Target: I can explain the rules for how electrons fill orbitals

Electron Configuration – an "address" for the electrons in an atom

An Orbital is:	How do we describe orbitals? 1. 2. 3. 4.		
Different orbitals are in different energy levels	Different orbitals have different shapes	Different orbitals have different orientations	Each orbital is only allowed to have two e⁻s
Where do e- live? What is the address for one? State ----------> Energy level ☐ City ----------> Type/shape of orbital ☐ Street ----------> Orientation or orbital ☐ House # ----------> Spin up or spin down of electron ☐		Electron configuration for an electron in the second energy level, inside a p shaped orbital that is lined up on the x axis and is a spin up electron:	
They can get REALLY long $1s_{+½}$, $1s_{-½}$, $2s_{+½}$, $2s_{-½}$ $2p_{x\ +½}$, $2p_{x\ -½}$, $2p_{y\ +½}$ $2p_{y\ -½}$, $2p_{z\ +½}$, $2p_{z\ -½}$		Want to describe where ALL the e- in an atom were? Shrink it down and only list: 1. 2. 3. Example:	

Steps to finding all the electrons

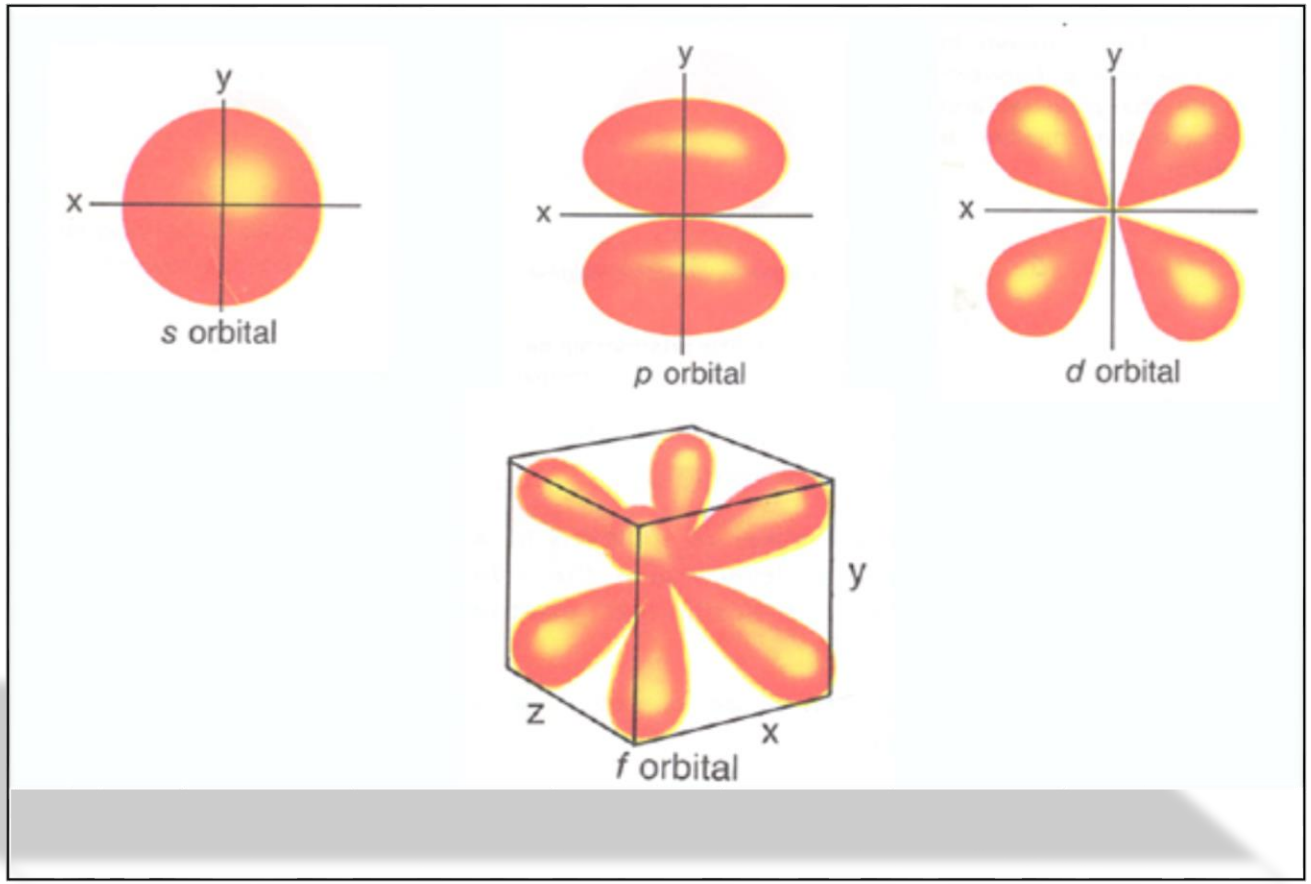
1. Pick an _____
2. Find the number of _____
3. Start putting electrons into the _____ Use an _____
4. List which _____ you used and _____ electrons in each one

