**WATER and LIFE**

**Water: The Molecule That Supports All of Life**

**🡪Polar covalent bonds in water molecules result in hydrogen bonding**

* **polar molecule -**

**Four properties that facilitate an environment for life are:**

* + **Cohesive behavior**
	+ **Ability to moderate temperature**
	+ **Expansion upon freezing**
	+ **Versatility as a solvent**



**Cohesion and Adhesion of Water Molecules**

* **Hydrogen bonds hold water molecules together, (a phenomenon called cohesion)**
* **Cohesion helps the transport of water against gravity in plants**
* **an attraction between different substances, for example, between water and plant cell walls**
* **Surface Tension**

**How does water moderate temperature?**

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***Remember…***

* **Kinetic energy is the energy of motion**
* **Heat is a measure of the total amount of kinetic energy due to molecular motion**
* **Temperature measures the intensity of heat due to the average kinetic energy of molecules**

**What is Specific Heat?**

**🡪 *Water has a high specific heat!***

* + ***Heat is absorbed when hydrogen bonds break***
	+ ***Heat is released when hydrogen bonds form***

**The high specific heat of water minimizes temperature fluctuations to within limits that permit life**

**What is Evaporative Cooling?**

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* **Heat of vaporization -**

**Water is Special! It has special properties that other compound don’t…**

 **Liquid water:**

**Hydrogen bonds**

 **break and re-form**

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 Like how ice floats on liquid water…**

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* **.**

**Ice:**

**Hydrogen bonds**

**are stable**

**And …**

***So… they say*“Water is The Solvent of Life”**

***Some vocab…***

* **A solution is a liquid that is a homogeneous mixture of substances**
* **A solvent is the dissolving agent of a solution**
* **The solute is the substance that is dissolved**
* **An aqueous solution is one in which water is the solvent**

**What makes water such a versatile solvent??**

**Na+**

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**Cl−**

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**Hydrophilic and Hydrophobic Substances**

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* **Oil molecules are hydrophobic because they have relatively nonpolar bonds**
* **A colloid is a stable suspension of fine particles in a liquid**

**Most biochemical reactions occur in water**

***Chemical reactions depend on …***

* **1.**
* **2.**

**Acidic and basic conditions and living organisms**

* Living organisms **are** affected by acidic and basic conditions

**
Acid and Base Review:**

**A hydrogen atom in a hydrogen bond between two water molecules can shift from one to the other**

* + **The hydrogen atom leaves its electron behind and is transferred as a hydrogen ion (H+)**
	+ **The molecule with the extra proton is now a hydronium ion (H3O+)**
		- **it is often represented as H+**
	+ **The molecule that lost the proton is now a hydroxide ion (OH–**

**Water is in a state of dynamic equilibrium**

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* ***Changes in concentrations of H+ and OH– can drastically affect the chemistry of a cell***

**Acid –**

**Base -**

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***Biologists use the pH scale to describe whether a solution is acidic or basic***

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**What are Buffers? And why do we use them?**

* **Buffers -**
	+ **Most buffers consist of an acid-base pair that reversibly combines with H+**
	+ **The internal pH of most living cells must remain close to pH 7**

**How does Acidification Threaten Water Quality?**

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* **As seawater acidifies, carbonate ions are converted into bicarbonate**
* **Marine organisms need Carbonate calcification (production of calcium carbonate)**
	+ **reef-building corals, marine organisms with shells**

**What about the good ole’ Acid Rain?**

* **The burning of fossil fuels is also a major source of sulfur oxides and nitrogen oxides**
	+ **These react with water in the air to form strong acids that fall in rain or snow**
	+ **Acid precipitation is rain, fog, or snow with a pH lower than 5.2**
* **Acid precipitation damages life in lakes and streams and changes soil chemistry on land**