

## Review 2: Periodic Trends Answers

- An ion is a charged atom (unequal number of protons and electrons).
  - An atom can either gain or lose electrons to form an ion.
  - Ionization energy is the energy required to lose an electron.
- Electron affinity is the energy released when an electron is added to an atom.
  - They both increase as you go left to right across the periodic table and up a group. If an atom has a high IE (hard to lose an electron) then it will have a high EA (easy to gain an electron).
- Atomic radius is the distance from the nucleus to the valence electrons, measured in pm.
- Chart:

Characteristic	Direction of Movement	Trend
First ionization energy	Left to right	Increases
First ionization energy	Up	Increases
Atomic radius	Left to right	Decreases
Atomic radius	Down	Increases
Reactivity of metals	Down	Increases
Reactivity of metals	Left to right	Decreases
Reactivity of nonmetals	Left to right	Increases
Reactivity of nonmetals	Down	Decreases

- Decreasing AR: larger to smaller AR Ba, Mg, Be (due to number of energy levels)
  - Increasing AR: smaller to larger AR Se, Ga, Ca (increase in nuclear charge so more attraction towards electrons, thus reducing the size)
  - Increasing IE: smaller to larger IE Xe, Ar, He (larger to smaller AR due to increase in number of energy levels)
  - Decreasing IE: larger to smaller IE Kr, Br, K (smaller to larger AR thus more attraction of electrons towards nucleus)
  - Lower first IE: N (larger-attraction of electrons-easier to remove an electron)
  - Lower first IE: K (larger-attraction of electrons-easier to remove an electron)
  - Lower EA: K (larger-attraction of electrons-less energy gained when adding an electron)
  - Higher EA: O (smaller-better attracts electrons-more energy gained when adding an electron)
- Metals with a high reactivity have a low IE
    - Nonmetals with a high reactivity have a high IE
  - Metals with a high reactivity have a large radius
    - Nonmetals with a high reactivity have a small radius
  - As the radius increases the IE decreases (larger AR → easier to remove e).
- Family 15 because they have 5 valence electrons. Large jump in IE shows the location of the noble gases.

8. Noble gases (group 18) because they have a full valence shell and don't typically form bonds.

- 9. a. X is a metal (wants to lose electrons)
- b. Z is a nonmetal (wants to gain electrons)
- c. nonmetal (Z)
- d. Z (nonmetals don't want to lose electrons)
- e. X (can give up 2 electrons)
- f. Z (increase in nuclear charge - can better attract the electrons)

10. Group 2 (two valence electrons)

11. First IE generally increases as the AR decreases because the electrons are more attracted to the nucleus and harder to remove.

12. K has a larger radius –metals want to lose electrons and it is easier to do so when the valence shell is further from the nucleus.

13. Cl (Ar is a noble gas-full valence shell)

14. Br (need a periodic table)

15. Rates of reactions increase when the temperature is increased- Cl is more reactive than Br so will be not as stable as Br in the higher temperature

16. A & B	F & G	P & Q	X & Y
P Bi	Po S	Cs Na	Ba Mg