<http://www.sumanasinc.com/webcontent/animations/content/propertiesofwater/water.html>

**word bank: use each word only once.**

*covalently bonded electronegativity density entropy four Hydrogen bond*

*ionic negatively partial negative partial positive polar polar covalent*

*positively shared electrons solvent specific speed state*

1 Life is based on water, primarily because if water’s \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_properties.

2 Water is formed by sharing of valence electrons between one O atom and two H atoms; because sharing valence electrons forms stable water molecules, water is termed a \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ compound.

3 Water is a polar molecule because its O atoms have higher e\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ than its H atoms, meaning that the O atom in each O—H bond of water attracts covalently bonded electrons strongly, whereas the H atoms attract the shared electrons much more weakly.

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| 4 Drawing showing the polarity of a molecule of water:  5 What is represented by the two circles between each H and O? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  6 What is represented by the δ+ symbol by each H atom? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  7 What is represented by the δ- symbol by the O atom? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ |

8 The partially positive H atoms in one water molecule become attracted to the partially negative O atoms of adjacent water molecules, creating \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_.

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| 9. Draw a water molecule whose H atoms are attracted to the O atoms in two different adjacent water molecules. Show the Hydrogen bonds, weaker than the O—H covalent bonds, as dashed lines. |

10 Water’s partially positive H and O atoms allow it to dissolve \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ compounds like NaCl, as well as \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ covalent compounds.

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| 11 Draw a \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_-charged-metal ion surrounded by 3 water molecules, and draw a \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_-charged nonmetal ion surrounded by 3 water molecules. |

12 Solid water, ice, floats on liquid water because the molecules in the solid state are linked by more Hydrogen bonds between water molecules than are the molecules in liquid water. Each molecule of solid water is Hydrogen bonded to \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ different water molecules, and these molecules spread farther apart than the molecules in liquid water.

13 Solid water has lower d\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ than liquid water.

14 Water’s ability to form Hydrogen bonds also results in its having a high \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ heat , a measure of how much energy 1g of substance absorbs to experience a 1⁰C increase in temperature.

15. The graphs show that the temperature of water remains constant as it is changing s\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ from either solid to liquid OR liquid to gas. After the state of matter changes, then the temperature rises as energy is absorbed, so that the molecules vibrate with greater \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

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| 16, Sketch and label a diagram showing how e\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ (disorder related to how rapidly the molecules are vibrating) increases as the water increases in temperature and as it changes state first from solid to liquid, then liquid to gas. X-axis entropy, y axis Celcius Temperature. |

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*covalently bonded electronegativity density entropy four Hydrogen bond*

*ionic negatively partial negative partial positive polar polar covalent*

*positively shared electrons solvent specific speed state*

1 Life is based on water, primarily because if water’s **solvent** properties.

2 Water is formed by sharing of valence electrons between one O atom and two H atoms; because sharing valence electrons forms stable water molecules, water is termed a **polar covalent** **(covalently bonded)** compound.

3 Water is a polar molecule because its O atoms have higher **electronegativity** than its H atoms, meaning that the O atom in each O—H bond of water attracts covalently bonded electrons strongly, whereas the H atoms attract the shared electrons much more weakly.

