Explore Student Journal

Name: _____ Date: _____

Background

1. What is a periodic trend?

2. What can the similar properties of the elements in a family be attributed to?

3. What are the three concepts that can be used to explain the different periodic trends?

4. Explain the two types of correlations?

5. If you worked at job for nine dollar per hour, what type of correlation is the number of hours worked and your take-home pay?

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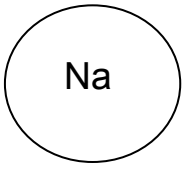
Part I: It's Just a Trend

1. What is the trend of the atomic numbers of the elements as you move from left to right across a period on the periodic table? How does this sequence continue to the next period?

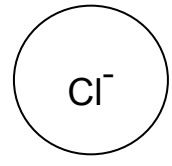
2. What is the trend for the number of valence electrons moving from left to right across a period on the periodic table? What is the pattern or trend within a group?



atomic radius = 186 pm

ionic radius = 95 pm

atomic radius = 99 pm



ionic radius = 181 pm

Use the diagrams above to answer questions 3 and 4.

3. What happens to the radius of the sodium atom when it forms a positive ion (cation)? What happens to the electrons?

4. What happens to the radius of the chlorine atom when it forms a negative ion (anion)? What happens to the electrons?

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Part I: It's Just a Trend, continued

5. Match each of the four trends listed to its description by writing the correct letter of the description next to the trend's name.

Trends

____ ionic radius ____ electronegativity

____ ionization energy ____ atomic radius

Descriptions

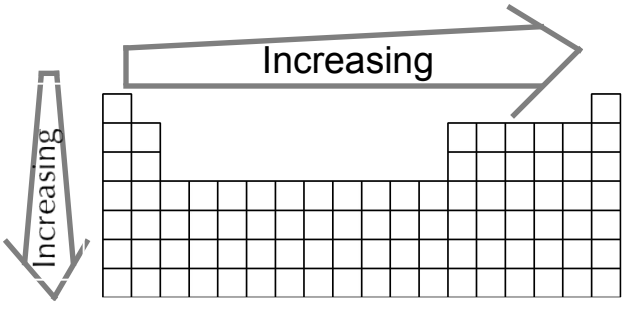
A. the amount of energy needed to remove an electron from a neutral atom
B. the radius of a neutral atom
C. the radius of a positive or negative ion
D. the ability of an element to attract electrons when forming a chemical bond

Use the diagrams shown below to answer questions 6 and 7.

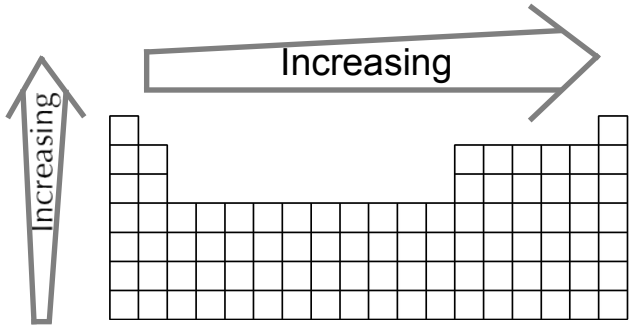
6. Which diagram represents the periodic trend for ionization energy?

7. Which diagram represents the periodic trend for electronegativity?

A



B



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Part II: Putting It All Together

Use the Student Reference Sheet and your graphs to help you answer the following questions. Do you recognize any trends from this information alone?

