

Chapter 5-Electrons in Atoms

Outcomes:

- identify the new proposal in the Bohr model of the atom.
- describe the energies and positions of electrons according to the quantum mechanical model.
- describe how the shapes of orbitals differ as it relates to different sublevels.
- write electron configuration diagrams using Hund's rule, Pauli exclusion principle and Aufbau principle (diagonal rule).
- demonstrate an introductory understanding of the Quantum Mechanical Model.

Bohr's model...



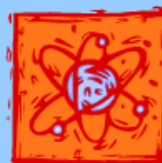
- Electrons are found in specific circular paths (orbits) around the nucleus.
- The electrons have fixed energies called energy levels.
- The amount of energy required to move an electron to another energy level is called a *quantum*.

restrictions

- Can explain electron behavior for hydrogen but not as valid for atoms with more electrons.

The Quantum Mechanical model

- It is based on the energy and possible location of an electron.
- how likely it is to find an electron is described in terms of probability.
- Based on work done by Shrodinger, deBroglie...



summary

- The energies of electrons are called energy levels.
- Electrons occupy atomic orbitals and are assigned quantum numbers.



ORBITAL

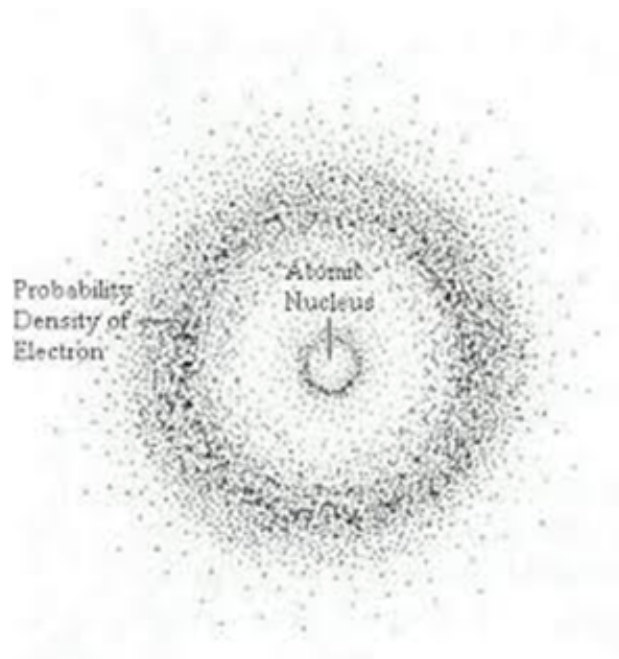
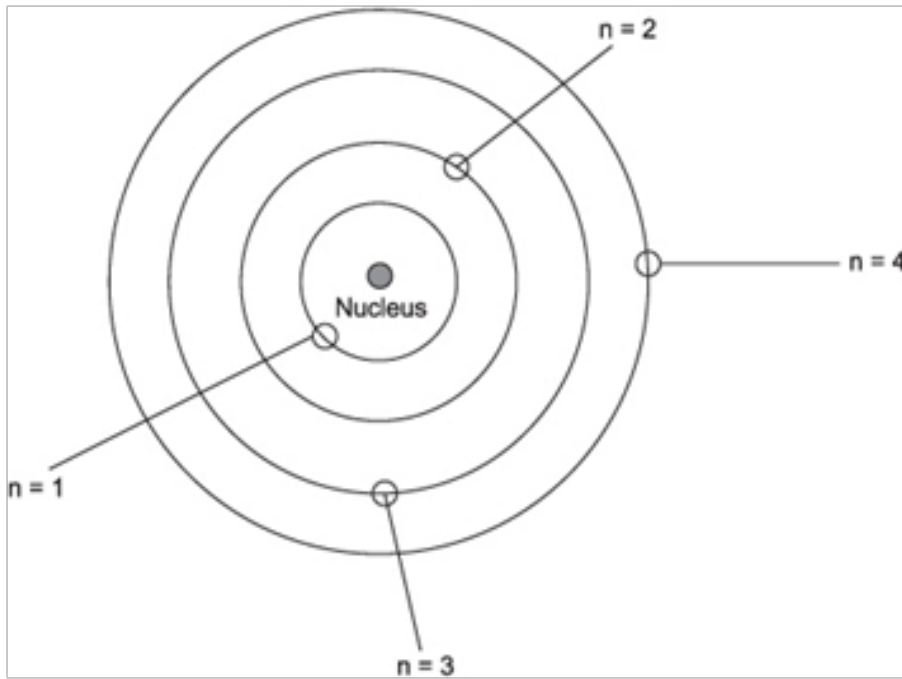
A region in space in which there is a high probability of finding electrons.

