

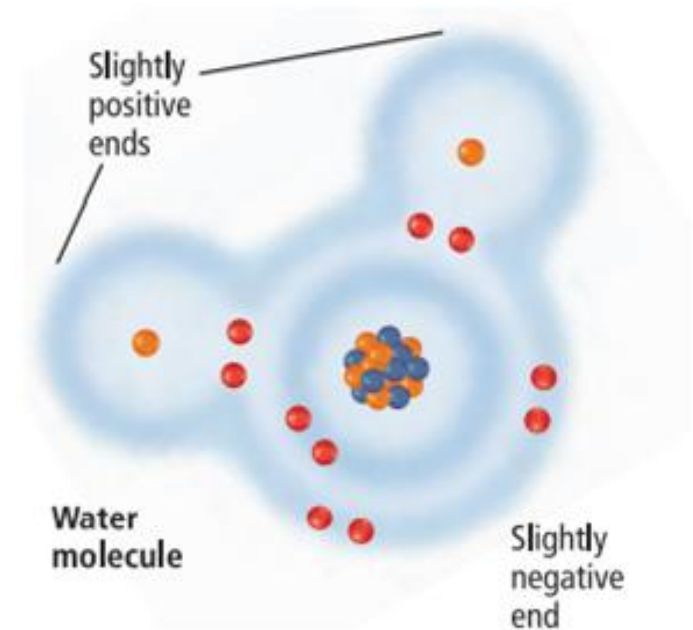
BY THE END OF THIS LESSON YOU WILL BE ABLE TO :

- **EVALUATE HOW THE STRUCTURE OF WATER MAKES IT A GOOD SOLVENT.**
- **COMPARE AND CONTRAST SOLUTIONS AND SUSPENSIONS.**
- **DESCRIBE THE DIFFERENCE BETWEEN ACIDS AND BASES.**

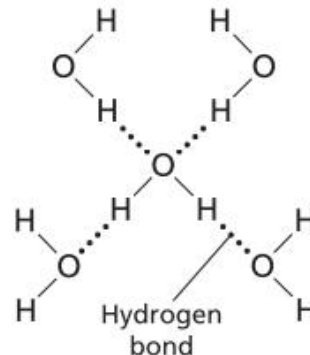
WATER'S POLARITY

- Water is made up of **one oxygen (O) atom and two hydrogen (H) atoms**.
- Water is polar – its bent shape results in a slightly **positive charge on the hydrogen atoms** and a **slightly negative charge on the oxygen atoms**.
- Water is the universal solvent because many substances dissolve in it.

■ **Figure 6.19** Because water has a bent shape and electrons are not shared equally between hydrogen and oxygen, hydrogen bonds form among the molecules. Due to the attraction among the atoms that make up water, the surface of water supports a water strider.



