

## Polar molecule case study: water



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**What makes a molecule polar?** (video #1 <https://www.youtube.com/watch?v=15NvwwuTr5E>)

1. What is the definition of a polar covalent bond?

2. Electronegativity refers to the

3. What values of electronegativity determine what kind of bonds will form?

Nonpolar covalent =

Polar covalent =

Ionic =

**NOTE:** The difference in electronegativity will tell us what type of bond will be made, just as an element's state of matter (metal, metalloid, or metal) does.

4. A **dipole moment** occurs when there is uneven sharing of electrons in the bond (polar covalent). It is represented as an arrow. How do you determine which way the dipole arrow is pointing?

5. How do you write a partial positive charge? \_\_\_\_\_

How do you write a partial negative charge? \_\_\_\_\_

6. Besides the electronegativity of a bond, what else determines if an atom will be polar?

7. Use the periodic table to determine what type of bond will form based on the difference in electronegativities for the following molecule. Then, draw the Lewis dot structure with partial charges and the dipole.

HCl: Electronegativity (show work):

Lewis dot structure:

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**The properties of water** (video #2: <https://www.youtube.com/watch?v=3jwAGWky98c>)

8. Draw a water molecule. Use different colors for Hydrogen and Oxygen and label which sides of the molecule are positive and negative.

9. Draw a diagram of the way water molecules interact with each other, using different colors to represent the Hydrogen and Oxygen and show their charges (draw at least 5 water molecules).

10. Cohesion is when molecules are \_\_\_\_\_

Adhesion is when molecules are \_\_\_\_\_

\_\_\_\_\_

11. Draw how cohesion and adhesion helps water travel up tree trunks. Label where in the trunk these processes are happening and use different colors for Hydrogen and Oxygen (draw at least 5 water molecules).

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12. Water is a polar molecule and uses its polar structure to help it get “sucked up” by trees. Are the molecules on the inside of a tree trunk (or those coffee filter strips) polar? Explain why or why not.

### **Salt and Water: The power of polarity!**

13. Draw the Lewis dot structure for NaCl:

14. When molecules that are bonded ionically are grouped together, they are called **compounds**. Draw the model of a compound of salt. Which ions are bigger and why?

15. Draw a before and after of your salt dish (before and after you add 10 ml of water). What does the before and after look like on a molecular level?

Salt dish before water	Salt dish after water
Our view:	Our view:
Molecular view:	Molecular view:

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16. Water is a **solvent**, which means it has the ability to dissolve certain substances. What other substances is water a solvent for?

### **Butter hands: Interactions with other molecules**

16. Have a volunteer in your group (or as many would like to try) rub butter on their hands. Then try and wash off the butter using just water.

17. Do you think butter is made of polar molecules, why or why not? Refer to polarity in your answer.

18. Butter is made of fats, the same thing that insulates our body. Why is it important that water is not a solvent for fats?

### **Playin' with models:**

19. Using the water molecules in your kit, build the tallest structure that you can! Then, draw it.

