

You have mastered this topic when you can:

- 1) define or explain these terms: **PERIODIC TREND** and **ATOMIC RADIUS**.
- 2) analyze data and communicate results in clear and understandable forms (draw, label and interpret graphs).
- 3) distinguish between observation and interpretation.
- 4) describe and provide a theoretical explanation for the *periodic trend* for **ATOMIC RADIUS** within a group of elements.

I) *A PERIODIC TREND is* _____.

e.g. The atomic number increases moving top to bottom within the *groups* and left to right within the *periods* of the periodic table. The atomic mass increases moving top to bottom within the *groups* and left to right within the *periods* of the periodic table.

A) There are many *periodic trends* embedded within the periodic table. This Topic and Topics 9 through 14 will explore several physical and reactivity related *periodic trends*.

ATOMIC RADIUS

I) *ATOMIC RADIUS is* _____.

Since the *atomic radius* is an extremely small distance it is measured using extremely small units called picometres, pm.

pm = picometre, there are 1 000 000 000 pm in 1 mm.

II) **EXPLORATION ACTIVITY:** Discovering the *periodic trend* for *atomic radius* within the groups of elements.

A) **The process of Science:** Scientists design and conduct experiments then record what they *observe*. The experiment you are about to analyze was designed and conducted by other scientists. The observations they recorded are given in the table of atomic and ionic radii found on page 3 this notes package. You will analyze their observations by constructing two graphs illustrating the relationship between the atomic number (number of protons and number of electrons in an atom) and *atomic radius* of a group of elements. Your *analysis* of these graphs will reveal several trends, which you will summarize as *conclusions*. **CONCLUSIONS are general statements of interpretation summarizing experimental observations.**

B) **Gathering Evidence:** Use the periodic table of atomic radii found on page 3 of this notes package and the grids found on pages 4 of this package to construct **two** graphs of ATOMIC NUMBER (x-axis) v. ATOMIC RADIUS (y-axis) for each of group 1 and group 17.

- 1) The top (light coloured) circles represent the relative size of each atom and the number under each pink (light coloured) circle is the atom's *atomic radius* in units pm = picometers. **Be sure to circle each point then label it with the elements symbol.**

C) **Analyzing the data (observations) and drawing conclusions:** Studying the data and describing what was observed is part of the process of creating empirical knowledge.

1. Study the graphs you created for groups 1 & 17. Describe the *periodic trend* observed.

2. **Conclusions:** Summarizing the *observations* as *conclusions* is part of the process of creating *empirical knowledge*. **MEMORIZE THIS TREND!!**

a.

D) **Synthesis is the process of explaining the conclusions:** Explaining observations and conclusions is the process of creating *theoretical knowledge*.

1) **Explaining the atomic radius trend within a group:** The *periodic trends* for *atomic radius* are explained using the *number of electrons and/or protons*, the *number of occupied orbits*, the SHIELDING EFFECT, and the *force of attraction between the nucleus and valence electrons*.

a) **The SHIELDING EFFECT** _____.

Increasing the *number of occupied orbits* causes an increase in the number of inner orbits between the nucleus and the valence shell. These inner orbits are full of negatively charged electrons, which *repel* the valence electrons, pushing them farther away from the nucleus.

2) **THEORETICAL EXPLANATION OF THE ATOMIC RADIUS TREND WITHIN A GROUP**

a) **THE TREND:** _____.

This *periodic trend* is explained using the theoretical reasoning outlined below. Draw orbital diagrams of the atoms of the first four group 1 elements to help you understand it.