Rules for putting electrons in an orbital diagram:

1. Aufbau Principle	2. Pauli Exclusion Principle	3. Hunds Rule
An electron occupies the lowest energy orbital that it can. Means:	*No two e⁻s in the same atom can have the same set of 4 quantum numbers* Means:	*Orbitals of equal energy are each occupied by one e⁻ before any orbital is occupied by a second e⁻.* Means:

K	C	Q

Electron Configuration



Don’t need to write this slide down

The Bohr Model of the Atom

Neils Bohr

I pictured electrons orbiting the nucleus much like planets orbiting the sun.

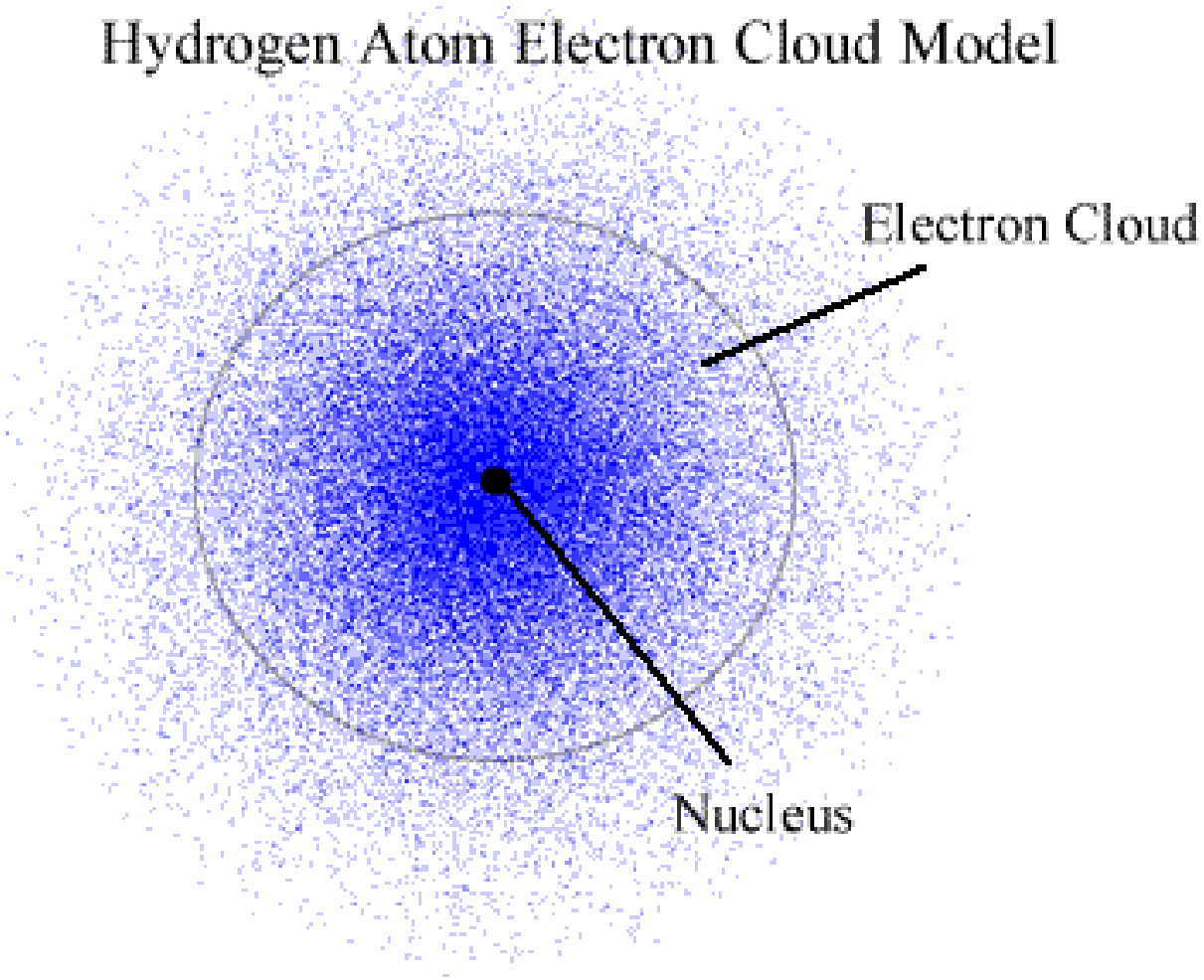
But I was wrong! They’re more like bees around a hive.

