# Chapter 7: Electron Structure of the Atom

Nov 7, 2022

Chemistry Department, Cypress College

# Class Announcements

**Lab**

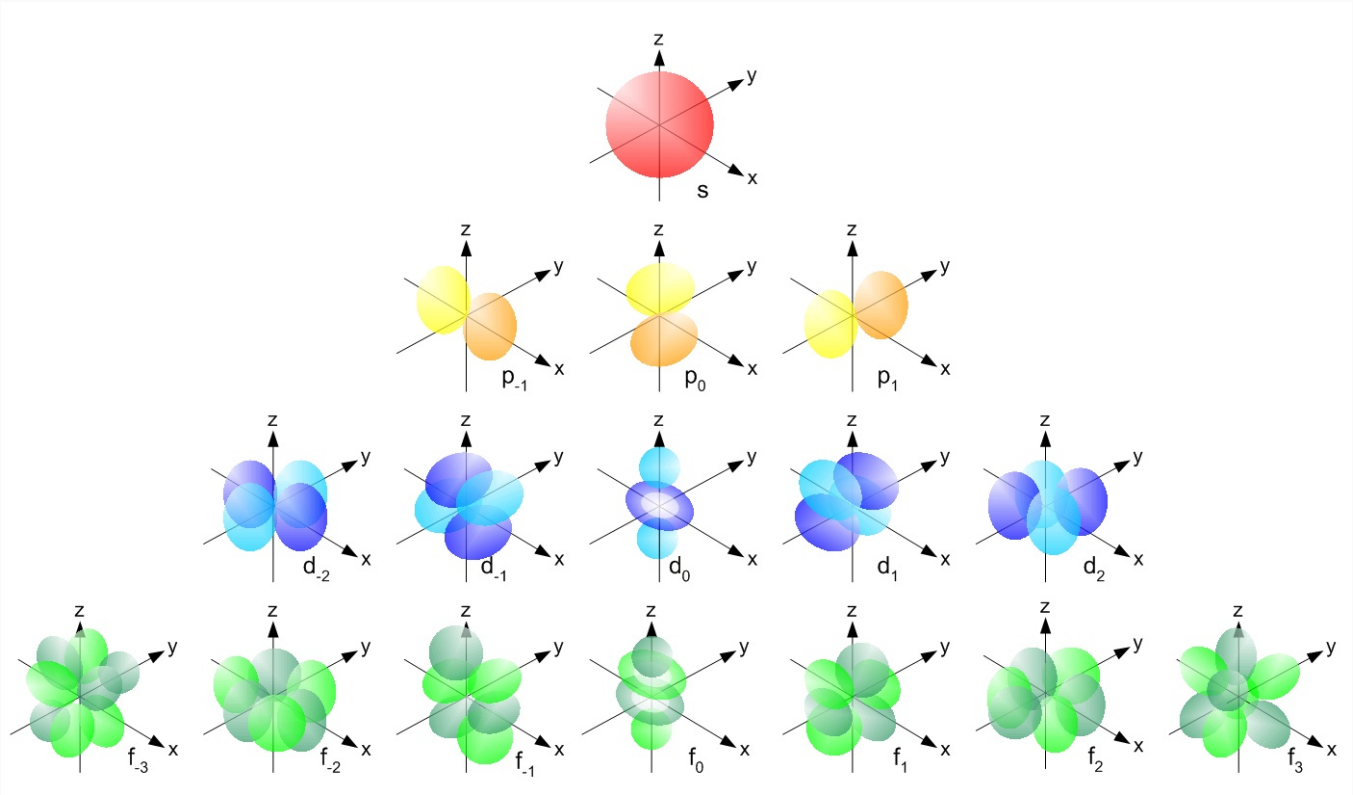
- Experiment 17 Lewis Structures and Molecular Models
- Basic steps for lewis structures
- Reminder - Need 70% of laborator points to pass the course

**Lecture**

- Finish up Ch 7 and begin Ch 8
- Go over homework 9 (EC for students who present)
- Quiz and Homework assignment released Fri, Nov 11th at 3pm

