

A Few Questions for Review

1. Which is larger--K or Ca? K, fewer protons affecting the same energy level.
P or As? As, there are more energy levels. More energy levels is a bigger factor in affecting trends than the number of protons.
2. From which of the following is it harder to remove an electron? Mg or Si? Fe or Ru?
Si ---- more protons holding the electrons tighter.
Fe ---- fewer energy levels. Remember, energy levels are a bigger factor than protons in affecting trends.
3. Which of the following holds a shared pair of electrons the tightest? S or Se? P or S?
S -- because it has fewer energy levels
S – because it has more protons, with the same amount of energy levels.
4. Explain why P is smaller than Al. (How can it be smaller if it has more stuff in it?)
P has more protons while the outer shell is the same.
5. Why is it so difficult to remove an electron from Cl and so easy to remove one from K? (even though K has more protons)
K has more energy levels, so the outer shell is further from the nucleus and is repelled by the inner shell electrons.
6. What is the relationship between size and electron affinity?
Big atoms generally have low electron affinity. This is because the inner shell electrons repel the outer shell.
7. What is the relationship between size and electronegativity?
Big atoms generally have low electronegativity. This is because the inner shell electrons repel the outer shell.
8. Discuss trends within both periods and families for atomic size, ionic size, ionization energy, electron affinity, electronegativity, and activity. Explain why they occur.

Periods—left to right

atomic radius	--- gets smaller
ionic size	--- gets smaller, then bigger, then smaller
ionization energy	--- gets larger
electron affinity	--- gets larger
electronegativity	---gets larger
activity	---large to low to high

Families --- top to bottom

atomic radius	--- gets larger
ionic size	--- gets larger
ionization energy	--- gets smaller
electron affinity	--- gets smaller
electronegativity	--- gets smaller
activity	--- more for metals, less for nonmetals

9. Where do you find exceptions to the ionization energy trend within periods? Why do they occur?
 p^1 and p^4 ---the first electron in a new p sublevel and the first electron after “half full” are easier to remove than an s^2 or p^3 electron.

10. Discuss the relationship between electron affinity and stability of the atom or ion.

Most atoms have a negative electron affinity, which means that their stability increases when an electron is added--energy is released.

For those atoms with a positive electron affinity (alkaline earth metals and noble gases), stability decreases with the addition of an electron.

11. Discuss the relationship between ionization energy and the stability of the atom or ion.

Energy is always required in order to remove an electron, so positive ions are less stable than their atoms.

12. Which is more stable, Ca or Ca^{++} ? Cl or Cl^- ? Ne or Ne^- ? Discuss the proper sign for what is occurring in each of the preceding situations.

Calcium atom – sign is positive for the process of losing an electron. Ionization energies are always positive, so energy is always put in to the process of losing electrons.

Chlorine ion --- sign is negative for the process of adding an electron. Electron affinity may be positive or negative, depending on the atom involved in the process of adding an electron. In this case, adding an electron creates a full sublevel, which is desirable in terms of increased stability. So in this case, energy is released.

Neon atom ---- sign is positive for the process of adding an electron. Neon already has a full outer shell, so the addition of an electron will require energy to be put into the process.

13. Where do you expect exceptions to the filling order of electrons to occur?

d^4 and d^9 half full and full sublevels tend to be more stable, so s electrons tend to get promoted in these positions.

14. Which family would have an extremely high 3rd ionization energy relative to the second ionization energy?

Why? Alkaline earth metals. The two outer shell electrons are easily removed, but the third electron must come from the next lower energy level, which will be held tighter.

15. Why is the 2nd ionization energy of C significantly higher than the first ionization energy when both electrons come from the p sublevel? The six protons in the nucleus can hold 5 electrons tighter than they could hold six electrons.

16. Why don't the inert gases react?

Their outer shells are full.

17. Why is the first ionization energy for O less than that for N if the general trend is to increase from left to right? The first electron past "half full" is easier to remove because of the repulsion from the electron already in the p orbital.

18. What is a fast and easy lab test for determining different metal ion unknowns? Describe why this test works.

Flame tests. Electrons are excited by heat, and give off unique colors of light when they return to the ground state.

19. S^{-2} , Cl^{-1} , Ar, K^{+1} , and Ca^{+2} are all isoelectronic. Does the electron labeled $n = 3$, $l = 1$, $m = +1$ and $s = +1/2$ have the same amount of energy in all of the above ions or atoms?

The electron has the same set of quantum numbers so the energies are similar. However, the number of protons is different for each atom, so the energies will not be identical.

20. Why does the electron affinity for Mg indicate that it is less likely to form an anion than sodium?

Magnesium has a full s sublevel. This means that it will not easily gain an electron to form the anion (anion = negative ion). Since Mg has a full s sublevel, its electron affinity is positive which means that energy will be required to add an electron.

Sodium has room for another electron in its 3s sublevel, so energy is released when an electron is added. A release of energy is a desirable event. There is a big trend in the universe toward a loss of configurational energy.