

BOHR MODELS

Mrs. Ross

Quick Review

The Atomic Model so far

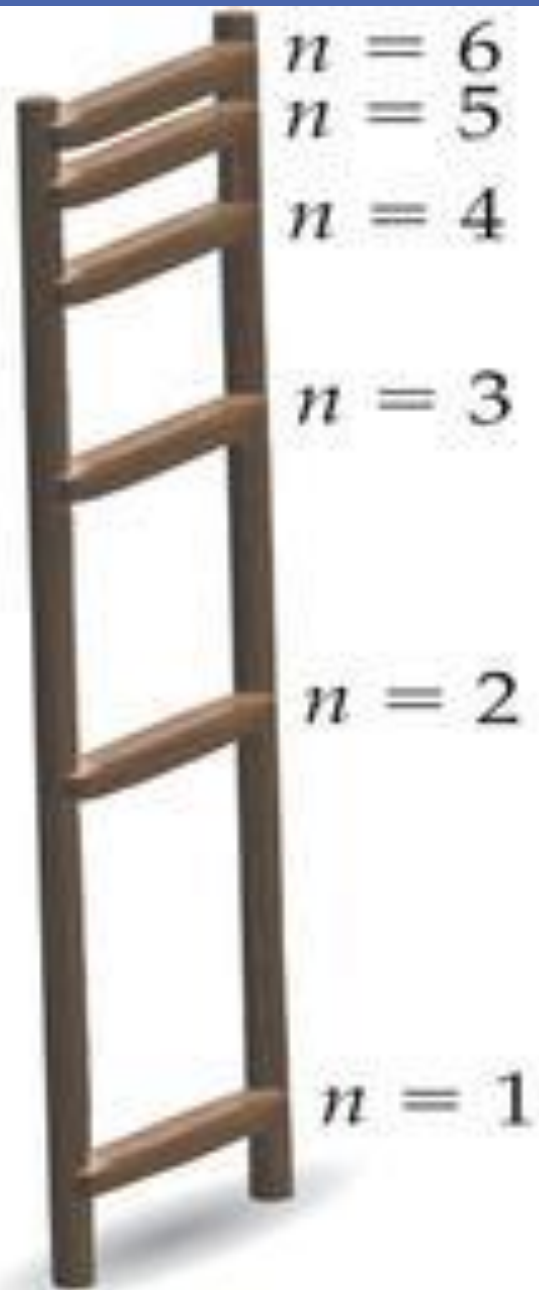
- Democritus
- Aristotle
- Dalton
- JJ Thomson
- Rutherford
- Chadwick

Something's still missing

- Even the most advanced atomic models of the time were missing something.
 - Specifically Rutherford's model couldn't explain the chemical properties of the various elements

