CHEMISTRY ♦ SPRING 2015 ♦ DR. BRESLYN **www.breslyn.org**	Name: Date:
A **chemical bond** forms when atoms are strongly attracted to each other. **Valence electrons** (e^- in outermost s and p orbitals) are involved in forming bonds. **Bond energy** is a measure of how much energy is involved in forming or breaking a bond. **Atoms bond in order to have more <u>stable</u> arrangements of electrons.** Three main types of bonds: ionic, covalent/molecular, and metallic.	
Ionic compounds are formed due to the electrostatic attraction between cations (positive ions) and anions (negative ions). In ionic bonds electrons are **transferred**. ⓘ Example (write electron configurations, show electron transfer with an arrow): Na + Cl → Na^+ + Cl^- Using electron dot symbols: Na + Cl → ⓘ How do the properties of ionic compounds relate to bond strength?	*Metal + NonMetal = Ionic* *Ionic compounds have very strong bonds. This explains many of their properties.* The electron dot symbol for KCl would look like: ⓘ K^+ [Cl]$^-$ Ionic compounds are held together in crystal lattices.
Covalent (also called molecular) **compounds** are formed when atoms **share** electrons. H + H → H H F + F → F F Most of the time the shared electrons are found between the atoms. Remember: ***NonMetal + NonMetal = Covalent (aka Molecular) Bond***	The properties of ionic, covalent, and metallic compounds are not given here. Refer to your class notes and lab results. *NonMetal + NonMetal = Covalent* *Covalent Bond is the same as a Molecular Bond*

The Octet Rule states that atoms bond to achieve a noble gas configuration. This means eight for every element except hydrogen.

Based on the octet rule we can draw **electron dot structures** to show how atoms are bonded.

Octet rule limitations:

- does not work for all molecules
- some atoms can have more than an octet.

Step-by-Step Electron Dot Structures

1. Count the valence e- for all atoms.
2. Add or subtract e- if molecule is charged (+1, -1,…).
3. Identify least electronegative atom and put at center (usually the biggest atom).
   Note: Hydrogen is never at the center.
4. Assign two electrons to each bond. Subtract 2 e- for each bond.
5. Complete octets on outside atoms. Subtract valence e- for each e- added.
6. Put remaining e- in pairs on central atom.
7. If central atom does not have an octet, move electrons from outer atoms to form double or triple bonds.

ⓘ

H_2	Br_2	H_2O	NH_3	O_2

N_2	C_2H_4	CH_4	OH^-	CO_3^{2-}

Electron Dot Structures represent the electrons in the outer energy level of an atom.

Electrons that are around an atom but not shared are called "*unpaired electrons*".

Polar Covalent Bonds are formed when electrons are shared *unequally*.

Shared electrons spend more time around the more electronegative atom(s).

H_2O is a polar molecule

Electronegativity is how strongly an atom attracts a shared pair of electrons.

The *difference* is electronegativity (between 0.0 and 4.0) of two atoms allows us to *predict* the type of bond that will form (data available in book).

- Difference is greater than 2.0, the bond is **ionic**.
- Difference is between 0.4 and 2.0, the bond is **polar covalent**.
- The difference is between 0.0 and 0.4, the bond is **nonpolar covalent**.

ⓘ Predict the bond type of the following compounds:

KCl Cl_2 NO_2 CH_4

The most electronegative element is fluorine (4.0)

The least electronegative is francium (0.7).

Hydrogen does not follow the trend for electronegativity. It has a value of 2.0