

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** among the periods 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 10 through 14 will explore several physical and reactivity related *periodic trends*.

## ATOMIC RADIUS

I) *ATOMIC RADIUS is defined as the distance from the centre of an atom to its valence shell*. 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) **ACTIVITY:** Discovering the *periodic trend* for *atomic radius* within the periods 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 at the end of this notes package. You will analyze their observations by constructing four graphs illustrating the relationship between the atomic number (number of protons and number of electrons in an atom) and *atomic radius*. 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 on page 3 of this notes package and the grids found on pages 4 of this notes package to construct **two** graphs of ATOMIC NUMBER (x-axis) v. ATOMIC RADIUS (y-axis) for each of period 2 and period 3.

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 periods 2 & 3. Describe the *periodic trend* observed.

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

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D) **THEORETICAL EXPLANATION OF THE ATOMIC RADIUS TREND ACROSS A PERIOD**

- 1) **THE TREND:** \_\_\_\_\_.

The decrease in *atomic radius* as atomic number increases across a period is explained with the theoretical reasoning outlined below. Draw orbital diagrams of the first three period 2 elements to help you understand it.

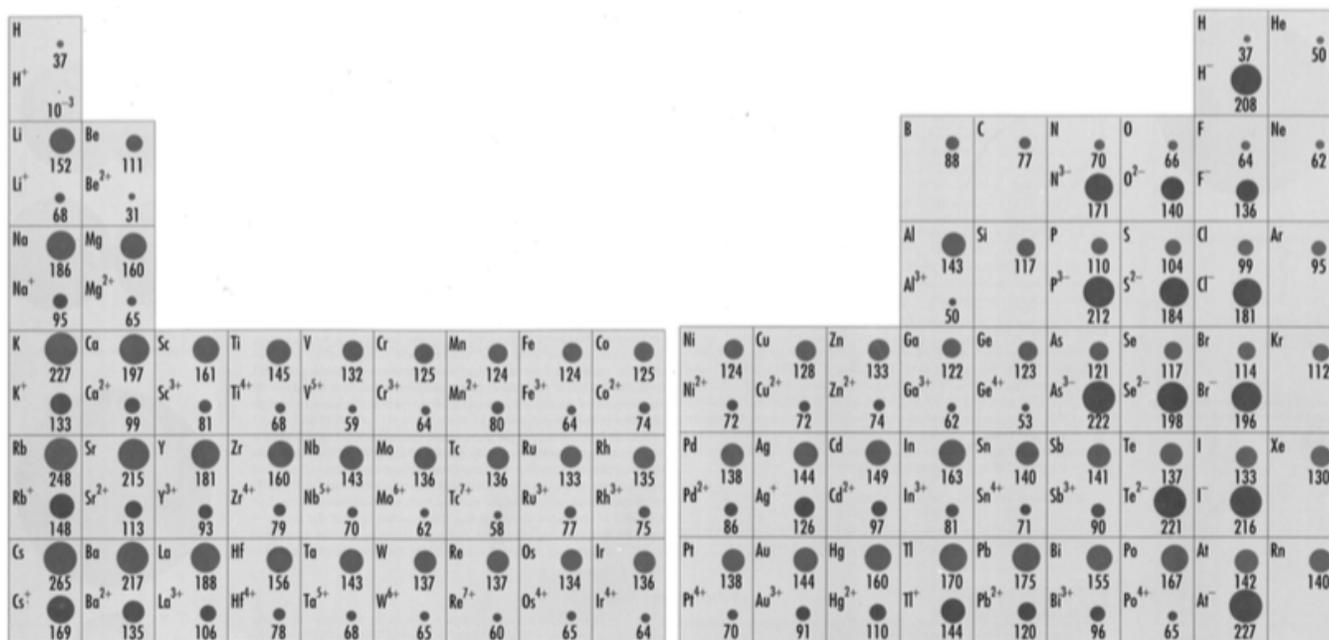
- a) **THE EXPLANATION FOR THIS TREND:** *As atomic number increases moving left to right across a period, the atomic radius decreases because...*

- 2) **Required Practice 1:** Answer this question on your own paper. {Answers are on page 3.}

