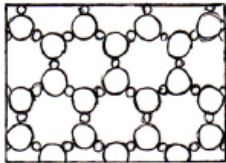
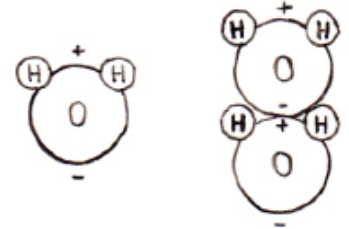


# NATURE NOTES

## WATER ON THE MOVE — "BLUE MAGIC"

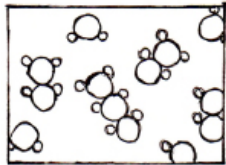
Water is always moving, and not just "gently down the stream." Water moves throughout all life forms and everywhere on the planet and in its atmosphere. The magic of water is essential for both physical and biological processes on planet Earth.

The **water molecule** has a simple atomic structure — two hydrogen (H) atoms joined to one oxygen (O) atom. The molecule is positively charged near the H atoms and negatively charged on the opposite side. This causes water molecules to be attracted to each other.



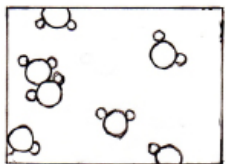
Solid

**Frozen water molecules** arrange themselves in a rigid geometric pattern with spaces, causing the mass of water to expand and become lighter.



Liquid

**Liquid water molecules** arrange themselves into small groups of joined particles. Water is liquid from 0° C to 100° C — an important range for both biological and physical systems.

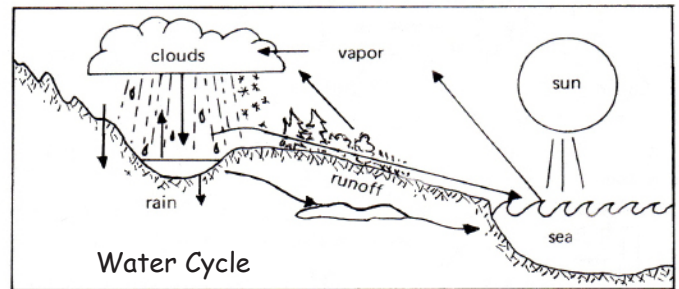


Gas

**As a gas, water molecules** are charged with energy and constantly moving, resulting in fewer bonds between molecules.

Water can change its physical state from a solid to a liquid to a vapour — the only substance on our planet that can do so naturally. Changes from one state to another involve massive amounts of heat being transferred. Much heat is absorbed to melt ice or evaporate water. For example, one gram of ice needs 80 calories of heat to melt into water. Heat is released when water vapour condenses into liquid or when liquid freezes.

Water, along with nutrients needed for growth, is taken up by plant roots. Because, along surfaces, water molecules are closely attached, the water column can be pulled up through the plant as some water is evaporated through the leaves.



Freshwater is essential for life. Without water, life would probably never have developed on planet Earth.

### Where on Earth is all the water?

Water, as solid, liquid or gas, is found in a very thin slice all around the Earth's surface. Only 2.5% is fresh; all the rest is saline. More water is chemically bound in rocks.

Of the freshwater, almost 99% is tied up in glaciers, ice caps and groundwater. Just over 1% is liquid on the surface or gas in the atmosphere. A tiny fraction of that is available to sustain all plant and animal life.

Just under 0.04% of freshwater is in the atmosphere, in constant motion around the planet. Huge amounts of solar energy are put into the atmosphere as heat stored in water vapour. This drives world weather systems and atmospheric temperature.

Water leaving Kennebec Lake in the Salmon River flows by way of Lake Ontario and the St. Lawrence River into the saltwater of the Atlantic Ocean. From all parts of Canada, over 100,000 cubic metres of freshwater per second flow back into the oceans.

### Water, water, everywhere ...

- Water moves downhill by gravity. Solar energy is the driving force that pumps water uphill — a free natural process that provides freshwater for living things on the land and in lakes and rivers.
- About 22% of the energy of the sun reaching Earth is used to evaporate water. About 99 trillion cubic metres of water is evaporated from the oceans and moved, as freshwater, to the continents each year.
- When clouds move over land or up into a cooler atmosphere, rain or snow condenses out, releasing some of its heat load to space, helping to regulate the temperature of the planet.
- Deep lakes such as the Great Lakes might seem to have a lot of water available for human use, but much of it is water that dates back to the melting of glaciers. Only about 5% by volume is replaced each year by runoff from the land.
- "Blue Magic" indeed!

by Aileen Merriam