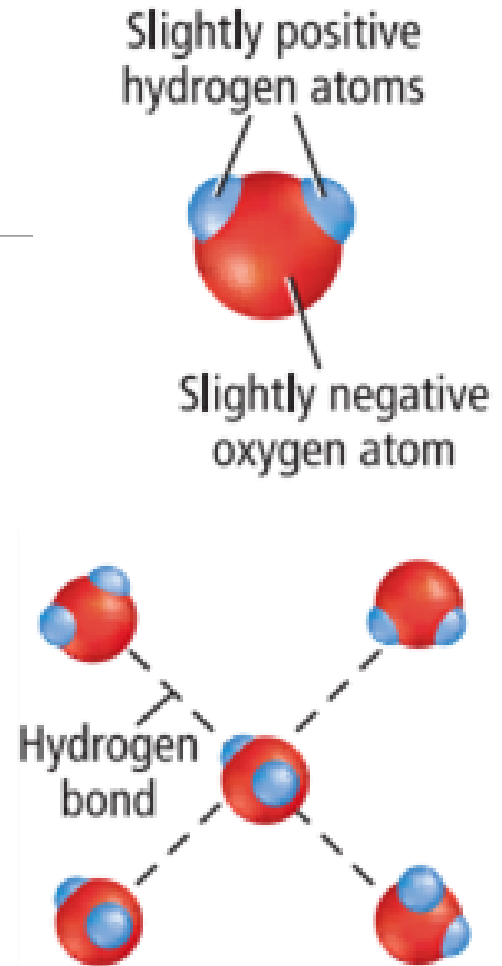
Water strider

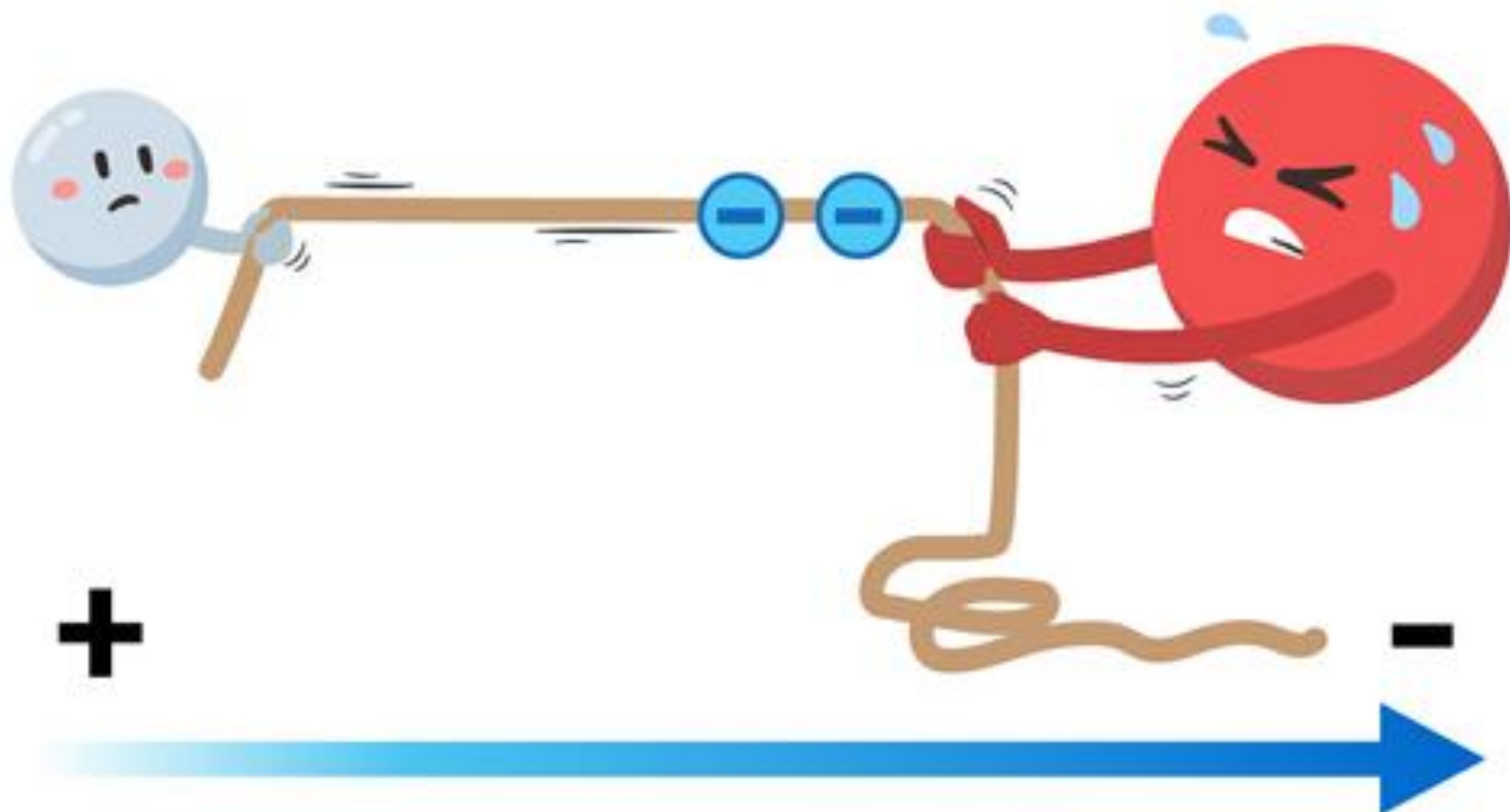


Molecules that have an unequal distribution of charges are called **polar molecules**, meaning that they have oppositely charged regions.

When the two ends are brought close to each other, they **attract each other**.

