
6	1.10	26	0.96
7	1.04	27	1.01
8	0.98	28	1.03
9	0.97	29	1.04
10	0.95	30	1.07
11	1.00	31	1.03
12	1.07	32	0.94
13	1.07	33	0.92
14	1.08	34	0.96
15	1.06	35	0.96
16	1.00	36	0.99
17	0.96	37	1.03
18	0.97	38	1.01
19	0.99	39	0.99
20	0.99	40	0.97

Notes:

- *This table is a subset of the data and only shows the water level every hour for 40 hours.*
- *Distance is measured from the sensor in the boathouse to the surface of the water.*

What data will you graph to answer the question?

Independent variable(s): _____

_____

Dependent variable(s): _____

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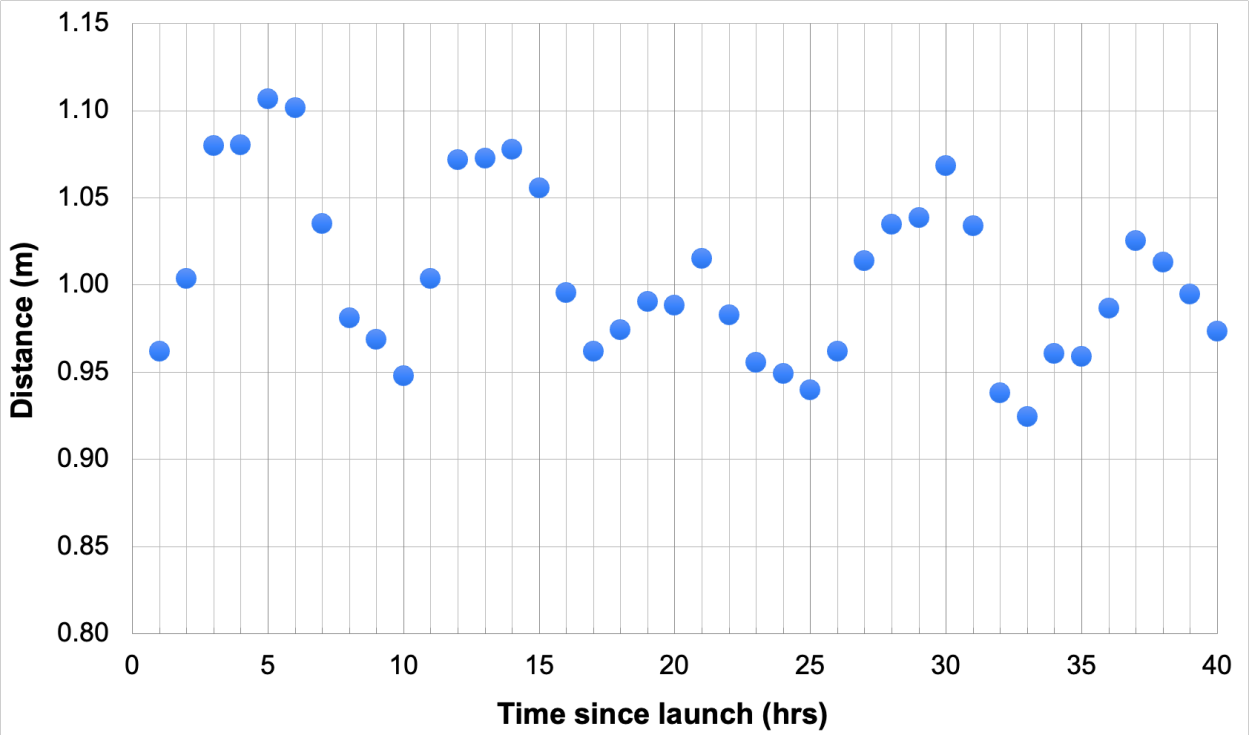
Name_____

Draw your graph below: Identify any changes, trends, or differences you see in your graph. Draw arrows pointing out what you see and write one sentence describing what you see next to each arrow.



Interpret the data:

Make a claim that answers the scientific question, What is the period and amplitude of the Lake Superior seiche in Bayfield?

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What evidence was used to write your claim? Reference specific parts of the table or graph.

Explain your reasoning and why the evidence supports your claim. Connect the data back to what you learned about seiches along with wave amplitudes and periods.

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Your next steps as a scientist: Science is an ongoing process. What new question(s) should be investigated to build on Ali and Gena's research? How do your questions build on the research that has already been done?

What future data should be collected to answer your question?

Independent variable(s): _____

Dependent variable(s): _____

For each variable, explain why you included it and how it could be measured.

What hypothesis are you testing in your experiment? A hypothesis is a proposed explanation for an observation, which can then be tested with experimentation or other types of studies.