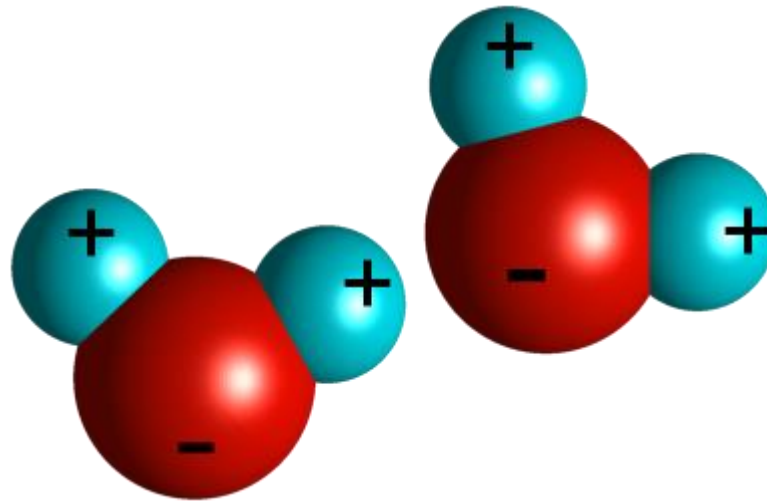


Properties of Water

(SYI-1.A)

