DLO

- Be able to describe periodic trends

Bell ?

- Why do ions form?

Periodic Trends

Charge of Ions, Ionization Energy
Electronegativity, Atomic Radius

Periodic Trends

- The periodic table is not arranged randomly
- Mendeleev was able to organize the periodic table in such a way that the properties of missing elements could be predicted.
- This arrangement we now know follows trends that are based on the number and arrangement of electrons in an atom.

Electron Configuration

- Electron configurations tell you the energy level and sub shells where electrons can be found.
- As you write the electron configuration you notice a pattern
- Write the electron configuration for the following:
  - Sodium- $1s^2 2s^2 2p^6 3s^1$
  - Aluminum- $1s^2 2s^2 2p^6 3s^2 3p^1$
  - Iron- $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^6$
  - Bromine- $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^{10} 4p^5$

Valence Electrons

- Those electrons in the highest energy level or the outer most shell are called valence electrons
- These electrons are the ones that atoms lose, gain, or share to form bonds.
- These electrons also determine the stability of the atom.
- The closer the atom is to having a full outer shell of 8 the more stable it becomes. This is called the Octet rule.

Charge of Ions

- Elements as they appear on the periodic table are neutral in charge
  - Why? Because the number of protons and electrons are equal
- When an atoms gains or loses electrons what happens? A charged atom, called an ion, is formed.
- Looking at the electron configuration for the elements a pattern appears with the s and p orbitals
  - What is the trend across a period? group?
  - What does this mean for the total number of electrons for the outer most shell?

Electron Configuration Short hand

- Who likes having to write those long electron configurations?
- Now you can learn the shortcut, using Noble Gases
- What is special about the Noble Gases?
- They have a full outer shell of electrons.
- They're all in the p block, so they have a full outer p shell

Steps for Shorthand Electron configuration

1. Determine the closest noble gas that comes before the element you need (the atomic number is less for the noble gas)
2. Write the symbol for the noble gas and put brackets around it
3. Remaining electrons put into electron configuration

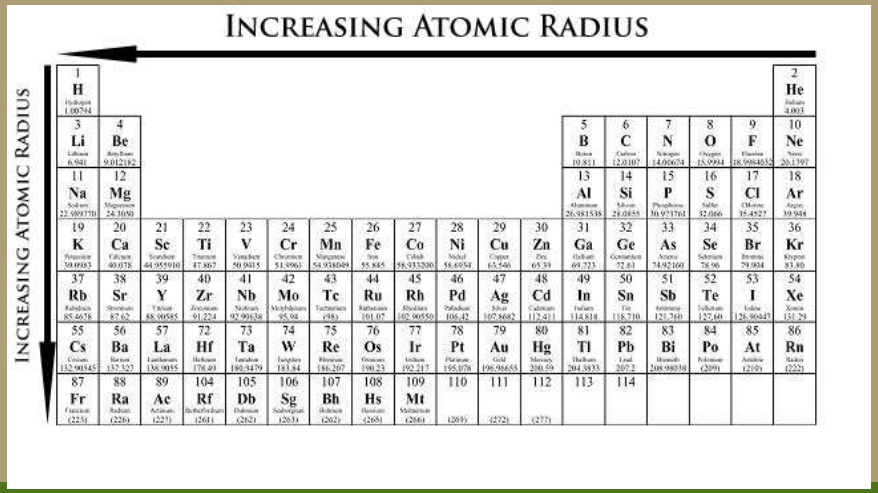
Shorthand Example

- Shorthand for Calcium:

