

## Study Guide

### Molecules of Life - Water and Organic Compounds

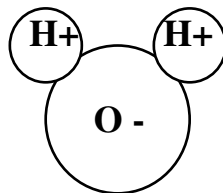
Water, H<sub>2</sub>O, Dihydrogen Monoxide is one of the most important substances on our planet. Water covers about 75% of Earth's surface, but of ALL the water in the world, how is it divided up?

Where is it?	Fresh or Salt	%
Oceans and salt lakes	salt	97%
Ice	fresh	2.28%
<b>Shallow Ground Water</b>	<b>fresh</b>	<b>0.36%</b>
Deep Ground Water	fresh	0.33%
<b>Lakes and Rivers</b>	<b>fresh</b>	<b>0.01%</b>
Water Vapor	fresh	0.001%

Remember that even though only 3% of the water in the world is fresh water, it is a MUCH smaller amount that is available to us to use – only about 0.37% (well less than 1%) of ALL the water in the world.

#### *Special Properties of Water*

The water molecule, made of one oxygen atom and two hydrogen atoms, can be drawn like this:



The water molecule is a **polar molecule** (having a positive electrical charge near the hydrogens and a negative charge near the oxygen). This is because the oxygen, like a mean big brother, shares electrons but doesn't share fairly. The electrons spend more time around the oxygen, giving the oxygen a negative charge (remember that electrons have a negative charge?) So what, you say? Because water is a polar molecule, it has the following properties:

- It is a good solvent, the **universal solvent**, because it dissolves other polar molecules
- It has **cohesion** as the hydrogens of one molecule connect with the oxygen of the next by a **hydrogen bond** (opposites attract). **Water molecules stick together.**
  - So what has surface tension! (the needle floats on the "skin" of the water!) - A water droplet holds together & makes a dome shape.
- It has **adhesion** – **water sticks to other stuff**, like drops of water on the side of your glass or the drop of water hanging on the tip of your finger. Remember how the slide stuck to the overhead projector.
- Adhesion and cohesion together cause **capillary action** – water creeps into small spaces like a glass tube or up through the xylem of the tree to the leaves
  - The process by which water moves from the roots of the plants to the leaves and then evaporates through the stomata is **TRANSPIRATION**

Unlike most stuff in the world, solid water is LESS dense than liquid water. When H<sub>2</sub>O start to freeze the molecules line up forming a grid-like crystal pattern. This causes lakes to freeze from the top down. The ice on top of the lakes insulates the liquid water below.

## Organic Compounds

The simplest definition of an organic compound is a compound containing carbon. Though this is an incomplete definition, it is a good starting point. Organic compounds are the compounds that living things are made of or that are produced by living things. There are four main categories that we have discussed:

**Carbohydrates** – the main source of energy living things. Many carbohydrates are eventually broken down into glucose, the fuel for life. Foods that come from plants are our biggest source of carbohydrates. Carbohydrates are compound made of carbon, hydrogen, and oxygen and can be divided into several categories:

- **Sugars** – the simplest carbohydrates, both monosaccharides and disaccharides are in this group. There are many types of sugar. The names usually end in “-ose”, like glucose ( $C_6H_{12}O_6$ ), sucrose, fructose, and lactose.
- **Polysaccharides** – sugar molecules can be connected together in long chains, or polymers, called polysaccharides. **Starch** is a common type and is found in grains & stored in things like potatoes. **Cellulose** forms the cell wall of plant cells.

**Proteins** – polymers (long, long chains) of amino acids. **Amino acids** are the building blocks of proteins. There are only about 20 different amino acids, but the type & order of these amino acids can form an amazing variety of different protein molecules. Proteins are used by the body for many purposes:

- They are enzymes that help chemical reactions in the body happen (catalase breaks down hydrogen peroxide, amylase breaks down starches)
- They helps cells communicate with other cells
- Proteins build up, maintain, and replace cells and tissues in your body. (Not the tissues you blow your nose in! Cells and tissues are the stuff your body's made up of.)

**Lipids** – Fats, Oils, and Waxes are useful to the body in many ways

- Energy rich – Lipids have twice the energy of sugars, starches and proteins (that is why it is easy to overeat if you eat lots of fatty foods....they taste good, too!)
- Important part of the outer covering of cells
- Used for communication between your body systems
- Help in digestion.

Unsaturated oils are much healthier than saturated fats. Some fats, mainly animal fats (like cholesterol) and trans fats, can build up in your blood vessels and can lead to a heart attack or stroke.

**Nucleic Acids** – DNA and RNA – long, long, long polymer of nucleotides. The order of these nucleotides (or nitrogen bases) gives us each our own look. DNA is truly “life’s little instruction book”. Your DNA holds all the info needed to make you.....you! Each of your cells holds a copy of this information. RNA puts the information to work, following the instruction in the DNA.

WE GET THESE THINGS FROM THE FOOD WE EAT. In digestion, we break these substances down so we can reuse them in our own bodies.