

Investigating the Properties of Water

Student Handout

Gather Evidence to determine what characteristics of a water molecule make it unique.

Claims, Evidence, and Reasoning

While completing each of the following activities, record your claims, evidence, and reasoning for each activity in the graphic organizer. Write a claim for each activity, and use evidence from your observations and from pp. 76 and 77 to support your claim by valid reasoning. Be sure to Include drawings from your lab activities as evidence.

1. Place a drop of water on a table and observe its shape. Then, write a claim about why the water forms a drop instead of spreading out on the table. Use evidence from your observations and from pp. 76 and 77 to support your claim by valid reasoning. Be sure to name any properties of water that you have demonstrated in this activity.

2. Using a pipette, slowly drop water onto a penny until the penny won't hold any more water. Then, write a claim about why the water behaved the way it did. Use evidence from your observations and from pp. 76 and 77 to support your claim by valid reasoning. Be sure to name any properties of water that you have demonstrated in this activity.

3. Place one drop of water on a piece of wax paper. Draw a diagram of the water droplet from the side perspective. Place a toothpick in soap and dip it into the water droplet. Then, write a claim about the effect the soap had on the water. Use evidence from your observations and from pp. 76 and 77 to support your claim by valid reasoning. Be sure to name any properties of water that you have demonstrated in this activity.

4. Fill a plastic cup $\frac{3}{4}$ full of water. Place an ice cube in the plastic cup. Draw a diagram of the plastic cup, ice, and water from the side perspective. Then, write a claim about why the ice behaved the way it did. Use evidence from your observations and from pp. 76 and 77 to support your claim by valid reasoning. Be sure to name any properties of water that you have demonstrated in this activity.

5. Fill a plastic cup $\frac{3}{4}$ full of water. Sprinkle some salt into the plastic cup. Then, write a claim about why the water and salt behaved the way they did. Use evidence from your observations and from pp. 76 and 77 to support your claim by valid reasoning. Be sure to name any properties of water that you have demonstrated in this activity.

6. Fill a plastic cup $\frac{3}{4}$ full of water. Observe how the water clings to the sides of the plastic cup and seems to climb up the sides of the beaker. Then, write a claim about why water behaves this way. Use evidence from your

observations and from pp. 76 and 77 to support your claim by valid reasoning. Be sure to include any properties of water that you have demonstrated in this activity.


7. One unique property of water is that it absorbs a lot of heat before it gets hot. Therefore, water is important in a car's radiator as a coolant. This unique property also helps regulate the rate at which atmospheric air changes temperature, which is why the temperature change between seasons is gradual rather than sudden, especially near the oceans. Make a claim about how this unique characteristic of water helps in regulating cell temperature and maintaining homeostasis. Use evidence from pp. 76 and 77 to support your claim by valid reasoning. Be sure to name any properties of water that you have demonstrated in this activity.

Investigating Properties of Water

Directions: Use the following graphic organizer to help you organize your thoughts when responding to each activity throughout the lab. (NOTE: COMPLETE the graphic organizer per activity)

#1

Place a drop of water on a table and observe its shape. Then, write a claim about why the water forms a drop instead of spreading out on the table. Use evidence from your observations and from pp. 76 and 77 to support your claim by valid reasoning. Be sure to name any properties of water that you have demonstrated in this activity.

<p>Claim: A drop of water spilled on a table forms a drop instead of spreading out on the table.</p>	<p>Evidence: (include drawings)</p> 
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Reasoning:

The water is made up of tiny molecules that are all attracted to each other by cohesion.

The evidence shows:

It shows a drop of water, dropped on a surface, that isn't spread out.

I know (relevant scientific facts and concepts that help answer the question):

“Cohesion in water is a property of water that makes its molecules attracted to each other. A water molecule is made of one oxygen atom bonded to two hydrogen atoms. This imbalance of charges makes opposites attract, and water molecules bond to one another with weak hydrogen bonds.”

Source:

<https://study.com/academy/lesson/cohesion-in-water-definition-example-quiz.html#:~:text=Cohesion%20in%20water%20is%20a,bonded%20to%20two%20hydrogen%20atoms.&text=This%20imbalance%20of%20charges%20makes,another%20with%20weak%20hydrogen%20bonds>.

I can apply (ideas that connect the claim and evidence):

I can apply the given evidence, the information I found, and my background knowledge to back up my claim.

Therefore, I can conclude that:

A droplet of spilled water will stay a droplet, because of the cohesion within the water.

