Honors Biology Name:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Chemistry Review Homework**

In Biology the most important molecule is dihydrogen monoxide (also known as water ☺). You already know that its chemical formula is H2O.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Element | Protons (*p+*) | Neutrons (*n0*) | Electrons (*e-*) | Atomic mass units (*amu*) |
| Hydrogen |  |  |  |  |
| Oxygen |  |  |  |  |

Based on this information, the mass of a water molecule = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ amu.

The number of ***valence electrons*** is the same as the element’s ***group number*** in the periodic table. The further UP and to the RIGHT an element is in the table, the greater its ***electronegativity***. Electronegativity is a measure of how strongly an element attracts electrons.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Element | Valence *e-* | Lewis dot-diagram | Metal or nonmetal? | Electronegativity (*look it up*) |
| Hydrogen |  |  |  |  |
| Oxygen |  |  |  |  |
| Nitrogen |  |  |  |  |
| Sodium |  |  |  |  |
| Chlorine |  |  |  |  |

A metal and non-metal atom form an ***ionic bond***. The metal loses its valence electron(s) and becomes a ***cation***, or positively charged ion. The non-metal gains electrons to make an octet, and becomes an ***anion***, or negatively charged ion.

Draw the Lewis dot-diagram for the ionic compound Magnesium chloride (MgCl2):

MgCl2:

Two non-metals make a ***covalent bond***. The atoms share and combine valence electrons to make an octet.

|  |  |  |
| --- | --- | --- |
| Element | Lewis dot-diagram | Methane (CH4) |
| Carbon |  |  |
| Hydrogen |  |

Neither Hydrogen nor Carbon have particularly high electronegativity values. Because their electronegativities are similar, Carbon and Hydrogen make a ***nonpolar covalent*** bond. When two non-metals have dissimilar electronegativities, i.e. one is high and one is low, they make a ***polar covalent*** bond.

|  |  |  |
| --- | --- | --- |
| Element | Lewis dot-diagram | Water (H2O) |
| Oxygen |  |  |
| Hydrogen |  |

Would these elements also make polar covalent bonds? (yes or no)

C-O\_\_\_\_\_\_\_\_\_\_ N-H\_\_\_\_\_\_\_\_\_\_ C-C\_\_\_\_\_\_\_\_\_\_ C-Cl\_\_\_\_\_\_\_\_\_\_ C-H\_\_\_\_\_\_\_\_\_\_

If a molecule contains polar covalent bonds, we assign the symbol δ- (*partially negative*) to the more electronegative atom, and δ+ (*partially positive*) to the less electronegative atom. Just as a negative ion is attracted to a positive ion, the δ- atom in one molecule is attracted to the δ+ atom in a different molecule. This attraction is known as a ***hydrogen bond***.

CAUTION: HYDROGEN BONDS OCCUR BETWEEN MOLECULES, NEVER WITHIN A SINGLE MOLECULE.

Label the atoms forming hydrogen bonds δ+ or δ- in the nitrogenous bases:



Before you finish, let’s review water’s special properties that result from its polar covalent bonds and hydrogen bonding between water molecules.

1. H2O molecules are ***cohesive***; they form hydrogen bonds with each other.
2. H2O molecules are ***adhesive***; they form hydrogen bonds with polar surfaces.
3. Water has a ***high specific heat***.
4. Water’s polarity makes it a great ***solvent*** for polar and ionic compounds.
5. Water’s greatest density occurs at 4 **°**C because of the space between water molecules h-bonded to each other.

Write in the letter (a, b, c, d, or e) that best explains the scenario. Some scenarios should be assigned more than one letter.

\_\_\_\_ During the winter, air temperatures in the northern United States can remain below 0 °C for months; however, the fish and other animals living below the lakes survive.

\_\_\_\_ Many substances—for example, salt (NaCl) and sucrose—dissolve quickly in water.

\_\_\_\_ When you pour water in to a 25-mL graduated cylinder, a meniscus forms at the top of the water column.

\_\_\_\_ Sweating helps reduce a human’s body temperature.

\_\_\_\_ Water drops that fall on a surface tend to form rounded drops or beads.

\_\_\_\_ If you touch the edge of a paper towel to a drop of colored water, the water will move up into (or be absorbed by) the towel.