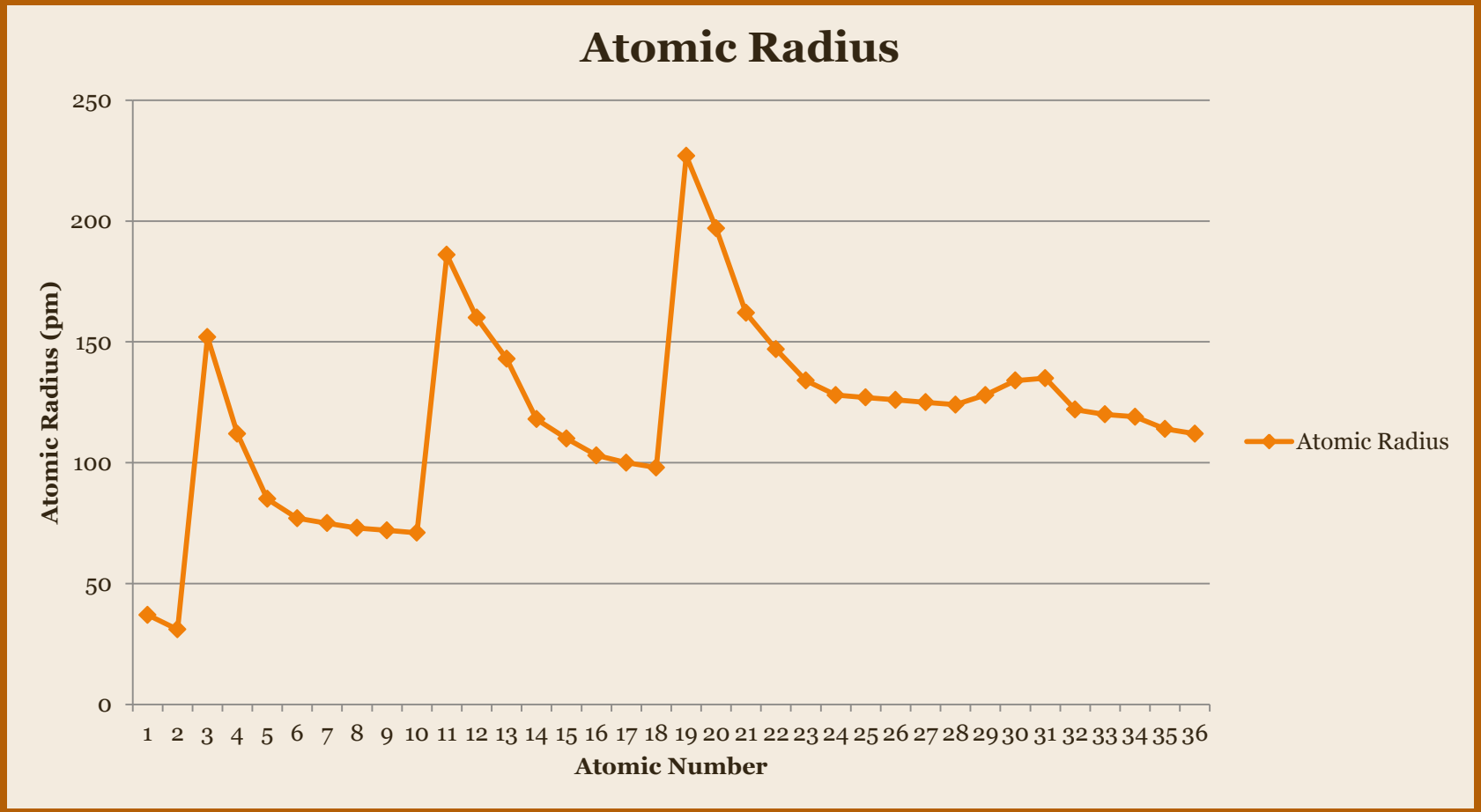
1. Nearest Noble Gas before Calcium? Argon
2. Symbol for that Noble Gas? Put it in brackets [Ar]
3. Remaining Electrons? 2

- Calcium: [Ar] $4s^2$
- Calcium full configuration:
- $1s^2\ 2s^2 2p^6\ 3s^2\ 3p^6 4s^2$