# Outline

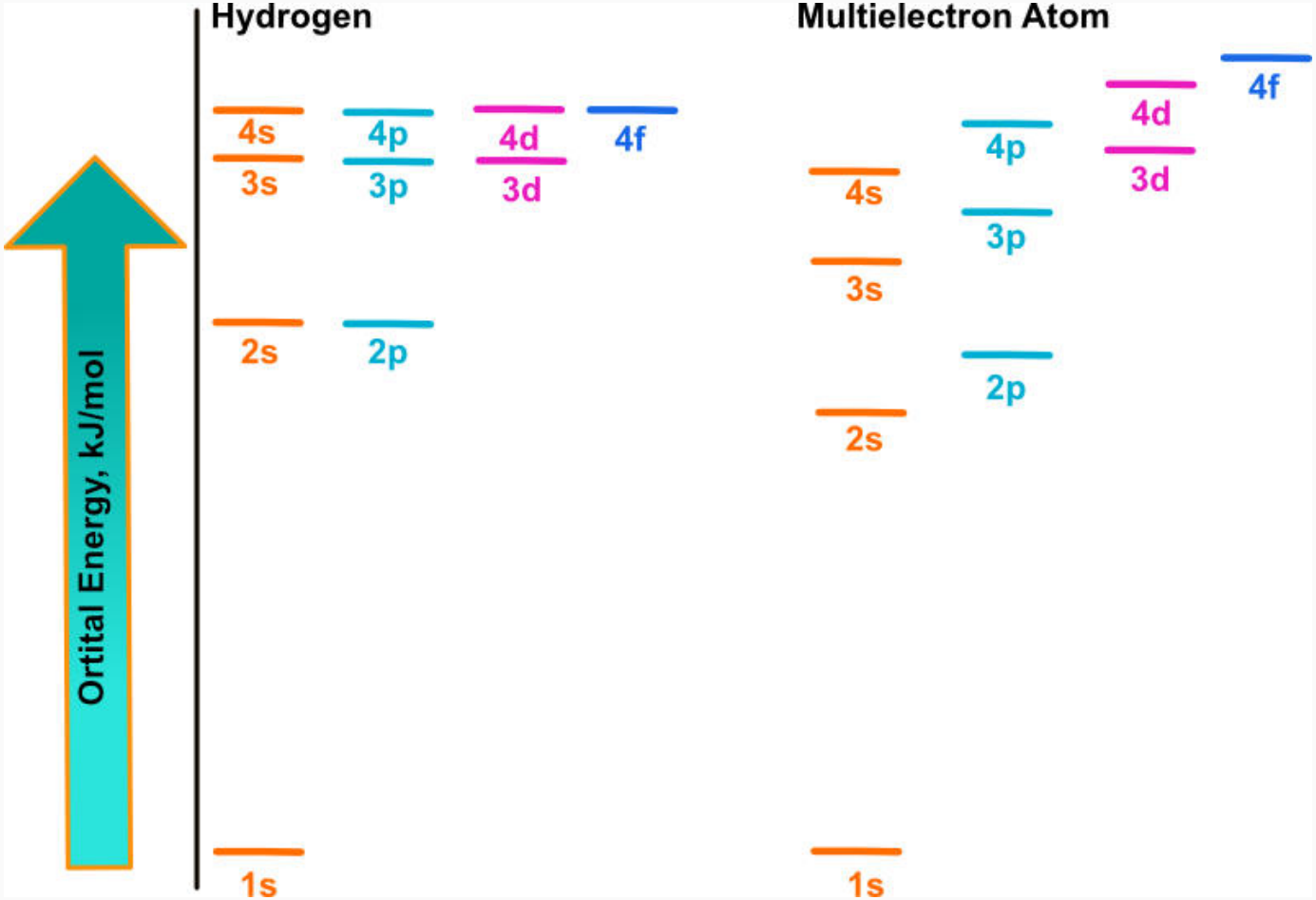
# Atomic Orbitals




- Specific orbitals occupy certain **principal energy level** e.g. $n = 1, 2, 3, \cdots$
- Basis in which atoms form bond; atomic orbitals combine to make molecular orbitals