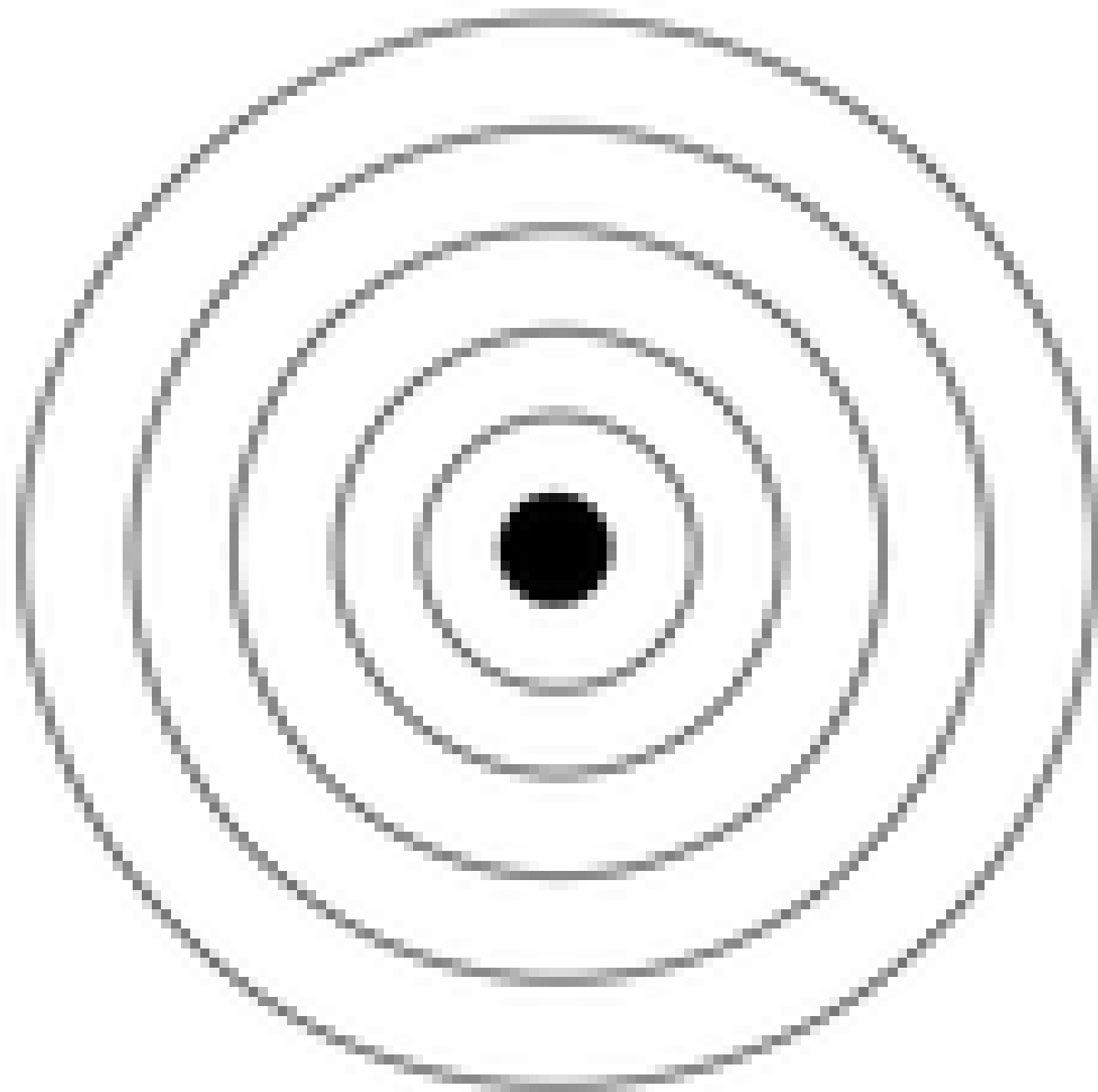
Niels Bohr

- Bohr proposed that an electron is found only in specific circular paths around the nucleus (Like planets around the sun)
- The name for these paths around the nucleus: Orbitals
 - Each possible electron orbit in Bohr's model has a fixed energy
 - Energy levels
 - Think of energy levels like uneven ladder rungs. To move higher, you need more energy
 - Quantum is the amount of energy required to move an electron to the next energy level



The Model

- The electrons in the atom fill the orbitals from the inside out until all electrons are placed.
- First orbital, or ring, can hold 2 electrons
- Second orbital, or ring, can hold 8
- Third ring, 18
- Fourth ring, 32
- Fifth ring, 32, and so on.
- 7 rings possible



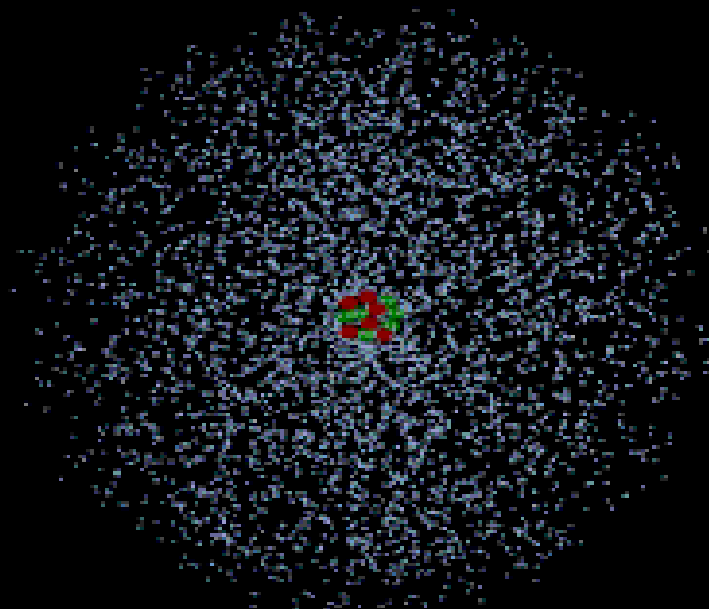
Who came next?

- Erwin Schrödinger
 - Schrödinger's cat, anyone?
- Like Bohr's model, Schrödinger's model, or the quantum mechanical model of the atom restricts the energy of electrons to certain values.
- Unlike Bohr's model, the quantum mechanical model does not involve an exact path the electron takes around the nucleus.
- Schrödinger's model determines the allowed energies an electron can have and how likely it is to find the electron in various locations around the nucleus. (Shorter definition next slide 😊)

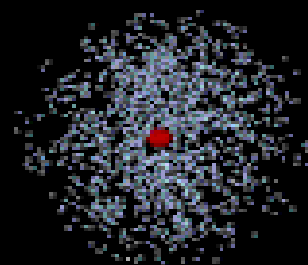
Quantum (Wave) Mechanical Model

- Schrödinger introduced the idea that atoms are mathematical creatures
- Instead of set paths, electrons are found in high probability areas, still called orbitals