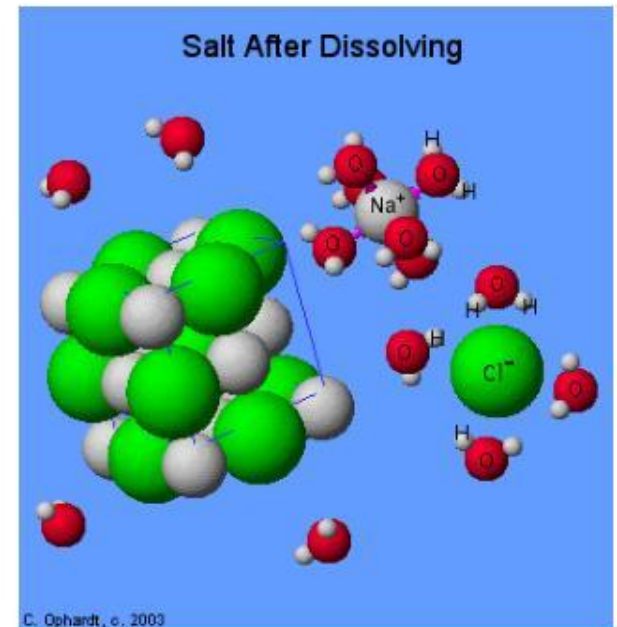
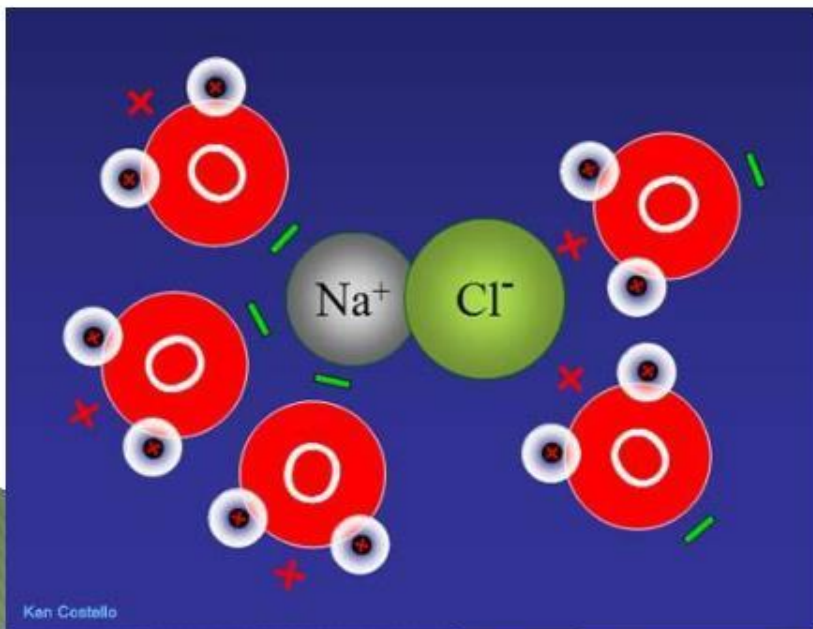
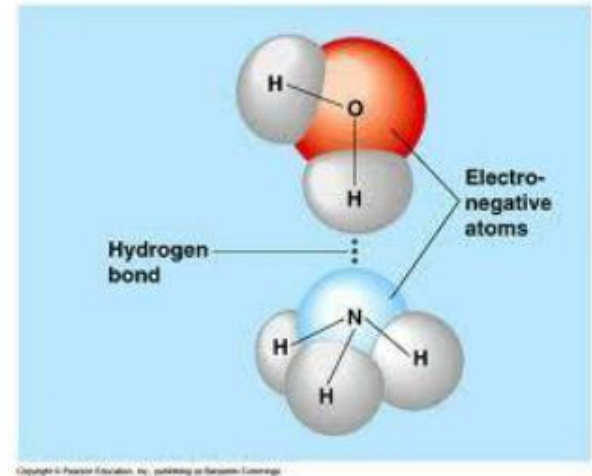
In water, the electrostatic attraction is called a **hydrogen bond** (a weak interaction involving a hydrogen atom and a fluorine, oxygen, or nitrogen atom).



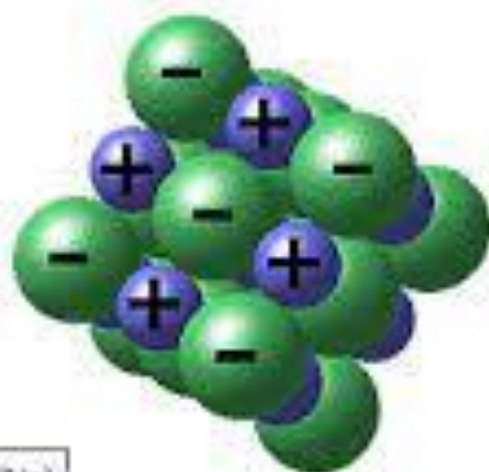


Solubility

- ▶ Polar molecules **only dissolve** into polar liquids. For example, salt dissolves into water.
- ▶ Salt (NaCl) is **ionic** and water is a **polar molecule** (polar covalent bonds)



