Chemistry Name _____ Period _____

Periodic Trends Review Worksheet

1. For each of the following sets of atoms, rank the atoms from smallest to largest atomic radius.

smallest largest

a.) Li, C, F — F < C < Li

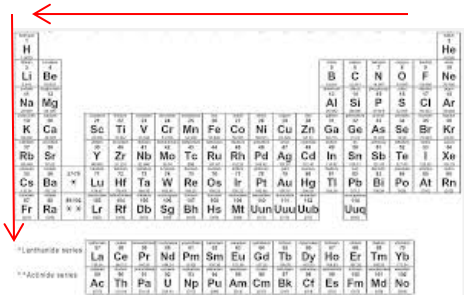
b.) Li, Na, K — Li < Na < K

c.) Ge, P, O — O < P < Ge

d.) C, N, Al — N < C < Al

e.) Al, Cl, Ga — Cl < Al < Ga

Draw arrows to show the trend for the direction of increasing Atomic Radii.



smallest atom

largest atom

- What two properties control the size of the atom? # of protons (increased electromagnetic force) and # of orbitals (increased shielding)
- Which is the largest atom? Fr Which is the smallest atom? He

2. For each of the following sets of ions and atoms indicate which is larger.

Cations lose electrons and become positive.

Anions gain electrons and become negative.

a.) Mg^{+2} or Mg — more orbitals: Mg^{+2} (Mg)

b.) N^{-3} or N — more electrons: (N^{-3}) N

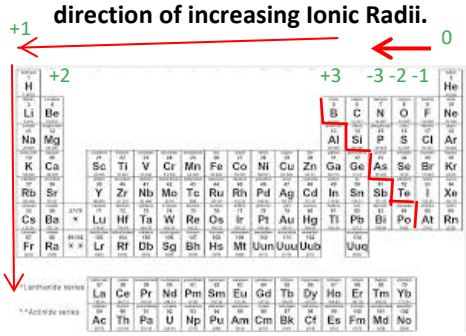
c.) K^{+1} or Fr^{+1} — more orbitals: K^{+1} (Fr^{+1})

d.) O^{-2} or N^{-3} — more electrons: O^{-2} (N^{-3})

e.) F^{-1} or F — more electrons: (F^{-1}) F

When metals lose electrons they have 1 less orbital.
When nonmetals gain electrons they keep the same # of orbitals, but the outer orbital spread out larger.

Draw arrows to show the trend for the direction of increasing Ionic Radii.



Noble gases DO NOT form ions!

- Why are ions larger or smaller than their original atoms? Nonmetal ions gain electrons so the electron repulsion spreads out the radius. Metals lose electrons so they have one less orbital, which decreases the radius.

Atoms form ions because they are trying to obtain a complete valence orbital. Having a filled s and p orbital is very stable.

- Which is the largest cation? Fr^{+1} Which is the smallest cation? H^{+1}
- Which is the largest anion? Te^{-2} Which is the smallest anion? F^{-1}

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3. For each of the following sets of atoms, rank them from lowest to highest ionization energy.

a.) Mg, Si, S Mg < Si < S

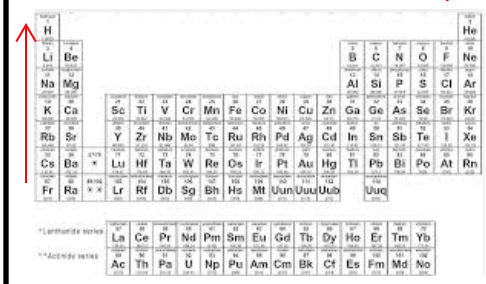
b.) Mg, Ca, Ba Ba < Ca < Mg

c.) F, Cl, Br Br < Cl < F

d.) Ca, Cu, Kr Ca < Cu < Kr

e.) C, Si, Sn Sn < Si < C

Draw arrows to show the trend for the direction of increasing Ionization Energy.