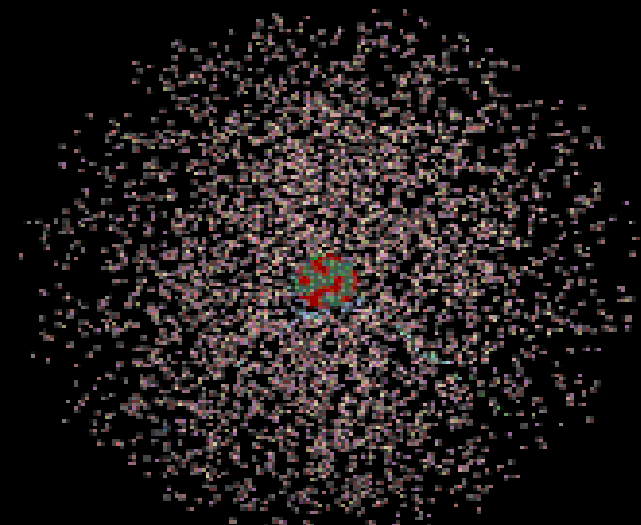
Introduction to Atoms



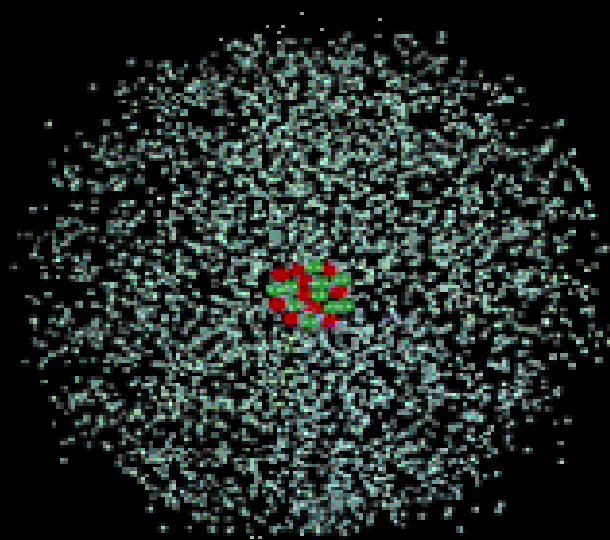
Carbon



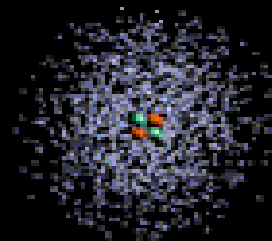
Hydrogen



Oxygen



Neon



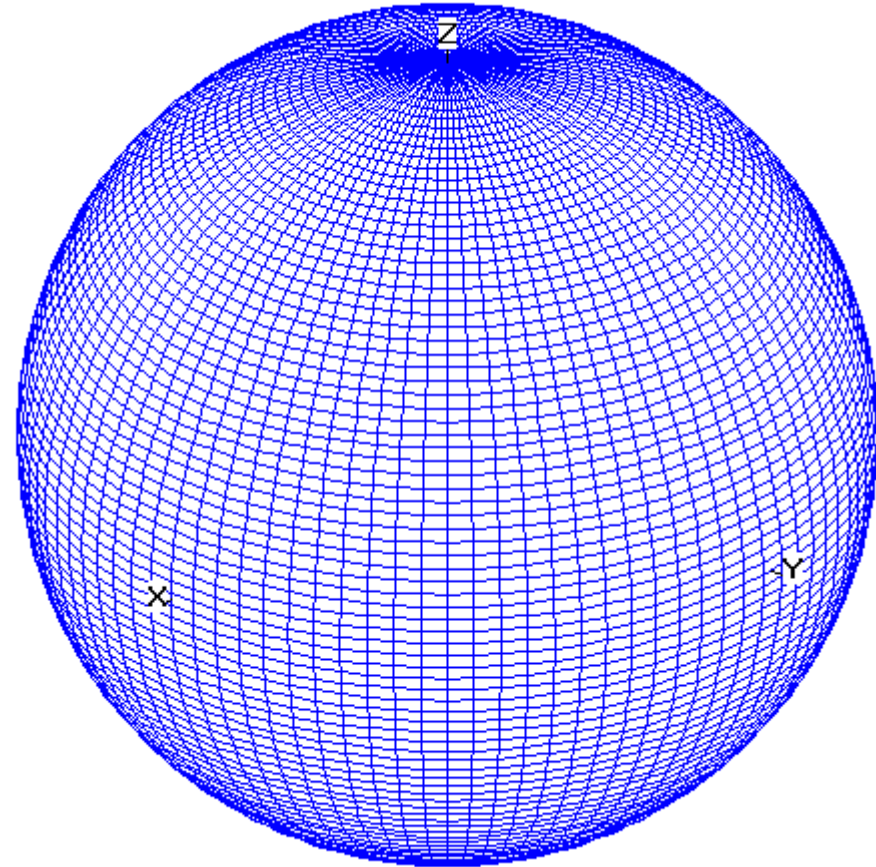
Helium

What does this do to our model?