# Orbital Diagram - Multielectron Element

**Q:** What do notice about the relative atomic orbital energies?



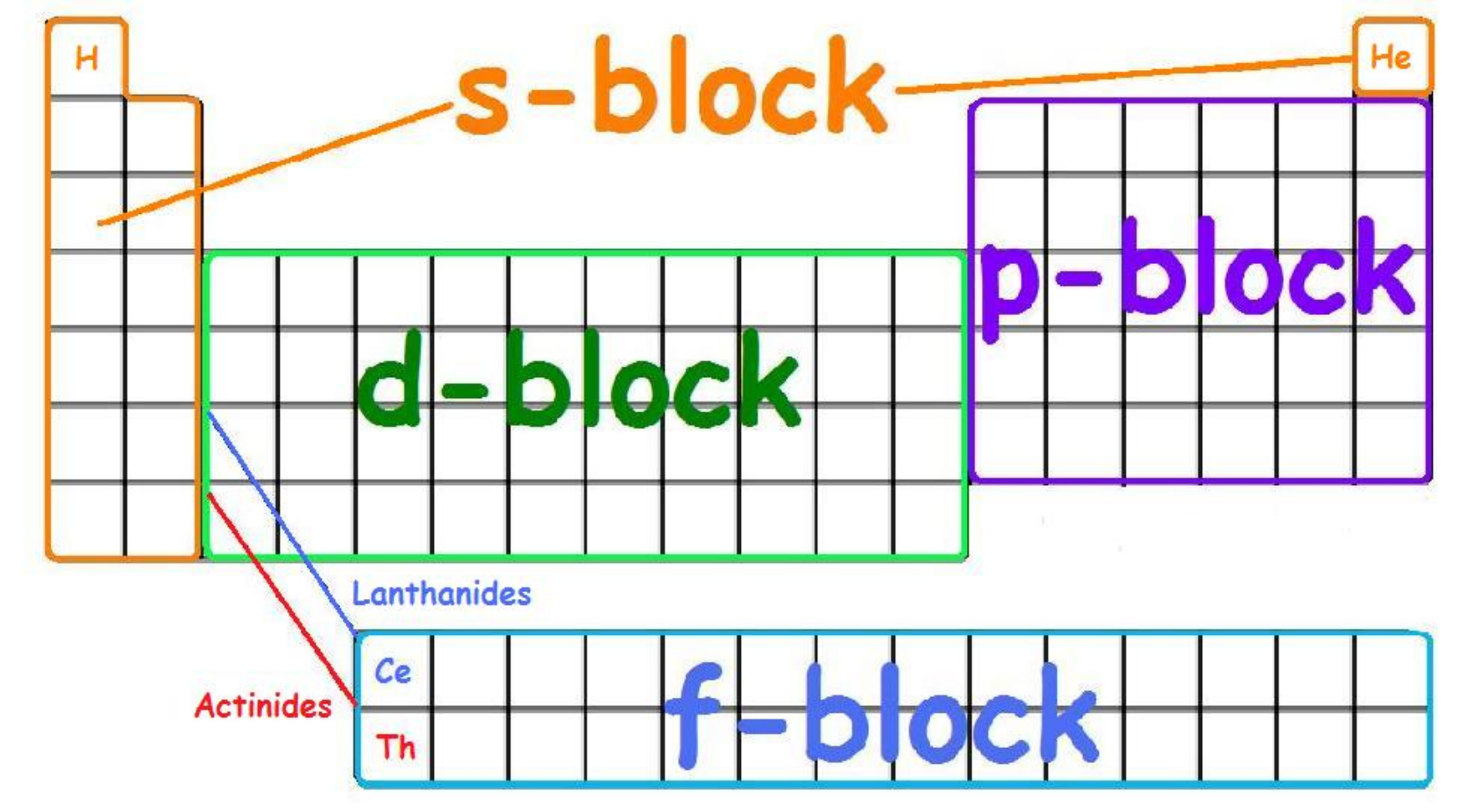
# Principles for Filling Atomic Orbitals

**Aufbau principle** - electrons fill an orbital starting with the lowest energy level

**Pauli exclusion princple** - No two electrons with the same spin can occupy the same orbital

**Hund's Rule** - Maximize the number of unpaired electrons

# Relating to Periodic Table



# Purpose of Electron Configurations

- Outermost shell is referred to as the valence electrons (**Q:** What is special about valence electrons?)
- Innermost shell is the core electrons
- Predicts stability of the atom e.g. unfilled orbitals indicate instability
- Make predictions how elements react forming new chemical compounds