NaCl crystal structure

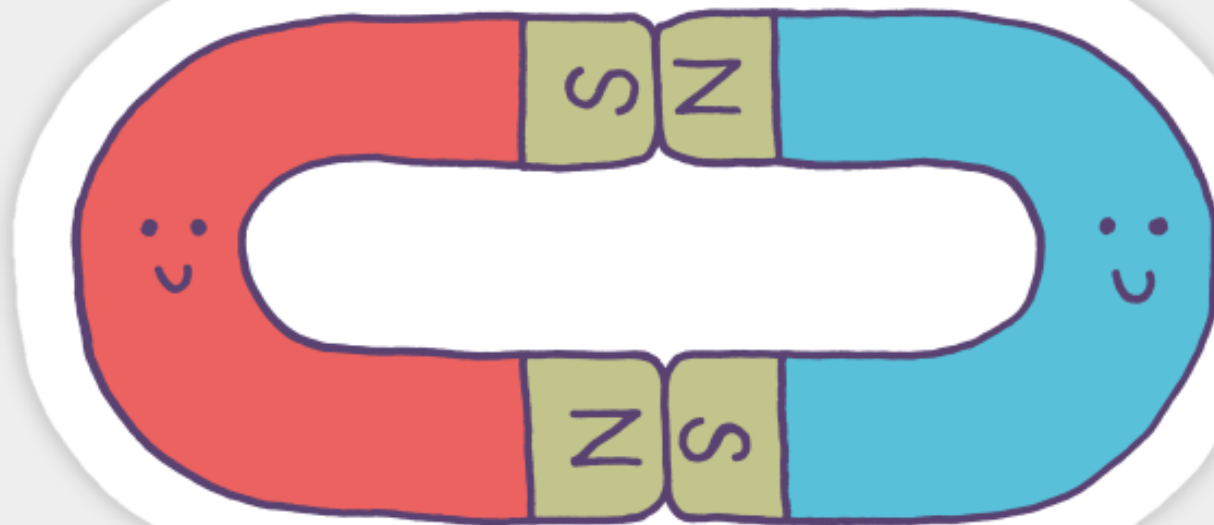


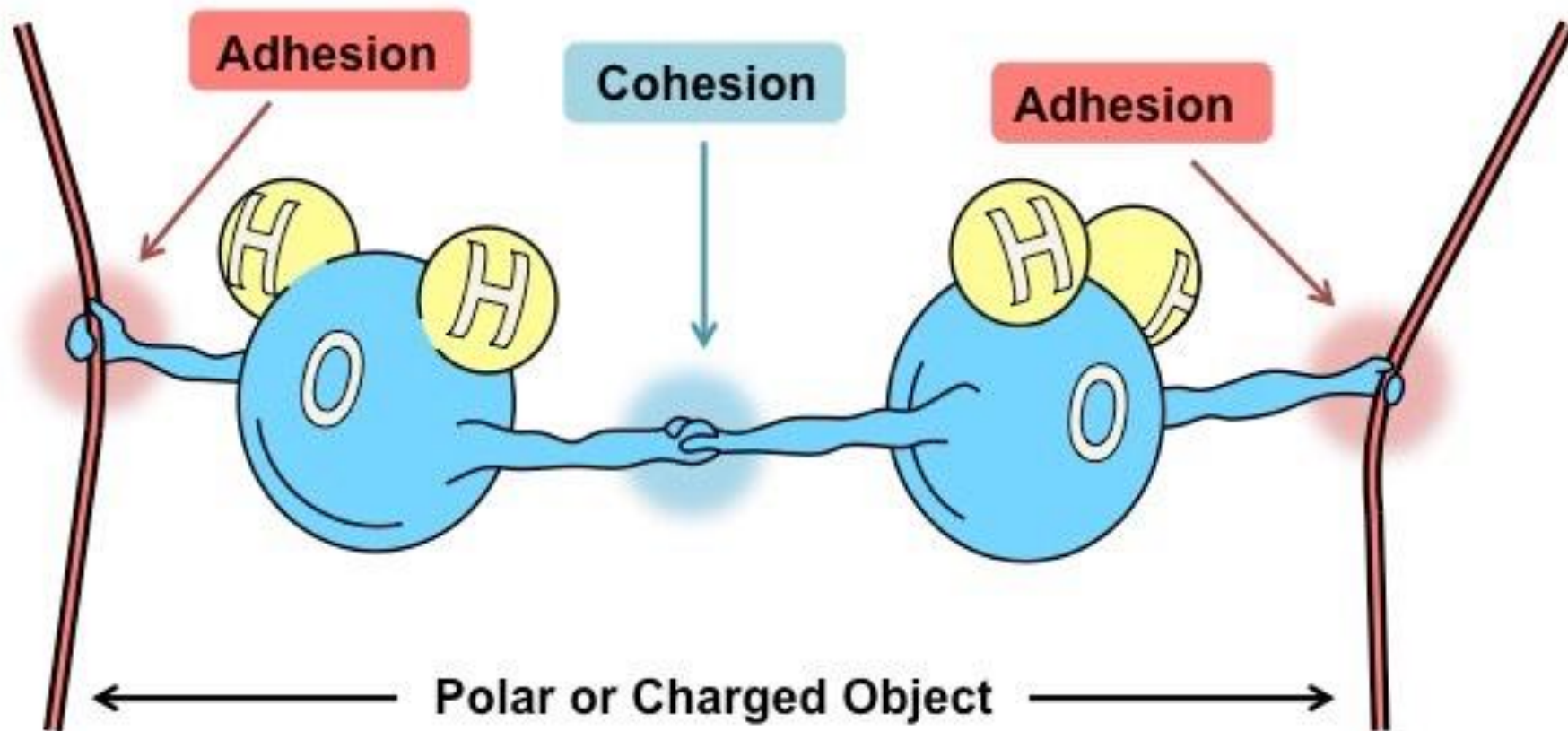
sodium (Na)
chlorine (Cl)