1. Which element below has the smallest atomic radius?
2.

   beryllium (Be) oxygen (O) sodium (Na)

2. Which element below has the smallest ionic radius?

   sodium (Na) rubidium (Rb) potassium (K)

3. Which element below has the lowest electronegativity?

   gallium (Ga) selenium (Se) bromine (Br)

4. Which element below has the highest ionization energy?

   strontium (Sr) magnesium (Mg) calcium (Ca)

5. Which element has the greatest electronegativity on the periodic table?

6. Which representative element has the largest atomic radius?

7. Place the elements below in order of decreasing ionization energy.

   aluminum (Al) chlorine (Cl) magnesium (Mg) sulfur (S)

   [largest] [smallest]

8. Place the elements in order of increasing atomic radius.

   gallium (Ga) nitrogen (N) indium (In) tellurium (Te)
   [smallest] [largest]

9. Choose which of the two is larger, the atom or its ion.
   A. Magnesium atom (Mg) **OR** Magnesium ion (Mg^{2+})

   B. Oxygen atom (O) **OR** Oxygen ion (O^{2-})

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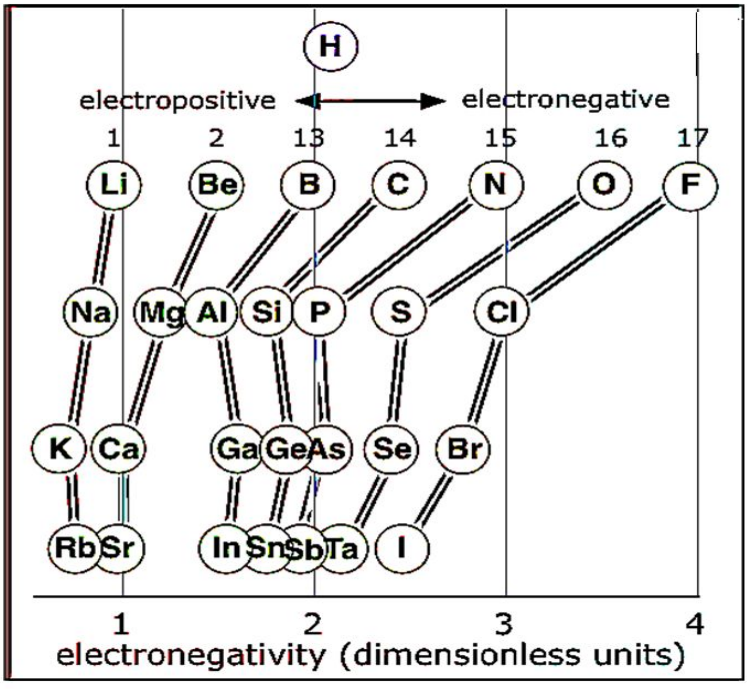
Part II: Putting It All Together, continued

Interpret this graph of electronegativities and answer the questions below.



10. What do you notice about the order of the elements on this graph? How do the rows on this graph relate to the periodic table?

11. What element shown on this graph has the greatest electronegativity?

12. Which element shown on this graph has the lowest electronegativity?

13. Explain how the information shown on this graph can help you identify the periodic trend of electronegativity on the periodic table.

