Chem 130, Eppley Name: KEY

In Class Assignment 7
Intro to Periodic Properties

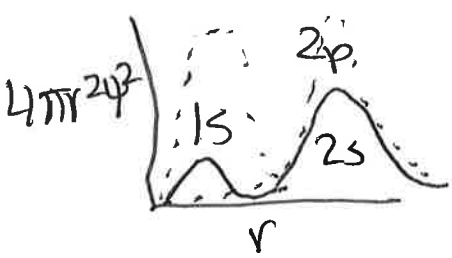
Explain the following statement as clearly and as thoroughly as you can. **Use radial probability diagrams, elelctron configurations, etc. to support your answers whenever possible.**

1. A fluorine atom is smaller than an oxygen atom and smaller than a chlorine atom.

F [Ne] $2s^2 2p^5$
O [Ne] $2s^2 2p^4$
Cl [Ar] $3s^2 3p^5$

Chlorine is larger than F because it has e^- in the $n=3$ principal quantum level rather than $n=2$ for the outermost e^- in F. Orbitals in higher levels are further from the nucleus ∴ make an e^- cloud larger. F is smaller than O because F has a higher Z_{eff}, pulling the e^- in more tightly. F has more p^+ and the same # of shielding e^- as O.

2. Electrons in a 2s orbital have lower energy (are more stable) than electrons in a 2p orbital.



Since the 2p orbitals are more shielded by the inner 1s e^- than the 2s are, and since the 2s e^- spend more time closer to the nucleus, the 2s are lower in energy

3. Thallium typically forms +1 and +3 ions, while zinc typically forms +2 ions.

Tl [Xe] $6s^2 5d^{10} 4f^{14} 6p^1$
Tl^+ [Xe] $6s^2 5d^{10} 4f^{14}$ ← remove 6p (highest l)
Tl^{3+} [Xe] $5d^{10} 4f^{14}$ ← remove all highest q.l. e^-
Zn [Ar] $4s^2 3d^{10}$
Zn^{2+} [Ar] $3d^{10}$ ← remove highest q.l. e^-

In both cases the highest principal quantum level e^- are removed. For Tl, you can also remove just the highest l in the highest q.l.