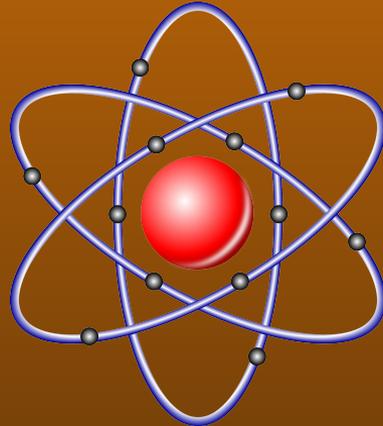


Pay Attention to Surface Tension

C28



PURPOSE & HYPOTHESIS

Purpose: How does the temperature of ocean water affect objects that float on it?

Hypothesis: As the temperature of ocean water increases, surface tension will decrease, causing more objects to sink.

RESEARCH

I got interested in understanding surface tension while I was thinking about ocean pollution, and I wanted to know about global warming's effects on ocean pollution.

Surface Tension of Water

- An effect where the surface of water can hold a weight due to cohesive forces.
- Cohesive forces hold a water droplet together, in a ball shape.
- If water is colder it increases the surface tension and decrease with warmer water.

Ocean Salinity

- The salinity of the ocean is about 35 parts per thousand.
- Salt increases the surface tension of water.

Decreasing salinity of the ocean

- If global warming continues, the polar ice caps will melt letting a large amount of freshwater out into the oceans.
- With all that freshwater in the oceans it will decrease the salinity in the oceans, and change major ocean currents.

Nutrient cycle of the ocean?

- If the salinity in the ocean decreases some nutrients could fall to the bottom which could kill the life down there because they are probably not used to so many nutrients, and the life near the surface wouldn't have enough nutrients which could also kill the life there.

What is the critical temperature increase for global warming?

- The average ocean temperature of the Pacific Ocean near Los Angeles is 60°F.
- 1.5 - 2°C (34.7 - 35.6°F)
- Global warming may not be reversible.

EXPERIMENT

Test three different estimated temperatures (about 60°F, 85°F, and 100°F (global warming critical temperature)) of imitated ocean water to see if surface tension changes when three different objects are placed on the surface of the water.

1. Imitate ocean water by mixing 18 cups of tap water with 15 teaspoons of table salt. Add two rocks rubbed together to add minerals similar to the ocean.
2. Pour 2 cups of ocean water into each container.
3. Measure and record the water temperature in each container.
4. Gently place toothpick, paperclip, and $\frac{1}{8}$ teaspoon of pepper one-by-one into each container.
5. Observe and record whether the objects float or sink.
6. Repeat this process for the other two temperatures. Increase water temperature by heating on the stove, using thermometer to check for temperature.

PHOTOS/VIDEOS



PHOTOS/VIDEOS



PHOTOS/VIDEOS



ANALYSIS

	56°F			87°F			100°F		
Temp.	1	2	3	1	2	3	1	2	3
Temp.	56°F	56°F	58°F	88°F	87°F	87°F	96°F > 86°F	100°F > 93°F	100°F > 95°F
Toothpick	Floated	Floated	Floated	Floated	Floated	Floated	Floated	Floated	Floated Salt makes "stripes"
Pepper	Floated Took a couple taps to get some to sink.	A few flakes sunk by themselves. Spread out.	A lot sunk. Was piled instead of sprinkled.	Spread out A lot sunk	Spread out Few sunk	Spread out A lot sunk	Took time to spread. A lot sunk Few floated back to surface.	A lot sunk Spread out Few floated up.	Spread out A lot sunk
Paper clip	Floated Surface tension broke easily.	Could not get to float	Could not get to float	Sunk	Sunk	Sunk	Could not get to float	Could not get to float	Could not get to float

- All of the toothpicks floated.
- All, except for one, of the paperclips sunk easily.
- Pepper was most affected by the different temperatures.

CONCLUSION

The experiment showed that large or heavy objects like the toothpick and paper may not be affected by increasing ocean temperatures because their response in the water stayed consistent. However, smaller objects like the pepper, are very light, so their response to change water temperature is more variable. The hypothesis was only partially proven since the warmer the water got, the more pepper flakes sunk. The temperature of ocean water does affect very small objects that float on its surface. Based on my data, the most effect things in the ocean due to global warming may be plankton, algae, other small lifeforms.

REAL WORLD CONNECTION

This project is important to the world because there hasn't been any research on global warming effects surface tension, so this experiment might provide some new research. My friends could use this information to make the decision to stop greenhouse gas emissions, so global warming and climate change can be slowed down.

WORKS CITED

Websites

- https://kids.kiddle.co/Surface_tension
- <https://www.quora.com/How-does-adding-salt-to-water-affect-surface-tension?share=1>
- https://crisis.ku.edu/sites/default/files/Education/K-12/IceIceBaby/3.6-IIB_lesson.pdf
- <https://www.jpl.nasa.gov/edu/learn/activities/science-fair-project/>
- <https://www.thoughtco.com/how-salty-is-the-ocean-2291873>
- <https://climatekids.nasa.gov/climate-change-evidence/>
- <https://climaterealityproject.org/blog/why-15-degrees-danger-line-global-warming>

Books

- How Science Works by Judith Hann