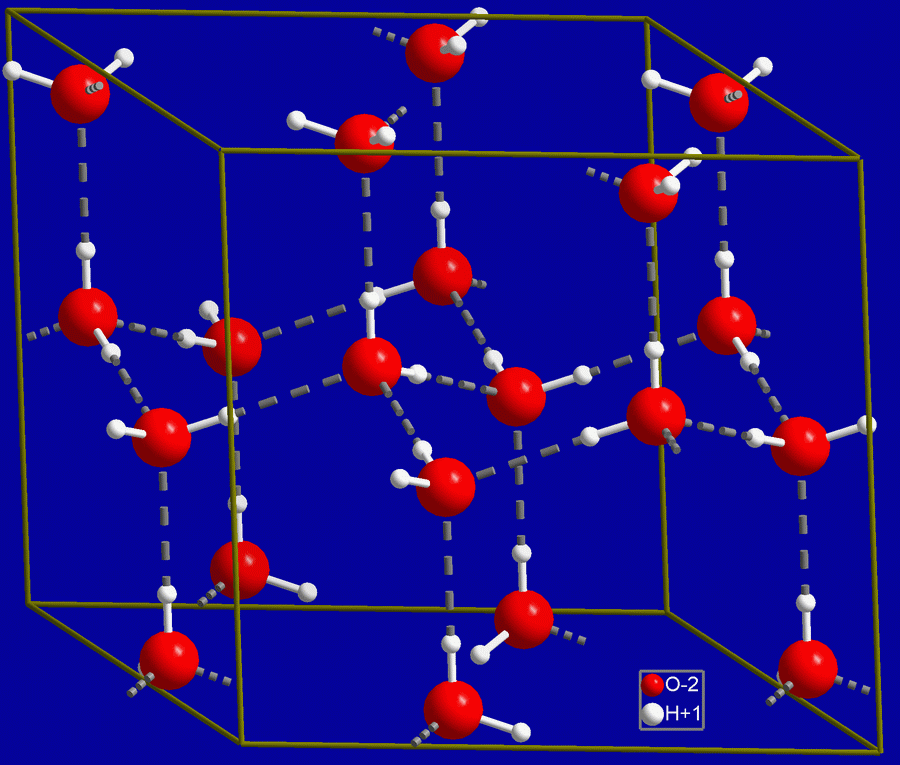
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| 4 Drawing showing the polarity of a molecule of water:  http://startswithabang.com/wp-content/uploads/2008/08/waterstructure.jpg  http://scienceblogs.com/ethicsandscience/upload/2007/03/DipoleWater.jpg  5 What is represented by the two circles between each H and O? **two shared electrons in the single covalent bond between H and O**  6 What is represented by the δ+ symbol by each H atom? **Partial positive charge on the less electronegative atom of H because on average, it is farther from the electrons than the oxygen atom.**  7 What is represented by the δ- symbol by the O atom? **Partial negative charge on the less electronegative atom of O because on average, it is Closer to the electrons than the less electronegative H atom.** |

8 The partially positive H atoms in one water molecule become attracted to the partially negative O atoms of adjacent water molecules, creating **hydrogen bonds**

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| 9. Draw a water molecule whose H atoms are attracted to the O atoms in two different adjacent water molecules. Show the Hydrogen bonds, weaker than the O—H covalent bonds, as dashed lines.  http://homepages.ius.edu/GKIRCHNE/waterFig2.gif |

10 Water’s partially positive H and O atoms allow it to dissolve **ionic** compounds like NaCl, as well as **polar** covalent compounds **like alcohols or sugars or amino acids.**.

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| 11 Draw a **positively**-charged-metal ion surrounded by 3 water molecules, and draw a **negatively**-charged nonmetal ion surrounded by 3 water molecules.  http://www.equistat.co.uk/images/membrane\_pores.gif |

12 Solid water, ice, floats on liquid water because the molecules in the solid state are linked by more Hydrogen bonds between water molecules than are the molecules in liquid water. Each molecule of solid water is Hydrogen bonded to **four** different water molecules, and these molecules spread farther apart than molecules in liquid water.  http://wpcontent.answers.com/wikipedia/en/5/5b/Hex\_ice.GIF

13 Solid water has lower **density** than liquid water. **Density liquid water: 1.00 g/ml, density ice: 0.92 g/1ml density=mass/volume**

14 Water’s ability to form Hydrogen bonds also results in its having a high **specific** heat , measure of how much energy 1g of substance absorbs to experience a 1⁰C increase in temperature. **Specific heat water= 1 calorie/(1g 1⁰C)**

15. The graphs show that the temperature of water remains constant as it is changing **state** from either solid to liquid OR liquid to gas. After the state of matter changes, then the temperature rises as energy is absorbed, so that the molecules vibrate with greater **speed (kinetic energy)**.

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| 16, Sketch and label a diagram showing how **entropy** (disorder related to how rapidly the molecules are vibrating) increases as the water increases in temperature and as it changes state first from solid to liquid, then liquid to gas. X-axis entropy, y axis Celcius Temperature. **Shows that the temperature doesn’t change as the water is changing state, from solid to liquid at the far left section with slope of 0 and from liquid to gas at right section with slope 0** |