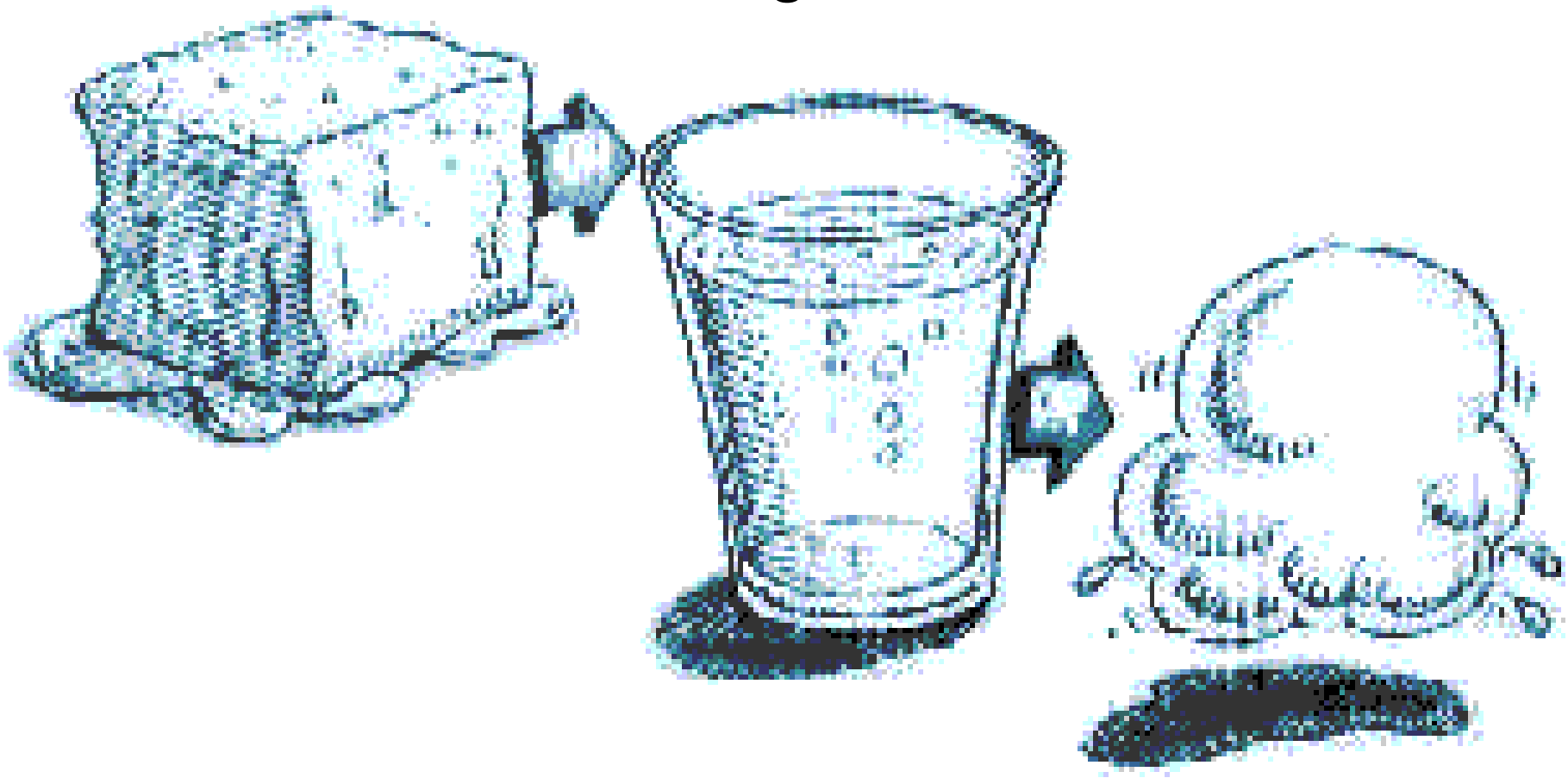
Water

A Vital Biological Molecule



What do you think about water?

