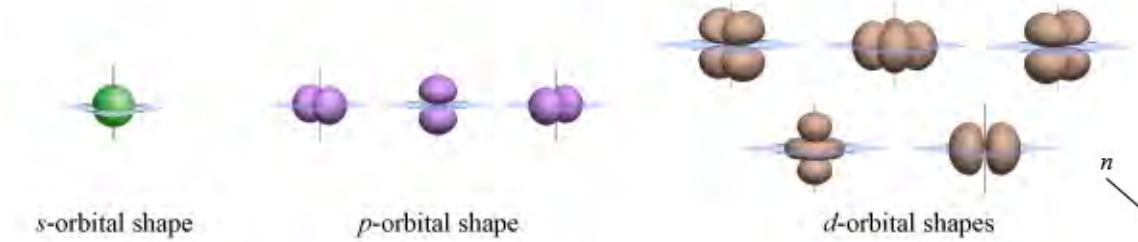
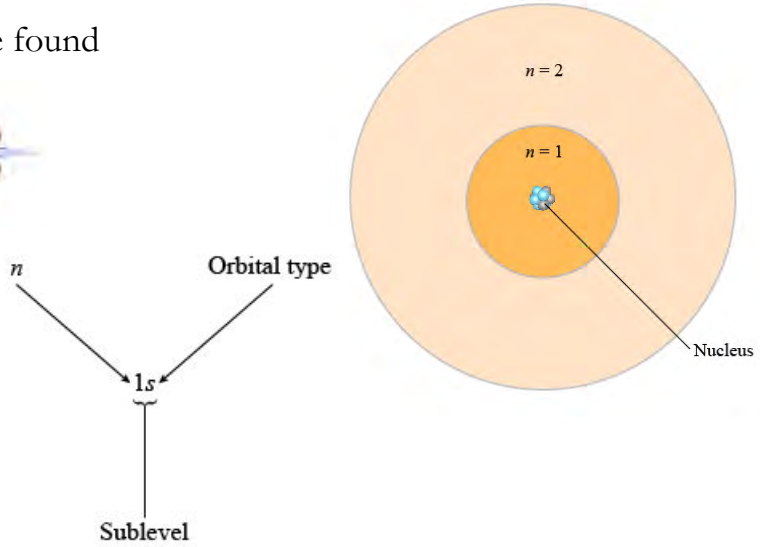
Electron Arrangements

Electron Configurations

- Heisenberg uncertainty principle – the principle that states that it's impossible to know the exact velocity and position of an electron (or any other type of particle) at the same time
- Atomic orbital – an area around the nucleus where electrons are likely to be found
  - *s*, *p*, *d*, and *f* orbitals have different shape(s)





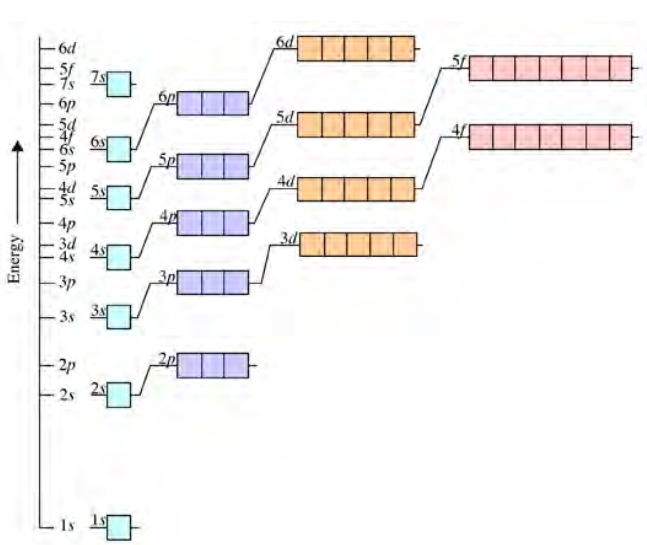
- Quantum numbers – the sets of numbers used to describe the properties of atomic orbitals and the electrons in them
- Principle quantum number (*n*) – a number that denotes an atomic orbital's size and principle energy level