1st Quantum #

Principle Quantum #

(n)

**Specifies the energy level
that the electron is on.**

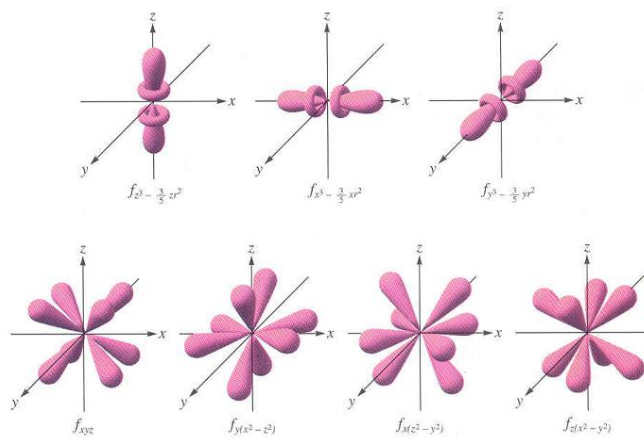
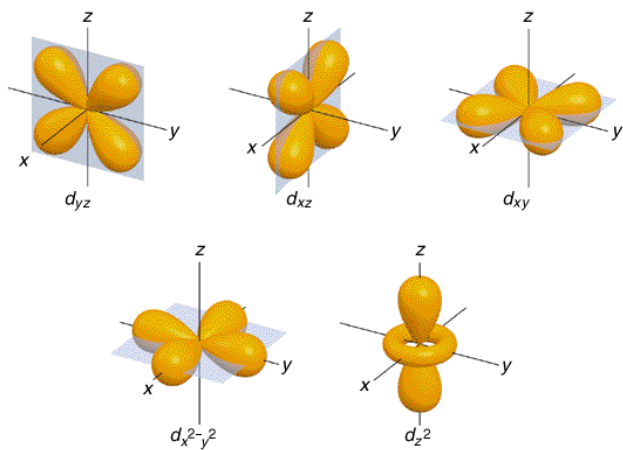
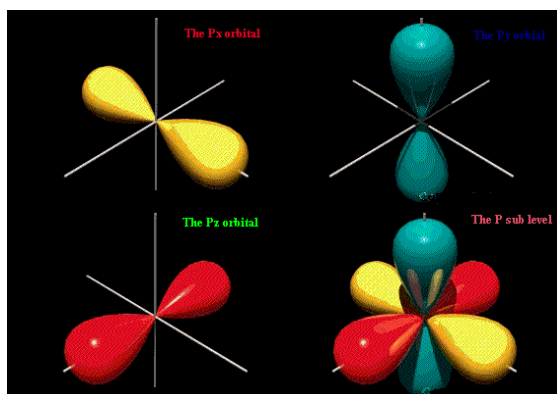
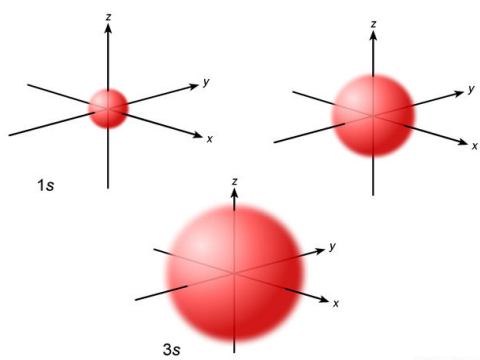


2nd Quantum


(1)

Specifies the shape of the
sub level .(orbital)







spherical
1 shape


dumbbell
3 shapes


diffuse
5 shapes


fundamental
7 shapes.

Each principal quantum level contains sublevels. Each energy sublevel corresponds to an orbital of a different shape! These orbital sublevels or shapes are designated with letters, s,p,d,f... Only 4 different types of orbital's are required to place all the electrons in the largest atom.

Orbital sublevel	Name	Number of orientations	Shape(s)
s	Spherical	1	
p	Principal	3	
d	Diffuse	5	
f	Fundamental	7	

Orbitals that have identical potential energies are said to be degenerate orbitals. For example all of the 2p orbitals have the same energies. 2px, 2py and 2pz all have the same energy .