Atomic Orbitals

Where electrons are most likely to be found

A “probability cloud”

Where 90% of the electron probability is


Hydrogen Atom Electron Cloud Model
Electron Cloud
Nucleus

How do we describe orbitals?

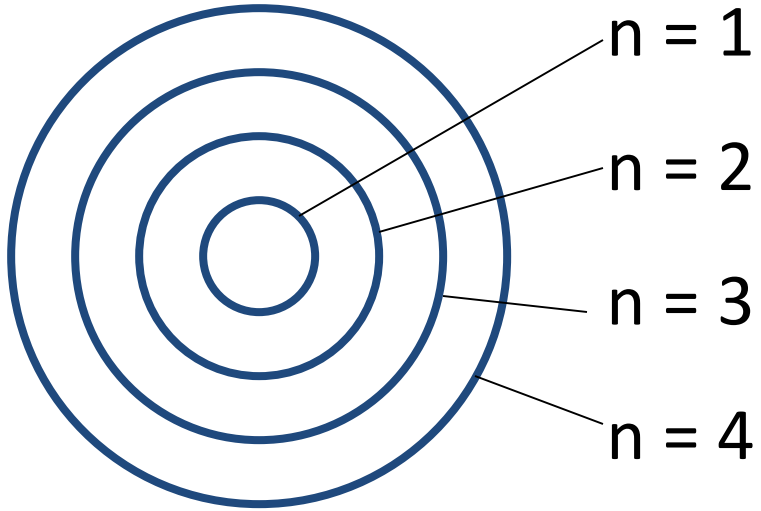
1) Energy level
2) Shape
3) Orientation
4) How many electrons are in each orbital

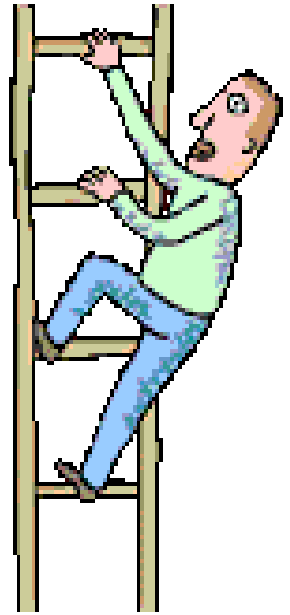
Energy Levels

Different orbitals are in different energy levels

n = 1, 2, 3, 4, 5, 6, 7.

