

CONCEPTUAL PHYSICS ALIVE! VIDEO QUESTION SET

Heat, Temperature & Expansion

In this lecture, Paul Hewitt distinguishes between temperature and internal energy. He describes and explains the expansion of water upon freezing, and why deep lakes never freeze. Read the following questions before the presentation begins. Answer them while the presentation is in progress. [44 minutes]

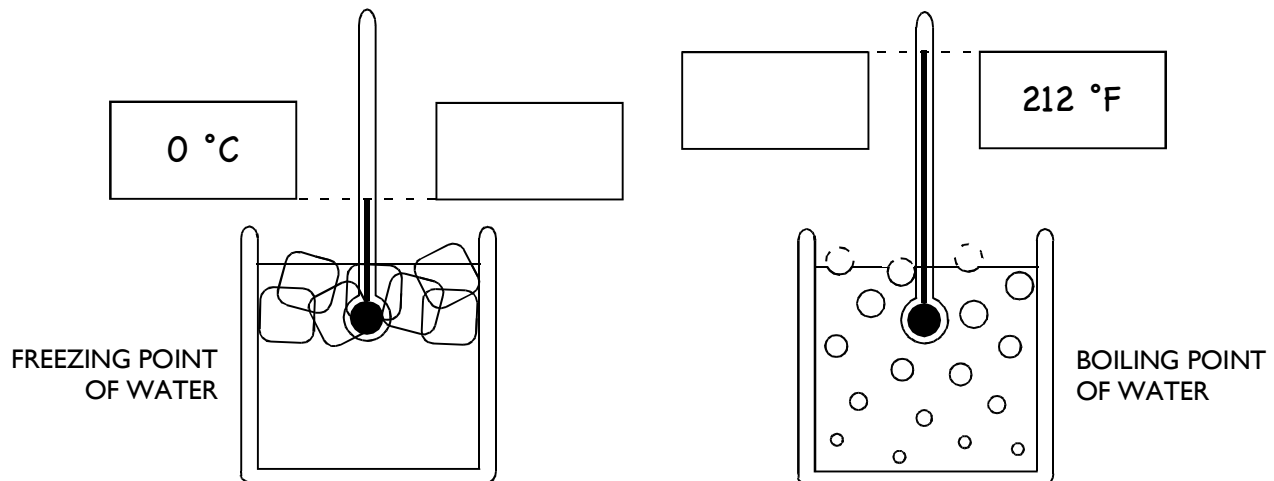
1. Which has more internal energy?

A. a hot cup of coffee

B. a giant iceberg

C. same for both

2. Add the missing values to the thermometer scales shown below.



3. Sparks from a sparkler have

A. high temperature and high total (internal) energy.

B. high temperature and low total (internal) energy.

C. low temperature and high total (internal) energy.

D. low temperature and low total (internal) energy.

4. Which absorbed more heat?

A. the empty frying pan

B. the water-filled frying pan

5. Water is unusual for its ability to

A. take in a little heat for a small change in temperature.

B. take in a little heat for a large change in temperature.

C. take in a lot of heat for a small change in temperature.

D. take in a lot of heat for a large change in temperature.

6. The high specific heat of water results in which—if any—of the following? Select all that are correct.

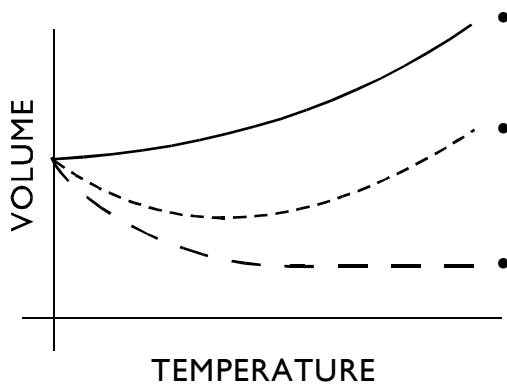
- A. a nicer climate for England than for Labrador
- B. a nicer climate for Washington, DC than for San Francisco, CA
- C. a stable (unchanging) climate for Hawaii
- D. an unstable climate for Iceland

7. Solid water (ice) floats on liquid water because

- A. the solid has a lower specific heat than the liquid.
- B. the liquid has a lower density than the solid.
- C. the greater internal energy of the liquid results in expansion.
- D. the open crystal structure of the solid results in expansion.

8. What was the temperature at the bottom of Lake Superior on New Year's Eve, 1900?

9. Match the plots on the graph below with the corresponding descriptions regarding the behavior of water at low temperature.