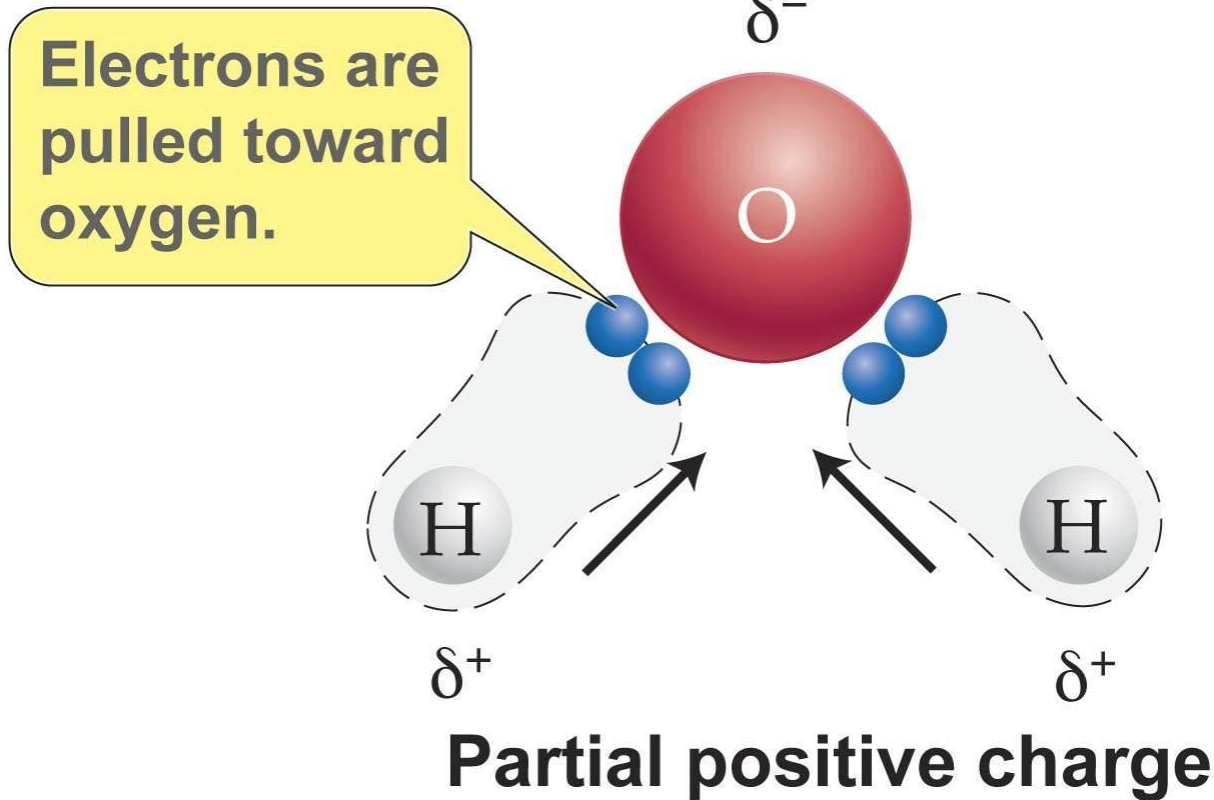


Properties of Water

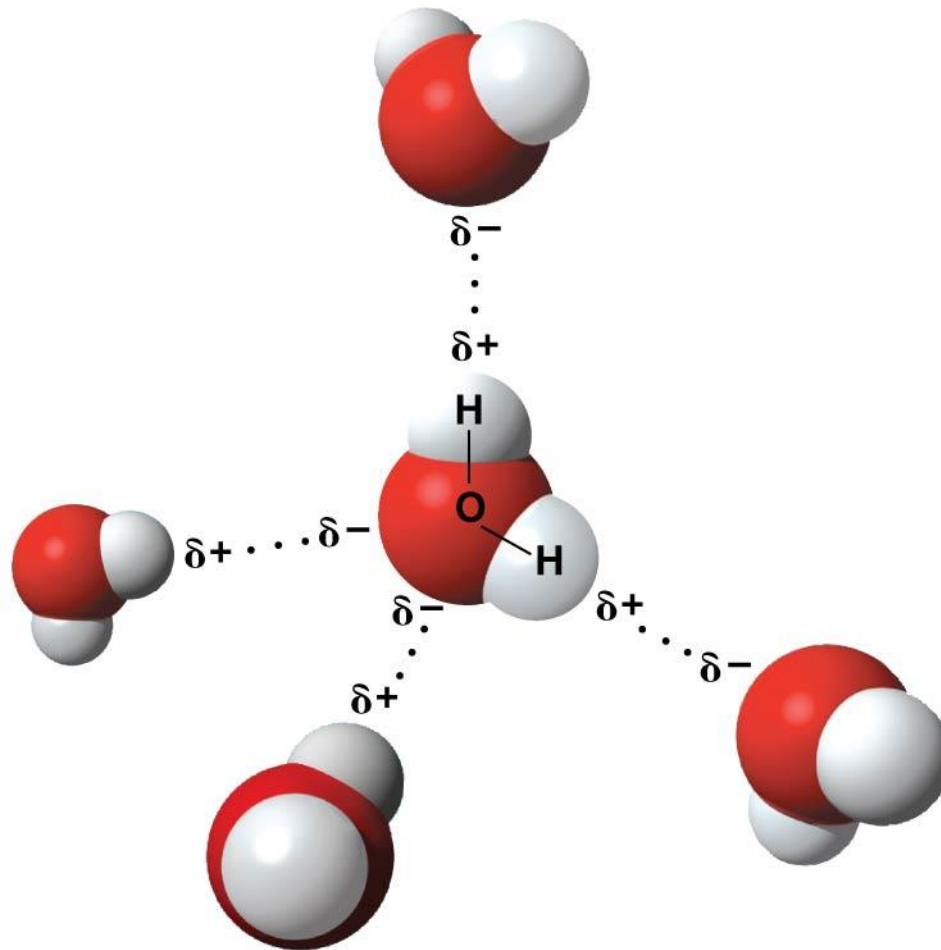
- Water molecules are **polar** (uneven distribution of charge), with the oxygen region having a partial negative charge and the hydrogen region a slight positive charge
- **Hydrogen bonding** gives water properties that help make life possible on Earth

Polarity

Partial negative charge

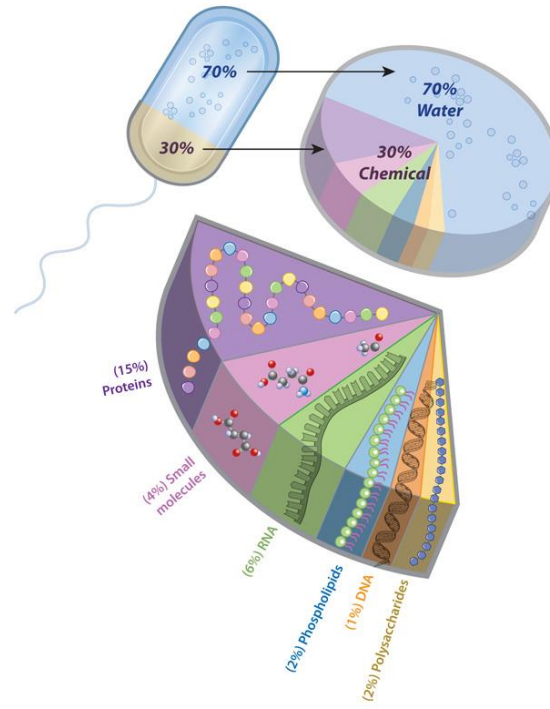


Hydrogen Bonding



Why is water important?