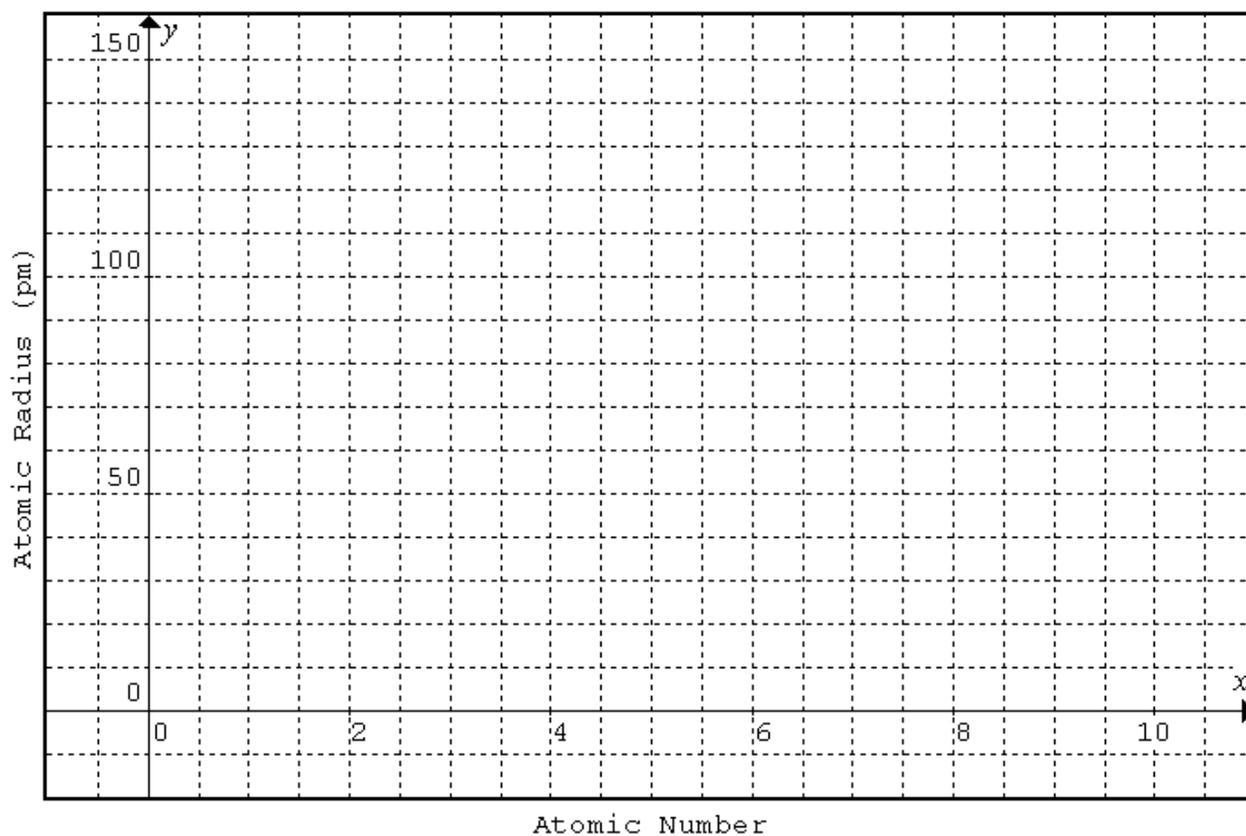
1. State the trend for atomic radius across a period.
2. As atomic number increases moving left to right across a period describe how the number of electrons change?
3. Provide a theoretical explanation for how the change in the number of electrons as the atomic number increases moving left to right across a period affects the number of occupied orbits and the shielding effect within the atom?
4. As atomic number increases moving left to right across a period describe how the number of electrons and protons change?
5. Describe how the attraction between valence electrons and the nucleus changes as atomic number increases moving left to right across a period. Provide a theoretical explanation.
6. Compare the changes to the shielding effect and the attraction between the valence electrons and the nucleus as atomic number increases moving left to right across a period. Provide a theoretical explanation.
7. Describe how the distance between valence electrons and the nucleus changes as atomic number increases moving left to right across a period. Provide a theoretical explanation.
8. Write a theoretical explanation for the atomic radius trend moving left to right across a period. **PLEASE USE NUMBERED POINT OR BULLIT FORM AS ILLUSTRATED ABOVE.**

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

- As the atomic number increases moving left to right across a period the atomic radius decreases.
- As the atomic number increases moving left to right across a period the number of electrons increases by one.
- Increasing in the number of electrons by one as the atomic number increases moving left to right across a period does not change the number of occupied orbits while it causes a slight increase in the shielding effect.
- As the atomic number increases moving left to right across a period the number of electrons and protons each increase by one.
- As the atomic number increases moving left to right across a period the attraction between nucleus and the valence electrons increases significantly because the number of occupied orbits remains the same while both the number of electrons and protons increase by one.
- The increase in the attraction between the nucleus and the valence electrons is larger than the increase in the shielding effect. This occurs because the total number of electrons is increases by one while the total number of protons and electrons increases by two.
- As the atomic number increases moving left to right across a period the distance between nucleus and the valence electrons decreases because the number of occupied orbits remains the same because the attraction between the nucleus and the valence electrons increases more than the shielding effect.
- i.e.**
  - As the atomic number increases moving left to right across a period, the atomic radius decreases because:
    - the number of electrons increases by one while the number of occupied orbits remains the same causing...
    - a relatively small increase in the shielding effect.
    - The number of both protons and electrons increase by one causing...
    - a relatively large increase in the attraction between the nucleus and the valence electrons, all of which...
    - decreases the distance between the nucleus and the valence electrons.



Atomic Number vs. Atomic Radius For Period 2 Elements



Atomic Number vs. Atomic Radius For Period 3 Elements