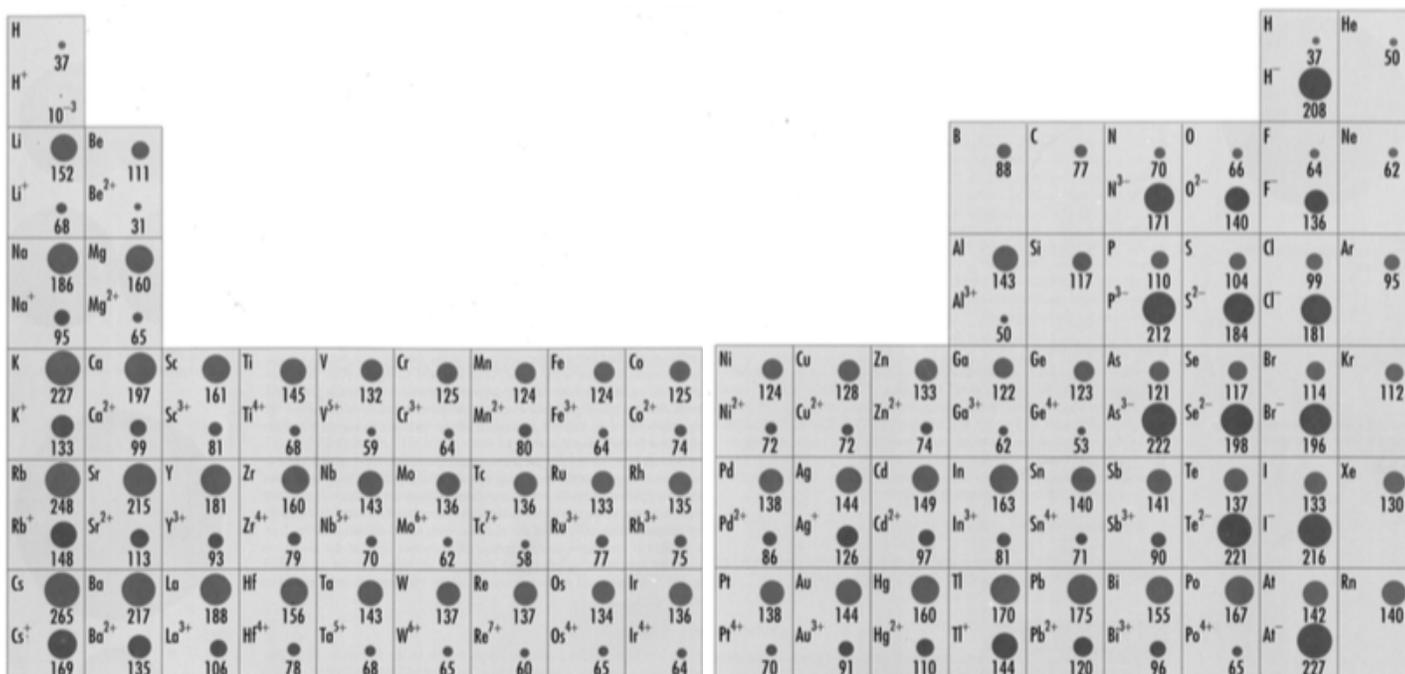
i) **THE EXPLANATION FOR THIS TREND:** *As the atomic number increases down a group, the atomic radius increases because...*

b) **Required Practice 1:** Answer these questions on your own paper. {Answers are on page 3.}