- All organisms are made mostly of water and live in an environment dominated by water
- Most cellular reactions occur in the cytoplasm which is primarily composed of water

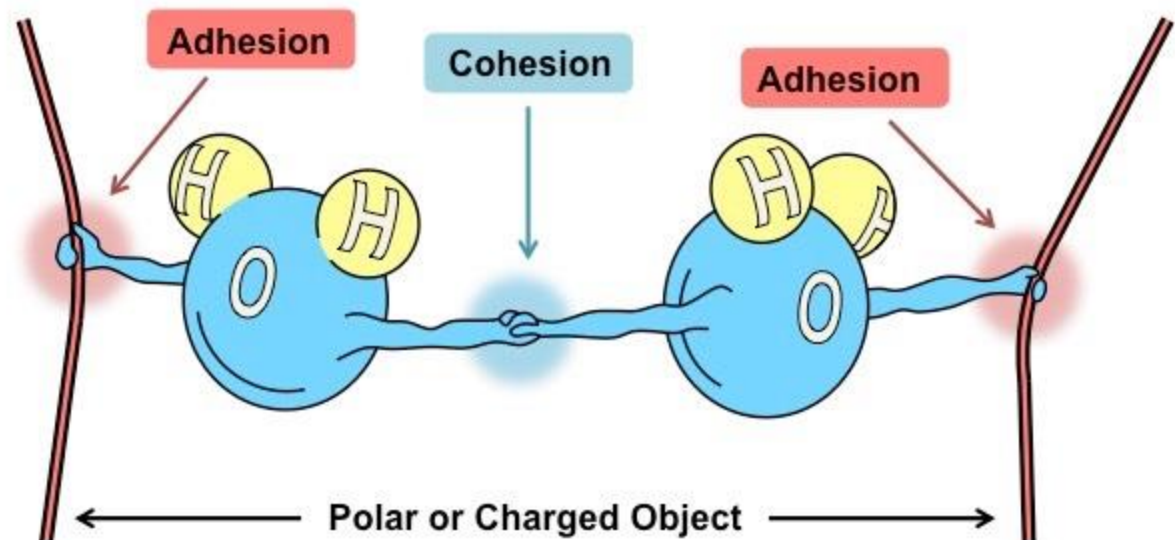


Properties of water contribute to Earth's suitability for life

- Cohesion
- Adhesion
- Ability to moderate temperature
- Expansion upon freezing
- Universal solvent supports reactions

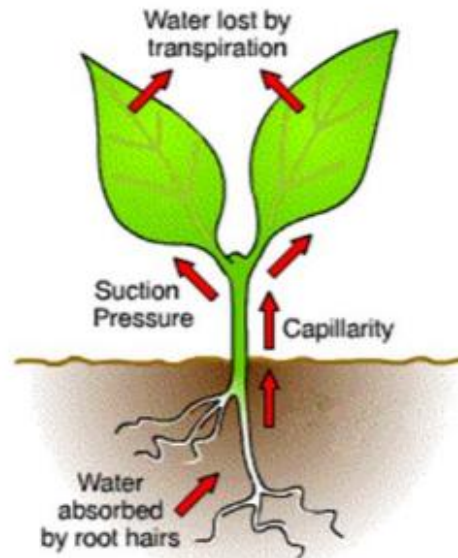
Cohesion and Adhesion

- Water molecules are linked by multiple hydrogen bonds
- The molecules stay close together because of this; it is called **cohesion**
- Molecules “stick” to unlike surfaces due to **adhesion**

