

Name:

Water—Earth's Special Substance

Our planet is the only place we know of in the entire Universe that has abundant water as a liquid, solid, and gas. Water is what makes our planet what it is, and what makes Life possible. In these activities, you will have the opportunity to learn about this amazing substance.

1) Water's Composition and Structure

Everybody knows that the chemical formula for water is H_2O —two atoms of hydrogen joined with one atom of oxygen. But the reason water can do so much is in the way these three atoms are arranged.

Use your book or other resources to read about the structure of a water molecule. Then draw a picture of it:

2) Because the water molecule is bent, it has an electrically positive side where the hydrogen atoms are, and an electrically negative side where the oxygen atom is. Chemists call this a **polar molecule**.

Draw the water molecule again and show the polarity.

3) Because water has positive and negative sides, water molecules attract each other with **hydrogen bonds**. These constantly form, break, and reform. They are the reason you can float, and water has many of its amazing properties.

Draw a diagram to represent the hydrogen bonds between some H_2O molecules.

- 4) Polarity also explains why water can dissolve many substances. The positive hydrogen side attracts negative atoms in other substances, such as Cl^- in salt, NaCl . The negative oxygen attracts the positive Na^+ . Because of its polar structure and abundance, we call water the **universal solvent**.

Make a drawing to represent Na^+ and Cl^- dissolved among H_2O molecules.

Not everything will dissolve in water. Most substances that do not dissolve are **non-polar**. One important group of these are **lipids**, organic molecules that include **oils**, **waxes**, and other **fats**. This is why grease in a dirty pan forms lumps in water. We have the saying, “Oil and water don’t mix.”

5) Solid Water (Ice)

When H_2O molecules join together to form solid water—ice and snow—the structure of the molecules causes water to behave in unexpected ways. Most substances become more **dense** when they cool.

Use your book to complete this table that shows the density of water at various temperatures

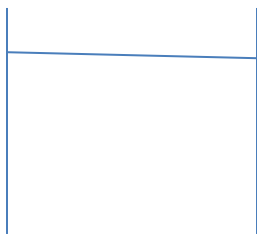
Temperature deg C	Density (g/cm ³)
100	
50	
25	
10	
4	
0 (liquid water)	
0 (ice)	

At what temperature does water have its greatest density? _____

What is the density of water at 0° ? _____

This explains why ice floats in water, with about 9/10 (90%) below the surface and 1/10 (10%) above the surface.

Make a drawing to show an ice cube floating in water.



6) When ice forms a snowflake, the bonds cause a **hexagonal** (6-sided) structure to grow. Make a drawing of a snowflake. Get as fancy as you wish—real snowflakes can be even fancier. Here are some links to images of snowflakes:

<http://chemistry.about.com/od/snowsnowflakes/ig/Snowflake-Photo-Gallery/>

<http://www.its.caltech.edu/~atomic/snowcrystals/photos/photos.htm>

<http://news.nationalgeographic.com/news/2004/02/photogalleries/snowflakes/>

<http://snowflakebentley.com/WBsnowflakes.htm>

7) Now it's your turn to read more about water, and **make a list of 10 things you have learned**. For this, go to Windows to the Universe:

<http://www.windows2universe.org/earth/Water/overview.html>

or, if you wish to read in Spanish, click on the circle at the top of the page. Use the "Explore Water"/"Explore Agua" links to find out as much as you can.

Use the rest of this page and the top of the other side to write what you learn.

- 8) USGS (US Geological Survey) Water Resources <http://water.usgs.gov/>
Explore this website to learn more, then **write about 5 things you learn.**