Ms. Randall
Regents Chemistry
Lab Activity: Graphing the Periodic Table

<u>**Background:**</u> In 1870, Dmitri Mendeleev first proposed a new way of studying and organizing the then known 63 elements. The modern form of the table has been modified and improved many times since Mendeleev's tables. Pioneers like Moseley (1913) and Seaborg (1941) have made the properties of the elements much simpler to study and understand. In this activity, you are going to discover some of the trends of the properties that exist on the modern periodic table. To do this, you are going to graph these properties.

<u>**Objective:**</u> To determine how density, radius, ionization energy, and electronegativity changes on the table.

<u>**Materials:**</u> graduated cylinder, balance, weighing dished, lead, silicon, tin, reference tables, graph paper, rulers.

<u>**Pre-Lab:**</u>

1. Explain how you plan to find the density of silicon, tin, and lead. Be specific.
2. Where can you find the actual densities of silicon, tin, and lead? List them with their atomic numbers:

<u>**Procedure:**</u> **For all graphs, label the axes, use constant intervals, circle your points, and connect with a best fit line. Use pencil and a ruler. Your graphs will be graded on both accuracy and appearance.**

1. Find the density of the tin, lead and silicon. Be sure to record all measurements and show all work.
2. Graph density versus atomic number for the three substances you measured.
3. Calculate the percent error of your densities using table S.
4. Why were some of your percent errors so high? What could have been your sources of error?

5. On your graph for question 2, estimate the density of carbon and germanium based on their atomic numbers. Place marks on the graph and label with symbol. Then calculate you percent error.
6. In a full sentence, state the trend between groups and density

7. Using your reference table S, create a data tables and graphs the following:
    a. Atomic Number versus Radius for the Halogens.
    b. Atomic Number versus Radius for Period 2.
8. In a full sentence, state the trend between groups and atomic radius:
9. In a full sentence, state the trend between periods and atomic radius:

10. Using your reference table S, create a data tables and graphs the following:
    a. Atomic Number versus Ionization Energy for the Alkali Metals.
    b. Atomic Number versus Ionization Energy for Period 3.
11. In a full sentence, state the trend between groups and ionization energy
12. In a full sentence, state the trend between periods and ionization energy

13. Using your reference table S, create a data tables and graphs the following:
    a. Atomic Number versus Electronegativity for the Alkaline Earth Metals
    b. Atomic Number versus Electronegativity for Period 2.
14. In a full sentence, state the trend between groups and electronegativity:
15. In a full sentence, state the trend between periods and electronegativity:
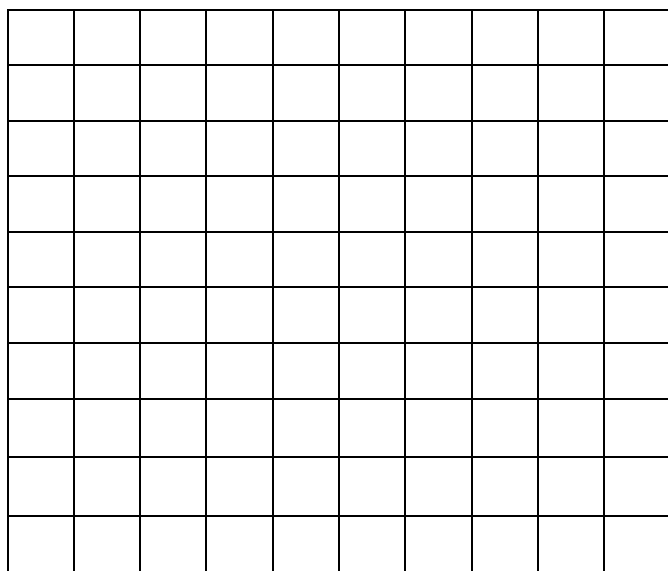
Graph density versus Atomic Number
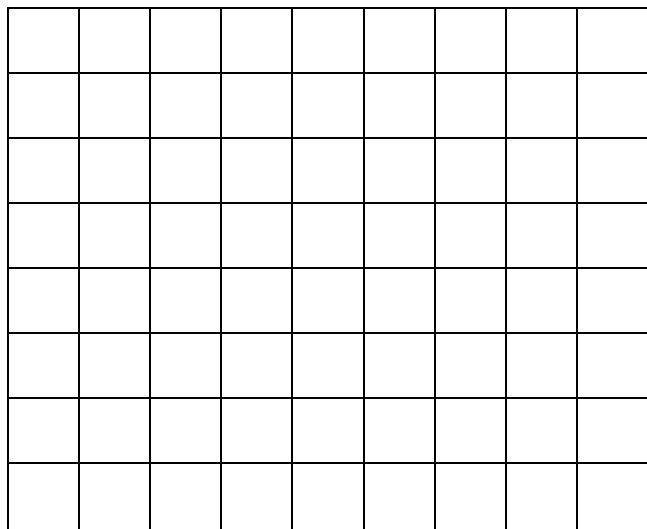
Atomic Number versus Radius for the Halogens
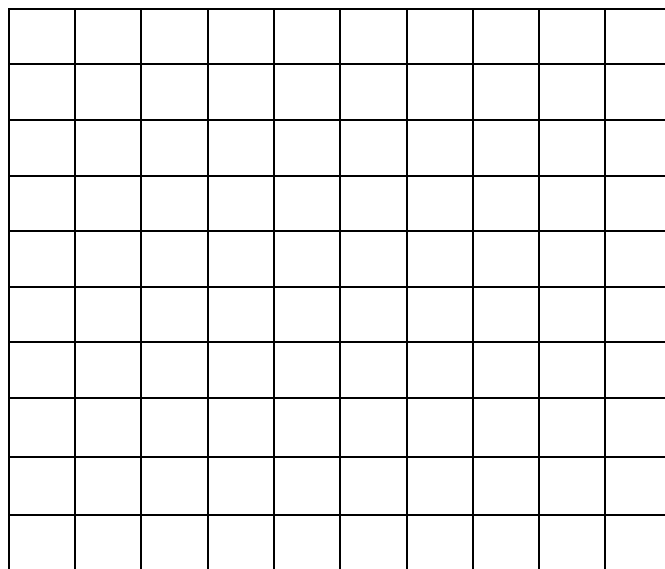
Atomic Number versus Radius for Period 2