Colourless

Droughts cause famines

We drink it

Fish swim in it

Life cannot continue without liquid water

Floods cause death & disease

We wash in it

It is the 2nd most common molecule in the Universe

We are about 70% water

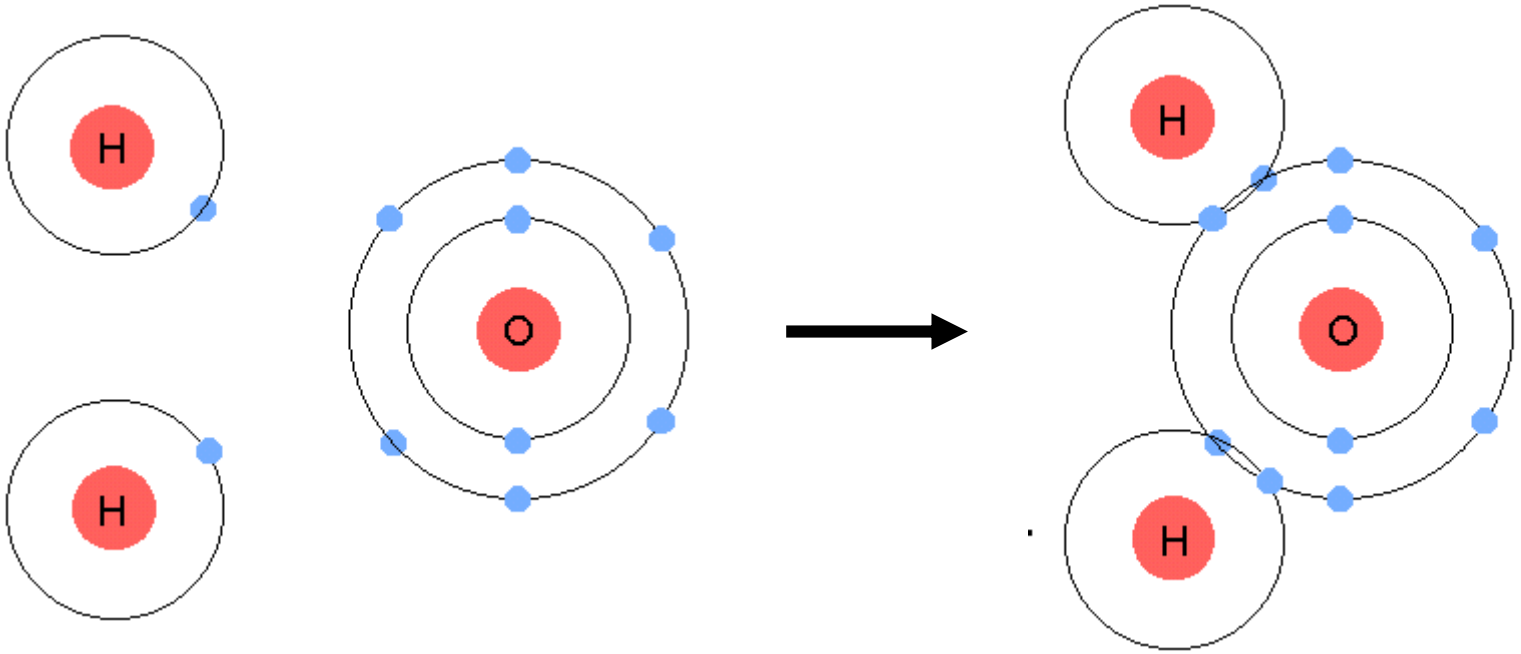
Odourless

We cook with it

It is the most abundant liquid on Earth

H_2O – The Molecule

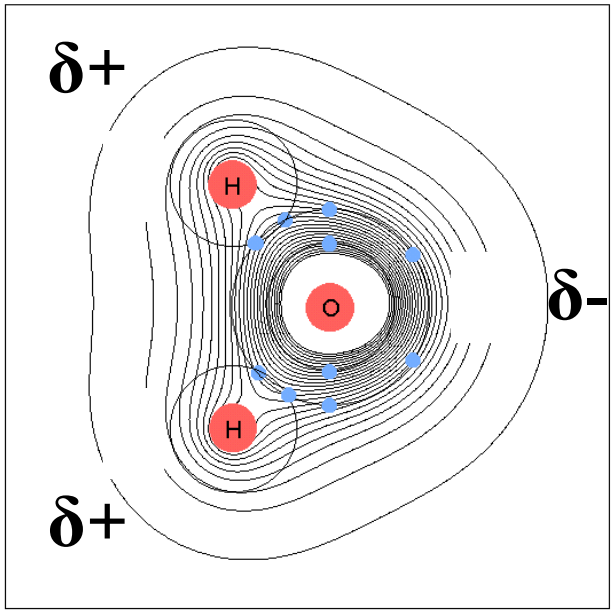
- Two Hydrogen atoms & one Oxygen atom.