# Outline

# Core and Valence Electrons

**Core Electrons** - Energy level $n$ below the valence electrons and these are completely filled orbitals

**Valence Electrons** - Outermost electrons above the energy level $n$ of the core electrons

**Example:** Si - $1s^2 2s^2 2p^6 3s^2 2p^2$

# Practice: Determine number of valence electrons

**Au**

**Na**

**Sb**

**$Ag^{+}$**

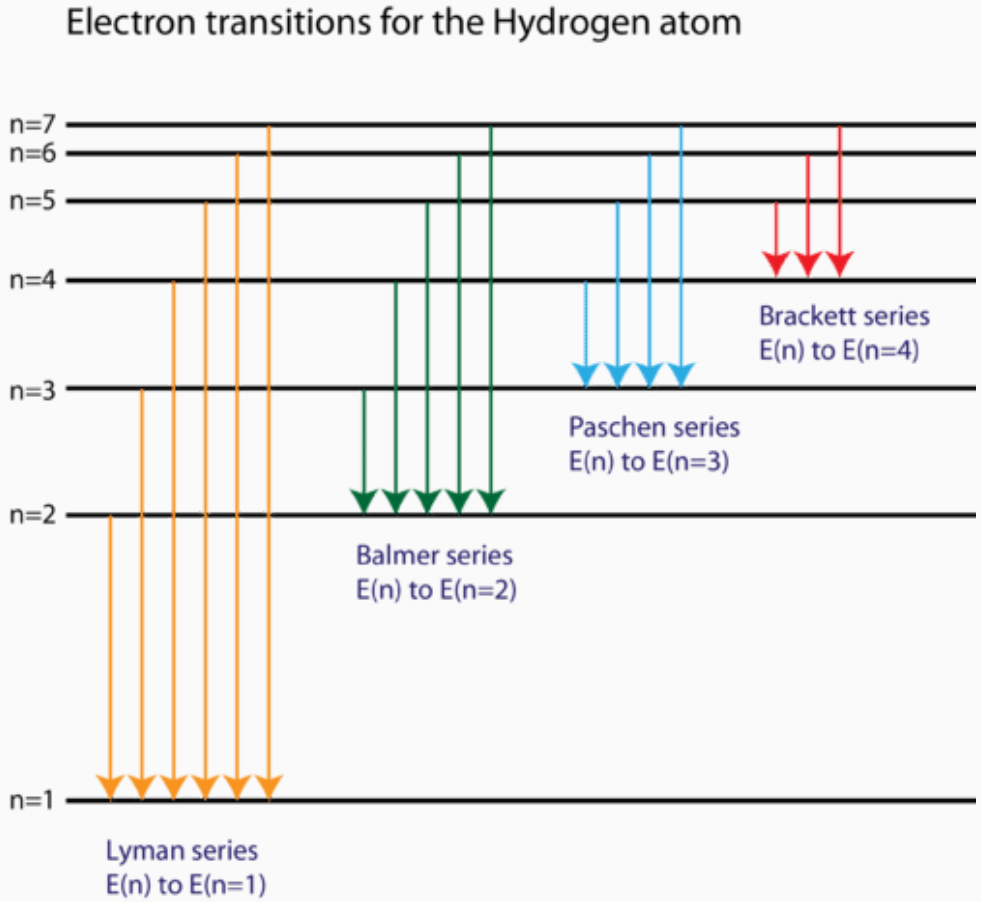
**$Cu^{3+}$**

**$Ca^{2+}$**

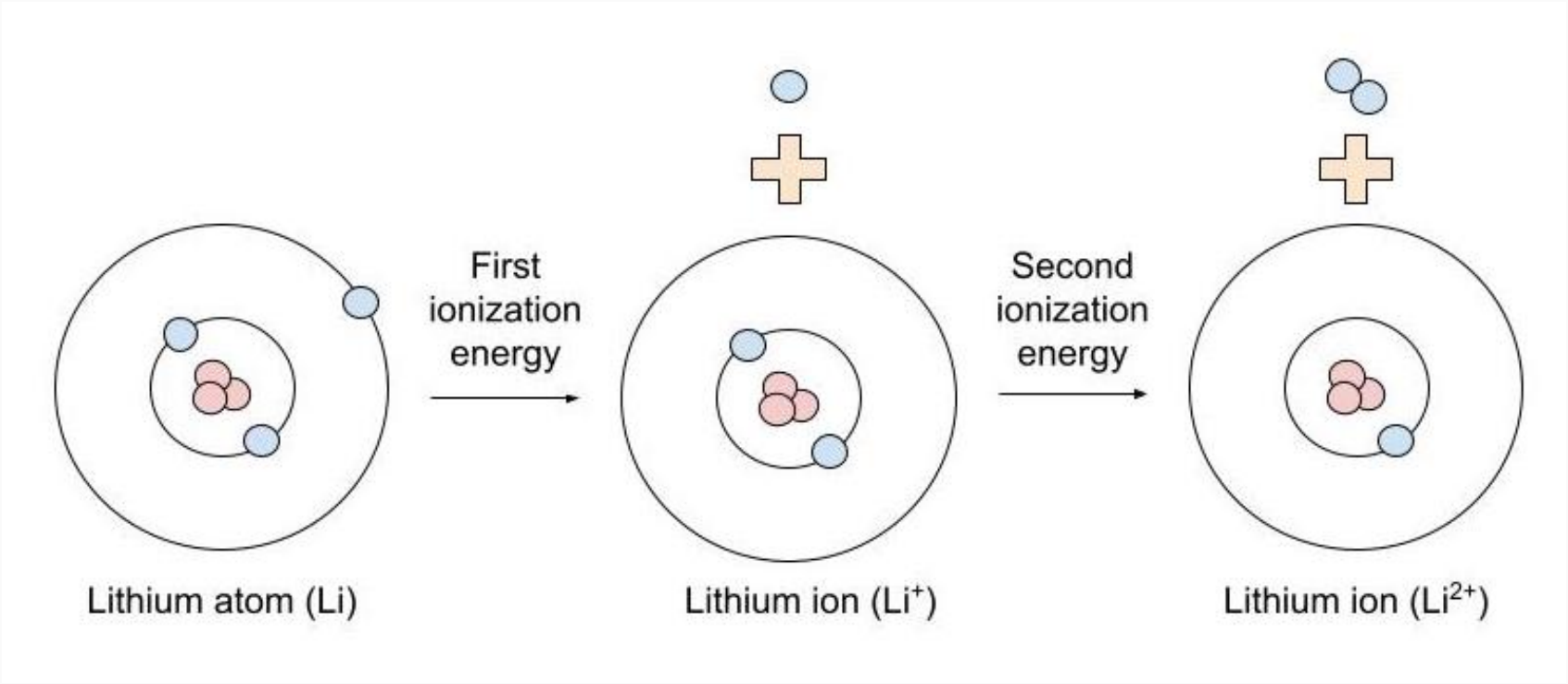