- Collapse of the ice crystals
- Pure thermal expansion
- Overall result

10. As 10 °C lake water is cooled by the winter air, its temperature decreases. To freeze, the surface water must reach a temperature of 0 °C. But what happens to the surface water when it reaches a temperature of 4 °C?

11. When an air-filled balloon is immersed in liquid nitrogen, it

- A. contracts.
- B. expands.
- C. pops.

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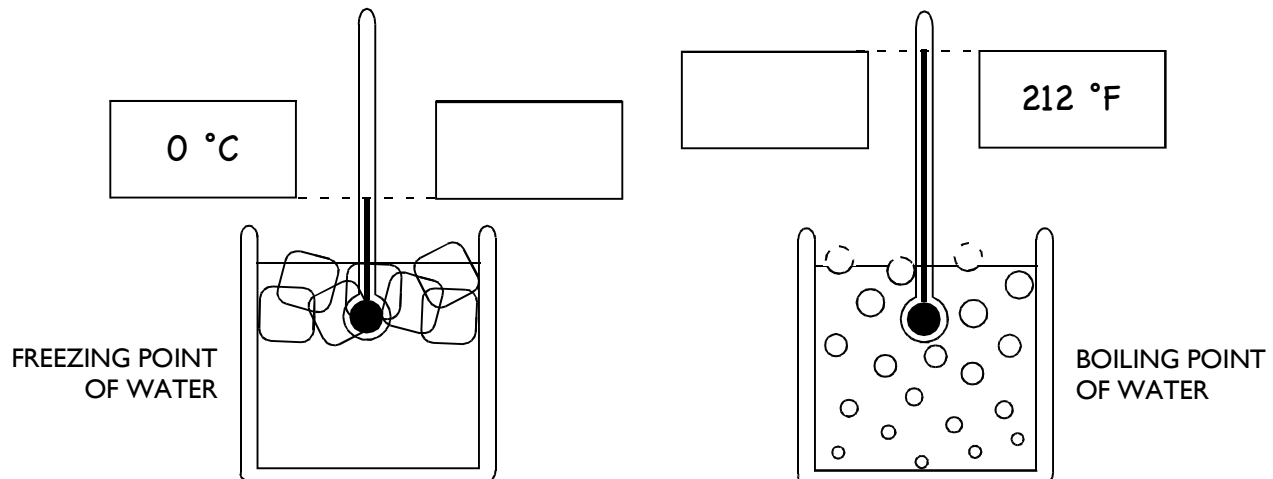
1. Which has more energy per molecule?

A. a hot cup of coffee

B. a giant iceberg

C. same for both

2. Add the missing values to the thermometer scales shown below.



3. Sparks from a sparkler have

A. low temperature and low total (internal) energy.

B. low temperature and high total (internal) energy.

C. high temperature and low total (internal) energy.

D. high temperature and high total (internal) energy.

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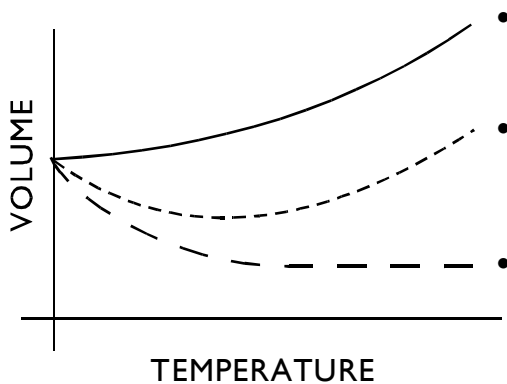
- A. a nicer climate for Labrador than for England
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- C. an unstable (always changing) climate for Hawaii
- D. a stable climate for Iceland

7. Solid water (ice) floats on liquid water because

- A. the solid has a lower specific heat than the liquid.
- B. the liquid has a lower density than the solid.
- C. the greater internal energy of the liquid results in expansion.
- D. the open crystal structure of the solid results in expansion.

8. What was the temperature at the bottom of Lake Tahoe at the time the lesson was recorded?

9. Match the plots on the graph below with the corresponding descriptions regarding the behavior of water at low temperature.



- Pure thermal expansion
- Collapse of the ice crystals
- Overall result

10. As 10 °C lake water is cooled by the winter air, its temperature decreases. To freeze, the surface water must reach a temperature of 0 °C. But what happens to the surface water when it reaches a temperature of 4 °C?

11. When an air-filled balloon that was immersed in liquid nitrogen is brought back out into room-temperature air, it

- A. contracts.
- B. expands.
- C. shatters.