Most energy required

least energy required

- What does Ionization Energy measure? The energy required to remove one electron from the valence orbital.

Noble gases require the MOST energy because they are stable. Removing an electron makes them unstable, so it will take a lot of energy to convince them to give away an electron.

- Which element has the lowest IE? **Fr** Which has the highest IE? **He**

4. For each of the following sets of atoms, rank them from lowest to highest electronegativity.

measures the desire to gain a valence electron

Fluorine has the highest EN

Notice that the word electronegativity has the word "electron" in the front. That will help you remember that it is trying to GAIN an electron.

a.) Li, C, N Li < C < N

b.) C, O, Ne Ne < C < O

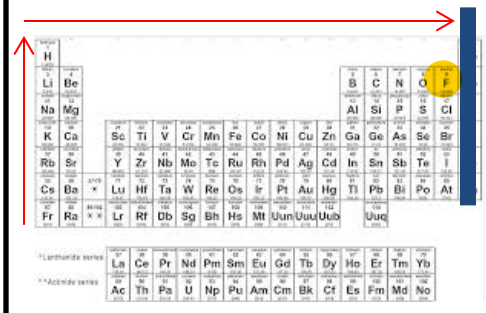
c.) C, Si, Pb Si < Pb < C

d.) Cs, Ni, F Cs < Ni < F

e.) S, F, He He < S < F

Large metals have the least desire to gain because the protons are so far away.

Draw arrows to show the trend for the direction of increasing Electronegativity.



Noble gases have ZERO desire to gain an electron because they cannot fit 9 in an orbital

- Why are metals less electronegative than nonmetals? Metals want to lose electrons not gain them. Therefore, they will have a lower EN number.
- Which element has the lowest EN? **Radon (a noble gas)**
- NOTE: **Francium** is the metal atom with the lowest EN value.
- Which has the highest EN? **Fluorine (F) a halogen**

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5. For each of the following sets of atoms, rank them from least to greatest in terms of metallic properties.

Being metallic is based on the likelihood of an atom to LOSE a valence electron

a.) Li, B, N N < B < Li

b.) Li, Na, K Li < Na < K

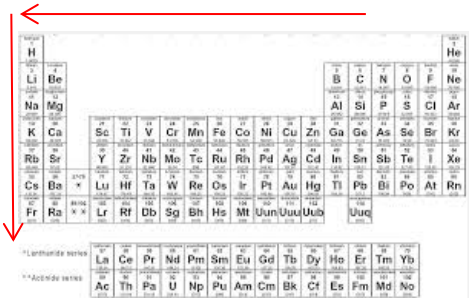
c.) Si, P, S S < P < Si

d.) Pb, Po, Rn Rn < Po < Pb

e.) Ra, Sr, Mg Mg < Sr < Ra

most likely to lose an electron

Draw arrows to show the trend for the direction of increasing Electronegativity.



least likely to lose an electron

- What are some properties of metals? Malleability, thermal and electrical conductivity, and reactivity with acids, ductility, high melting points, solid, luster

- Which *metal* element is least metallic? **Be** Which *metal* is most metallic? **Fr**
- Which nometal element is least metallic? **He**

6. Indicate greater than, less than, or equal to in order to compare the shielding effect of the following atoms.

a.) Li, B, N Li = B = N

b.) Li, Na, K Li < Na < K

c.) Si, P, S Si = P = S

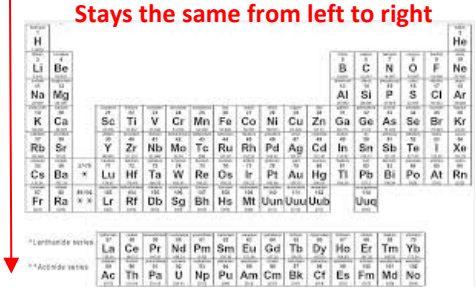
d.) Cu, Ag, Au Cu < Ag < Au

Add more core orbitals as you go down each row

e.) Ra, Sr, Mg Ra > Sr > Mg

Draw arrows to show the trend for the direction of increasing Shielding Effect

Stays the same from left to right



- Why is shielding constant across a period? # of orbitals stays the same
- Why does shielding increase down a group? More orbitals are added
- Which elements have the most shielding? Period 7 elements
- Which elements have the least shielding? Period 1 elements