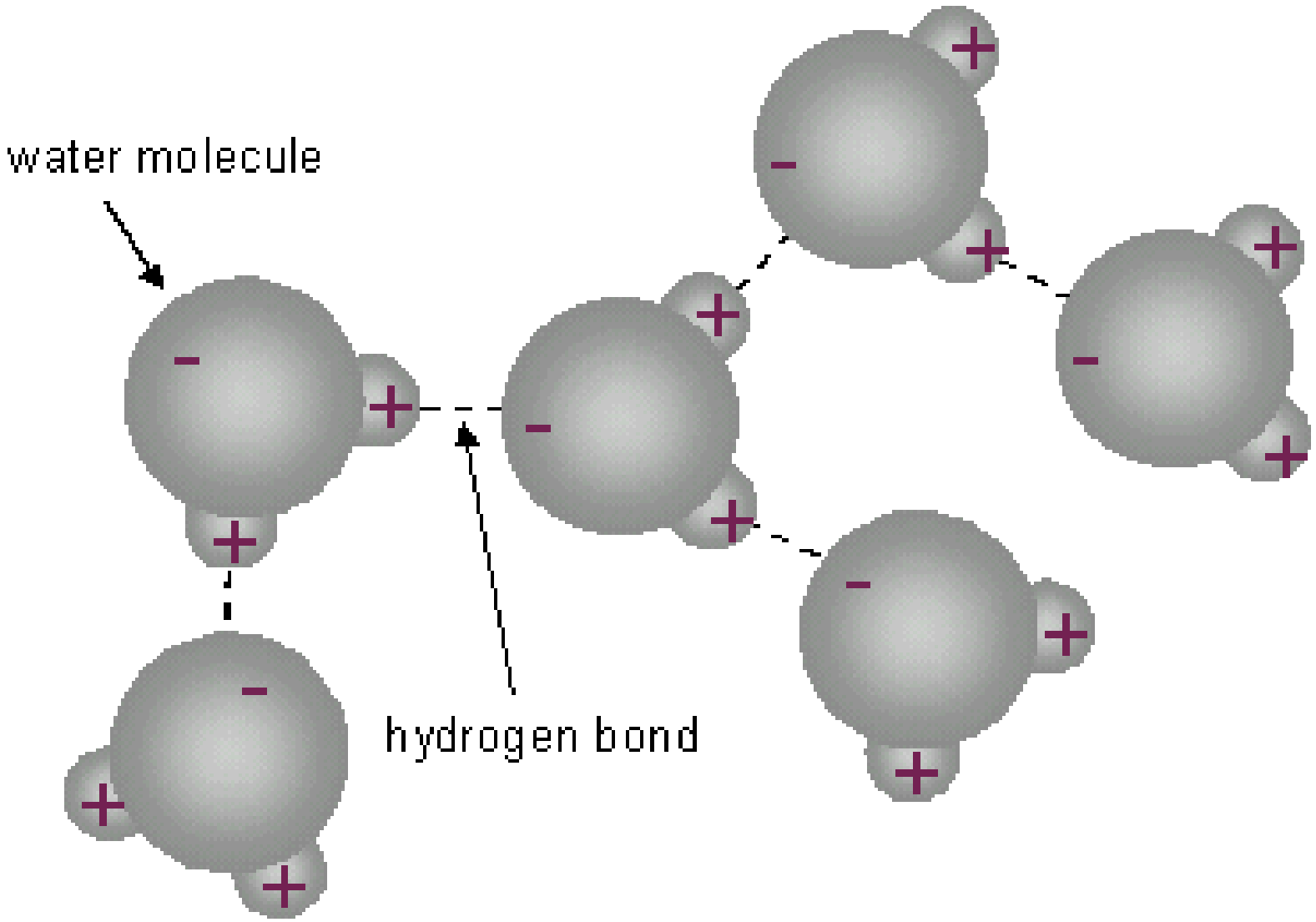
Simple Molecule – Remarkable Properties

Greedy Oxygen

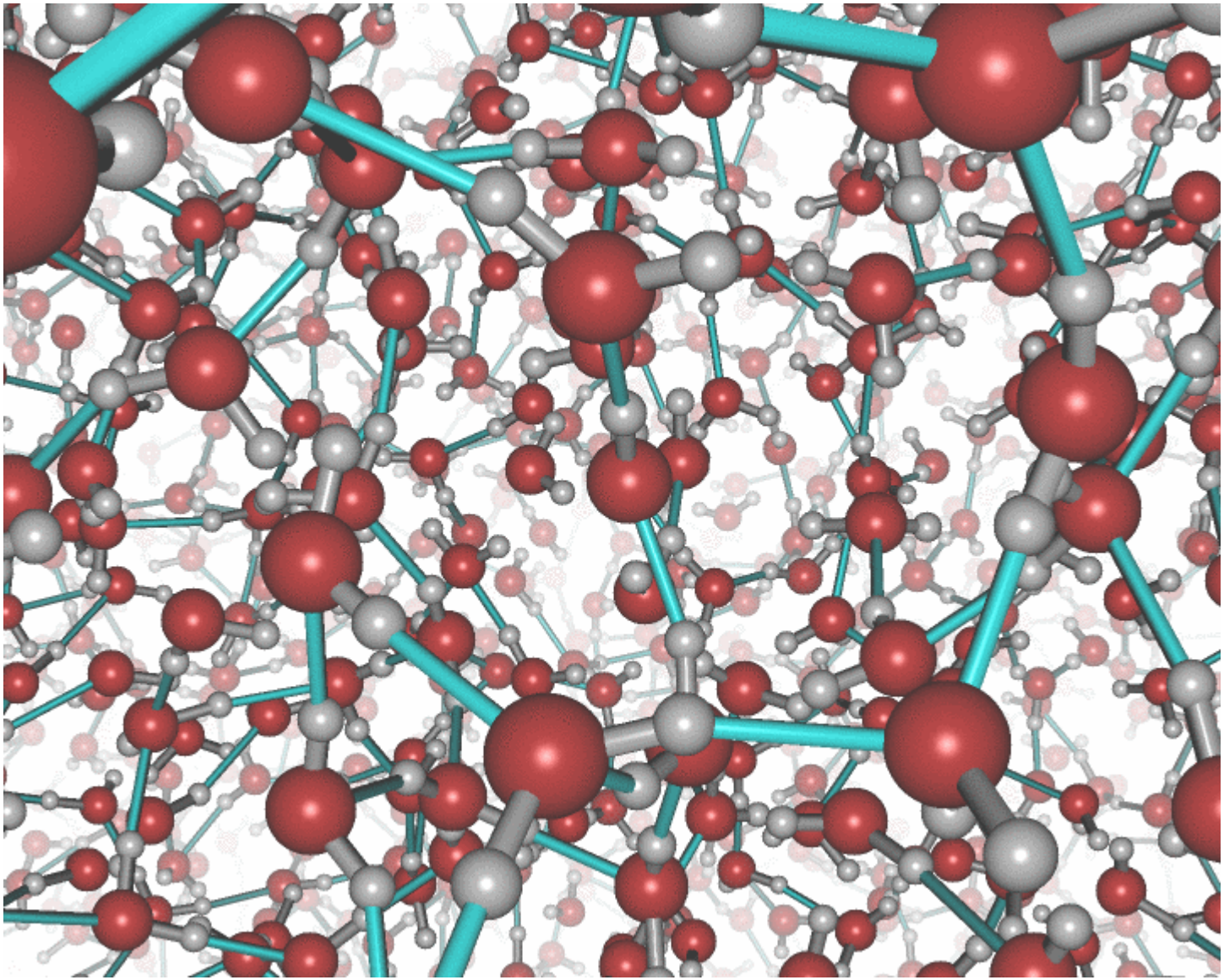
- The shared electrons in a water molecule are not shared equally.
  - Oxygen attracts electrons more than hydrogen does.
  - Electrons are pulled away from hydrogen.



