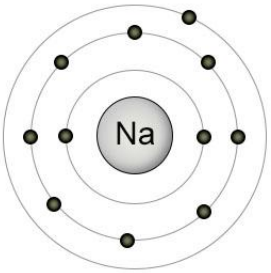
SCH 3U

PERIODIC TRENDS involving SIZE & ENERGY LEVELS of ATOMS

① ATOMIC RADIUS

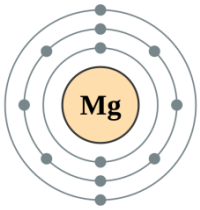


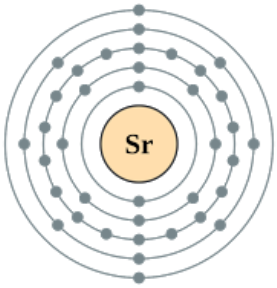
- Measured in picometres (pm)
- Distance from nucleus to valence shell

(a) as you go down a family, the radius increases

- Valence shell farther from nucleus
- Valence electrons attracted less by nucleus
- Inner electrons "shield" the valence electrons from nuclear attraction.

Which atom is larger -- Mg or Sr?



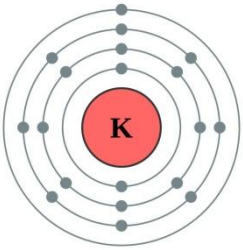


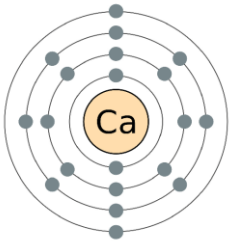
Which atom is larger -- Br or Cl?

(b) as you go from left to right along a period, the radius decreases

- Nucleus gets stronger (more positive)
- Valence electrons pulled closer by stronger attraction

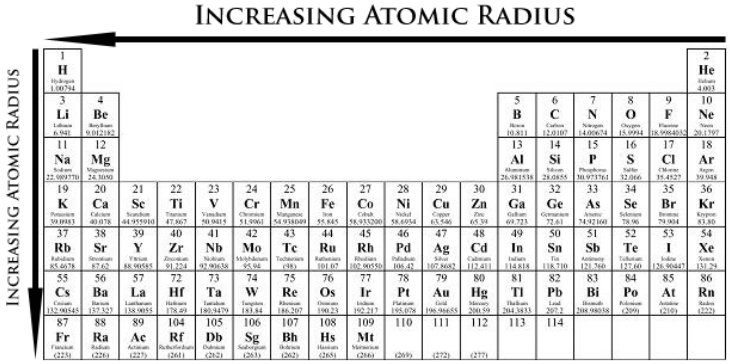
Which atom is larger -- K or Ca?





Which atom is larger -- S or Al?

Order the atoms according to size: Na P Rb



② IONIZATION ENERGY

- Measured in kJ/mol
- Atom is neutral – the number of protons = the number of electrons
- Atom gains or loses electrons → forms an ion (charged particle)
- Ion gains electrons → negative charge (anion)
- Ion loses electrons → positive charge (cation)

IE = energy needed to remove an electron from the valence shell

- Easier to remove from metals than non-metals (less energy, lower IE)
- Farther valence shell is from nucleus, the lower the IE.

(a) as you go down a family, the radius increases; therefore, the IE decreases
- Valence electrons attracted less to nucleus

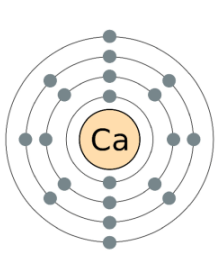
(b) from left to right along a period, radius decreases; therefore, the IE increases
- Valence electrons attracted stronger to nucleus

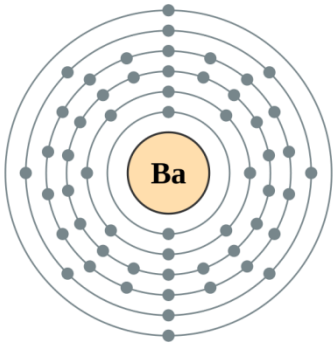
In each group of atoms, which one has the larger IE?