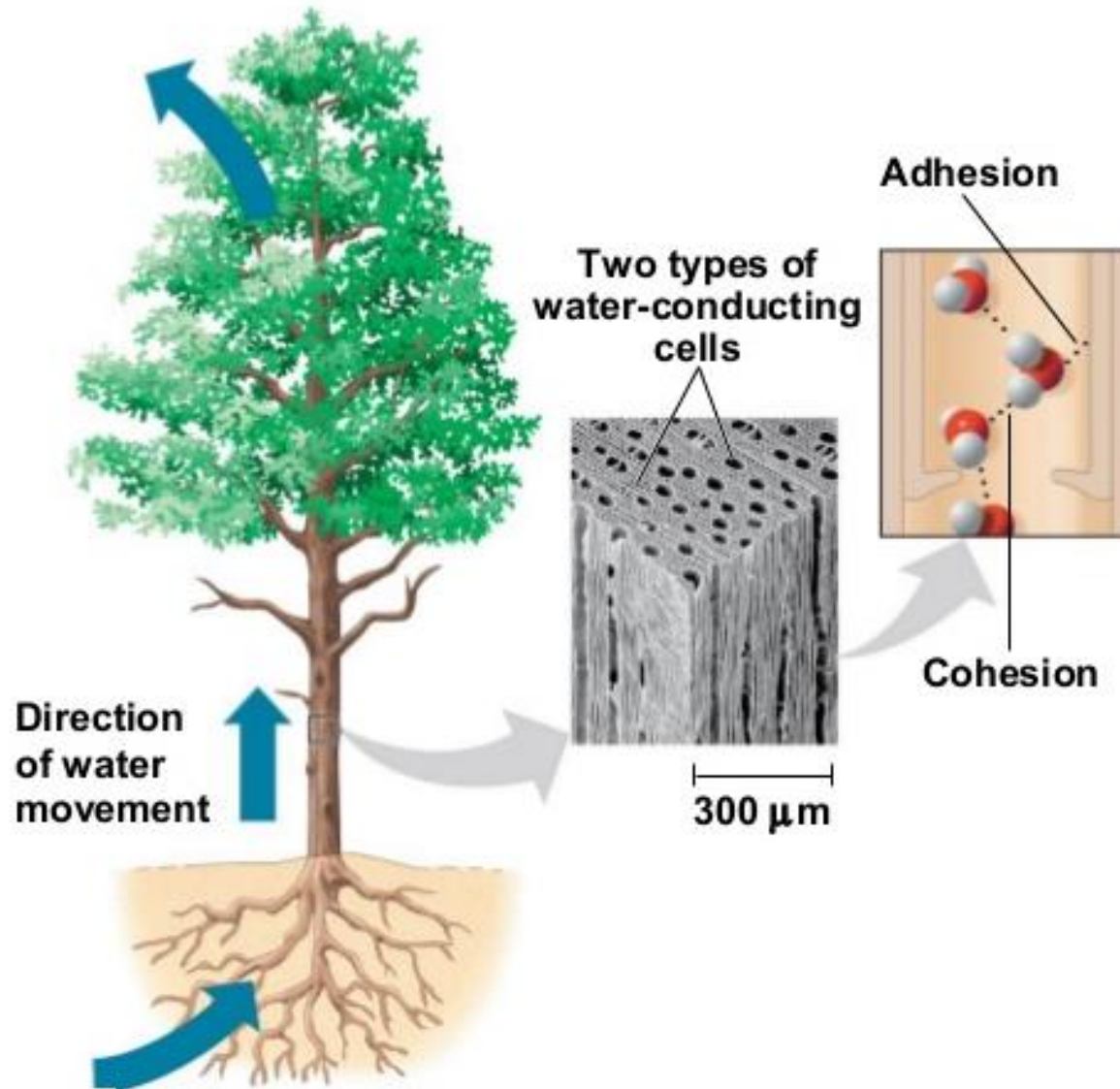


Water Transport in Plants

- Evaporation from leaves pulls water upward from the roots through water-conducting cells
- Properties of **cohesion** and **adhesion** allows plants to transport water against gravity
- Water transport in plants is known as **capillary action**



Water Transport in Plants



Surface Tension

- **Surface tension** is a measure of how hard it is to break the surface of a liquid (invisible film)
- Surface tension is related to cohesion



Moderation of Temperature by Water

- Water absorbs heat from warmer air and releases stored heat to cooler air
- Water can absorb or release a large amount of heat with only a slight change in its own temperature
- Climate is affected by large bodies of water
- Due to water's **high specific heat**



Affect on Climate

- Due to its high **specific heat capacity**, water will change its temperature less than other liquids when it absorbs or loses a given amount of heat