Hydrogen Bonding



Bonds break & remake in liquid water



Cohesion

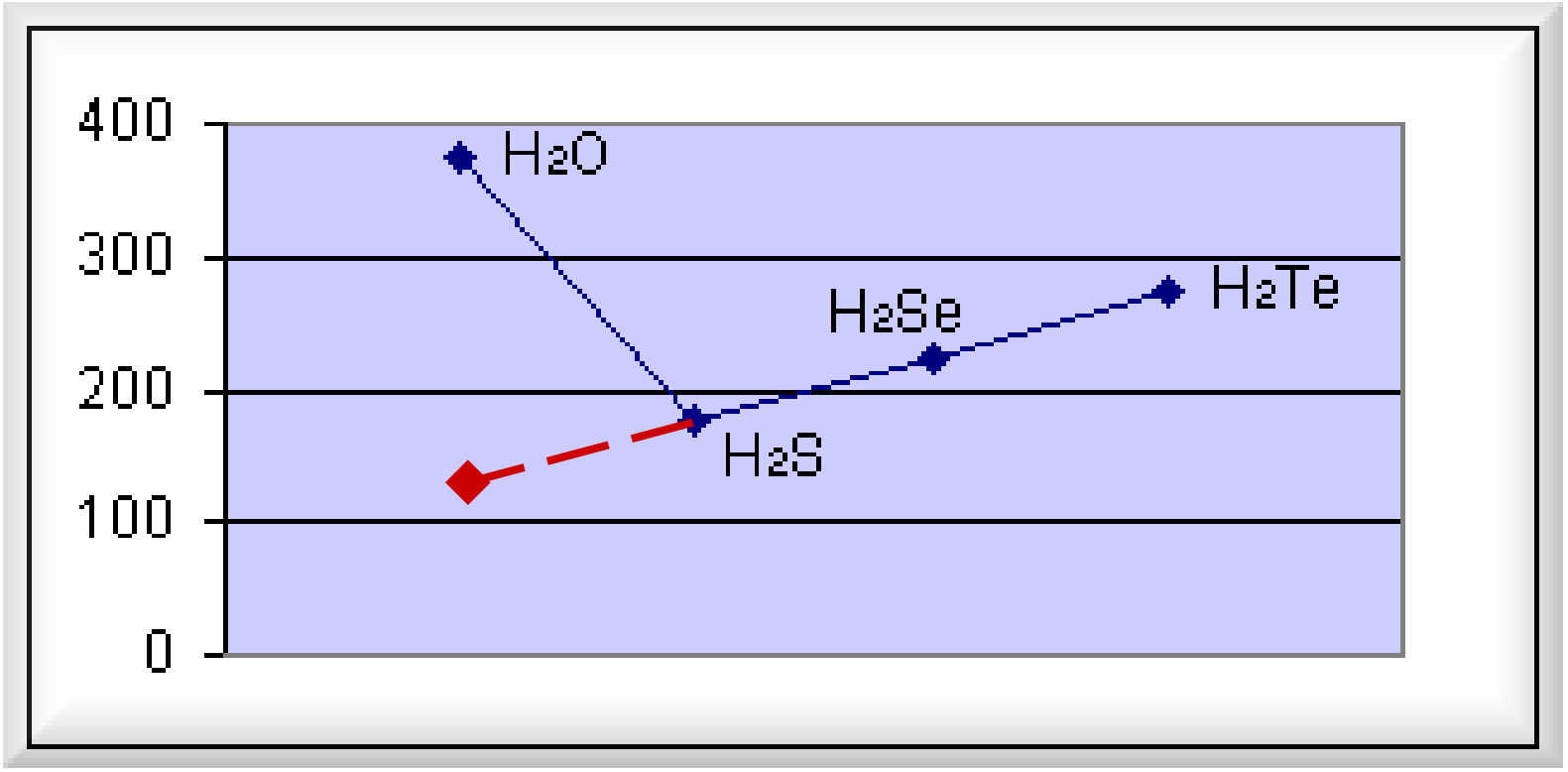
- Hydrogen bonds cause water molecules to stick together.
  - Also termed cohesion.