1 = lowest energy, closest to the nucleus

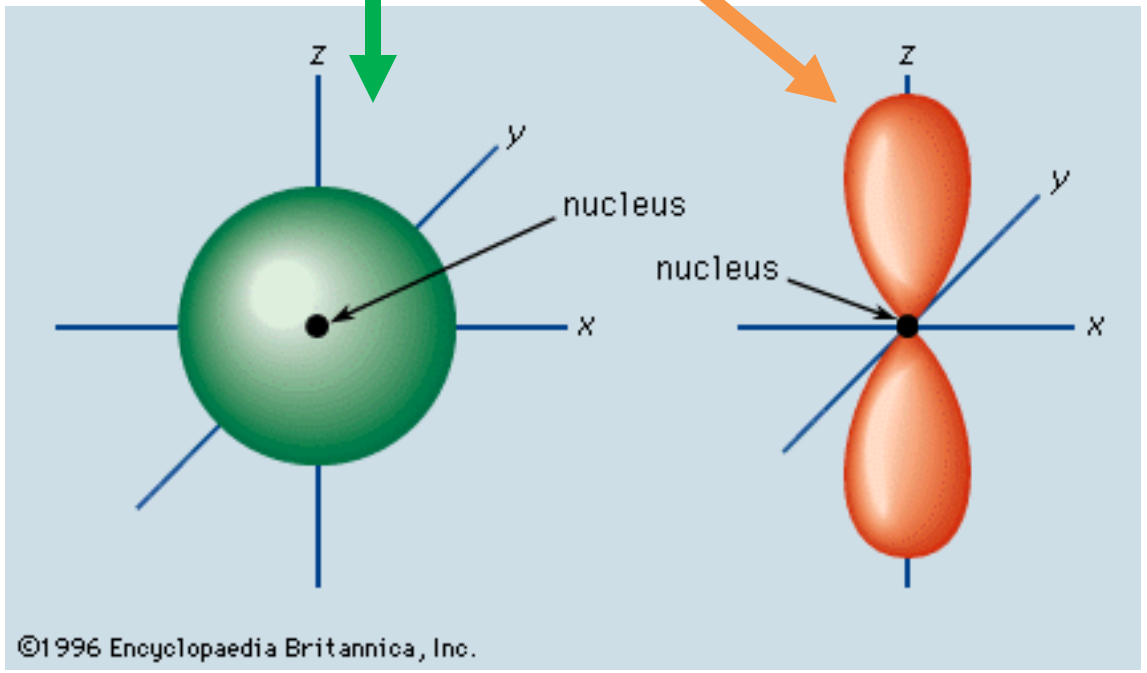




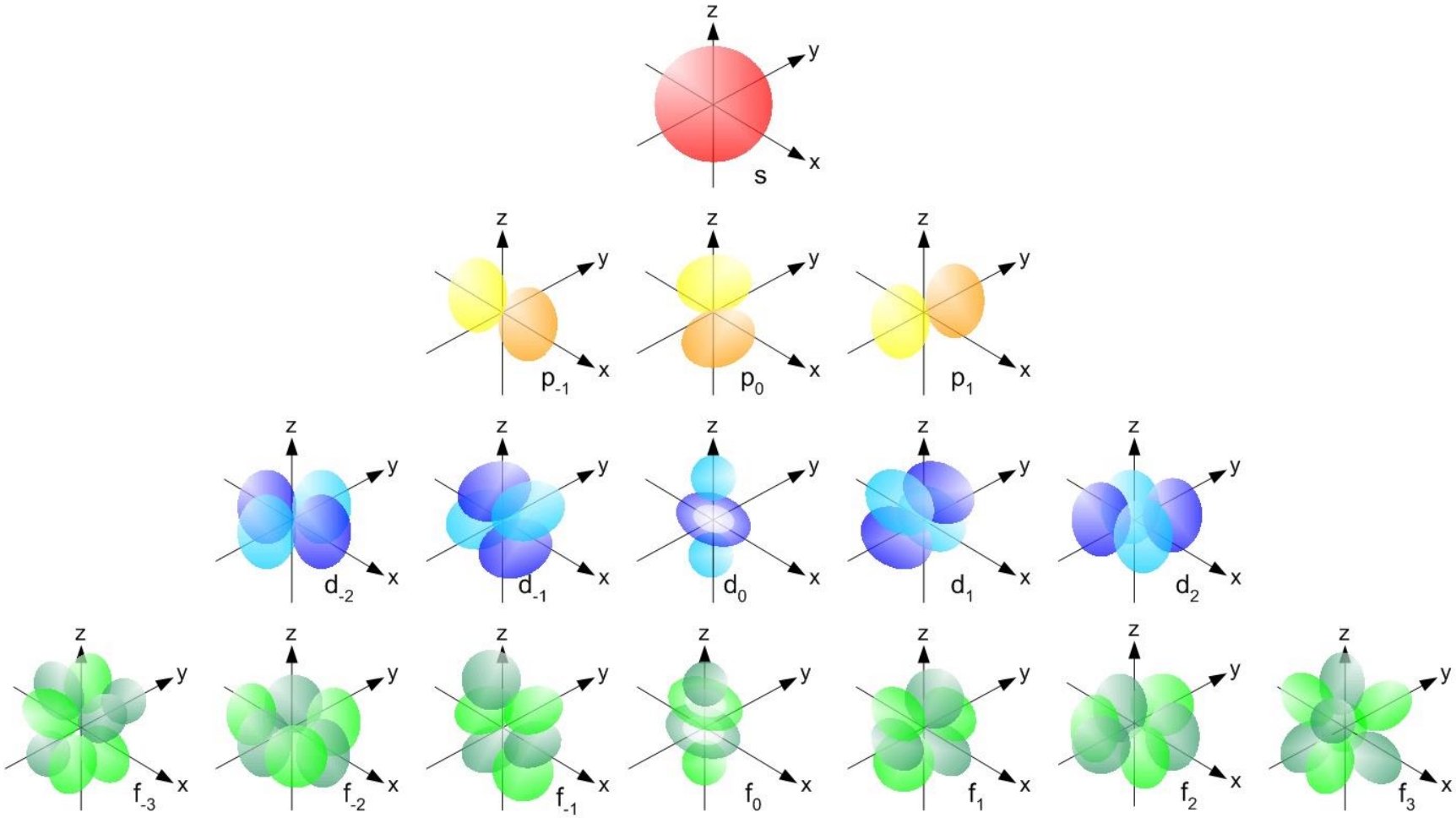
Orbital Shape