Evaporative Cooling

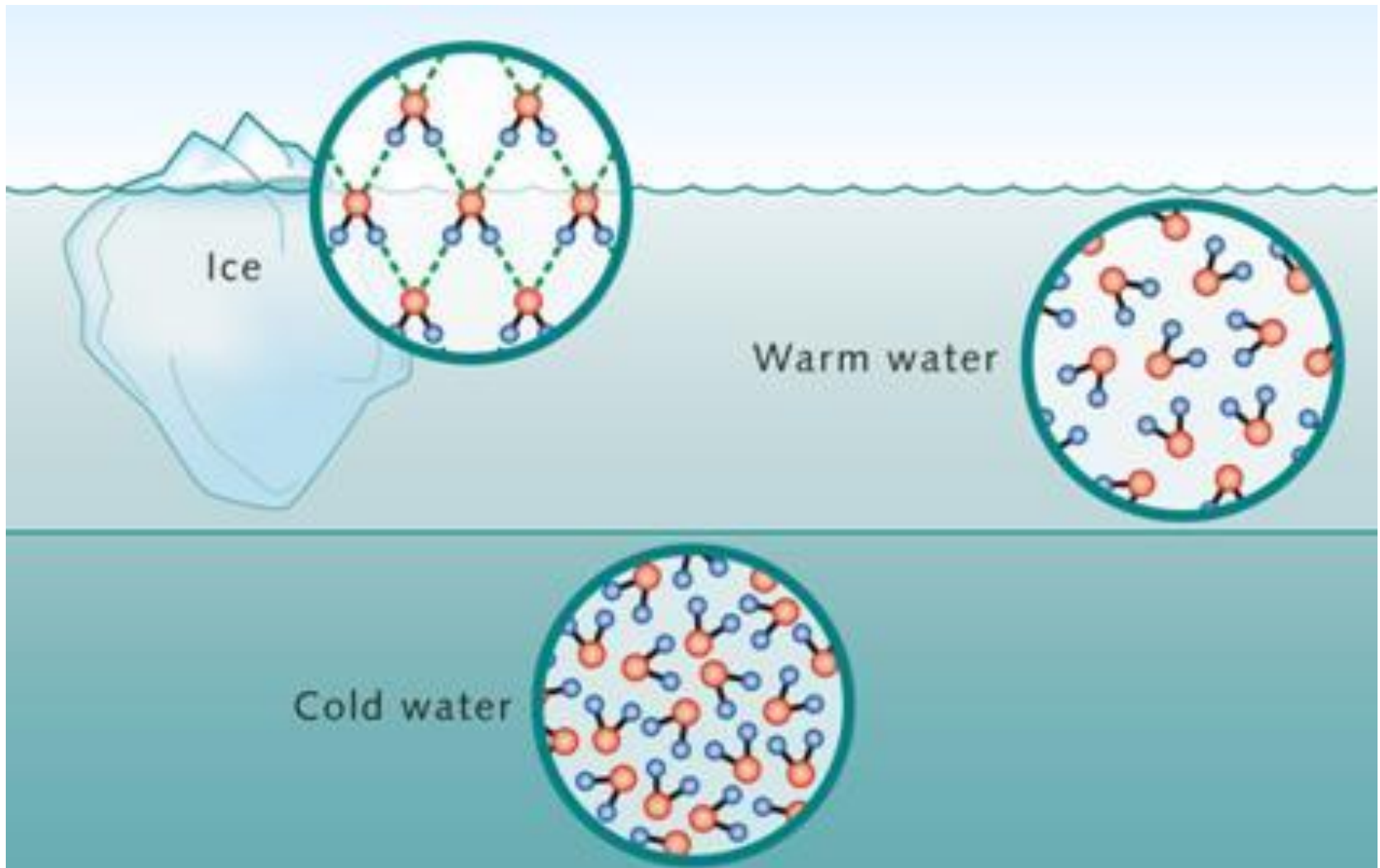
- As a liquid evaporates, its remaining surface cools, a process called **evaporative cooling**
- Evaporative cooling of water helps stabilize temperatures in organisms and bodies of water