- A lot. Let's learn!
- We are going to equate an atom and its energy levels (rings) to a hotel— it'll help us make sense of them.
 - If you don't like this analogy, just wait, I have more if they are needed 😊
- Floors= the rings around the nucleus
- Suite style= letter or orbital (Some have more or less "rooms" in the suite)
- Persons= electrons, two per room

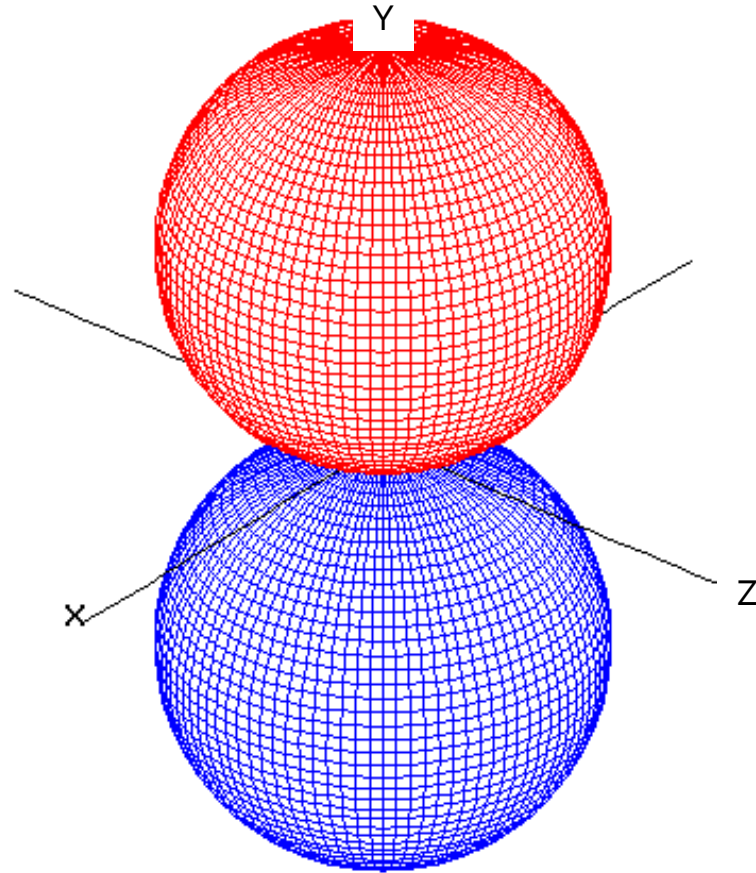
s Orbital

- Shape of a ball
- One “room”
- Two electrons can fit
- Found on every ring

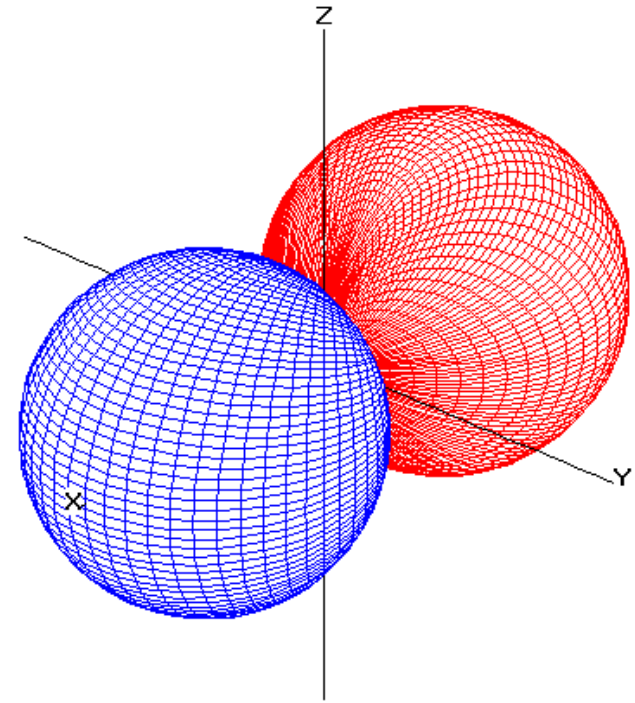
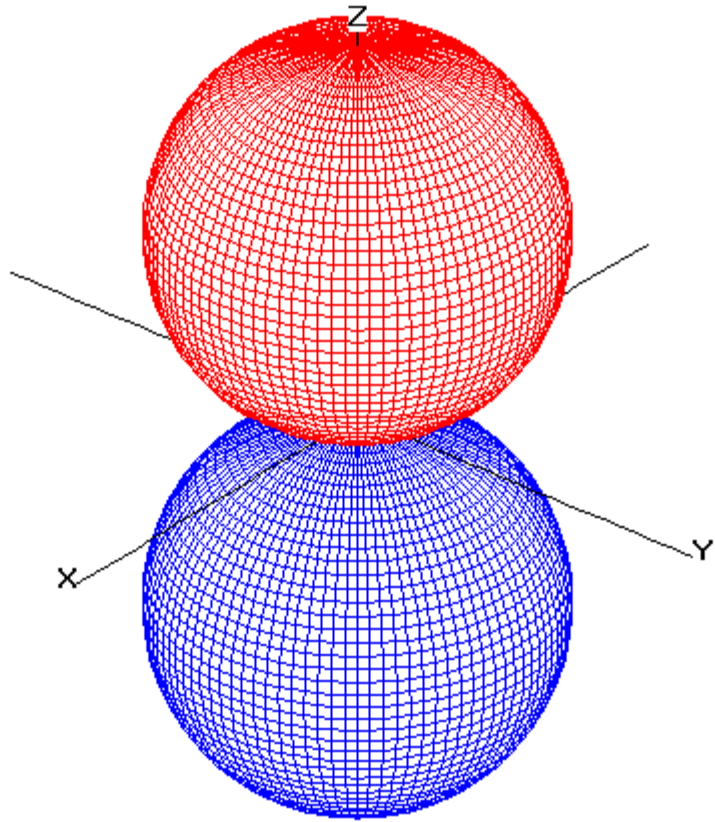


p Orbital

- Shape of a dumbbell
- 3 "rooms" (two electrons each)
- 6 electrons can fit
- Found on second ring and every ring after