# Outline

# Ionization Energy

**Ionization energy** - Energy required to eject an electron



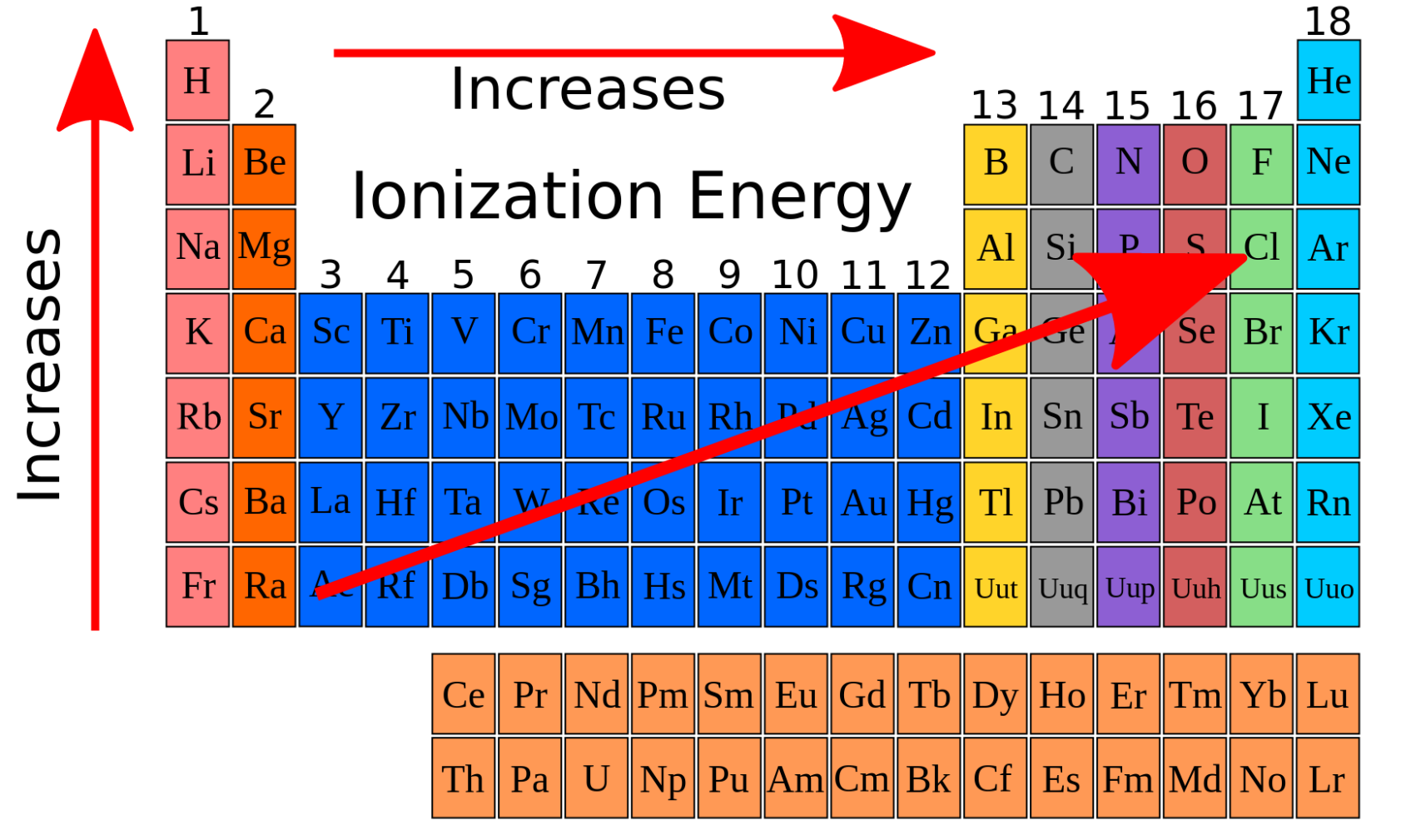
# Meaning of Ionization




First ionization takes 520 kJ/mol and second ionization takes 7298 kJ/mol