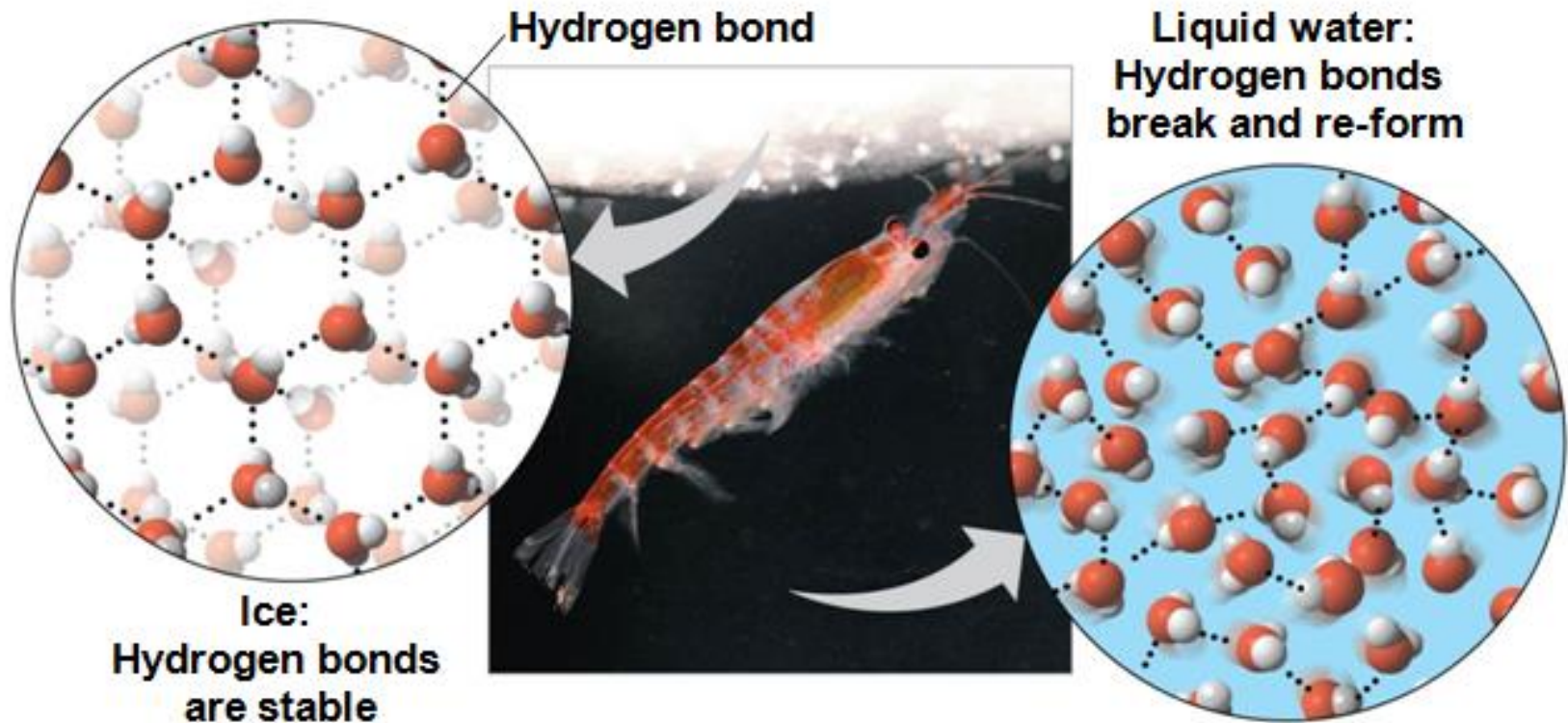
Expansion Upon Freezing

- Ice floats in liquid water because hydrogen bonds in ice are more “ordered,” making ice less dense
- Water reaches its greatest density at 4°C
- If ice sank, all bodies of water would eventually freeze solid, making life impossible on Earth