- Hydrogen bonds give water all of its unusual properties

Unusual Properties of Water

- It has a high boiling point.
- A lot of energy is needed to increase its temperature.
- Ice is less dense than water.
- It forms droplets on surfaces.
- It appears to have a skin.
- It is an excellent solvent.

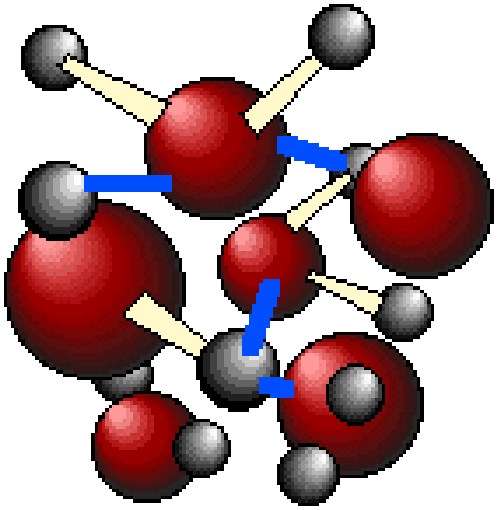
High Boiling Point



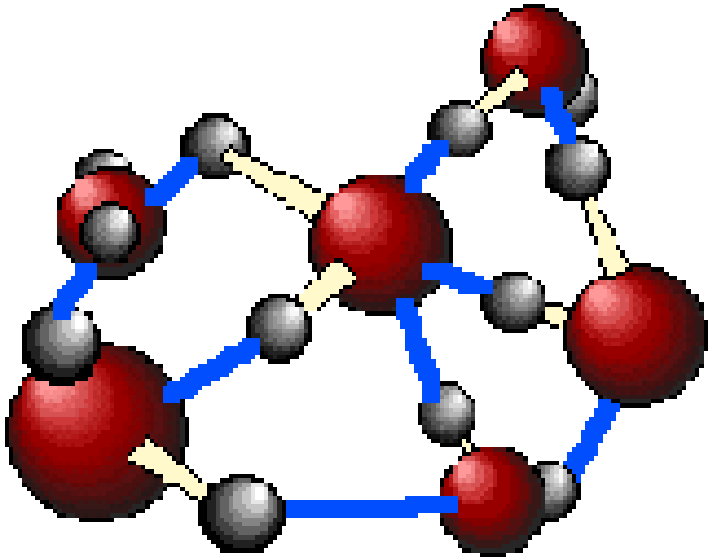
H Bonds enable water to be liquid at Earth temperatures.

Resistance to Temperature Changes

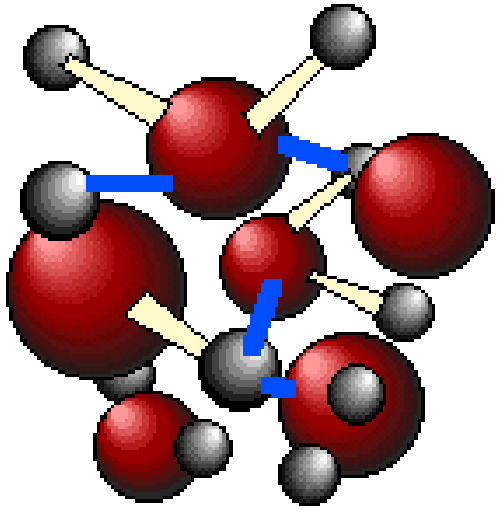
- With H bonds restricting the movement of molecules, more energy is needed to increase the temperature.
  - Water acts as a buffer against temperature variations.
    - Chemical reactions occur at a constant rate.
    - Water remains liquid over a large temperature range.



