

Name: _____

Group: _____ Block #: _____

Date: _____



Exceed to Succeed

Worksheet: Periodic Trends

1. ATOMIC RADIUS

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

- Li, C, F
- Li, Na, K
- Ge, P, O
- C, N, Al
- Al, Cl, Ga

2. IONIC RADIUS

For each of the following sets of ions, rank them from smallest to largest ionic radius.

- Mg^{2+} , Si^{4+} , S^{2-}
- Mg^{2+} , Ca^{2+} , Ba^{2+}
- F^- , Cl^- , Br^-
- Ba^{2+} , Cu^{2+} , Zn^{2+}
- Si^{4-} , P^{3-} , O^{2-}

3. IONIZATION ENERGY

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

- Mg, Si, S
- Mg, Ca, Ba
- F, Cl, Br
- Ba, Cu, Ne
- Si, P, He

4. ELECTRONEGATIVITY

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

- Li, C, N
- C, O, Ne
- Si, P, O
- K, Mg, P
- S, F, He

Answers for Comparing Atomic Sizes

Here are answers for the questions above.

a. Li, C, F

All are in the same period and thus have the same number of energy levels. Therefore, the important factor is the nuclear charge. Li is the largest because it has the smallest nuclear charge and pulls the electrons toward the nucleus less than the others. F is the smallest because it has the largest nuclear charge and pulls the electrons toward the nucleus more than the others.

b. Li, Na, K

All are in the same group and thus have the same effective nuclear charge. Therefore, the important factor is the number of energy levels. Li is the smallest because it uses the smallest number of electron energy levels. K is the largest because it uses the largest number of electron energy levels.

c. Ge, P, O

All are in different groups and periods, therefore both factors must be taken into account. Fortunately both factors reinforce one another. Ge is the largest because it uses the largest number of energy levels and has the smallest effective nuclear charge. O is the smallest because it uses the smallest number of energy levels and has the largest effective nuclear charge.

d. C, N, Si

Not all are in the same group and period, so, again, both factors must be taken into account. C and N tie for using the smallest number of energy levels, but N has a higher effective nuclear charge. Therefore, N is the smallest. C and Si tie for having the lowest effective nuclear charge, but Si uses more energy levels. Therefore, Si is the largest.

e. Al, Cl, Br

Not all are in the same group and period, so, again, both factors must be taken into account. Cl is the smallest because it has higher effective nuclear charge than Al and uses fewer energy levels than Br. Which is largest is less straightforward. Al has a lower effective nuclear charge (by four), but Br uses more energy levels (by one). Because the difference in effective nuclear charge is larger, it should be the more important factor in this case, making Al the largest.

Al and Br can also be compared to one another indirectly by comparing both to Cl. Both Al and Br are larger than Cl. Al is larger than Cl because it has lower effective nuclear charge (by four). Br is larger than Cl because it uses more energy levels (by one). Because Al is larger than Cl by four "steps" and Br is larger than Cl by only one "step", Al is likely the largest of the three.

Answers to Comparing Ionization Energies

Here are answers to the exercises above.

a. Mg, Si, S

All are in the same period and use the same number of energy levels. Mg has the lowest I.E. because it has the lowest effective nuclear charge. S has the highest I.E. because it has the highest effective nuclear charge.

b. Mg, Ca, Ba

All are in the same group and have the same effective nuclear charge. Mg has the highest I.E. because it uses the smallest number of energy levels. Ba has the lowest I.E. because it uses the largest number of energy levels.

c. F, Cl, Br

All are in the same group and have the same effective nuclear charge. F has the highest I.E. because it uses the smallest number of energy levels. Br has the lowest I.E. because it uses the largest number of energy levels.

d. Ba, Cu, Ne

All are in different groups and periods, so both factors must be considered. Fortunately both factors reinforce one another. Ba has the lowest I.E. because it has the lowest effective nuclear charge and uses the highest number of energy levels. Ne has the highest I.E. because it has the highest effective nuclear charge and uses the lowest number of energy levels.

e. Si, P, N

Si has the lowest I.E. because it has the lowest effective nuclear charge and is tied (with P) for using the most energy levels. N has the highest I.E. because it uses the fewest energy levels and is tied (with P) for having the highest effective nuclear charge.

Answers for Comparing Tendencies to Gain Electrons

Here are answers to the exercises above.

a. Li, C, N

Li has the least tendency to gain electrons because it has the lowest effective nuclear charge (and all use the same number of energy levels). N has the greatest tendency to gain electrons because it has the highest effective nuclear charge (and all use the same number of energy levels).

b. C, O, Ne

Ne has the lowest tendency to gain electrons because its outer energy level is full and there is no room for an additional electron. O has the greatest tendency to gain electrons because it has a higher effective nuclear charge than C (and both use the same number of energy levels).

c. Si, P, O

O has the greatest tendency to gain electrons because it has the highest effective nuclear charge and uses the smallest number of energy levels. Si has the lowest tendency to gain electrons because it has the lowest effective nuclear charge and is tied (with P) for using the most energy levels.

d. K, Mg, P

P has the greatest tendency to gain electrons because it has the highest effective nuclear charge and is tied (with Mg) for using the smallest number of energy levels. Neither Mg nor K have much attraction for electrons, but K has the lowest tendency to gain electrons because it has the lowest effective nuclear charge and uses the most energy levels.

e. S, F, He

He has the lowest tendency to gain electrons because its outer energy level is full and there is no room for an additional electron. F has the greatest tendency to gain electrons because it has a higher effective nuclear charge and uses fewer energy levels than S.