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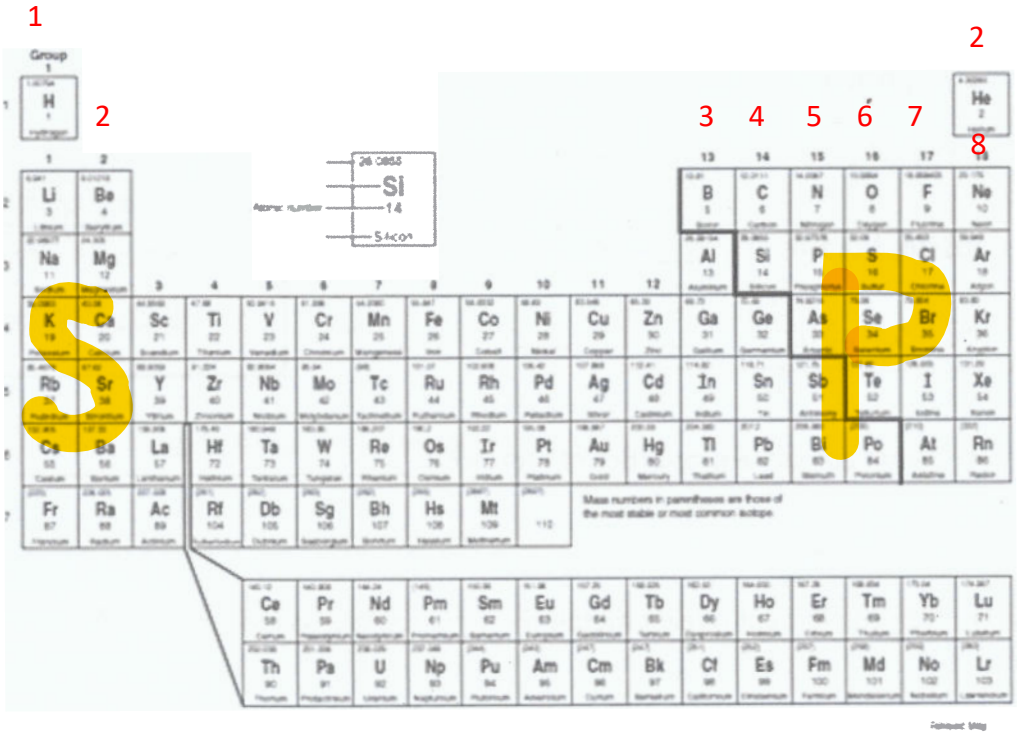
7. What determines an elements chemical properties? valence electrons

8. List the number of valence electrons above each group for the **s** and **p block** elements.

8 valence electrons = OCTET Rule



9. **List the names for the following groups:**

- **Group 1** Alkali Metals (Li, Na, K, Rb, Cs, Fr) - Hydrogen is NOT a metal
- **Group 2** Alkaline Earth Metals (Be, Mg, Ca, Sr, Ba, Ra)
- **Group 17** Halogens (F, Cl, Br, I)
- **Group 18** Nobel Gases (He, Ne, Ar, Kr, Xe, Rn)

10. **List examples of chemical changes:** change in color, temperature, gas, odor, oxidation (rust), forms a precipitate, produces light, etc.

11. **Define Ionic Bonding:** When a **metal** atom **TRANSFERS** a valence electron to a **nonmetal** toam

Ionic Bonding involves oppositely charged ions coming together.

12. **Define Covalent Bonding:** **Only nonmetal** atoms **SHARING** electrons

Covalent bonding involves neutral atoms sharing electrons.