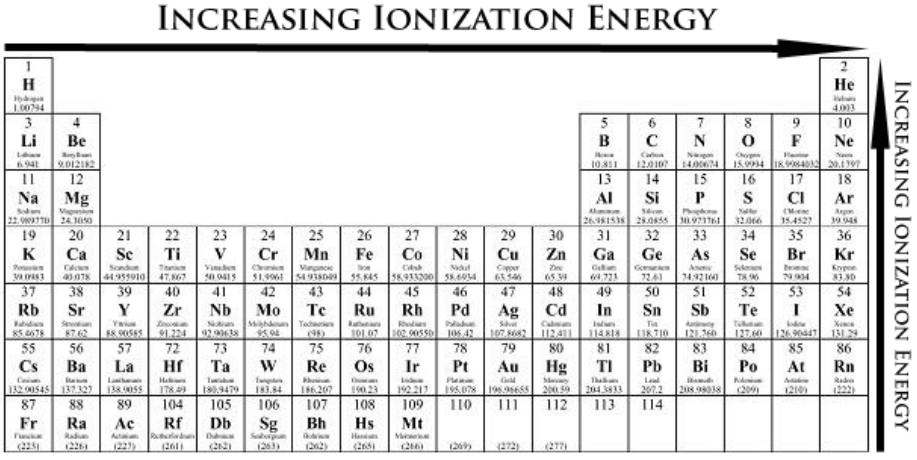
1. Ca or Ba

2. O or C

3. Na or K or Cl







③ ELECTRON AFFINITY

- Measured in kJ/mol

EA = change in energy when an electron added to valence shell to make an anion.

- Metals prefer to lose electrons, not gain; therefore, low electron affinity
- Non-metals prefer to gain electrons; therefore, higher EA

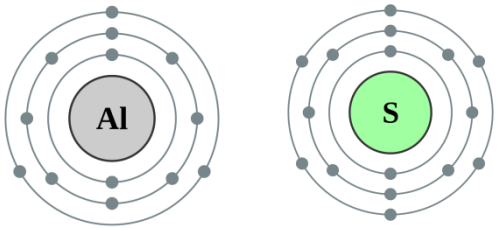
- Energy is released when electrons are gained
- Trend is more irregular than atomic radius and ionization energy, but resemble IE and opposite to atomic radius.

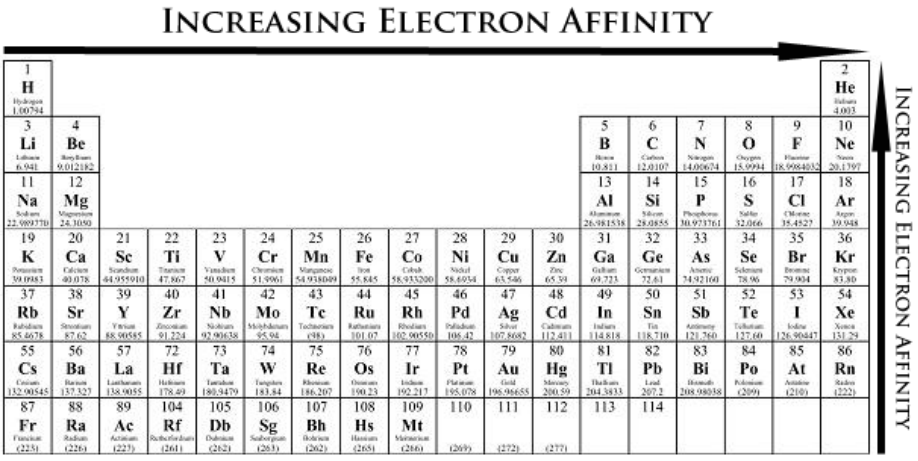
In each group of atoms, which one has the larger EA?

