

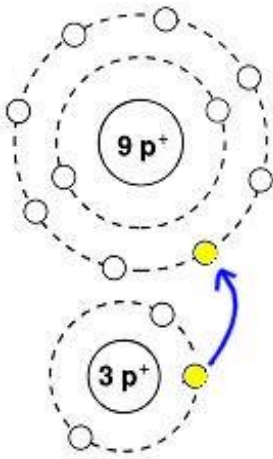
CHEMICAL BONDS

DEFINITION/DESCRIPTION:

Attraction that holds molecules together
Involves valence electrons

TYPES:

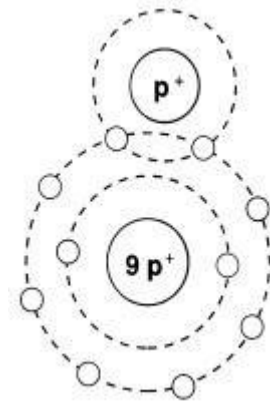
Ionic Bonds



- Transfer of electrons from one atom to another
 - Difference in electronegativity is high
 - Electronegativity = atom's ability to attract and hold electrons
 - Forms ions
 - Cations** = positive ions
 - Anions** = negative ions
- Weak bonds in solution

Covalent Bonds

Involves sharing of electrons
Electronegativities
O = 3.5
N = 3.0
C = 2.5
H = 2.1



- Nonpolar** = electrons shared equally C-C or C-H
- Small or no difference in electronegativity

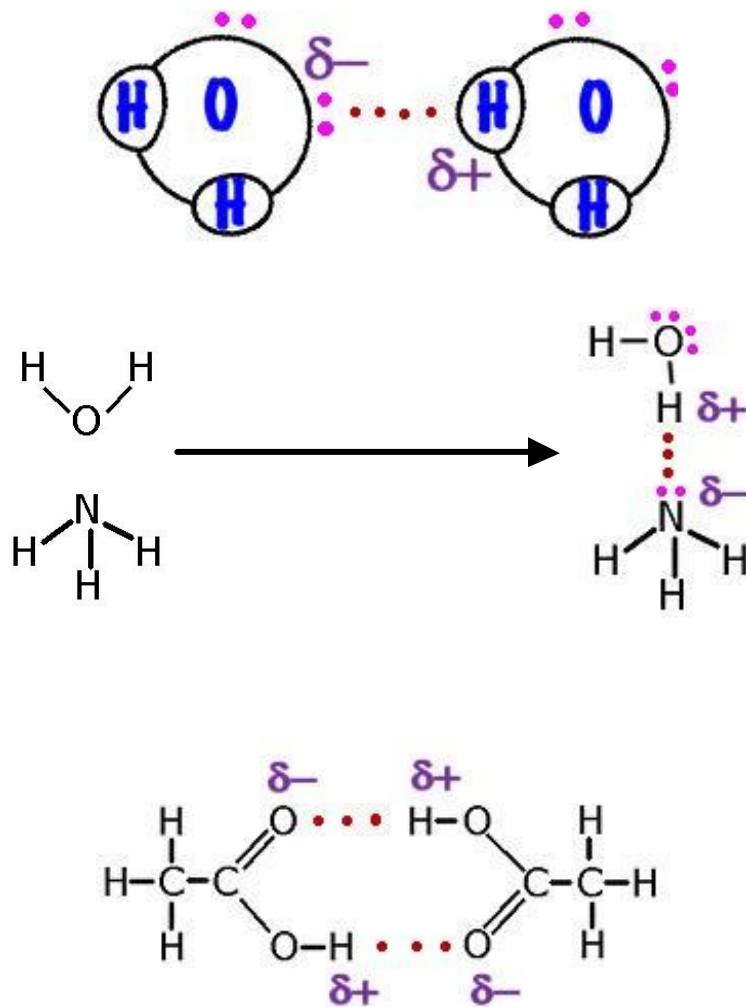
- Polar** = electrons NOT shared equally C-O or H-O
- Difference in electronegativity is larger than nonpolar, but smaller than ionic

TYPES:

Hydrogen Bonds

- Attraction between oppositely charged portions of 2 different molecules
- Weak
- Easily broken
- Easily reformed

Hydrogen bond (red) between water molecules



QUESTIONS:

2.1

1. Define the following terms:

Matter	
Element	
Compound	

2. What elements make up 96% of living matter?

2.2

3. Define the following terms:

Neutron	
Proton	
Electron	
Atomic Number	
Atomic Mass	
Electron Shells	
Isotope	
Valence Electron	
Valence Shell	
Energy	

4. Which is the only subatomic particle that is directly involved in the chemical reactions between atoms?

5. How is the chemical behavior of an atom determined by its electron configuration?

6. Why do atoms form chemical bonds?

2.3

7. Define *molecule*. _____

8. Now, refer back to your definition of a *compound* and fill in the following chart:

	Molecule? (y/n)	Compound? (y/n)	Molecular Formula	Structural Formula
Water				
Carbon dioxide				
Methane				
O ₂			O ₂	