**Q:** Why is the second ionization energy significantly higher?

# First Ionization Energy Trends



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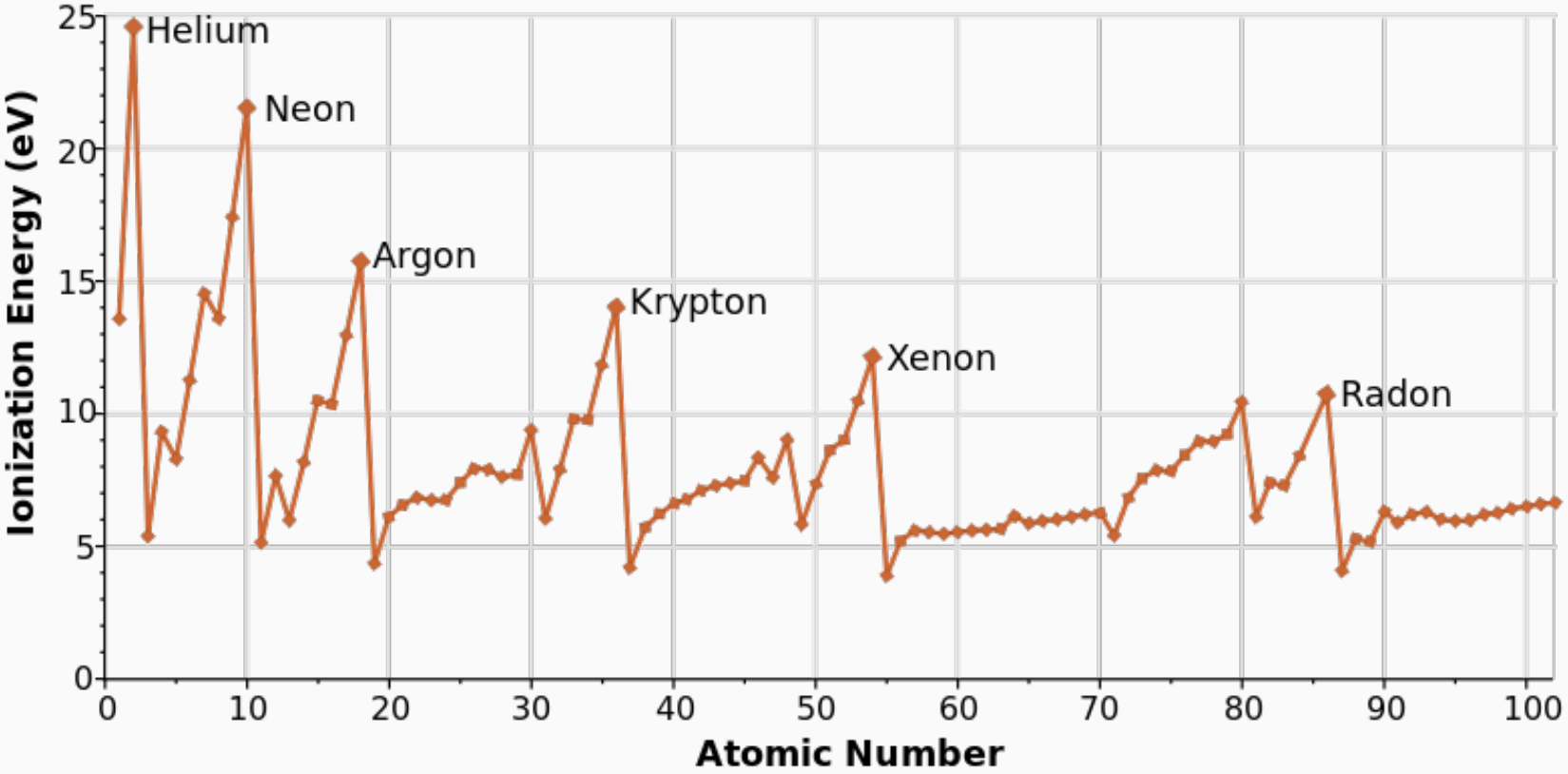
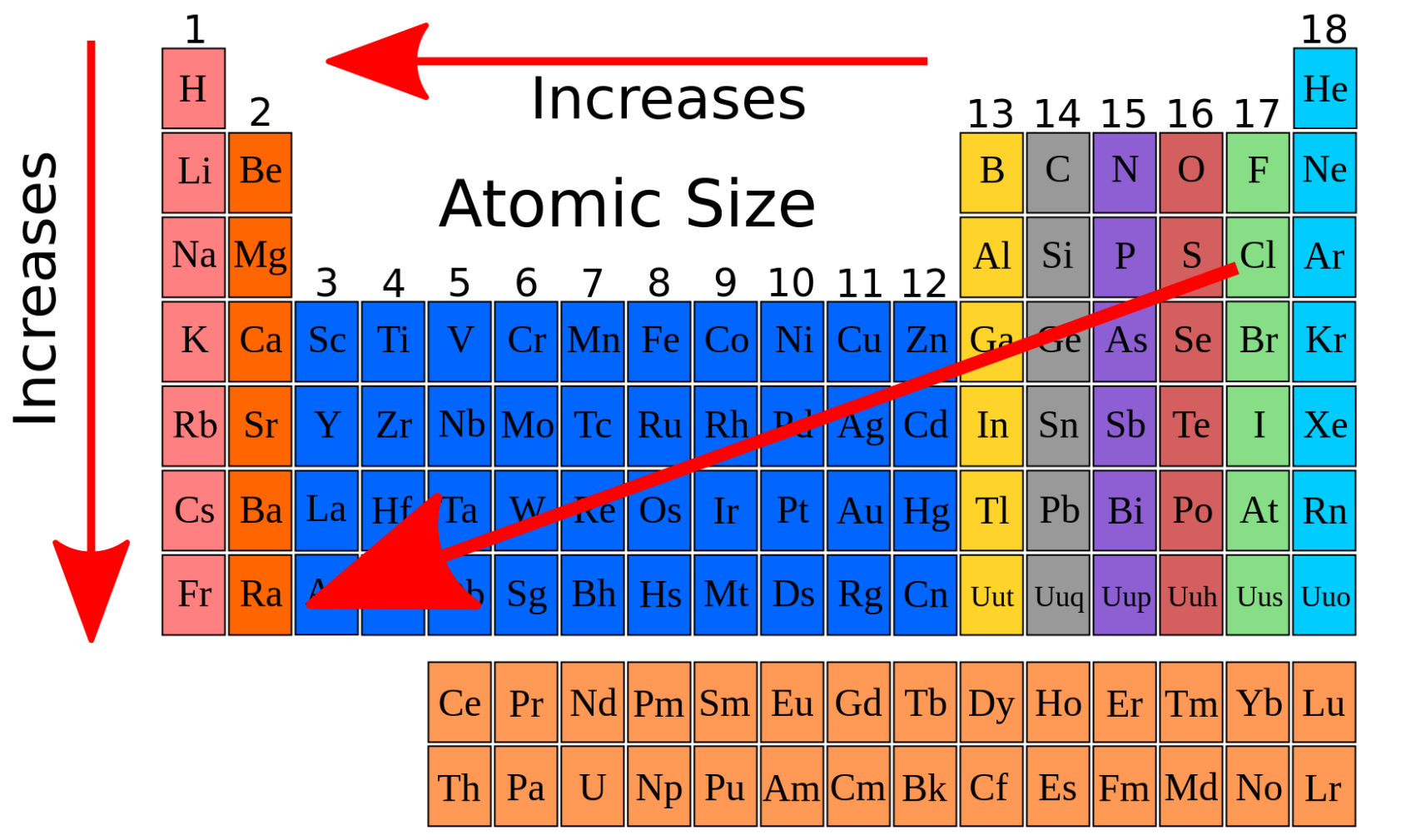


