Relationship of Electron Configuration and Region of the Periodic Table

Transition Metals
see Table 8.4
All 4th period elements have the configuration \([\text{argon}] (n - 1)d^y ns^x\) and so are “d-block” elements.

Transition Element Configurations
3d orbitals used for Sc - Zn (Table 8.4)

Lanthanides and Actinides
All these elements have the configuration \([\text{core}] (n - 2)f^z (n - 1)d^y ns^x\) and so are “f-block” elements.

Copper
Iron
Chromium
**Lanthanide Element Configurations**

4f orbitals used for Ce - Lu and 5f for Th - Lr (Table 8.3)

---

**Ion Configurations**

To form cations from elements, remove 1 or more e\(^{-}\) from the subshell of highest energy [or highest (n + l)].

\[
P\,[Ne] \, 3s^{2} \, 3p^{3} \quad \text{-} \quad 3e^{-} \rightarrow \quad P^{3+}\,[Ne] \, 3s^{2} \, 3p^{0}
\]

---

**Ion Configurations**

For transition metals, remove ns electrons and then (n - 1) electrons.

\[
Fe\,[Ar] \, 4s^{2} \, 3d^{6} \quad \text{loses 2 electrons} \rightarrow \quad Fe^{2+}\,[Ar] \, 4s^{0} \, 3d^{6}
\]

---

**Ion Configurations**

How do we know the configurations of ions? We can determine the magnetic properties of ions.

Ions with UNPAIRED ELECTRONS are PARAMAGNETIC.

Without unpaired electrons they are DIAMAGNETIC.
PERIODIC TRENDS

• Atomic and ionic size
• Ionization energy
• Electron affinity

General Periodic Trends

• Atomic and ionic size
• Ionization energy
• Electron affinity

Higher Z*. Electrons held more tightly.

Larger orbitals. Electrons held less tightly.

Atomic Size

• Size goes UP on going down a group. See Figure 8.10.
• Because electrons are added further from the nucleus, there is less attraction.
• Size goes DOWN on going across a period.

Atomic Radii

Size decreases across a period owing to an increase in Z*. Each added electron feels a greater and greater + charge.
Sizes of Transition Elements  
See Figure 8.12

• The 3d subshell is inside the 4s subshell.
• 4s electrons feel a more or less constant $Z^*$.
• Sizes stay about the same and chemistries are similar!