HPS Graphing Periodic Trends Lab Name_____per____

DIRECTIONS: Print out this lab and attach your graphs to the back of it.
PURPOSE: To determine how certain properties are periodic when the elements are arranged in periods or groups.
MATERIALS: HPS web page, graph paper.

DISCUSSION: There are many periodic trends that occur as you cross a period or go down a family on the Periodic Table. For example, as you go across a period the elements generally increase in atomic mass and become less metallic. As you go down a family (group) both the atomic mass and atomic number increase. When graphing this data use the rules of graphing in the Graphing Scientific Data program.

REFERENCE:
Angstrom - A unit of distance equal to one ten-billionth of a meter (1 x 10ee-10 meter).
Atomic Radius - The distance from the center of the nucleus to the valence electron energy level.
Ionization energy - the energy required to remove an electron from an atom.
Valence electrons - the electrons that occupy the outside energy level in an atom.

DATA:

Properties of the First 18 Elements

Element	Atomic Number	Atomic Radius (Angstroms)	Ionization Energy
H	1	0.79	314
He	2	0.49	567
Li	3	2.05	124
Be	4	1.4	215
B	5	1.17	191
C	6	0.91	260
N	7	0.75	335
O	8	0.65	314
F	9	0.57	402
Ne	10	0.51	497
Na	11	2.23	119
Mg	12	1.72	176
Al	13	1.82	138
Si	14	1.46	188
P	15	1.23	242
S	16	1.09	239
Cl	17	0.97	299
Ar	18	0.88	363

Using the data above, make a line graph the following data. *Draw a dark vertical line to separate the 3*

periods. Maximum of 2 graphs per page. Important: **Connect your points** since the data is extremely accurate.

1. Atomic Radius (y) vs. Atomic Number (x) for the first 3 periods (18 elements).*
2. Ionization energy (y) vs. Atomic Number (x) for the first 3 periods (18 elements).*
3. Valence electrons (y) vs. Atomic Number (x) for the first 3 periods (18 elements).*

*Important: Label each point with the chemical symbol and draw vertical lines on your graph paper to show periods 1, 2 and 3.

Properties of the Alkali Metals & Halogens

Element	Atomic Radius (Angstroms)	Ionization Energy
Alkali Metals		
Li	2.05	124
Na	2.23	119
K	2.77	100
Rb	2.98	96
Cs	3.34	90
Halogens	---	------
F	0.57	402
Cl	0.97	299
Br	1.12	272
I	1.32	241
At	1.43	?

Fr & At are extremely rare - they exist only in trace amounts.

Using the data above, graph (line graph) the following data. Use element symbols on x-axis instead of atomic number. Connect your points since the data is extremely accurate.
1. Atomic Radius(y) vs. Alkali Metals(x) arranged in increasing atomic number.*
2. Ionization Energy (y) vs. Alkali Metals(x).
3. Atomic Radius(y) vs. Halogens(x).
4. Ionization Energy (y) vs. Halogens(x).
*Don't plot points for elements with questions marks. Maximum of 2 graphs per page.

Now that you have your data graphed, answer the conclusion questions on the next sheet.

Use your graphs to answer these Conclusion questions:

Circle the correct answer then explain why it is correct.
1. Radii of the atoms [increase, decrease] as you go across (L to R) a period? Explain why:

_____

2. Radii of the atoms [increase, decrease] as you go down a family? Explain why.

_____

3. The energy needed to remove an electron from an atom generally [increases, decreases] as you go across a period? Explain why this occurs.

_____

4. What is the relationship between ionization energy and members of:

a. The Alkali Metals:_____

b. The Halogens:_____

5. Circle the atom with the largest atomic radius (size) in each group:

a. aluminum, sulfur, phosphorus b. arsenic, bismuth, nitrogen

c. iron, lithium, silicon d. barium, beryllium, bromine

6. Circle the atom that would require the LEAST amount of energy to remove an e-

a. magnesium, chlorine, silicon b. lithium, cesium, potassium

c. fluorine, iodine, chlorine d. calcium, bromine, cobalt

7. Circle the atom that would require the MOST amount of energy to remove an e-

a. lithium, potassium, rubidium b. sodium, chlorine, silicon

c. polonium, oxygen, sulfur d. fluorine, iodine, chlorine

----------Circle the correct answer(s) in the brackets below.----------

8. Going across a period from left to right: The [**p+, N0, e-**] in the nucleus increase, thus pulling the [**p+ , N0, e-**] closer towards the center of the atom and [**increasing, decreasing**] the atomic radii. Because of this increase in [**electromagnetic, strong**] force atoms tend to [**gain, lose**] electrons as you go across the periodic table.

9. Going down a metallic family:The number of [**p+ N0 e-**] energy levels increases by one, making the atomi radius [**larger, smaller**]. Because the electrons are farther from the nucleus they tend to be [**gained, lost**] more easily. Therefore metals tend to be [**more, less**] chemically active as you go down a family.