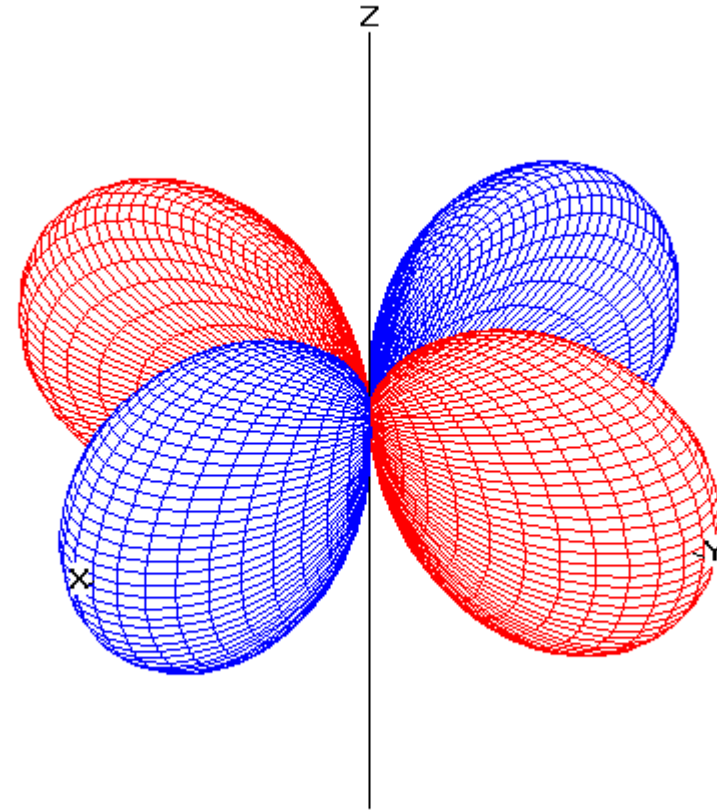


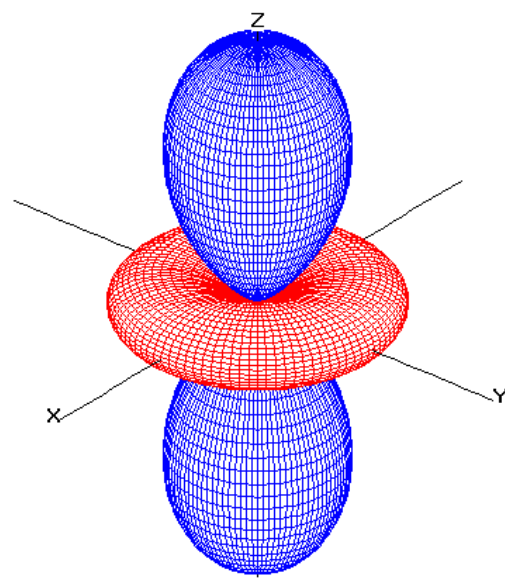
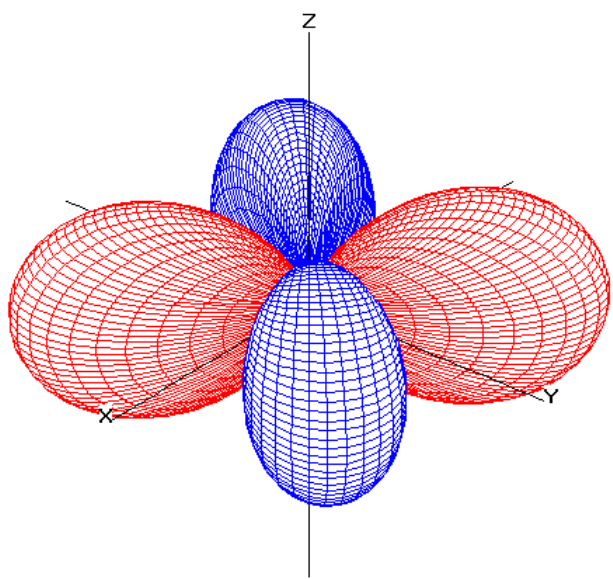
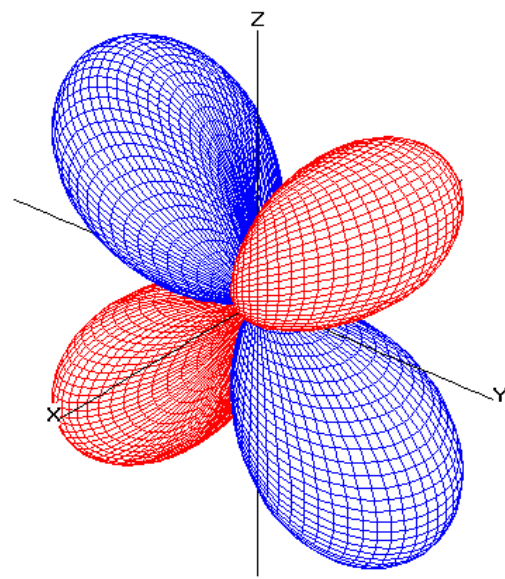
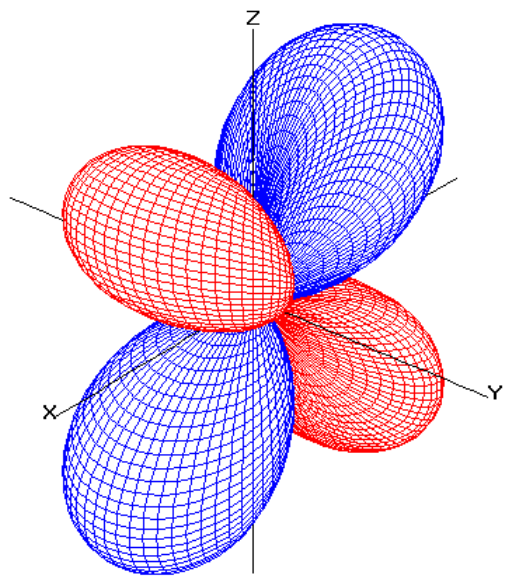
