

Study Questions: Water (Ch. 3)

- Explain what a polar covalent bond is.
 - Bond where the electronegativity is not equal
- Now explain what a hydrogen bond is.
 - Attraction between relatively positive and relatively negative ends of separate polar molecules
- What's the relationship between these two?
 - They both involve polar molecules, charges
 - Hydrogen bond: only form with a H with an N or a H with an O
- Which occurs *within* a molecule and which occurs *between* molecules?
 - Polar Bond: within a molecule
 - Hydrogen Bond: between molecules
- Make a very simple drawing of a water molecule, using letters for the atoms involved and line segments for the covalent bonds. Indicate with small circles each shared electron - how many are there forming each bond? Place the shared electrons nearer to the atom that they orbit more frequently.
- Now draw another water molecule and indicate with a dashed line any attractive interactions between the two molecules.

- Define and contrast the properties of cohesion and adhesion.
 - Cohesion: attraction force between like substances, 2 water molecules
 - Adhesion: adheres to other substances
- What is surface tension?
 - A measure of how difficult it is to stretch or break the surface of a liquid, related to cohesion
- What feature of water causes it to exhibit these properties?
 - Hydrogen Bonding
- Give examples of how each these properties of water are significant to living things.
 - Polar so water can evaporate in it
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- What is specific heat, and how does water compare with other substances in relation to this property?
 - Amount of heat required to raise temperature by 1 degree Celsius; water has an usually high specific heat

- How does specific heat affect the heat of vaporization of water?

- o High specific heat means water stores a lot of energy; slow give it up and change temperature; hydrogen bond must be broken down
- Explain how this property is relevant to animal homeostasis.
 - o Evaporation greatly cools down the surface from which it evaporates which allows many organisms to maintain proper body temperature (thermoregulation); homeostasis
 - o
- Describe how the density of water changes as it cools toward its freezing point.
 - o As water freezes it gets less dense because if the hydrogen bonds between them pull them closer together
- At what temperature is water most dense?
 - o 4 degrees Celsius
 - o 0 degree Celsius least dense
- Explain how this affects the behavior of bodies of water through the seasons, and why it is relevant to aquatic organisms.
 - o Lake freezes on top and fish can still swim and live on bottom
- Explain why water is essential to life on earth.
 - o It is the solvent of biological systems
- What is meant by hydrophilic and hydrophobic, and what kinds of substances exhibit such properties?
 - o Hydrophobic: Water does not dissolve non polar substances
 - o Hydrophilic: Water dissolves polar and ionic substances
- Explain what a mole is.
 - o Avogadro number
- What is a molar solution (M), and what are the advantages of measuring solute concentration in M ?
 - o
- Explain how you would go about preparing a 1 M solution of, for example, KNO_3 . How would you prepare a 10% percent solution of this compound?
 - o Find how many grams are in KNO_3
 - o Put 10% of KNO_3 then add water
- Explain what makes a solution acidic or basic.
 - o Acid; increase H^+
 - o Base: decrease H^+
- Why is this important to living things?

- o If the PH rises even a little bit we die, so are PH has ro say neutral
- What do acids do when they are dissolved in water?
 - o Compounds dissoaciate and release protons
- Give an example of an acid; show with a simple chemical equation what happens to it in water.
 - o
- What do bases do when they are dissolved in water?
 - o Dissociate from water and release OH
- Give an example of a base; show with a simple chemical equation what happens to it in water.
 - o
- Describe the dissociation of water.
 - o
- Explain with the appropriate formula how the concentration of hydrogen ion $[H^+]$ in a solution is related to the concentration of hydroxide $[OH^-]$.
 - o notes
- Explain what pH is, and how the pH scale measures acidity/basicity.
 - o $pH = -\log[H^+]$, where $[\] =$ concentration in moles per liter
 - o pH below 7= ACIDIC
 - o pH above 7= BASIC
 - o
- What are buffers and how do they work?
 - o Living cells and tissues have a balance of certain compounds that tend to prevent the pH from changing very much.

Are buffers common in living organisms? Why or why not?

 - o Yes because they contribute to pH stability