**Periodic Table Review**

Vocabulary

* *Electronegativity*-The ability of an atom to attract electrons.
* *Ionization Energy-*The energy needed to remove an electron from the valence shell of a gaseous atom or ion in the ground state
* *Atomic Radius-*The size of the atom in the ground state
* *Ionic Radius-* The radius of an atom’s ion
* *Electron Affinity*- The change in energy of a neutral atom
* *Shielding-* A barrier made of inner shell electrons and it decreases the nucleus’ pull on the outer electrons

Key Information

* Atomic radius increases down a group due to more energy levels, electron-electron repulsions, and shielding of the kernel electrons.
* Atomic radius decreases down a period due to a higher nuclear charge (more protons) pulling the electrons in tighter.
* Ionic radius increases down a group due to increase in energy levels, electron-electron repulsions and shielding.
* Across a period the ionic radius depends on its charge and configuration.



* Electronegativity decreases down a group due to higher shielding from the nucleus by inner electrons. 
* Electronegativity increases across a period due to stronger nuclear charge and needing to fill the octet.
* Ionization energy decreases down a group because electrons are less bound to the nucleus due to higher shielding from the nucleus by more inner electrons.
* Ionization energy increases across a period because electrons are more tightly bound to a stronger nuclear charge, therefore they are harder to remove.
* Fluorine has the highest electronegativity and one of the highest ionization energies.
* A compound is polar if it’s electronegativity difference (END) is greater than .4
* A compound is nonpolar if it’s electronegativity difference (END) is less than .4

Octet Rule

 Atoms bond with other atoms by sharing or transferring electrons in order to achieve a stable octet (8 valence electrons).

* When bonds are formed, energy is released.
* When bonds are broken, energy is absorbed.

Metallic Bonds

* Sea of electrons
* Metals only
* High melting and boiling points
* Insoluble
* Always conduct
* All other metallic properties

Covalent Bonds

* Share electrons
* Nonmetals only
* Low melting and boiling points
* Insoluble unless polar
* Never conduct
* Creates molecules
* If two atoms or more form a bond with the same electronegativity, the bonds are nonpolar and they share electrons equally.
* If there is an electronegativity difference between bonded atoms, the bonds are polar and electrons are pulled toward the more electronegative atom.

Lattice Energy

* Lattice energy is the change in energy that takes place when separate gaseous ions are packed together ions are packed together to form an ionic solid.
* Lattice energy is generally exothermic and has a major affect on whether a compound can be made.
* Coulomb’s Law can be used to calculate and compare the lattice energy of compounds.
	+ LE = k(Q1Q2/r)
	+ K = constant
	+ Q = charge of ion
	+ r = distance between ions

Heat of Formation

* The following steps must be taken to find heat of formation:
	+ Sublimation
	+ Ionization
	+ Dissociation
	+ Electron Affinity
	+ Lattice Energy

Geometry

* *Linear-* The molecule is on one plane (flat).
* *Bent*- The molecule is bent at an angle due to unshared electrons and two bonding pairs on the central atom.
* *Pyramidal*- The molecule has a triangular shape due to a lone pair and three bonding pairs on the central atom.
* *Tetrahedral*- The molecule has four bonding pairs and no lone pairs on the central atom.



Dipolar Molecules

* If a molecule is polar, it will have a slightly negative and slightly positive side, called a dipolar molecule.
* Dipolar bonds can create polar or nonpolar molecules.
* A polar molecule will have polar bonds and be asymmetrical.
* A nonpolar molecule will either have nonpolar bonds or polar bonds with a symmetrical shape.

 Bond Energy

* Forming bonds is exothermic and need to be negated.
* Breaking bonds is endothermic and are positive.
* Heat of Formation = (Bonds broken) - (Bonds formed)

*Metals v. Nonmetals vs. Semimetals*

* Metals are ductile and malleable while nonmetals are brittle
* Metals are good conductors of heat and electricity while nonmetals are poor conductors and semimetals only partially conduct electricity
* Metals tend to lose electrons while nonmetals tend to gain them

*How to Draw a Lewis Dot Diagram*

* Find the number of electrons that are in the compound
* Arrange the electrons so that each atom contributes one electron to a single bond between each atom
* If each atom has an octet then it is complete but if not then you need to rearrange the electrons so that each atom as a stable octet

*Special Periodic Groups*

* Alkali Metals: group one metals that have low melting and boiling points that are very reactive, soft, can be cut with a knife, and have low densities
* Alkaline Earth Metals: group two metals that are shiny, somewhat reactive, and have low densities, boiling points and melting points
* Halogens: group 17 nonmetals that are highly electronegative and reactive
* Noble Gases: group 18 gases that are odorless, colorless, monatomic and non reactive due to their already stable octet

Practice Problems

* Which of the following has the highest electron affinity?
1. Rb b. Br- c. Br d. Rb+
* **Answer**: **C) Br**
* Which of the following has the smallest atomic radius?
1. Li b. Rb c. Cs d. Na
* **Answer**: **A) Li**
* **Which of the following molecules is the most polar?**
1. CH4 b. NH4 c. CCL4 d. H2O
* **Answer: D) H2O**
* How much energy is absorbed or released (identify which) when the following reaction takes place?

The relevant bond energies are:

C—H 414 kJ/mol CH4 (g) + 2 O2 (g) --> CO2 (g) + 2 H2O (g)

O==O 502 kJ/mol

C==O 730 kJ/mol

O—H 464 kJ/mol

H—H 435 kJ/mol

* **Answer**: **656 kJ released**
* Predict the trend in radius for Be, Mg, Ca, and Sr.
* **Answer**: **Be, Mg, Ca, and Sr increase due to an increased number of principal energy levels.**
* What happens to electronegativity as you go across a period?
* **Answer: Electronegativity increases as you go across a period due to stronger nuclear charge.**
* What happens to atomic radius as you go down a group?
* **Answer: As you go down a group atomic radius increases due to more energy levels.**
* What would happen to the lattice energy if the radii was tripled?
* **Answer: If the radii triples, the LE decreases.**