Atomic Radius

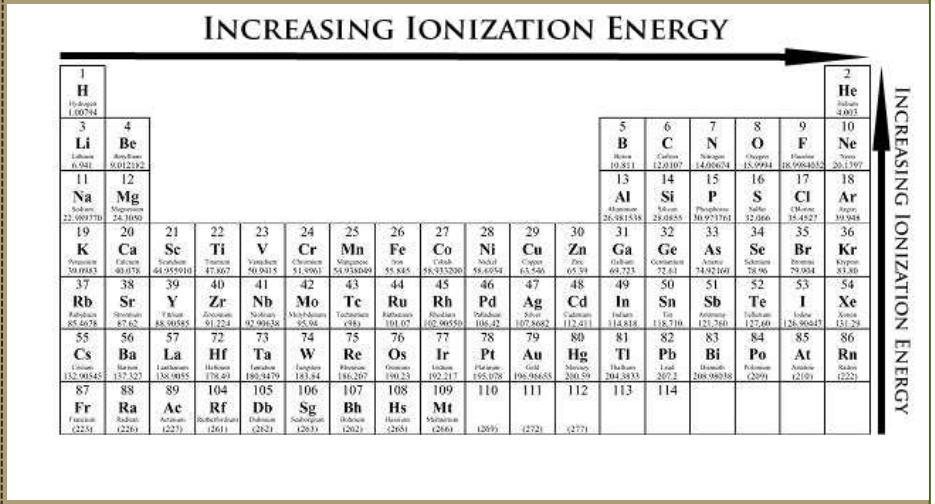


- Atomic radius is the measure of half the distance of two like atoms bonded together
  - What is the trend: across a period?
    across a group?
  - Why is this occurring?


Atomic Radius
Atomic Radius (pm)
250
200
150
100
50
0
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36
Atomic Number
Atomic Radius

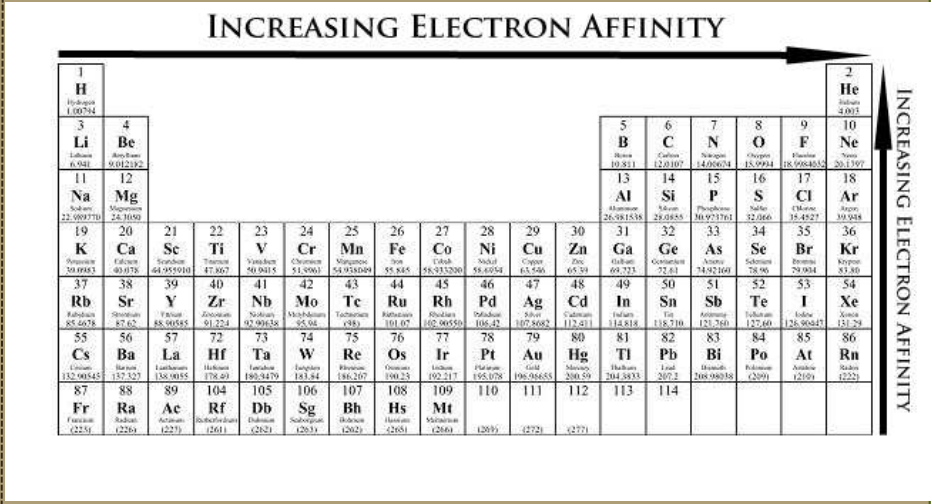
Ionization Energy

- Ionization energy is the energy required to remove the outer most electrons
  - Why would atoms want other another atom's electrons?
  - What is the trend across a period? group?
- The octet rule plays a part in determining the ionization energy
  - What does Octet mean?