#2

Using a pipette, slowly drop water onto a penny until the penny won't hold any more water. Then, write a claim about why the water behaved the way it did. Use evidence from your observations and from pp. 76 and 77 to support your claim by valid reasoning. Be sure to name any properties of water that you have demonstrated in this activity.

Claim:	Evidence: (include drawings)
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The water stuck to the penny, while holding onto itself, because of adhesion and cohesion.



Reasoning:

The water sticks to the penny because of adhesion, but sticks together because of cohesion.

The evidence shows:

It shows a blob of water on a penny in one picture, and a blob of water spilled on the table.

I know (relevant scientific facts and concepts that help answer the question):

“Adhesion makes a water drop a drop. Water is highly cohesive—it is the highest of the non-metallic liquids. More precisely, the positive and negative charges of the hydrogen and oxygen atoms that make up water molecules makes them attracted to each other.”

Source:

<https://www.usgs.gov/special-topic/water-science-school/science/adhesion-and-cohesion-water#:~:text=A>

hesion%20makes%20a%20water%20drop,of%20the%20non%20metallic%20liquids.&text=More%20precisely%20C%20the%20positive%20and,them%20attracted%20to%20each%20other.

“Cohesion in water is a property of water that makes its molecules attracted to each other. A water molecule is made of one oxygen atom bonded to two hydrogen atoms. This imbalance of charges makes opposites attract, and water molecules bond to one another with weak hydrogen bonds.”

Source:

<https://study.com/academy/lesson/cohesion-in-water-definition-example-quiz.html#:~:text=Cohesion%20in%20water%20is%20a,bonded%20to%20two%20hydrogen%20atoms.&text=This%20imbalance%20of%20charges%20makes,another%20with%20weak%20hydrogen%20bonds>.

I can apply (ideas that connect the claim and evidence):

I can apply the reliable information I got from researching the topic, my own background knowledge, and the evidence to support my claim.

Therefore, I can conclude that:

The adhesion and cohesion in water led to the water sticking onto the penny, while holding itself together until it spilled over.

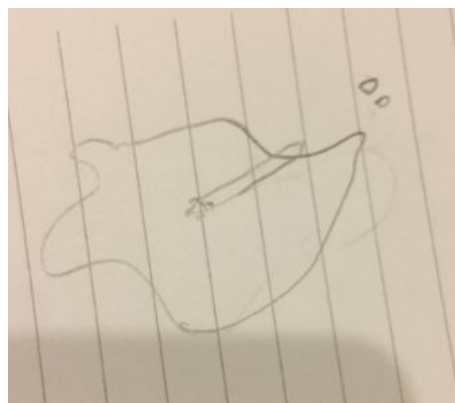
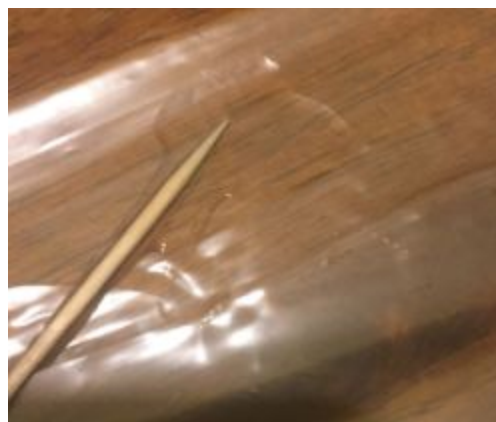
#3

Place one drop of water on a piece of wax paper. Draw a diagram of the water droplet from the side perspective. Place a toothpick in soap and dip it into the water droplet. Then, write a claim about the effect the soap had on the water. Use evidence from your observations and from pp. 76 and 77 to support your claim by valid reasoning. Be sure to name any properties of water that you have demonstrated in this activity.

Claim:

Evidence: (include drawings)

Soap weakens water drops and makes them spread when they come in contact with it.



Reasoning:

I placed a bit of soap into the drop of water and it automatically spread. Therefore, soap weakens the water's cohesion and makes it spread.

The evidence shows:

The drop of water being spread, in contact of the soap and toothpick.

I know (relevant scientific facts and concepts that help answer the question):

“Adding soap lowers the water's surface tension so the drop becomes weaker and breaks apart sooner. Making water molecules stick together less is what helps soaps clean dishes and clothes more easily.”

