

Water Properties Foldable

Polarity

Definition:

Polarity

Definition: Unequal charge distribution on a molecule.

Elaboration (Polarity)

Elaboration (Polarity)

Bond polarities arise from bonds between atoms of different electronegativity. Oxygen is much more electronegative than hydrogen. This results in unequal sharing of electrons. The oxygen side of a water molecule has a partial negative charge and the hydrogen side has a partial positive charge.

Example (Polarity)

Example (Polarity)

Due to its polarity, water readily dissolves ions.

Hydrogen Bonding

Definition:

Hydrogen Bonding

Definition: Attractive force between the hydrogen on one polar molecule and the more electronegative atom on another polar molecule.

Elaboration (Hydrogen Bonding)

Elaboration (Hydrogen Bonding)

- In water, the hydrogen atoms have a partial positive charge and are attracted to oxygen atoms, which have partial negative charges, on other water molecules.

Example (Hydrogen Bonding)

Example (Hydrogen Bonding)

There are many. Hydrogen bonding is the basis for most of water's unique properties.

Cohesion

- Definition:

Cohesion

- Definition: Attraction of a molecule to other molecules of the **same** type.

Elaboration (Cohesion)

Elaboration (Cohesion)

- Caused by hydrogen bonding between two or more water molecules (must explain hydrogen bonding!)

Example (Cohesion)

Example (Cohesion)

- Causes water to have a high surface tension. This enables insects and other small organisms to walk on water.

Adhesion

- Definition:

Adhesion

- Definition: Attraction of one molecule to other, different molecules.

Elaboration (Adhesion)

Elaboration (Adhesion)

- Caused by hydrogen bonding between a water molecule and another, different, polar molecule (must explain hydrogen bonding).

Example (Adhesion)

Example (Adhesion)

- Water molecules stick to the sides of xylem tubules in plants. This keeps water from falling down the tubes due to the force of gravity. This helps with transpiration.

Will elaborate on transpiration later!

High Surface Tension

- Definition:

High Surface Tension

- Definition: Is a measure of how hard it is to break the surface of a liquid.

Elaboration (High Surface Tension)

Elaboration (High Surface Tension)

- Same as for cohesion!

Example (High Surface Tension)

Example (High Surface Tension)

- Water walking by insects, water held by soil particles.

High Specific Heat

- Definition:

High Specific Heat

- Definition: Amount of heat needed to change the temperature of one gram of water by one degree Celsius.

Elaboration (High Specific Heat)

Elaboration (High Specific Heat)

- Water is held together with many hydrogen bonds. Temperature is really a measure of how fast molecules are moving. So, in order to increase the temperature of water, one must first add enough energy to break the hydrogen bonds holding water together, then add more energy to increase the temperature.
- Water absorbs/releases heat slowly.

Example (High Specific Heat)

Example (High Specific Heat)

- Water moderates the temperature of land near large bodies of water. It creates milder climates because air temperature may change quickly, but as the air cools, the lake will release heat, which in turn warms the land.
- Organisms made largely of water have a “temperature buffer” since it takes a lot of time and energy to heat up water.

High Heat of Vaporization

- Definition:

High Heat of Vaporization

- Definition: Energy required for a liquid to become a gas.

Elaboration (High Heat of Vaporization)

Elaboration (High Heat of Vaporization)

- In order to change the state of water from liquid to gas, one must first add enough energy to break the hydrogen bonds holding the water together.

Example (High Heat of Vaporization)

Example (High Heat of Vaporization)

- Evaporative cooling: sweat is released from body. As that sweat evaporates, it carries away large amounts of heat (energy).

Versatile Solvent

- Definition:

Versatile Solvent

- Definition: Water dissolves many compounds.

Elaboration (Versatile Solvent)

Elaboration (Versatile Solvent)

- Water dissolves by ionization, forming hydration shells, with the hydrogen side of water surrounding anions and the oxygen side of water surrounding cations.
- Water dissolves large molecules by attraction to hydrophilic regions of the molecule.

Example (Versatile Solvent)

Example (Versatile Solvent)

- Salts dissolve in water
- Acids dissolve in water and fall to the ground as acid rain.

Ice Floats

- Definition:

Ice Floats

- Definition: Solid water is less dense than liquid water.

Elaboration (Ice Floats)

Elaboration (Ice Floats)

- As water cools, the water molecules slow down and are able to form the maximum number of hydrogen bonds. This creates a crystal lattice structure with water molecules spaced farther apart than in liquid water.

Example (Ice Floats)

Example (Ice Floats)

- Ice insulates bodies of water, allowing organisms to continue living in the liquid water below.

All 3 Phases on Earth

- Definition:

All 3 Phases on Earth

- Definition: Water can exist as a solid, liquid, or gas under normal earth temperatures.

Elaboration (All 3 Phases on Earth)

Elaboration (All 3 Phases on Earth)

- Phase changes involve greater energy absorbed or released due to hydrogen bonding.

Examples (All 3 Phases on Earth)

Examples (All 3 Phases on Earth)

- Availability of water in different habitats varies with seasonal or climatic temperature changes.