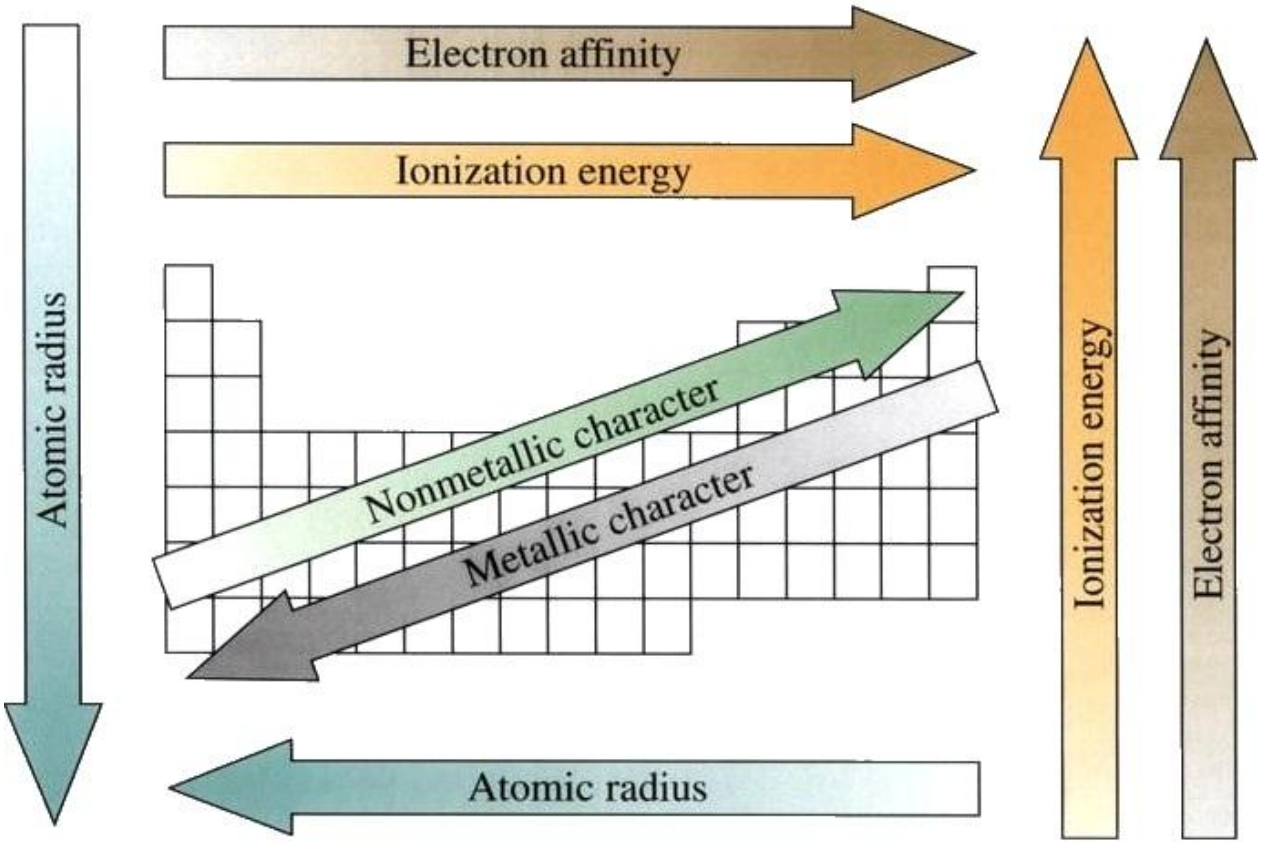
1. Al or S

2. Cs or K

3. Cl or Ca or Mg






Electron affinity
Ionization energy
Atomic radius
Nonmetallic character
Metallic character
Atomic radius
Ionization energy
Electron affinity