# Atomic Sizes of Neutral Atoms



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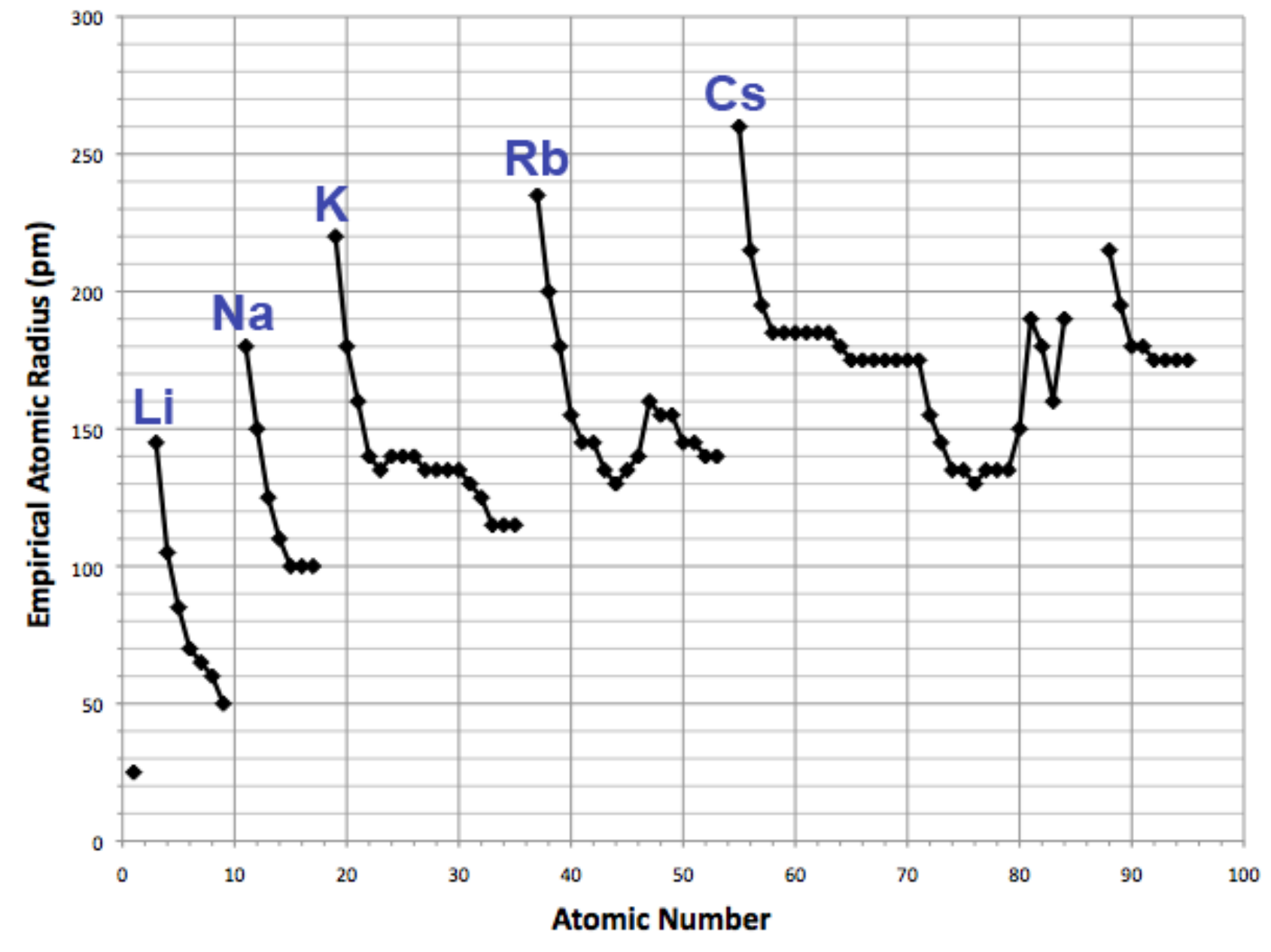

# Atomic Sizes of Ions