***Bonding:***

 **Allows atoms to get an octet Octet = 8 valence electrons**

**-Valence electrons are the electrons in the outermost S & P sublevels (last # in electron configuration on Periodic Table) -Maximum # of valence electrons = 8 (only 2 in smaller elements; ex: H, He)**

**-Endothermic = absorbing energy, which occurs when a bond is *BROKEN*  -Exothermic = releasing energy, which occurs when a bond is *FORMED***

**Hint: “absorb to break, release to make”**

**-Covalent Bonding = sharing of electrons -Non-polar covalent bond = sharing electrons equally -Polar covalent bond = sharing electrons unequally**

**-Ionic Bonding = transfer of electrons from a metal to a nonmetal, resulting in the formation of a positive ion (metal) and a negative ion (nonmetal) \*metals lose electrons to form positive ions\* \*nonmetals gain electrons to form negative ions\***

***Ionic Bonding Lewis Dot Diagrams:***

**Steps: 1) write formula 2) draw the diagram for the metal(s) and nonmetal(s) 3) transfer the electrons from the metal to the nonmetal 4) write answer using brackets and charges \*HINT\* the metal should have no dots & a (+) charge, the nonmetal should have 8 dots and a (-) charge**

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***Noble Gas Electron Configurations:***

 **After bonding, elements will have the same electron configuration as a noble gas**

**Examples:**

**1) NaCl Na 2-8-1becomes 2-8, the electron configuration of Neon [Ne] Cl 2-8-7 becomes 2-8-8, the electron configuration of Argon [Ar]**

**2) Li2O Li 2-1 becomes 2, the electron configuration of Helium [He] O 2-6 becomes 2-8, the electron configuration of Neon [Ne]**

**3) Al2S3 Al 2-8-3 becomes 2-8, the electron configuration of Neon [Ne] S 2-8-6 becomes 2-8-8, the electron configuration of Argon [Ar]**

***Ionic Character:***

**Ionic Character is determined by the difference in electronegativity between two atoms in a compound. The greater the difference, the greater the ionic character**

**Electronegativity (found on Table S) = an atom’s attraction for electrons; scaled from 0.0 to 4.0**

**Fluorine = 4.0**

**1.7 Rule -if the ionic character is greater than 1.7, the compound is ionic -if the ionic character is less than 1.7, the compound is covalent**

**Examples:**

**1) NaCl 2) CO2 3) O2 .9 3.2 2.6 3.4 3.4 3.4 3.2-.9= 2.3 3.4-2.6=.8 3.4-3.4=0**

***Covalent Bonding:***

 **Sharing of electrons**

**1 bond = 2 electrons being shared molecule = covalent bonding**

**Polar Covalent Bonds = unequal sharing of electrons. Non-polar Covalent Bonds = equal sharing of electrons.**

**NON-POLAR MOLECULES POLAR MOLECULES -Diatomic (ex: O2 ) -NH3 -CX4 (ex: CH4) -H2O -CO2 -HCl**

** **

** **

** **

**Non-polar Bonds: Only occur with diatomics. Polar bonds are much more common Non-polar Molecules: symmetrical in shape, equal distribution of charge**

**Polar Bonds: All bonds except diatomics. Polar Molecules: asymmetrical in shape, unequal distribution of charge**

**Electronegativity difference (ionic character) determines if a bond is polar or non-polar (0=non-polar, anything else = polar)**

***Diatomic Bonds:***

 **# of bonds diatomics form with themselves**

**O2 Double Bond N2 Triple Bond H2 Single Bond F2 Single Bond I2 Single Bond Cl2 Single Bond Br2 Single Bond**

***Determining the # of Bonds an Element Will Form***

**Maximum # of valence electrons – actual # of valence electrons = # of bonds the element will form**

**Max. # of valence electrons (for most elements)= 8 Max. # of valence electrons for Hydrogen (H) = 2**

***Symmetry:***

 **Determines if a molecule is Polar or Non-polar**

 **Use SNAP!**

**Symmetrical Non-polar Asymmetrical Polar**

**Non-polar, symmetrical = equal distribution of charge Polar, asymmetrical = unequal distribution of charge**

***Covalent Bonding Lewis Dot Diagrams:***

***Dot Diagrams for Molecules vs.Dot Diagrams for Atoms***

**\*1 bond = 2 electrons**



**Oxygen Molecule**

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**Chlorine Molecule**

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**Nitrogen Molecule**

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**Diatomics: Non-polar molecules with non-polar bonds shape: linear**

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**Molecule of water (H2O): Polar molecule with polar bonds shape: bent**

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**Molecule of Carbon Dioxide (CO2): Non-polar molecule with polar bonds shape: linear**

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**Molecule of Ammonia (NH3): Polar molecule with polar bonds shape: pyramidal**

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**Molecule of CX4 (ex. = CCl4): Non-polar molecule with polar bonds shape: tetrahedral**

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***Compounds with both Ionic and Covalent Bonds:***

 **Contain a metal (positive) being attracted to a negative polyatomic ion (found on Table E)**

**Ex.) CaSO4 Ca + SO4 ionic bonding metal covalent bond**

**HINT: look for a metal and a polyatomic ion**

***Dipoles:***

**Dipoles occur in molecules (covalent bonding) in which one end is slightly positive and another is slightly negative due to differences in electronegativity**

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***Molecule Ion Attractions:***

 **Occur when a positive and/or negative ion is attracted to the negative and/or positive pole of a molecule**

**Ex. 1) NaCl (aq) aq = dissolved in water (H2O) Sodium Chloride is an ionic compound that will disassociate when dissolved in water Na + Cl -**

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**Ex. 2) KBr mixed with ammonia (NH3)**

***Hydrogen Bonding – an Intermolecular Force:***

**-When a sample of H2O, NH3, or HF is in a container, the poles of each substance will line up positive to negative.**

**-O, N, and F are the most electronegative elements on the Periodic Table. When they bond with Hydrogen, this force is present.**

**Intermolecular Force: a force present between molecules**

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**This intermolecular force accounts for the unusually high boiling point of water**

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***Metallic Bonding:***

**NOT A BOND BETWEEN METALS!!!!!!!!!!!!!!!!!!!**

**Metallic bonding is a term used to describe the movement of electrons on the surface of a metal**

**“Sea of mobile electrons” is a phrase often tied to metallic bonding**

**The movement of electrons on metals explains why they are such good conductors of electricity and heat**

**-What displays metallic bonding? The answer to this question is always a metallic element**

**Electrolyte = something that conducts electricity**

***London Dispersion:***

**A temporary force of attraction that occurs between positive and negative poles of a non-polar molecule**

**Ex.) H2**

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***Coordinate Covalent Bond:***

**Ex.) NH4+ and H3O+**

 **In these molecules, a proton is attracted to the lone pair of electrons, forming a coordinate covalent bond. This results in a positive charge.**

**Proton: a Hydrogen (H) atom that has lost its electron**

**Lone Pair of Electrons: pair of electrons that is not found in a bond**

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**H20 (water) becomes H30+ (Hydronium), and NH3 (ammonia) becomes NH4+ (ammonium)**

**OH- H2O H3O+ base neutral acid**