Other p Orbital "rooms"



d Orbital

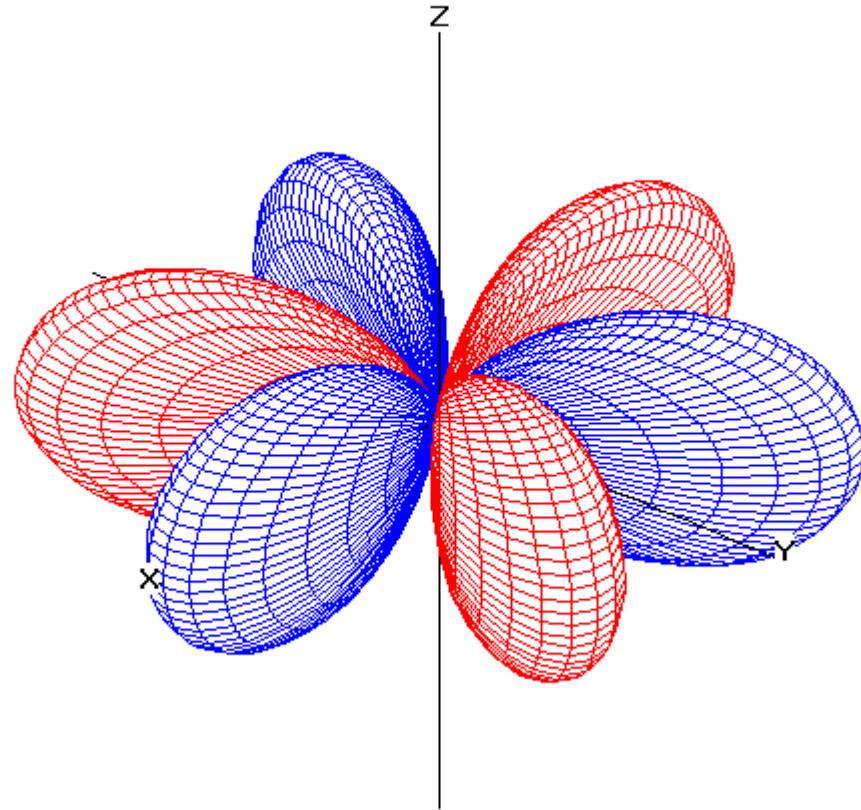
- Shape of a four leaf clover
- 5 room styles
- 10 electrons total
- Found on 3rd ring and each ring after