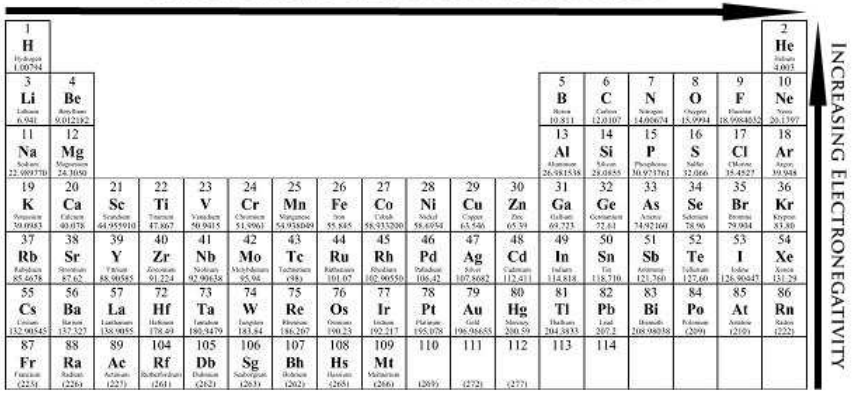
Electron Affinity

- What does affinity mean?
- Ability to attract electrons

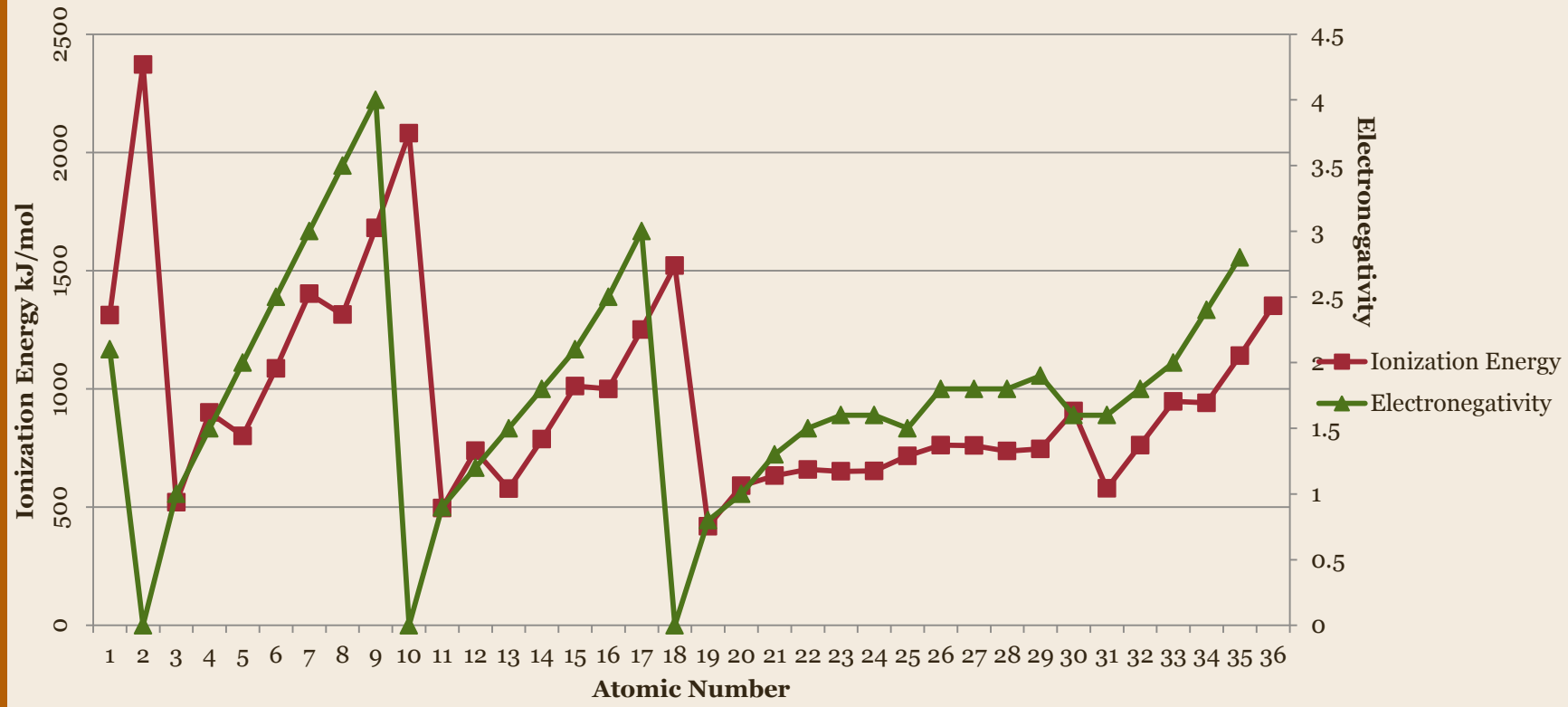


Electronegativity

- Electronegativity is the desire for atoms to grab electrons
  - What is the trend across a period? group?
- This again is related to the Octet rule and the goal of filling the outer most energy level with electrons to have a complete outer shell.



Ionization Energy and Electronegativity as a function of Atomic Number



Exceptions

- Are there any exceptions to the trends?
- Why do you think this occurs?
- How do the exceptions relate to the s and p orbitals?