Different orbitals have different shapes

s, p, d, f



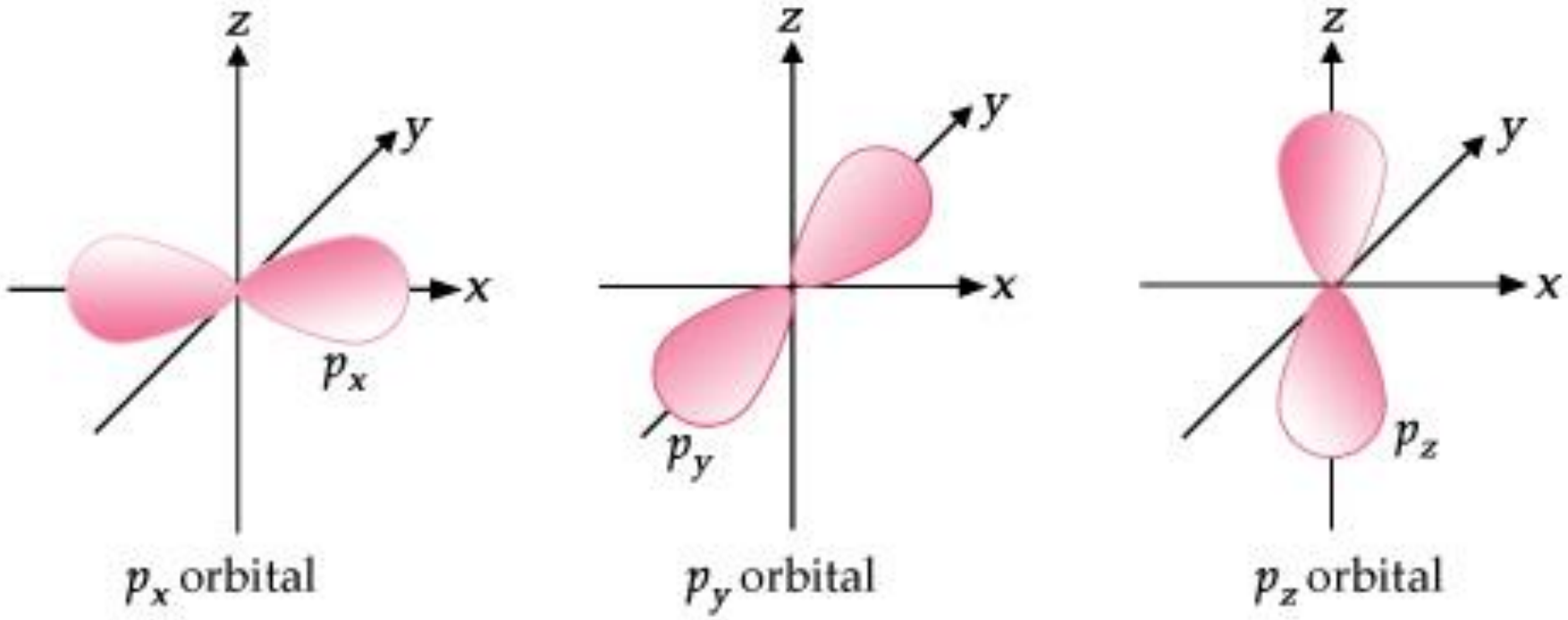
Some Orbitals Are Weird Looking!