Expansion Upon Freezing

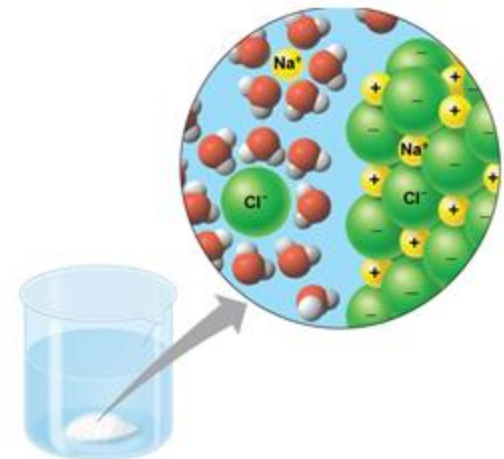


Expansion Upon Freezing

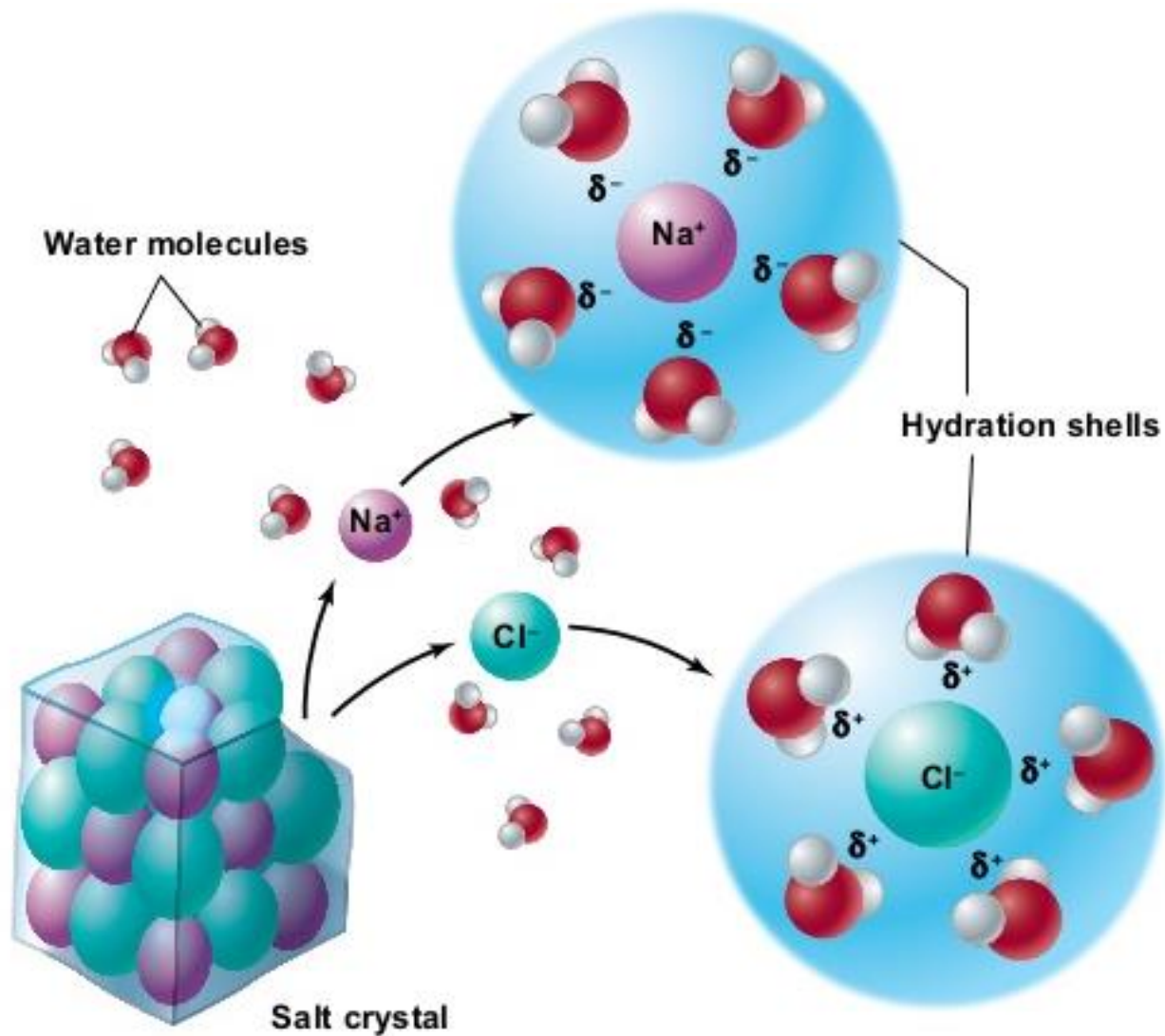


Universal Solvent Supports Reactions

- Water is a versatile solvent due to its polarity, which allows it to form hydrogen bonds easily
- Water dissolves ionic compounds, nonionic polar compounds (such as sugars), and large proteins as long as they have ionic and polar regions
- Cellular use of molecules



Universal Solvent



Hydrophobic and Hydrophilic

- A **hydrophilic** substance is one that has an affinity for water (love)
- A **hydrophobic** substance is one that does not have an affinity for water (fear)