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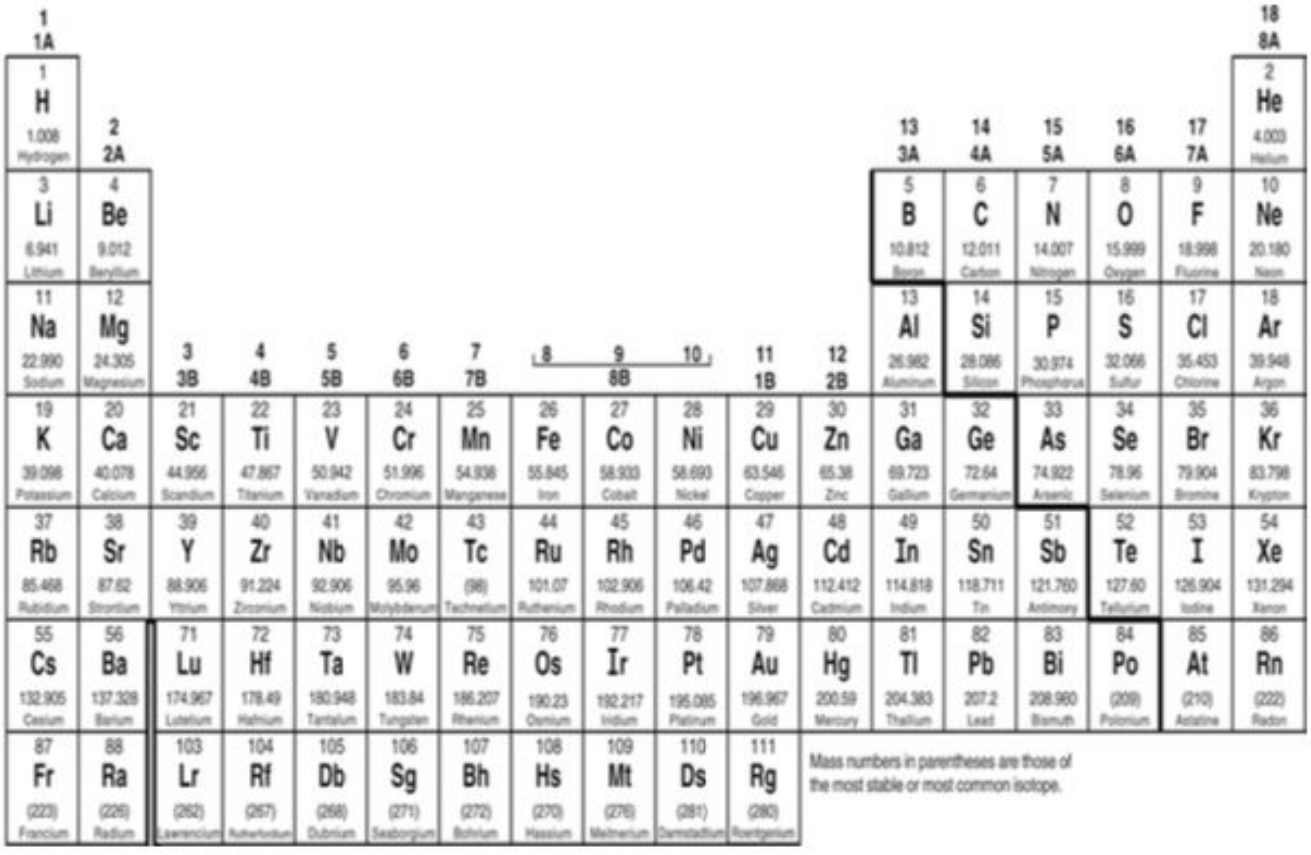
Part II: Putting It All Together, continued

14. Now that you have completed your graphs, analyze them to draw vertical arrows on the right and horizontal arrows on the top of the periodic table below to show the direction of the trends.

Follow these instructions.

- Draw blue arrows for the increasing atomic radii trend.
- Draw red arrows for the increasing ionic radii trend.
- Draw black arrows for the increasing first ionization energy trend.
- Draw brown arrows for the increasing electronegativity trend.



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Reflection and Conclusions

1. Across a period, the ionic radii of the anions is larger than that of the cations. Use what you know about ions and electric charges to help explain this trend.

2. Fluorine is the most electronegative element on the periodic table. Use what you know about the halogens to help explain why fluorine is such a highly electronegative element. (Hint: It has to do with electrons.)

3. The ionization energy of an element relates to the amount of energy that is required to remove an electron from a neutral atom. The first ionization energy is the amount of energy it takes to remove the first electron. Use the trends you have learned to explain why the first ionization energy for lithium is 520 kJ/mol, while the first ionization energy for oxygen is 1,314 kJ/mol. What characteristics of these two neutral atoms could account for the large difference in energy?

4. On another sheet of paper, use all of the following terms to develop a graphic organizer based on what you have learned in this Explore.

   Terms: periodic table, elements, properties, groups, periods, column, row, trends, electronegativity, ionization energy, atomic radius, ionic radius, increasing, decreasing, shielding effect, neutral, cation, anion