NaCl in water



LET'S STICK
TOGETHER

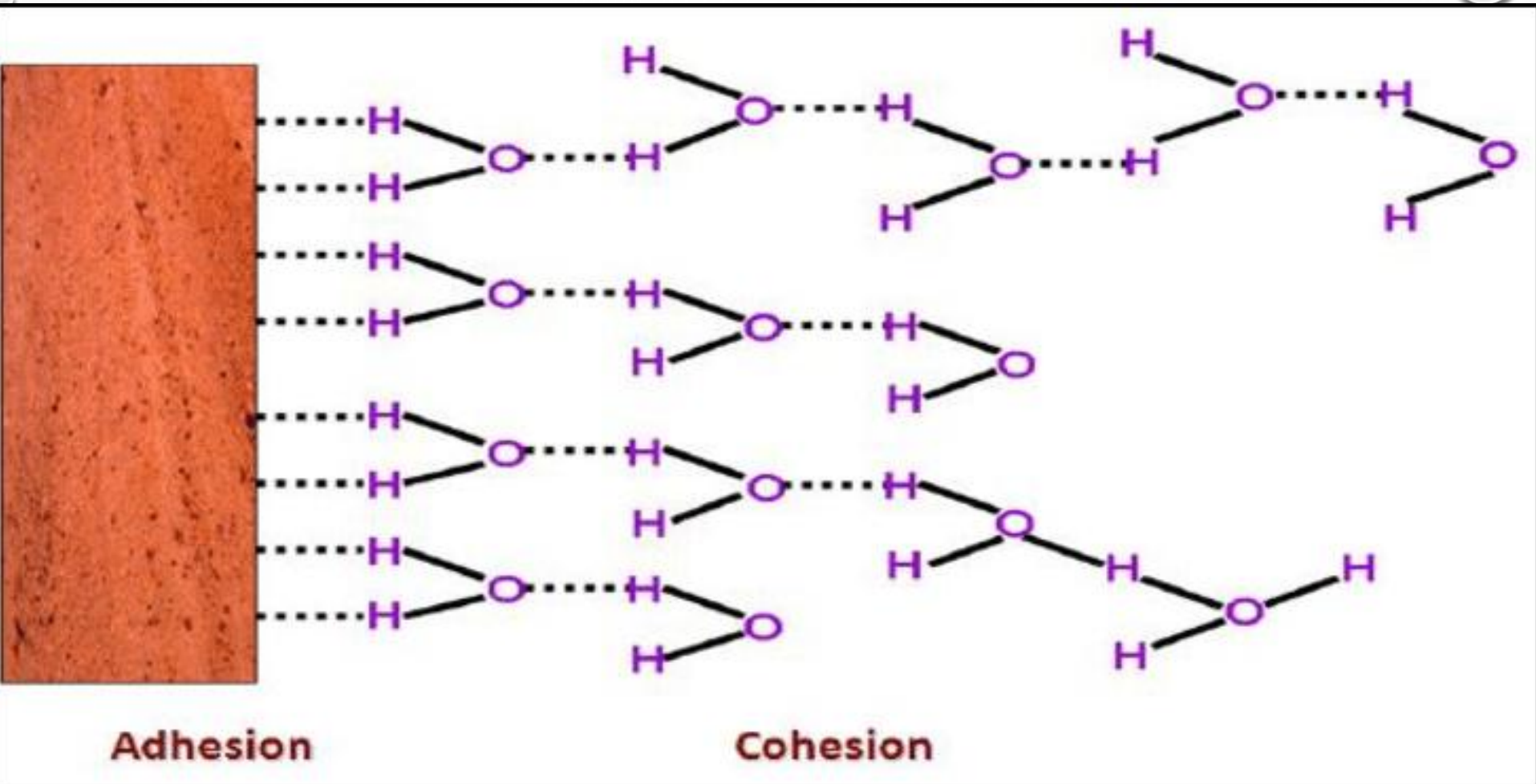




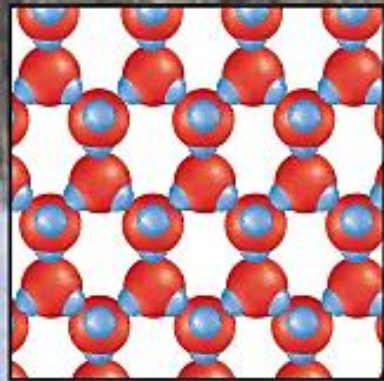
Adhesion Vs Cohesion



- **Adhesion:** the attraction between molecules of a different substance
 - **Cohesion:** the attraction between molecules of the same substance
-

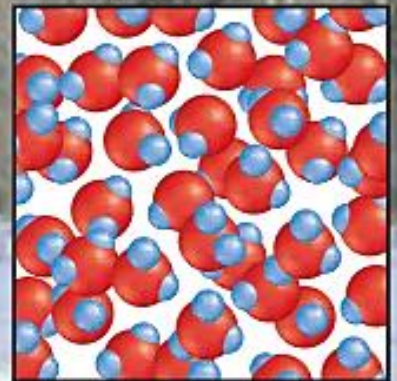


Solid



Liquid water becomes more dense as it cools to 4°C . Yet ice is less dense than liquid water. As a result, nutrients in bodies of water mix due to changes in water density during spring and fall. Also, fish can survive winter because ice floats—they continue to live and function in the water beneath the ice.