Source:

<https://www.scientificamerican.com/article/measure-surface-tension-with-a-penny/#:~:text=Adding%20soap%20lowers%20the%20water's,dishes%20and%20clothes%20more%20easily.>

I can apply (ideas that connect the claim and evidence):

I can apply that information that I found, which was similar to my reasoning, and use my evidence to support that, which will support my overall claim.

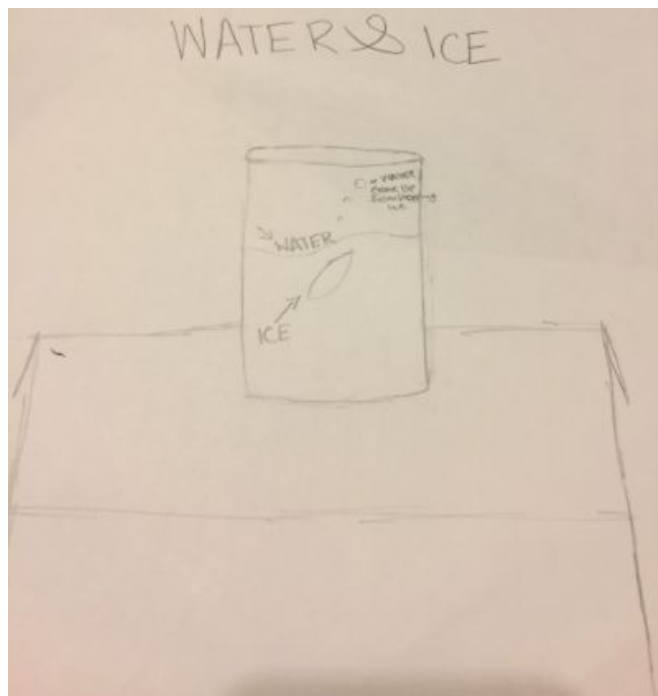
Therefore, I can conclude that:

Water molecules' bounds when it comes to cohesion gets weaker when it comes in contact with soap.

Fill a plastic cup $\frac{3}{4}$ full of water. Place an ice cube in the plastic cup. Draw a diagram of the plastic cup, ice, and water from the side perspective. Then, write a claim about why the ice behaved the way it did. Use evidence from your observations and from pp. 76 and 77 to support your claim by valid reasoning. Be sure to name any properties of water that you have demonstrated in this activity.

Claim: Ice floats in water, hence it's less dense than liquid water.

Evidence: (include drawings)



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Reasoning:

I added one ice, which is why the ice isn't directly floating on top of the water. However, it is floating in the water, sinking as it melts. As well as that, ice has a different structure than liquid water, which is one of the reasons it's less dense than liquid water.

The evidence shows:

The evidence shows ice floating in water, which supports my reasoning.

I know (relevant scientific facts and concepts that help answer the question):

"Like most things that float, ice floats because it is less dense than liquid water. Ice is about 9% less dense. When ice forms, it takes up about 9% more space than it did as a liquid."

Source:

<http://www.units.miamioh.edu/dragonfly/snow/icefloat.shtml>

I can apply (ideas that connect the claim and evidence):

I can apply the piece of information that I got (which I quoted) to my evidence and reasoning, which are essentially the same thing, to support my claim.


Therefore, I can conclude that:

According to the stated facts and evidence, Ice is less dense than water, which is essentially why it floats in/on water.

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#5

Fill a plastic cup $\frac{3}{4}$ full of water. Sprinkle some salt into the plastic cup. Then, write a claim about why the water and salt behaved the way they did. Use evidence from your observations and from pp. 76 and 77 to support your claim by valid reasoning. Be sure to name any properties of water that you have demonstrated in this activity.

<p>Claim: Salt dissolves in water, when placed in it because of both substances' polarity.</p>	<p>Evidence: (include drawings)</p> 
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Reasoning:

Water and salt are both polar. The fact that they are both polar, makes the salt dissolve into the water. Whereas oil, that is nonpolar, wouldn't dissolve into water.

The evidence shows:

It shows salt dissolved into water, and the remaining salt at the bottom of the cup.

I know (relevant scientific facts and concepts that help answer the question):

“When salt is mixed with water, the salt dissolves because the covalent bonds of water are stronger than the ionic bonds in the salt molecules. Water molecules pull the sodium and chloride ions apart, breaking the ionic bond that held them together.”