Orbital Orientation

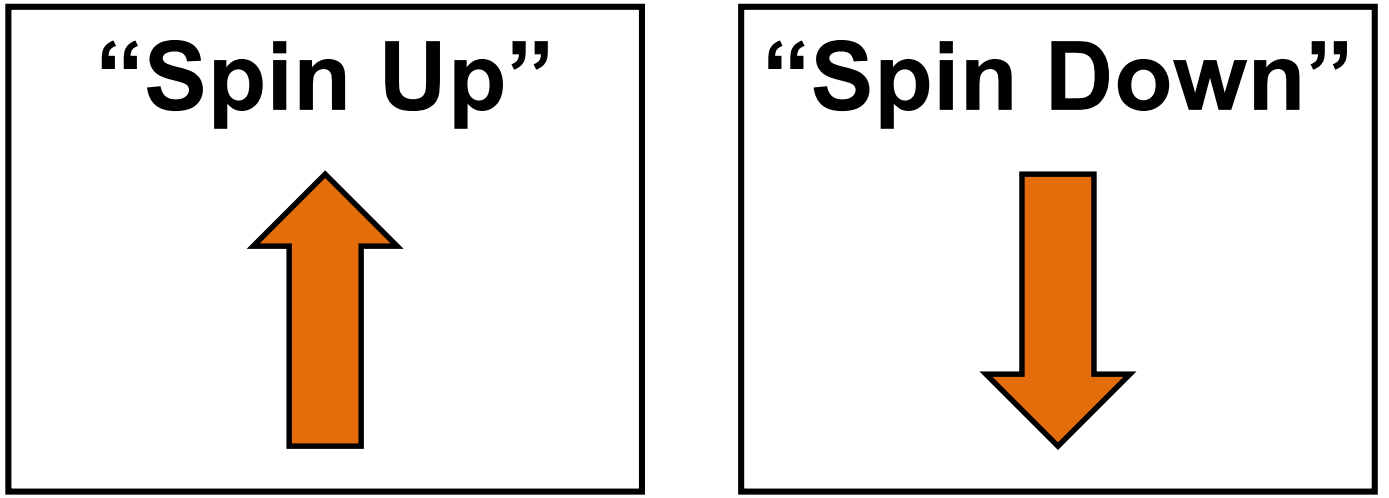
Different orbitals have different orientations

x, y, z (axis)



Electrons in an orbital

Each orbital is only allowed to have TWO e^-s



So how do I tell someone exactly where an electron is???

Think about where you live…

California	**State**
Pleasanton	**City**
Ferdinand Avenue	**Street**
#2345	**House #**

You can write an ADDRESS for where you live
(and no…this isn't my real address, students ask me that every year – ha!)

So couldn't you write an ADDRESS for where the electrons are in an atom???

Where do e- live?
What is the address for one?

State	⇢	Energy Level
City	⇢	Type/Shape of Orbital
Street	⇢	Orientation
House #	⇢	Spin up or Spin down

Electron Configuration is an address!

