ANSWER KEY.

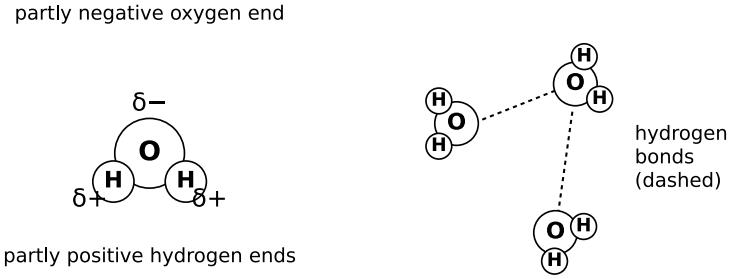
ZornScience
zornscience.org

Properties of Water

Biology | ANSWER KEY

Answer in complete sentences. Use the graphs and tables as evidence.

1. The drawing shows water molecules.



One water molecule **Molecules attract each other**

(a) On the single molecule, label the partly negative end δ− and the partly positive ends δ+.

(b) On the group of three molecules, what do the dashed lines stand for?

(a) **δ− on the oxygen atom; δ+ on each hydrogen atom** (shown above).

(b) **Hydrogen bonds:** weak attractions between the δ+ hydrogen of one molecule and the δ− oxygen of another.

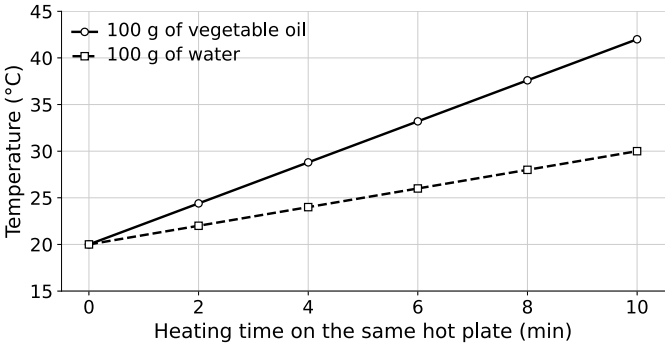
2. Name the property of water that explains each observation. Choose from: cohesion, adhesion, high specific heat.

Observation	Property of water
(a) A water strider walks on the surface of a pond.	**Cohesion (surface tension)**
(b) A paper towel soaks up a spill, pulling water up into the towel.	**Adhesion (capillary action)**
(c) A city on the ocean has milder winters than a city 300 km inland.	**High specific heat**

Cohesion is water sticking to water. Adhesion is water sticking to other surfaces.

CC BY-NC-SA 4.0 | zornscience.org

3. Equal masses of water and vegetable oil are heated on the same hot plate.



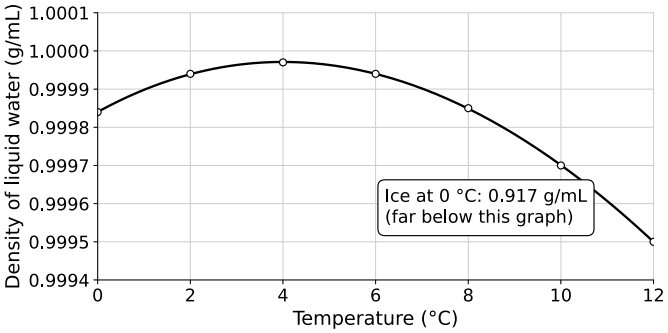
(a) How much did each liquid's temperature rise in 10 min?

(b) Which liquid has the higher specific heat? Use your answer to (a) as evidence.

(a) Water: 30 °C − 20 °C = **10 °C**. Oil: 42 °C − 20 °C = **22 °C**.

(b) **Water.** With the same energy added, its temperature rose less than half as much (10 °C compared with 22 °C).

4. The graph shows the density of liquid water at different temperatures.



(a) At what temperature is liquid water most dense? Where in a lake would you find this water in winter?

(b) Ice has a density of 0.917 g/mL. Explain how this protects fish in winter.

(a) **About 4 °C** (about 0.99997 g/mL). **At the bottom**, because the densest water sinks below colder, less dense water.

(b) **Ice is less dense than liquid water, so it floats** and forms an insulating layer. The water under it stays liquid.

5. Salt dissolves in water, but vegetable oil does not. Explain the difference using the word *polar*.

Water is polar. Its δ− and δ+ ends attract the charged ions in salt and pull them apart, so salt dissolves. **Oil is nonpolar**, so water is not attracted to it, and it does not dissolve.

CC BY-NC-SA 4.0 | zornscience.org