Energy Level	Types of orbital's	Number of orbital's	Maximum number of electrons
n=1	1	s	2 (2)
n=2	2	s ² , p ⁶	8
n=3	3	s ² , p ⁶ , d ¹⁰	18
n=4	4	s ² , p ⁶ , d ¹⁰ , f ¹⁴	32
Can you spot the pattern?			
n			

Read pages 130 → 132

Complete #1 → 7

The 3rd (m) and 4th quantum numbers (s) ...

- Deals with the orbital within the sublevel (p_x, p_y)
and the spin of the electron. or p_z

We must follow 3 rules...

- Aufbau principle
- Electrons occupy energy levels with lowest energy first.

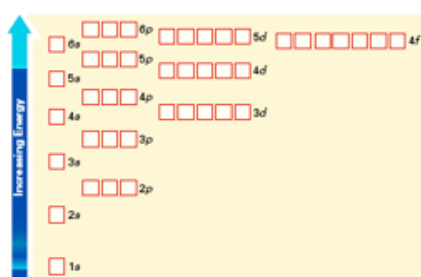


Figure 5.7 This aufbau diagram shows the energy levels of the various atomic orbitals. Orbitals of greater energy are higher on the diagram. **Using Tables** Which is of higher energy, a 4d or a 5s orbital?

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Hund's rule...

- Electrons that occupy orbitals of the same energy will have the maximum number of electrons with the same spin.



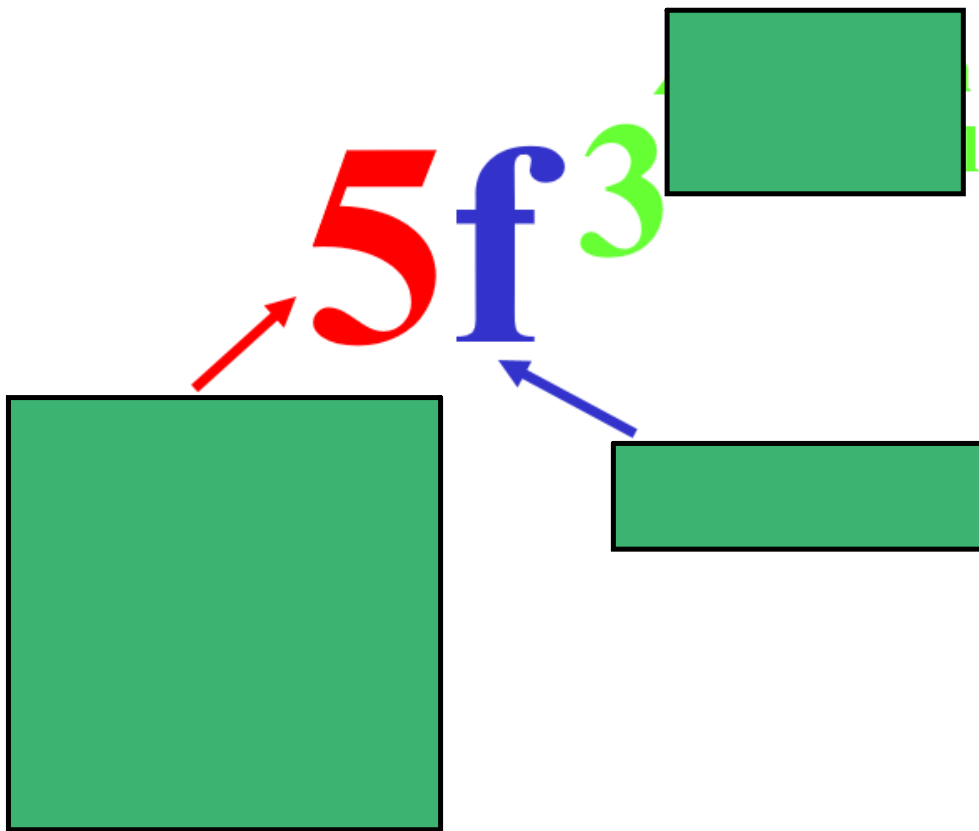
Pauli exclusion principle

- If 2 electrons occupy the same energy level they must have opposite spins.



Electron Configuration

**A detailed way of showing the
order in which electrons fill in
around the nucleus**



Example:

Give the **Orbital filling diagram** and **electron configurations** for:
Carbon, Sulfur, and Iron

