

Name: _____

Class Period: _____

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Chapter 3: Chemistry of Life

Section 2: Water and Solutions

Before we begin, let's review Section 1: Matter and Substances

1. Use your periodic table to complete the information below then DRAW the atomic structure.

Oxygen (O)

Atomic Number: 8

Atomic Mass: 16

Protons: 8

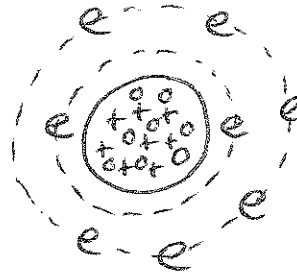
Neutrons: 8

Electrons: 8

How many valence electrons does Oxygen have? 6

Is Oxygen stable? NO

Draw a Dot Diagram of Oxygen:



2. Use your periodic table to complete the information below then DRAW the atomic structure.

Hydrogen (H)

Atomic Number: 1

Atomic Mass: 1

Protons: 1

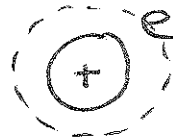
Neutrons: 0

Electrons: 1

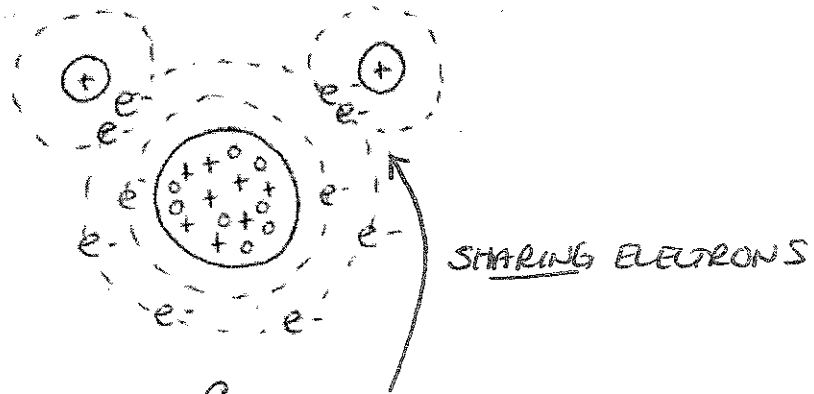
How many valence electrons does Hydrogen have? 1

Is Hydrogen stable? NO

Draw a Dot Diagram of Hydrogen:



3. Refer to the image to the below to answer the questions that follow.



What type of bond is represented? (Ionic or Covalent?) COVALENT

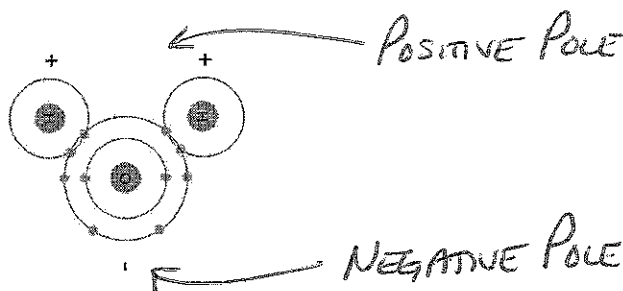
Is each hydrogen stable? YES Is oxygen stable? YES How do you know? THE HYDROGEN ATOMS NOW HAVE 2e- IN THE FIRST LEVEL AND OXYGEN HAS 8e- IN THE SECOND LEVEL.

What is a molecule? TWO OR MORE ATOMS COVALENTLY BONDED TOGETHER.

Read page 54 then answer the following questions.

Polarity

1. A polar molecule has one end with a partial POSITIVE charge, while the opposite end has a partial NEGATIVE charge.
2. Because of an "unfair" sharing of electrons between the two hydrogen atoms and the one oxygen atom, water is polar. Refer to the image below. The hydrogen end of a water molecule has a slight POSITIVE charge and the oxygen end of the atom has a slight NEGATIVE charge. Notice that there are more negative electrons on the oxygen end of the molecule.