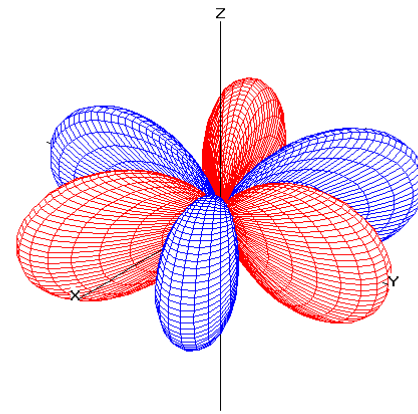
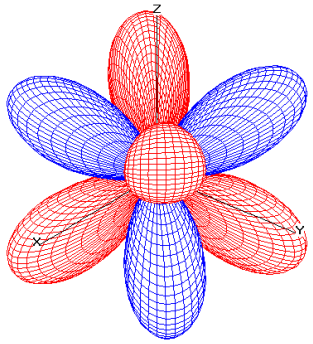
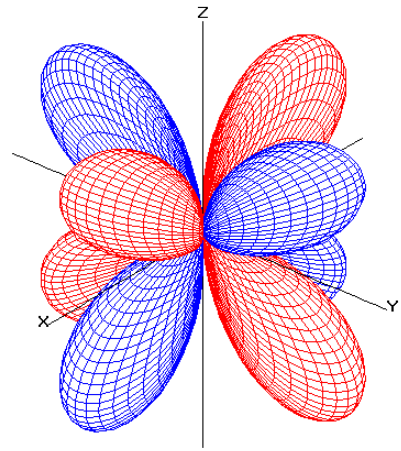
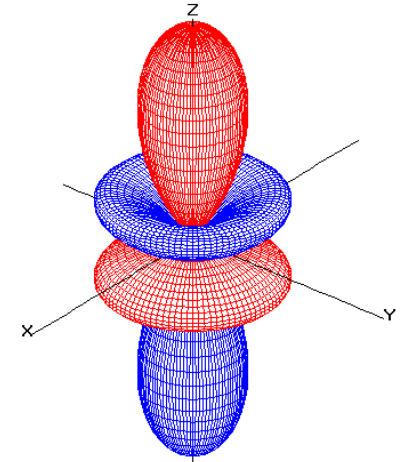
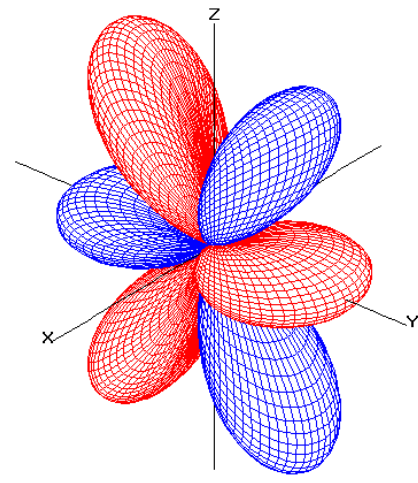
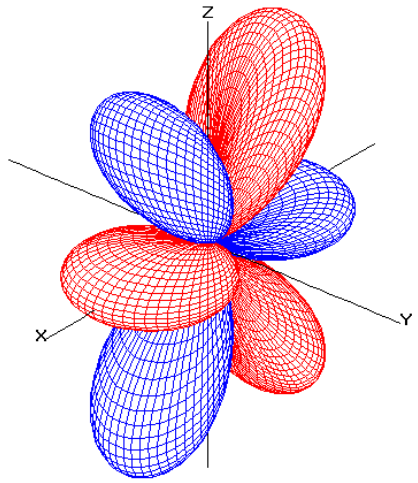




f Orbital

- Shape of a flower
- 7 room styles
- 14 total electrons can fit
- Shows up on 4th floor and each one after





Ok, cool. How does all that apply?

