

Freezing – Homework Teacher Notes

Homework Measuring the anomalous expansion of water

Scientific practise requires data which is *measurable* against international standards.

Explanation

Water expands 9% on freezing. This is because at temperatures under 40°C its hydrogen atoms start to line up and form hydrogen bonds. The bonding creates spaces in crystalline ice.

Materials per student

- A dictionary or access to the internet
 - One empty clear clean cool drink bottle or glass
 - Water
 - Ruler
 - Texta or sticky tape
 - Permission to use the household freezer
1. Half fill a plastic cool drink bottle with water and place on a level surface
 2. Mark the water level on the side of the bottle with a Texta or sticky tape
 3. Measure the height of the water from the base of the bottle.
 4. What units of measure will you use
 5. Place upright in the freezer
 6. Freeze overnight
 7. Mark and measure the new level.
 8. Calculate the percentage increase in volume

We are measuring the anomalous expansion of water. What does “ANOMALOUS” mean?

Unusual/not normal

Which units of measurement will you use to be scientifically accurate? mm

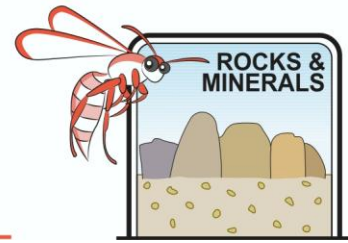
Height of water before freezing _____

Height of water after freezing _____

Percentage increase of water $\frac{\text{height after freezing} \times 100}{\text{Height before freezing}}$ _____

My water increased _____% on freezing

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What would you have to do to make this data more accurate? [Repeat many times and average. Use a more precise measuring device. Avoid parallax.](#)

[Ice is less dense than water because it has less mass per unit volume. This is why it floats on water.](#)