Unusual Density



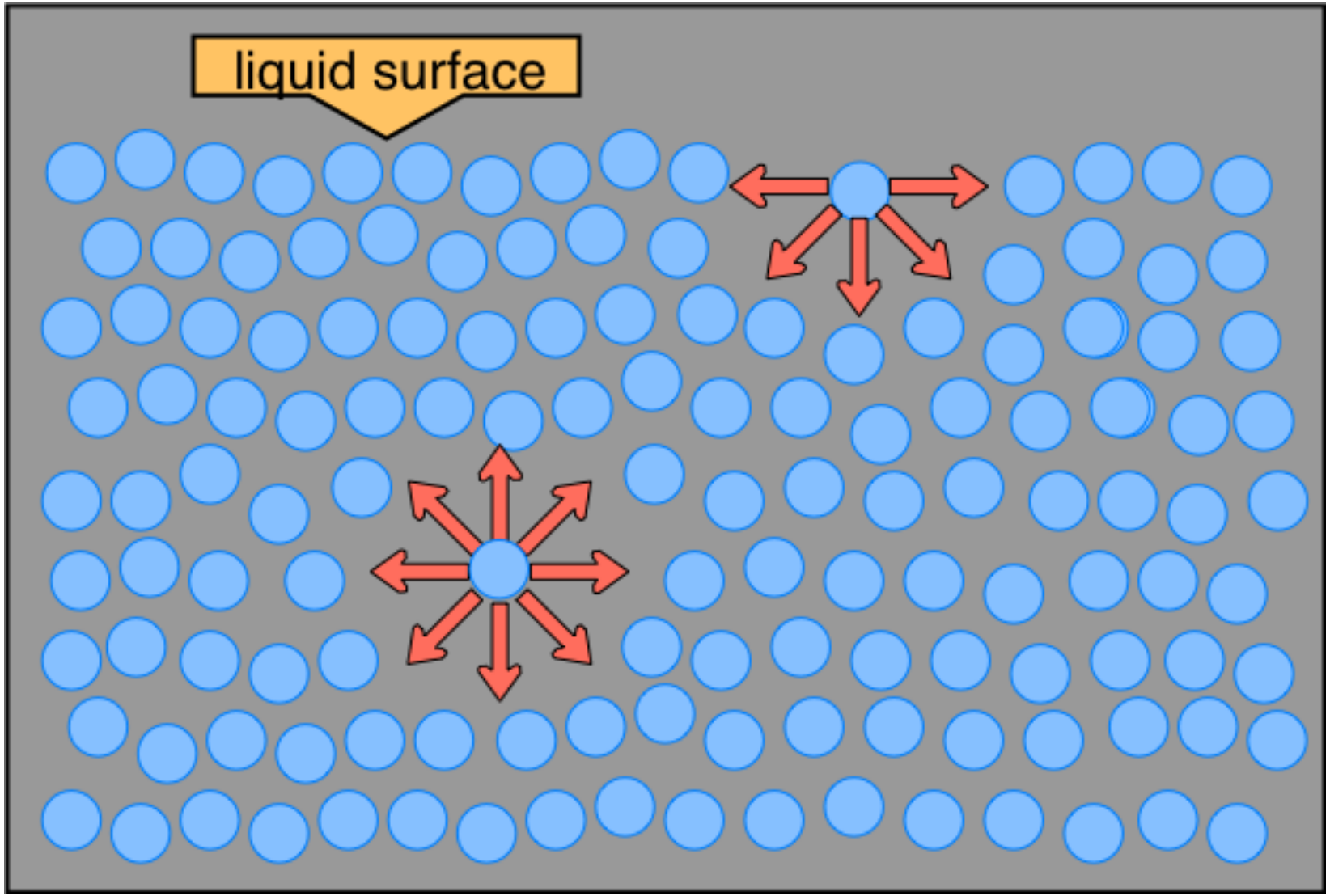
Ice



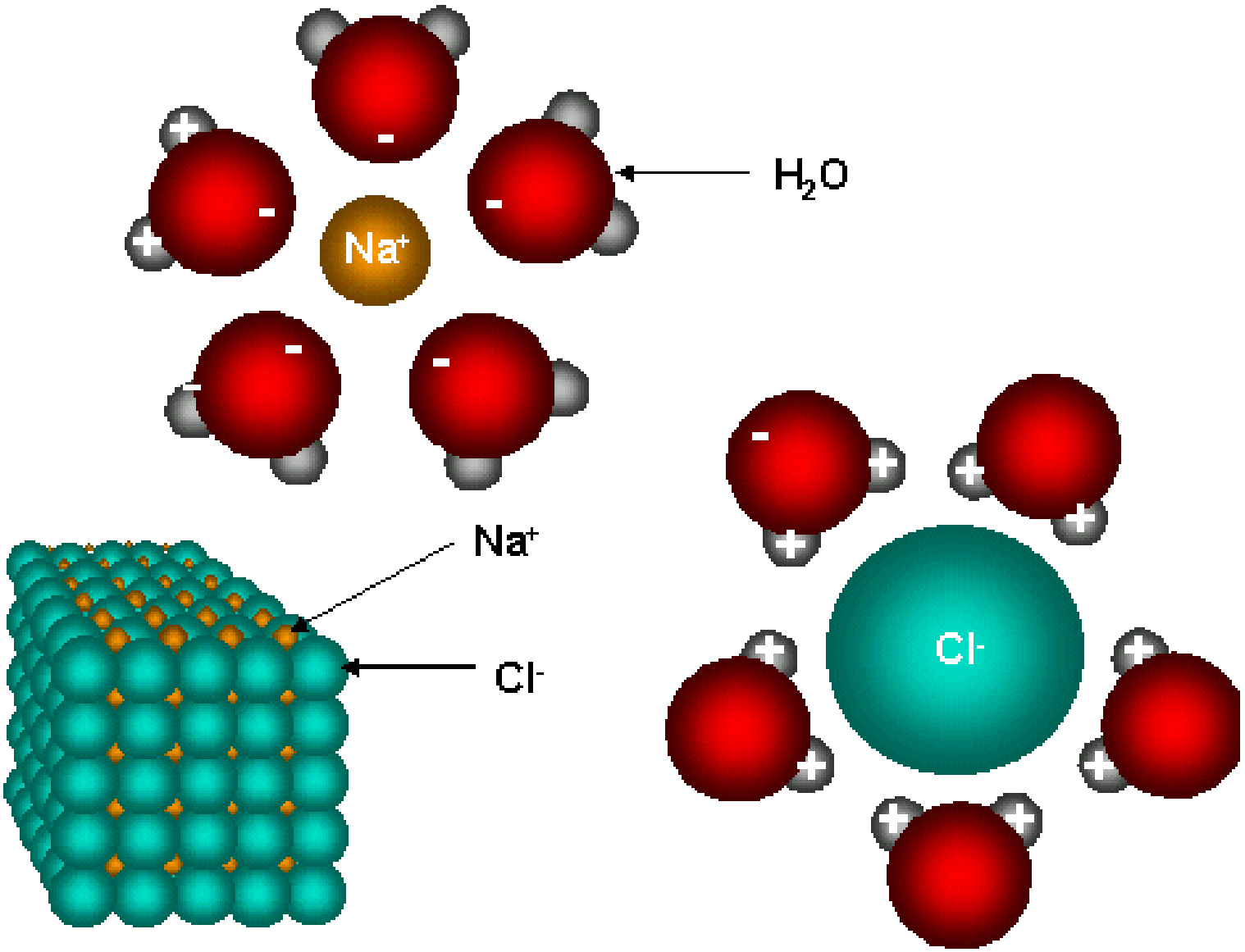
Water

- Ice floats on the surface of a body of water.
  - This insulates the water below, keeping it liquid.
  - Aquatic organisms can still survive Winter

Surface Tension



Water as a Solvent



Water as a Transport Medium

- Water makes an ideal transport medium.
  - It remains liquid over a large temperature range.
  - It is a solvent for many chemicals.

- Eg. Blood in animals & phloem in plants.

Water in Metabolism

- Water is both a reactant and a product in many biological reactions:
  - Hydrolysis reactions
    - Water is added to split up molecules
  - Condensation reactions
    - When some molecules join together, water is released.