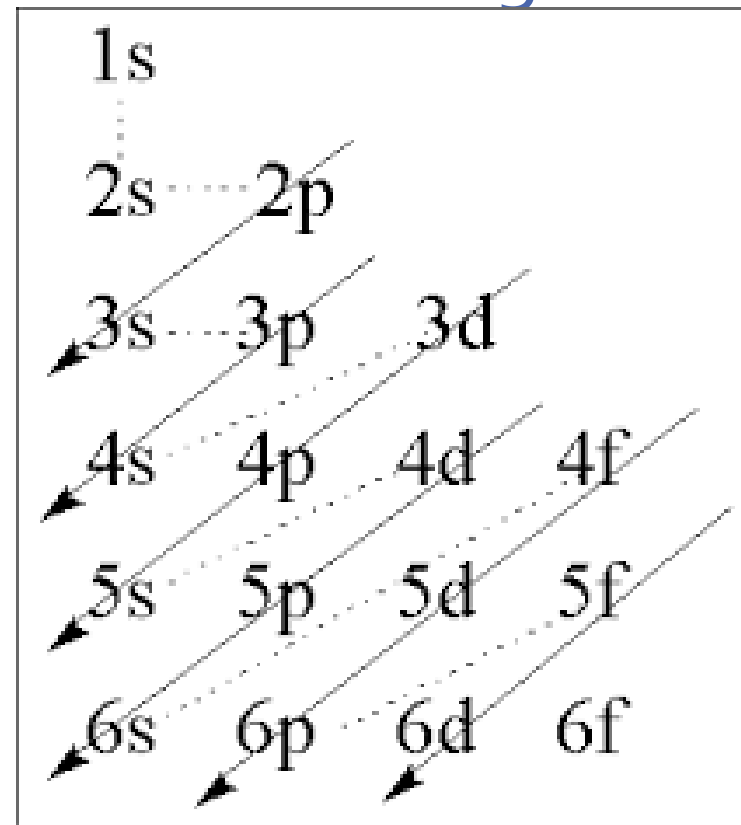
- Configurations! Better Bohr models! Spin Diagrams! Yay!

Three principles that help us with all these things:

- ✓ Aufbau Principle– electrons occupy the lowest energy level first
- ✓ Pauli Exclusion Principle– An orbital can hold at most two electrons of opposite spin
- ✓ Hund's rule (Hot bus seat rule)– Each “room” in the orbital gets one electron until there are no more available “rooms”
 - ✓ Official not as fun definition– electrons occupy orbitals of the same energy in a way that makes the number of electrons with the same spin direction as large as possible.

Aufbau Principle

- Fill the lowest energy level first while we give all the electrons a home!
- Let's do some examples!
 - Hydrogen
 - Helium
 - Lithium
 - Oxygen



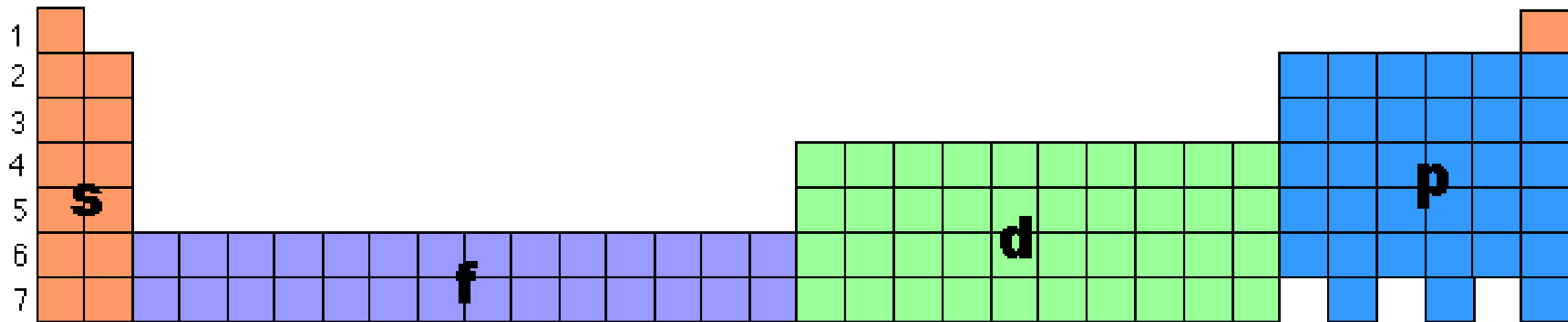
Spin Diagrams

- Gives a visual of where the electrons are
- Let's use the examples we just did- save some thinking!
 - Hydrogen
 - Helium
 - Lithium
 - Oxygen
- Some different ones!
 - Nitrogen
 - Aluminum
 - Sodium

You're doing great!

Wanna learn a shortcut?!?!?

- Periodic table takes the place of the aufbau series
- Noble gases become your starting point!



or in a more condensed form