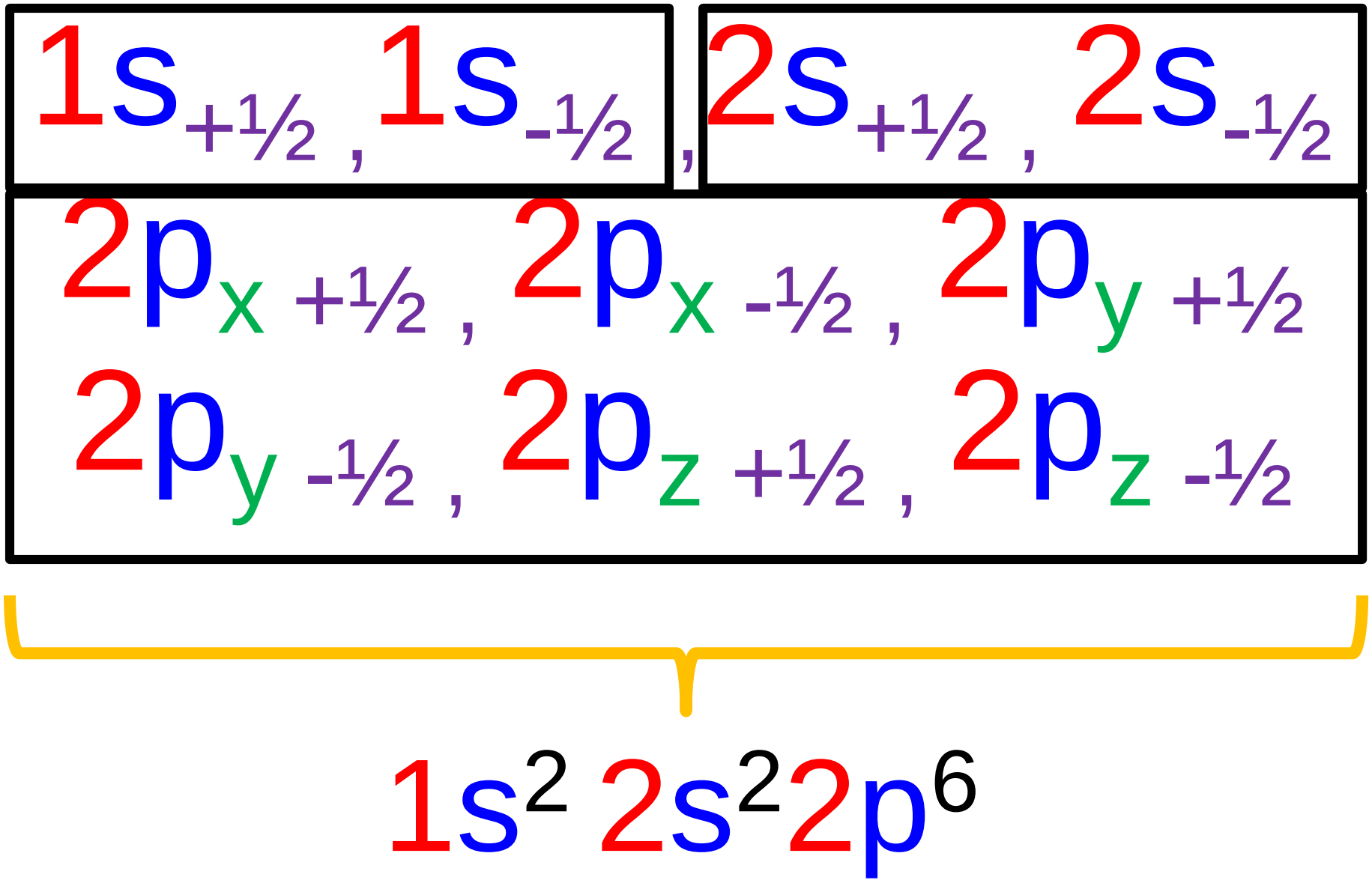
$$2p_x +½$$

Energy Level

Type/Shape of Orbital

Orientation

Spin up or Spin down **+ ½ , - ½**


1s+½ , 1s-½
2s+½ , 2s-½
2px +½ , 2px -½ , 2py +½
2py -½ , 2pz +½ , 2pz -½
1s² 2s²2p⁶

Want to describe where ALL the e^-s in an atom were?

Shrink it down and only list the basics!