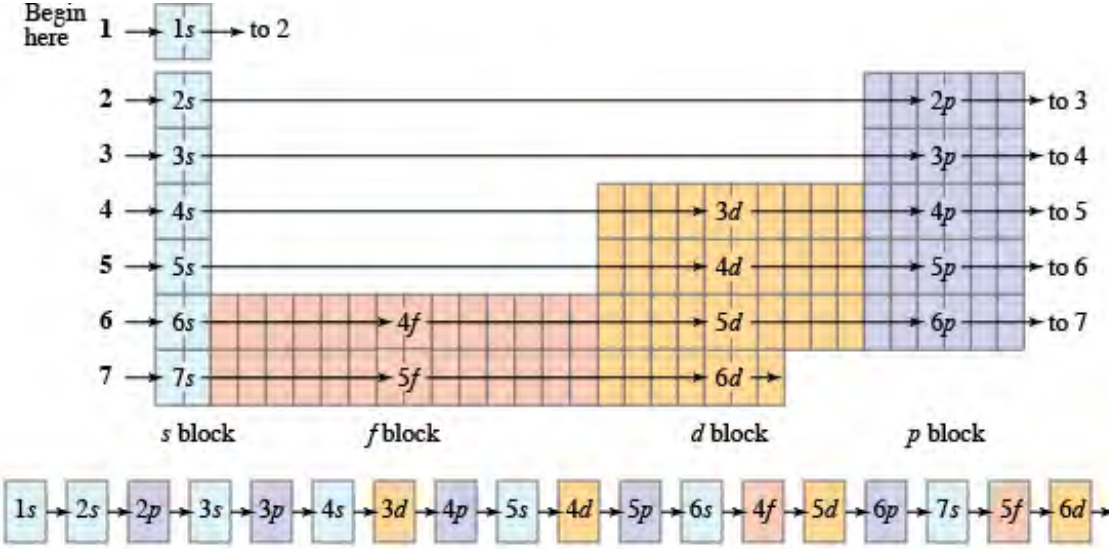
Sublevel Type	Orbital Type	Number of Orbitals per Sublevel	Number of Electrons per Sublevel
s	*s*	1	Up to 2
p	*p*	3	Up to 6
d	*d*	5	Up to 10
f	*f*	7	Up to 14

- Electron configuration – a set of numbers and letters that describe an atom's electron arrangement
- Ground-state electron configuration – an arrangement of electrons that gives an atom the least possible energy
  - Three rules govern ground-state electron configurations the Aufbau principle, the Pauli exclusion principle, and Hund's rule

Electron Arrangements

- Aufbau principle – the principle that states that electrons fill available orbitals with the least energy first

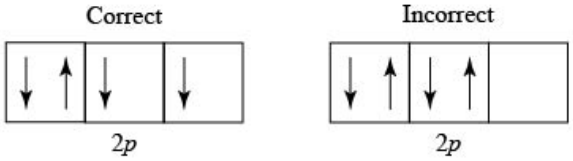




- Highest energy electrons of a neutral atom will be found in the sublevel indicated by the period and the block of the periodic table containing the element

- Pauli exclusion principle – the principle that states that each orbital can hold a maximum of two electrons
  - Electrons have opposite spins when in same orbital

- Hund's rule – the rule that states that when filling equal energy orbitals, electrons fill each orbital singly before filling orbitals with another electron already in them
  - Ex)



Electron Arrangements

Representing Electron Arrangements		
Method	**Steps**	**Example**
Orbital diagram	• Determine the highest energy sublevel of the atom • Use the Aufbau principle to draw sublevels in filling order • Fill orbitals with the correct number of electrons • Atomic number is same as number of electrons in neutral atom	Orbital diagram of oxygen  1*s* 2*s* 2*p*
Electron configuration	• Determine the highest energy sublevel of the atom • Write the sublevels in the order they are filled • Write the number of electrons in each sublevel as a superscript on each sublevel	Electron configuration of iron $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^6$
Noble gas configuration	• Write the noble gas of the previous period in brackets • Write the remainder of the electron configuration afterwards	Noble gas configuration of iron $[Ar] 4s^2 3d^6$

- End of the electron configuration of each element contains valence electrons

Electron Arrangements

Lewis Dot Structures

- Valence electron – an electron in an atom's highest occupied energy level
- Steps for drawing an electron dot structure for an atom
  - Step 1| Identify the symbol for the element and its number of valence electrons using the periodic table.
  - Step 2| Place the corresponding number of electron dots around the symbol. Imagine that the symbol has four sides: top, right, bottom, and left. Begin by assigning one dot per side, moving clockwise around the symbol. Then, if there are still more dots to assign, start adding a second dot to each side until all of the valence electrons have been accounted for.