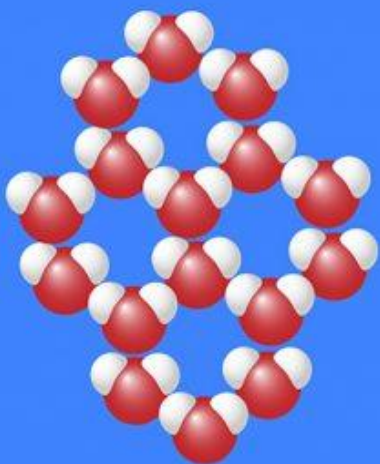
Liquid



Water is cohesive—the molecules are attracted to each other due to hydrogen bonds. This attraction creates surface tension, which causes water to form droplets and allows insects and leaves to rest on the surface of a body of water.

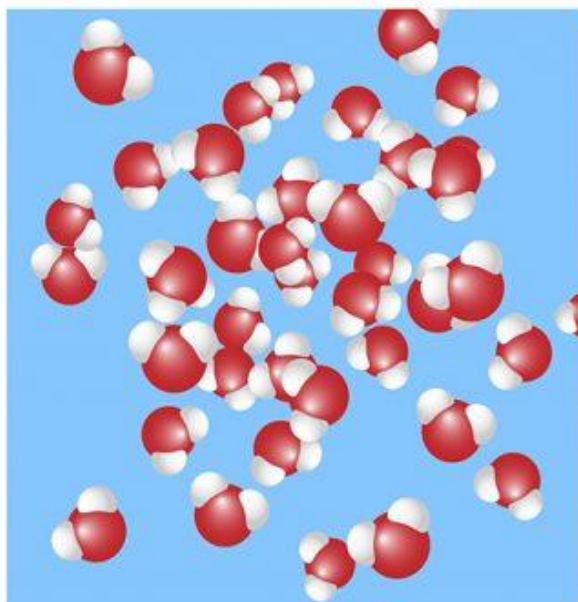
Water is adhesive—it forms hydrogen bonds with molecules on other surfaces. Capillary action is the result of adhesion. Water travels up the stem of a plant, and seeds swell and germinate by capillary action.