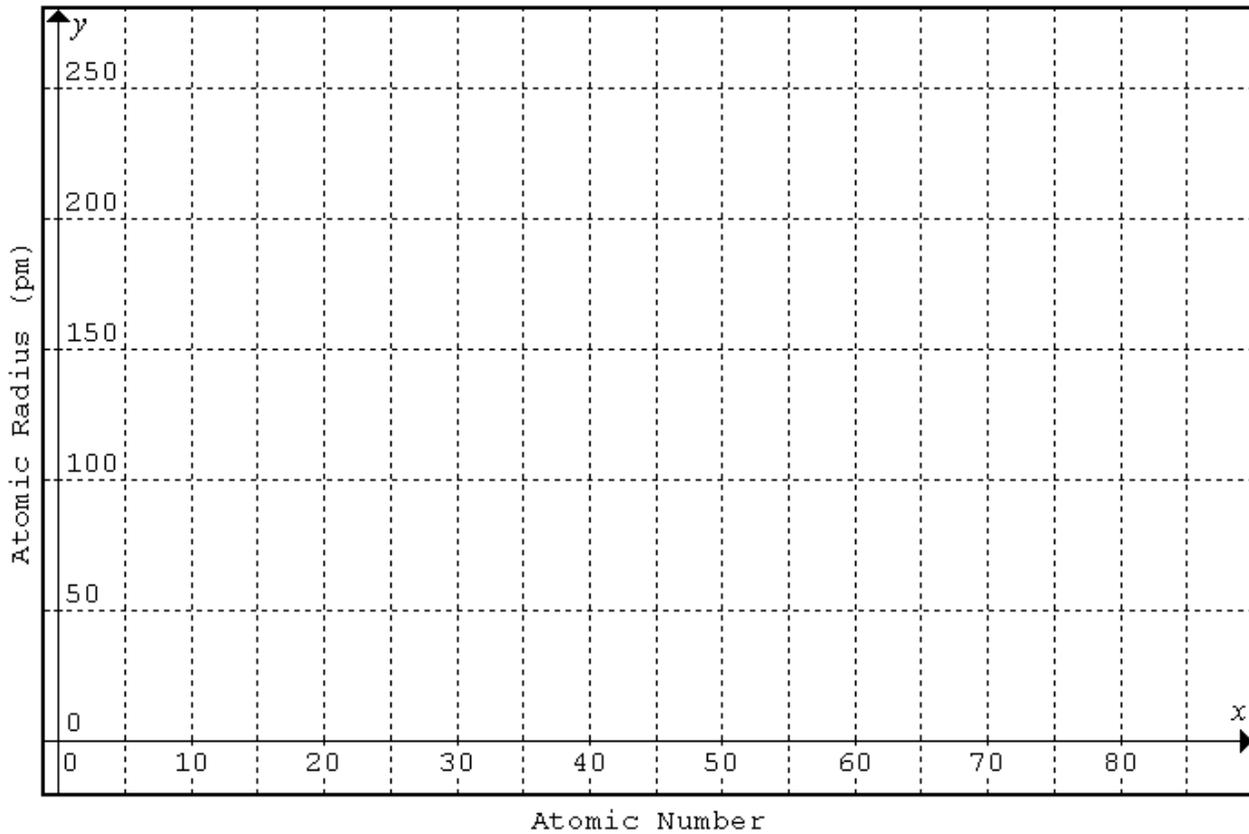
1. State the trend for atomic radius within a group.
2. How does the number of electrons change as atomic number increases moving down a group?
3. Describe how the change in the number of electrons as the atomic number increases moving down a group alter the number of occupied orbits?
4. How does the change in the number of occupied orbits effect the distance between the nucleus and the valence electrons as the atomic number increases moving down a group?
5. Describe how the attraction between valence electrons and the nucleus changes as atomic number increases moving down a group. Provide a theoretical explanation.
6. Define or describe the term shielding effect.
7. Describe how the shielding effect changes as atomic number increases moving down a group. Provide a theoretical explanation.
8. Provide a theoretical explanation for how the shielding effect changes as atomic number increases moving down a group affects the atomic radius.
9. Write a theoretical explanation for the atomic radius trend moving down a group. **PLEASE USE NUMBERED POINT OR BULLIT FORM AS ILLUSTRATED ABOVE.**

ANSWERS TO THE REQUIRED PRACTICE**Required Practice 1 from page 2**

- As the atomic number increases moving down a group, the atomic radius increases.
- As the atomic number increases moving down a group the number of electrons increases by 8 or 18.
- The substantial increase in the number of electrons as the atomic number increases moving down a group increases the number of occupied orbits.
- Increasing the number of occupied orbits increases the distance between the nucleus and the valence electrons.
- As the atomic number increases moving down a group the attraction between the nucleus and the valence electrons decreases because the number of occupied orbits increases causing an increase in the distance between the nucleus and the valence electrons.
- Shielding effect is the force of repulsion between electrons.
- As the atomic number increases moving down a group the shielding effect increases because the number of occupied orbits increases.
- The increase in the shielding effect as the atomic number increases moving down a group increases the atomic radius because increasing number of electrons and thus the number of occupied orbits increases the repulsion between the electrons thus pushing the valence electrons farther away from the nucleus.
- i.e.
 - As the atomic number increases moving down a group, the atomic radius increases
 - because the number of electrons increases by 8 or 18 causing an increase in the number of occupied orbits, which...
 - causes an increase in the shielding effect and...
 - an increase in the distance between the nucleus and the valence electrons, which...
 - decreases the attraction between the nucleus and the valence electrons.



Atomic Number vs. Atomic Radius For Group 1 Elements



Atomic Number vs. Atomic Radius For Group 17 Elements