Source:

<https://www.usgs.gov/media/images/water-molecules-and-their-interaction-salt-molecules#:~:text=When%20salt%20is%20mixed%20with,bonds%20in%20the%20salt%20molecules.&text=Water%20molecules%20pull%20the%20sodium,bond%20that%20held%20them%20together.>

I can apply (ideas that connect the claim and evidence):

I can use the information that I researched with the evidence that I gathered to support my reasoning and claim.

Therefore, I can conclude that:

Polarity is one of the reasons why salt dissolves in water.

#6

Fill a plastic cup $\frac{3}{4}$ full of water. Observe how the water clings to the sides of the plastic cup and seems to climb up the sides of the beaker. Then, write a claim about why water behaves this way. Use evidence from your observations and from pp. 76 and 77 to support your claim by valid reasoning. Be sure to include any properties of water that you have demonstrated in this activity.

Claim: Water has greater adhesion than cohesion. because it sticks more to the sides of the cup than itself.

Evidence: (include drawings)



Reasoning:

The water sticks more to the sides of the cup than itself. Therefore, it has more adhesion than cohesion.

The evidence shows:

Water that is sticking (in a way) to the sides of a cup.

I know (relevant scientific facts and concepts that help answer the question):

“Since water is attracted to other molecules, adhesive forces pull the water toward other molecules.”

Source:

[https://bio.libretexts.org/Bookshelves/Introductory_and_General_Biology/Book%3A_General_Biology_\(Boundless\)/2%3A_The_Chemical_Foundation_of_Life/2.2%3A_Water/2.2E%3A_Water%E2%80%99s_Cohesive_and_Adhesive_Properties](https://bio.libretexts.org/Bookshelves/Introductory_and_General_Biology/Book%3A_General_Biology_(Boundless)/2%3A_The_Chemical_Foundation_of_Life/2.2%3A_Water/2.2E%3A_Water%E2%80%99s_Cohesive_and_Adhesive_Properties)

I can apply (ideas that connect the claim and evidence):

The sources that I used and the evidence that I got can support my claim and reasoning.

Therefore, I can conclude that:

Water has more adhesion than cohesion.

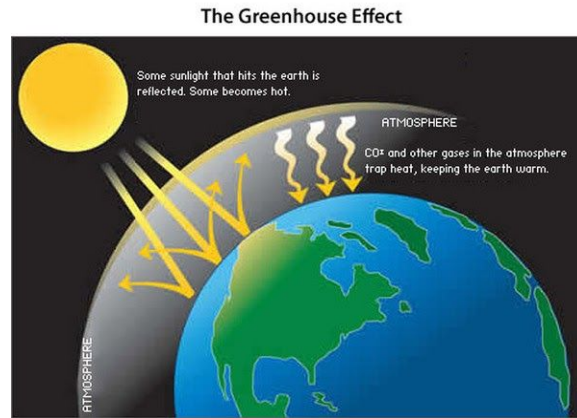
#7

One unique property of water is that it absorbs a lot of heat before it gets hot. Therefore, water is important in a car's radiator as a coolant. This unique property also helps regulate the rate at which atmospheric air changes temperature, which is why the temperature change between seasons is gradual rather than sudden, especially near the oceans. Make a claim about how this unique characteristic of water helps in regulating cell temperature and maintaining homeostasis. Use evidence from pp. 76 and 77 to support your claim by valid reasoning. Be sure to name any properties of water that you have demonstrated in this activity.

Claim:

Water's ability to absorb heat helps regulate cell temperature and maintain homeostasis.

Evidence: (include drawings)



Reasoning:

Every organism needs to live in a particular type of temperature to remain homeostasis. Water helps organisms, so absorbing heat before it gets too hot.

The evidence shows:

The Greenhouse Effect, which uses water vapor to trap heat. This helps Earth not overheat, and helps organisms remain homeostasis.

I know (relevant scientific facts and concepts that help answer the question):

“Water has a high heat capacity (an ability to absorb heat) because for water to increase in temperature, water molecules must be made to move faster within the water; doing this requires breaking hydrogen bonds (the H₂ in H₂O) and the breaking of hydrogen bonds absorbs heat.”

Source:

<http://scienceline.ucsb.edu/getkey.php?key=3440#:~:text=Water%20has%20a%20high%20heat,of%20hydrogen%20bonds%20absorbs%20heat>.

I can apply (ideas that connect the claim and evidence):

I can apply my knowledge of homeostasis, and absorbing heat, to support my claim and reasoning.

Therefore, I can conclude that:

Organisms remain homeostasis because of water's ability to absorb/trap heat.