Ice



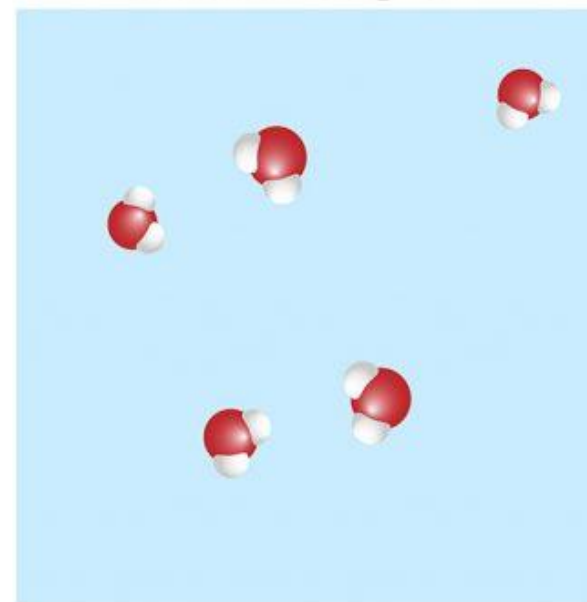
Solid

Water

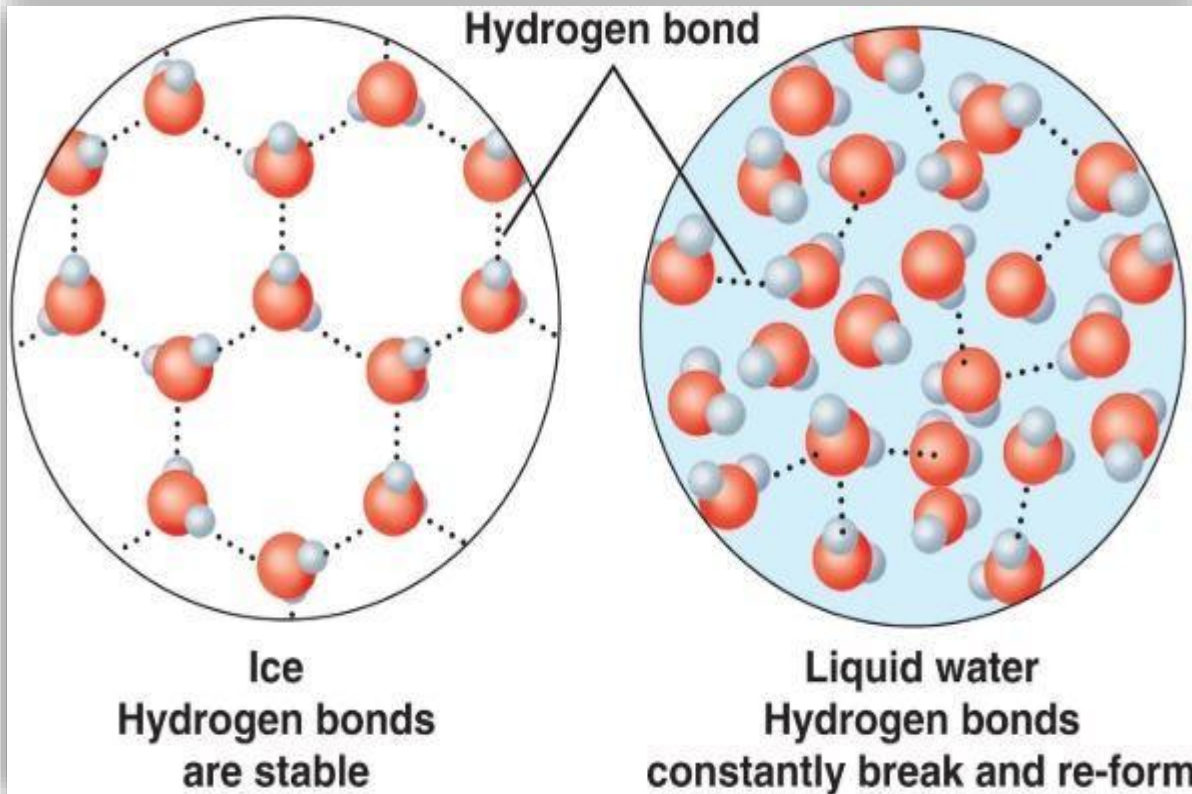


Liquid

Water Vapor



Gas



Ice is less denser than water because in ice the molecules arrange themselves in a rigid tetrahedral structure due to which cage like spaces remain in their bonding. But water molecules remain in linear bonding form. As the volume of ice becomes greater, it is less denser.

Why this is important?

MIXTURES WITH WATER

- A **mixture** is a combination of two or more substances in which **each substance retains its individual characteristics and properties.**



- **Homogenous mixtures** (solution) are mixtures **that have a uniform composition.**

E.x.tea and water



- **Heterogeneous mixture** (suspension), are mixtures where **the components remain distinct.**

E.x. water and sand

- A colloid is a **heterogeneous mixture in which the particles do not settle out.**

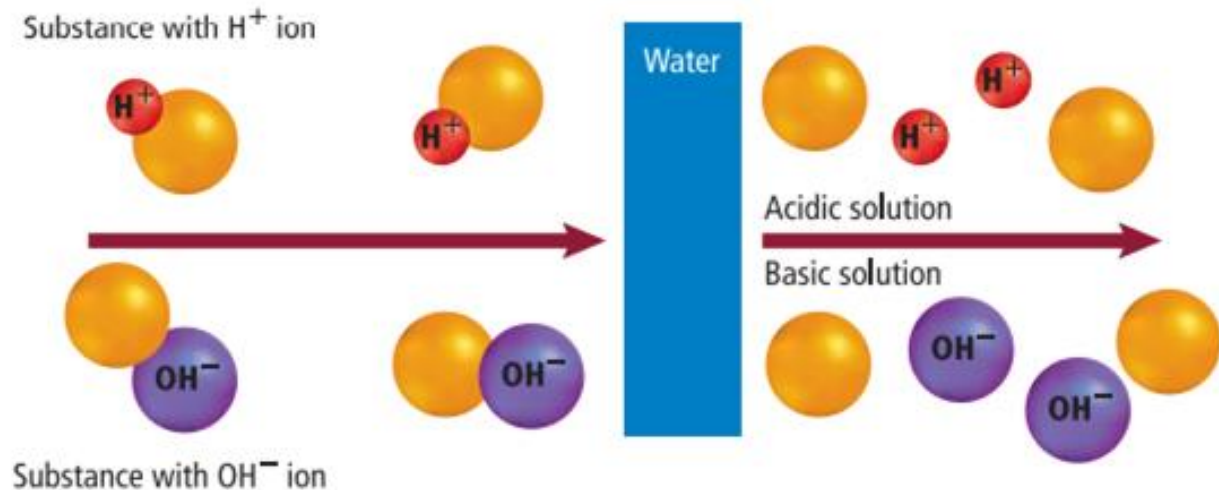
- E.x. blood, smoke, butter, mayonnaise, milk, paint.



ACIDS AND BASES

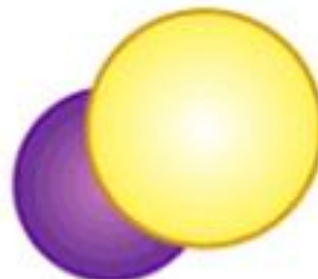
- When a substance that contains hydrogen is dissolved in water, the substance might release a hydrogen ion (H^+) because it is attracted to the negatively charged oxygen atoms in water.
- **Acids** are called substances that release hydrogen ions (H^+) when dissolved in water.
- **Bases** are substances that release hydroxide ions (OH^-) when dissolved in water.

Figure 6.23 Substances that release H^+ in water are acids. Substances that release OH^- in water are bases.