Energy levels

Shapes of Orbitals

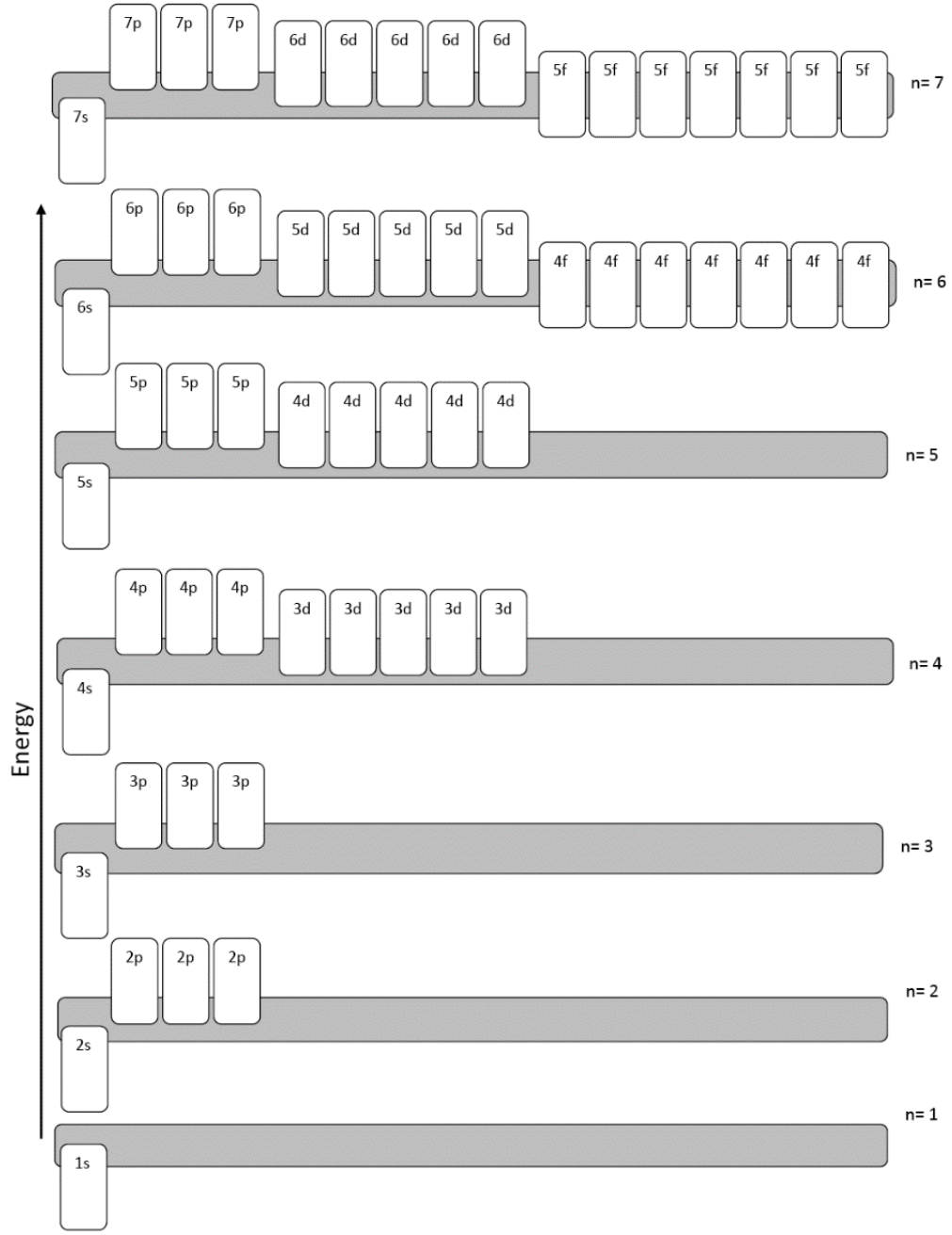
Number of electrons in each orbital

$1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^4$

$= 2+2+6+2+4 = 16\ e^-$ Sulfur!

Orbital Diagram

A chart that shows you the order that the orbitals go in.



Steps to finding all the electrons

1) Pick an **atom**

2) Find the number of **electrons it has**

3) Start putting electrons into the **orbitals**
Use an **ORBITAL CHART/DIAGRAM**

4) List which **orbitals** you used and **how many** electrons in each one

Rules for putting e⁻s in orbital diagrams

Aufbau Principle

An electron occupies the lowest energy orbital that it can.

Means: **Fill from the bottom up**

Electrons are lazy!

Rules for putting e⁻s in orbital diagrams

Pauli Exclusion Principle

No two electrons in the same atom can have the same set of 4 quantum numbers

Means: **If there are two e⁻s in one orbital, one must be spin up, one spin down.**

They can't have exactly the same "address"

Rules for putting e⁻s in orbital diagrams

Hund's Rule

Orbitals of equal energy are each occupied by one electron before any orbital is occupied by a second electron.

Means: **If there are more than one orbital at the same energy, put one electron into each orbital before pairing up**

Don't share a bedroom unless you have to!

YouTube Link for Presentation

https://youtu.be/9s7qsAinE7o