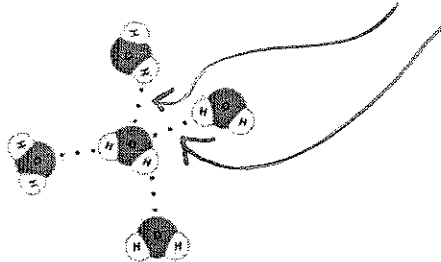


Solubility

1. Because of the polar nature of water molecules, water can dissolve (or pull apart) other polar molecules and ionic compounds like SUGAR AND SALT. Nonpolar substances (substances without polar charges) cannot be dissolved in water like OIL, GREASE, AND WAX.
2. Refer to Figure 4. The image shows water dissolving the ionic compound SODIUM CHLORIDE or NaCl.

Hydrogen Bonds

1. When hydrogen bonds to other atoms to form molecules, the unfair sharing of electrons causes the hydrogen end of the molecule to have a POSITIVE charge like the proton it contains. This end of any molecule will be attracted to the NEGATIVE end of any other compound. This is called **hydrogen bonding**.



2. Hydrogen bonds between molecules are strong but not as strong as covalent or ionic bonds between atoms.

Finally we are ready to start Section 2! Read page 55 then answer the questions that follow.

Properties of Water

1. Most of the unique properties of water result because water molecules form HYDROGEN BONDS with each other.
2. Ice floats because air gets trapped between water molecules when they are hydrogen bonding. How does it benefit living organisms that ice floats? LIFE CAN STILL EXIST IN WATER UNDER ICE
3. It takes a long time for water to heat up and a long time to cool. How does this help the climate of the earth? THIS KEEPS TEMPERATURES ON EARTH FROM CHANGING TOO FAST

4. **Cohesion** is the attraction of particles of the SAME substance. For example water sticking to water to form dew drops. Cohesion also prevents evaporation from happening too quickly.
5. **Adhesion** is the attraction between particles of DIFFERENT substances.
6. Refer to figure 5. Adhesion and cohesion contribute to the UPWARD MOVEMENT OF WATER FROM THE ROOTS OF PLANTS.
7. This is **NOT** in the book but you will see this in the lab. Read closely. **Surface Tension** is the combination of cohesion and adhesion in a closed environment. Imagine a puddle of water in the park after a heavy rain. The water molecules in the puddle are sticking together due to cohesion and the water molecules are also sticking to the polar molecules of the soil. This creates an invisible "skin" on the surface of the water which can hold very small objects like mosquitoes!

Read pages 56 and 57 then answer the following questions.

Solutions

1. A **solution** is a MIXTURE in which ions or molecules of one or more substances are evenly DISTRIBUTED in another substance.
2. Many substances are TRANSPORTED through LIVING things as solutions of WATER.
3. Dissolved substances can move more easily within and between CELLS.

Acids and Bases

1. Refer to Figure 6. When one water molecule loses a hydrogen atom to another water molecule, two ions are formed. H_3O^+ is called a HYDRONIUM ion and OH^- is called a HYDROXIDE ion.
2. In pure water, hydronium ions and hydroxide ions are present in _____ numbers.
3. **Acids** are compounds that form extra HYDRONIUM ions in water. (H_3O^+)
4. An example of an acid that helps your stomach digest food is called HYDROCHLORIC acid (HCl).
5. **Bases** are compounds that form extra HYDROXIDE ions in water (OH^-).
6. An example of a compound that is used to unclog drains is called SODIUM HYDROXIDE (NaOH).
7. When acids and bases are mixed together, the ions react to form WATER.

pH and Buffers

8. Refer to Figure 7 on page 56. The pH scale demonstrates how acidic or basic a solution is. Use the scale to determine the pH number of Lemon 2, Vinegar 3, Milk 6, Antacid 8, Hand soap 10, Ammonia 12.

Circle the solutions above that are acids. Put a box around the solutions above that are bases.

9. Pure water has a pH of 7. What two substances from above could you mix together to get close to the neutral pH of water? MILK and ANTACID.
10. The pH of solutions in living organisms must be STABLE. Not in book...what characteristic of life describes the need for stable internal conditions (staying the same)? HOMEOSTASIS.
11. The pH of human blood is 7.4.
12. A **buffer** is a substance that reacts to PREVENT pH changes in a solution. One important buffer in living organisms is the BICARBONATE ion (HCO_3^-).