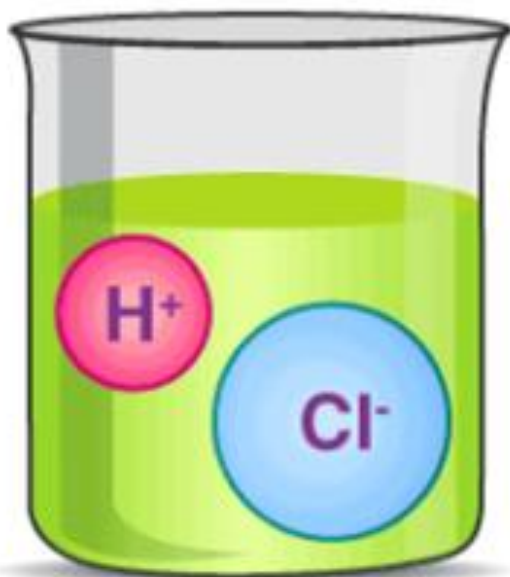




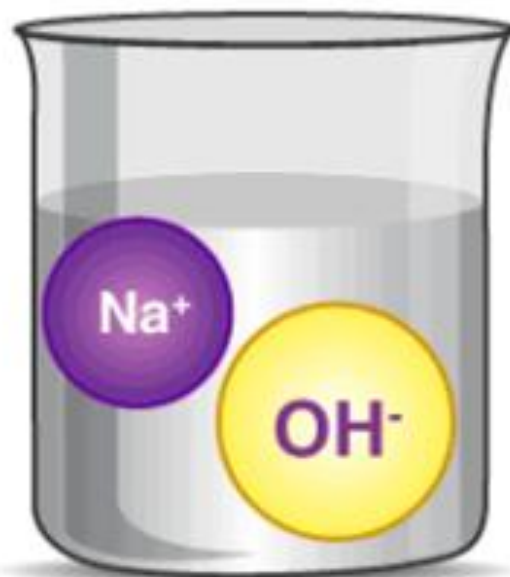
HCl



NaOH



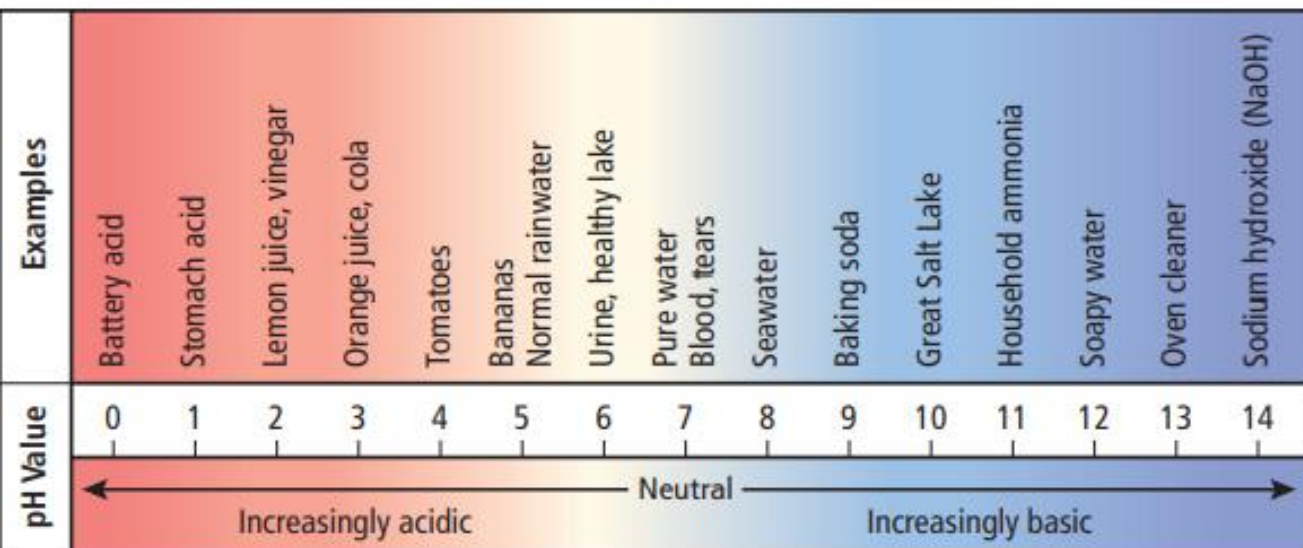
Acid



Base

PH AND BUFFERS

- **PH** IS THE MEASURE OF CONCENTRATION OF H^+ IN A SOLUTION (**ACIDITY**) OF A SUBSTANCE.
- **ACIDIC SOLUTIONS** HAVE MORE H^+ AND HAVE PH VALUES **LOWER THAN 7**.
- **BASIC SOLUTIONS** HAVE MORE OH^- THAN H^+ AND HAVE PH VALUES **HIGHER THAN 7**.



■ **Figure 6.24** The pH scale is used to indicate the relative strength of acids and bases—in other words, the amount of hydrogen ions (H^+) in a solution.



Unbuffered
 H_2O



Buffer
pH 7.0

Add 1 mL 0.1 M HCl



pH much
lower



pH stable
with buffer



Unbuffered
 H_2O



Buffer
pH 7.0

pH meter

Electrode

Add 1 mL 0.1 M NaOH



pH much
higher



pH stable
with buffer