NAME _____ PREF _____ SECTION SC_____ DATE _____

LAB 22: PERIODIC TABLE - Graphing Periodic Properties

Objectives - To prepare graphs of several important properties of the elements which will aid in the understanding of The periodic table. The construction of these graphs should verify the modern periodic law which states that: "the chemical properties of elements are periodic functions of their atomic number."

Properties to be investigated in Lab:

1. Density - mass per unit volume (data given in grams / mL)
2. Ionization Potential - energy required to remove the outermost electrons from an atom (data given in electron volts).
3. Atomic Radius - measured in units called Angstroms (Å), where one $Å=10^{-10}$ meters. Atomic radii are determined by x-ray and spectral analysis to find distance between centers of adjacent atoms. Values from your reference tables are in your data chart for graphing.

Procedure

1. Prepare three (3) separate graphs of the above properties.
   * The horizontal axis (x-axis) will be atomic number for all three graphs.
   * Vertical axis (y-axis) will be the given properties.
   ** Note: You will be eliminating the transition elements (see data charts), BUT leave no gap on the x-axis.

   Label your X and Y axes for each graph as below.

1. Density vs. atomic number - Label x-axis - elements numbers (1-20), (31-38), (49-56). Change by 1 unit for each. Y-axis will be 0 to 7.5, $\Delta y = 0.5$ units per line.

2. 1st Ionization Potential vs. atomic number - x-axis (same as 1 above). Y-axis = 1-26; $\Delta y = 1$ unit each line.

3. Atomic Radius vs. atomic number - x-axis (same as above). Y-axis = 0 to 2.70; $\Delta y = 0.1$ unit per line.

   * Write the symbol of the Group 1 and Group 18 elements next to the dot representing them on each of your graphs.

   ** Explain the pattern you see in each of your graphs. How does this substantiate the statement of the periodic law "*the chemical properties of elements are periodic functions of their atomic number*"?

   All data, explanations and questions are to be put neatly on looseleaf paper. Graphs are to be put on graph paper.

Lab Questions (Answer in complete sentences)!

1. Name the following Groups:

   Group 1 _____

   Group 2 _____

   Group 17 _____

   Group 18 _____

2. How is the modern periodic table arranged?

   _____

3. What are the vertical columns called? _____

   _____

4. What are the horizontal rows called? _____

   _____

5. What does the atomic number of an element tell us? _____

6. What are the majority of elements on the periodic table classified as? _____

7. What are the "middle elements" using the "d" orbitals called? _____

8. What is the charge of the following particles:

   a) neutron _____

   b) proton _____

   c) electron _____

9. What do we call the elements that show properties of both metals and non-metals?

   _____

10. Which "family" is considered "highly inactive"? _____

Data Chart

Atomic #	Density g/mL	1st Ionization Potential (eV = electron Volts)	Atomic Radius Å	Atomic #	Density g/mL	1st Ionization Potential (eV = electron Volts)	Atomic Radius Å
1	0.07	13.5 eV	1.20	19	0.86	4.3	2.27
2	0.13	25.5	1.22	20	1.55	6.1	1.97
3	0.53	5.4	1.52	31 **	5.91	5.9	1.22
4	1.85	9.3	1.13	32	5.82	8.1	1.23
5	2.34	8.3	0.83	33	5.72	10.5	1.25
6	2.26	11.2	0.77	34	4.79	9.7	1.17
7	0.81	14.5	0.55	35	3.12	11.8	1.14
8	1.14	13.6	0.60	36	2.60	13.9	1.84
9	1.11	17.9	0.72	37	1.53	4.2	2.48
10	1.20	21.5	1.31	38	2.60	5.7	2.15
11	0.97	5.1	1.54	49	7.31	5.8	1.63
12	1.74	7.6	1.60	50	7.30	7.3	1.41
13	2.70	5.9	1.43	51	6.62	8.5	1.41
14	2.33	8.1	1.17	52	6.24	8.9	1.37
15	1.82	10.9	1.08	53	4.94	10.6	1.33
16	2.07	10.3	0.94	54	3.06	12.1	2.18
17	1.56	12.9	0.99	55	1.90	3.9	2.65
18	1.40	15.7	1.74	56	3.50	5.2	2.17