9. What is meant by *electronegativity*?

10. Identify the type of bond described in each of the following. Use the key below to indicate your answers.

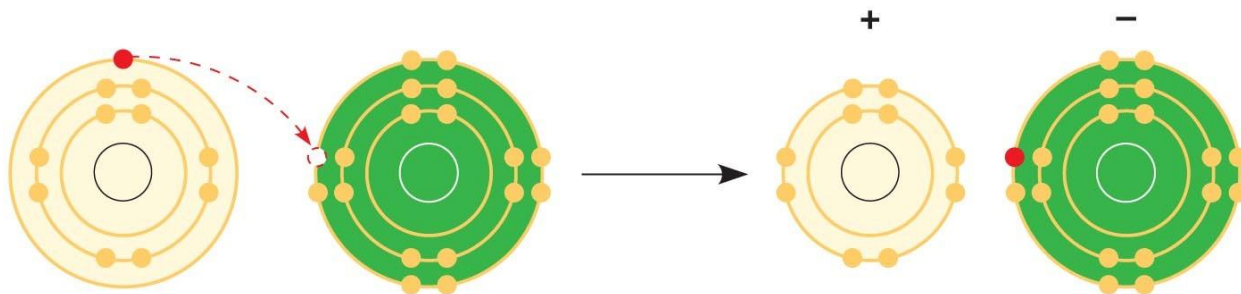
- A. Covalent, polar C. Hydrogen
B. Covalent, nonpolar D. Ionic

- _____ Strongest bonds
_____ Weakest type of bond
_____ Bonds formed by the complete transfer of electrons from atom to another
_____ Bonds formed by the equal sharing of electrons between two atoms
_____ Bonds formed by the unequal sharing of electrons between two atoms
_____ Attraction between oppositely charged portions of two different polar molecules
_____ C—C _____ Na—Cl
_____ H—C _____ P—O
_____ C—O _____ N—H

11. How can you determine if the bond between two atoms is polar covalent, nonpolar covalent, or ionic?

12. Make an electron distribution diagram of water. Which element is most electronegative? Why is water considered a *polar* molecule? Label the regions that are more positive or more negative. (This is a very important concept. Spend some time with this one!)

13. Another bond type is the *ionic bond*. Explain what is happening in the figure below (2.14):



14. What two elements are involved above?

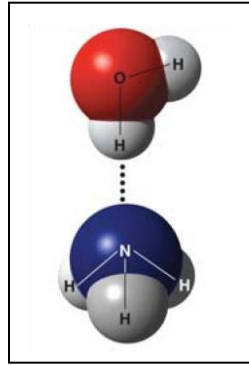
15. Match the description with the correct term.

- | | |
|--------------------------------|-----------|
| _____ Charged atom or molecule | A. Anion |
| _____ Negatively charged ion | B. Cation |
| _____ Positively charged ion | C. Ion |

16. How many electrons are shared between the atoms in each of the following:

Chemical Bond	# of e- shared	Chemical Bond	# of e- shared
C-C		N≡N	
O=O		H-C	

17. What is a *hydrogen bond*? Indicate where the hydrogen bond occurs in this figure.



18. What is the biological importance of weak hydrogen bonds?

19. What is the meaning of the following statement: “Nonpolar covalent bonds and ionic bonds are two extremes of a continuum.”

20. Explain *van der Waals interactions*. Though they represent very weak attractions, when these interactions are numerous they can stick a gecko to the ceiling!

21. Here is a list of the types of bonds and interactions discussed in this section. Place them in order from the strongest to the weakest: hydrogen bonds, van der Waals interactions, covalent bonds, ionic bonds.

STRONG



WEAK

22. How is the shape of a molecule important in biological systems?

2.4

23. Write the chemical shorthand equation for photosynthesis. Label the *reactants* and the *products*.

24. For the equation you just wrote, how many molecules of carbon dioxide are there? _____

How many molecules of glucose? _____ How many elements in glucose? _____

25. What is meant by *dynamic equilibrium*? Does this imply equal concentrations of each reactant and product?

End of Chapter Synthesis and Evaluation Problems

Do problems 1-8. Check and correct your answers in back of the text.

1. _____
2. _____
3. _____
4. _____
5. _____
6. _____
7. _____
8. _____

Study Guide/ISN (20 points)

In your study guide, review pages 33 to 35. In you ISN do the following: Title the page: **Chapter 2 The Chemistry of Life Must Know!** In one color, copy down each of the must know items listed on page 33 (leave space underneath for next step). Directly under each of the must knows in a different color provide a brief description, diagram, model, mnemonic device that will help you study for the unit test and more importantly for the AP Test in May.

Bozeman Science/Podcasts/ISN (See Syllabus for format) (20 points each)

1. Covalent and Ionic Bonding
2. Water: A Polar Molecule (Supplemental)