Atomic Number versus Ionization Energy for the Alkali Metals

Atomic Number versus Ionization Energy for Period 3

Atomic Number versus Electronegativity for the Alkaline Earth Metals

Atomic Number versus Electronegativity for Period 2
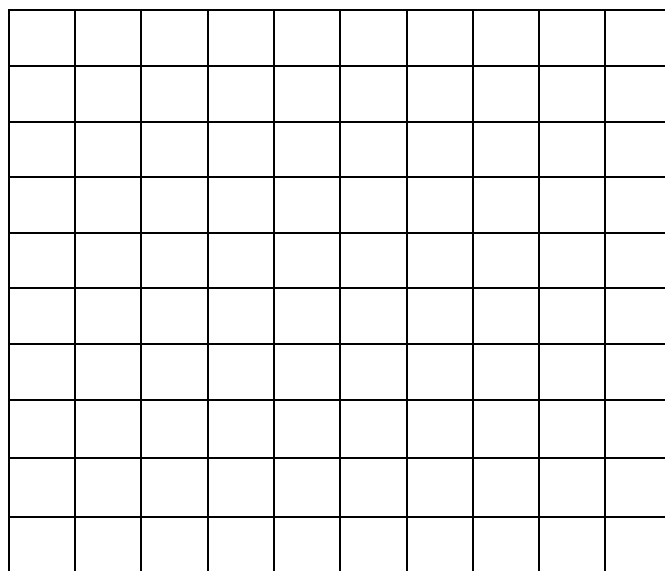
1. Write a paragraph summarizing what you have learned about the scientific concept of the lab from doing the lab. Back up your statement with details from your lab experience.

2. Which general trend is demonstrated by the Group 17 elements as they are considered in order from top to bottom on the Periodic Table?

     A) a decrease in atomic radius

     B) a decrease in electronegativity

     C) an increase in first ionization energy

     D) an increase in nonmetallic behavior

3. In the ground state, each atom of an element has two valence electrons. This element has lower first ionization energy than calcium. Where is this element located on the Periodic Table?

     A) Group 1, Period 4   B) Group 2, Period 5

     C) Group 2, Period 3   D) Group 3, Period4

   Base your answer to the following question on the table below.

First Ionization Energy of Selected Elements

Element	Atomic Number	First Ionization Energy (kJ/mol)
lithium	3	520
sodium	11	496
potassium	19	419
rubidium	37	403
cesium	55	376

4. Explain, in terms of atomic structure, why cesium has lower first ionization energy than rubidium.

5. *Base your answer to the following question on the information below.*

A metal, *M*, was obtained from a compound in a rock sample. Experiments have determined that the element is a member of Group 2 on the Periodic Table of the Elements. Explain why the radius of a positive ion of element *M* is *smaller* than the radius of an atom of element *M*.