Chapter 5 Outline

Electrons in Atoms

- **Section 5.1 – Models of the Atom**
- The _____ model of the atom did not explain how an atom can _____ or the chemical properties of an atom.
- Niels Bohr studied the _____ atom because it was the most _____.
- _____ proposed that an electron is found only in specific _____ paths, or _____, around the nucleus.
- Each possible electron _____ in Bohr's model has a _____. The fixed energies an _____ can have are called _____ _____.
- The _____ get _____ together as you move _____ from the nucleus.
- The _____ also get higher in _____ as you move farther from the _____.
- Electrons can _____ from one _____ _____ to another.
- A _____ of energy is the amount of energy required to move an _____ from one _____ to another.
- An electron must _____ to jump to a _____ energy level.
- When an _____ has jumped to a _____ energy level, it is in an _____.
- An electron must _____ to fall to a _____ energy level.
- When an _____ is at the _____ energy level possible, it is at _____.
- _____ model accurately describes the movement of an electron in the _____ atom, but it cannot describe the movement of _____ atoms.
- The _____ of the atom is based on the mathematical

_____ of the location of _____ using the Schrodinger equation.

- The quantum mechanical model stills has _____, but the exact path or orbit of the electron is _____.
- Since the quantum mechanical model is based on the _____ of finding an electron, then the _____ are normally shaded with a _____ edge.
- An _____ is a region of space in which there is a _____ of finding an _____.
- Within the _____ of an atomic orbital, there is a _____ chance of finding an electron.
- The _____ the shading of the orbital, the _____ the chance of finding an _____.
- 4 Atomic Models
- Plum Pudding Model Rutherford's Model
- Bohr's Model Quantum Mechanical Model

- Each _____ can be composed of multiple _____.
- _____ are assigned a number from _____ based on the _____ on the periodic table.
- Each _____ can be composed of multiple _____.
- The _____ are assigned a letter: _____ _____.
- Each _____ can hold a maximum of _____ _____.

- All _____ have ____ orbital and can hold a maximum of ___ electrons.
- The _____ in front of s represents the _____. As the energy level _____, the _____ of the s sublevel _____, but it can still only hold ___ electrons. (Ex: 1s, 2s, 3s, etc.)
- The _____ has a _____ shape.
- All _____ have ___ orbitals and can hold a maximum of ___ electrons.
- The p sublevel has a _____ or _____ _____ shape. Each tear drop is referred to as a _____.
- All _____ have ___ orbitals and can hold a maximum of ___ electrons.
- The d sublevel has a _____ shape (4 lobes) or 2 lobes and a _____.
- All _____ have ___ orbitals and can hold a maximum of ___ electrons.
- All _____ have ___ orbitals and can hold a maximum of ___ electrons.
- There are not enough _____ to fill in the g sublevels yet.

Sublevel	# of Orbitals	# of Electrons
s	1	2
p	3	6
d	5	10
f	7	14
g	9	18

- **Section 5.1 Assessment**

1. Why did Rutherford's atomic model need to be replaced?

2. What was the basic new proposal in the Bohr model of the atom?

3. What does the quantum mechanical model determine about electrons in atoms?

4. How do two sublevels of the same principle energy level differ from each other?

5. How can electrons in an atom move from one energy level to another?

6. How many orbitals are in the following sublevels?
    a. 3p
    b. 2s
    c. 4p
    d. 3d
    e. 4f

- **Section 5.2 – Electron Arrangement in Atoms**
- The _____ of an atom is the arrangement of the _____.
- There are 3 rules that govern the electron configuration: _____

_____.

- _____ principle states that electrons occupy the _____ energy levels first.
- The following is a diagram of the order of the sublevels.
- _____ states that an orbital can hold at most ___ electrons.
- When ___ electrons occupy the same _____, they have _____ spins.
- _____ states that electrons would rather be _____ than together in a sublevel with multiple orbitals.
- When you write the _____ configuration for an element, the first step is to determine the number of _____ by using the _____ _____.
- For _____ charged particles, _____ electrons. For _____ charged particles, _____ electrons.
- The _____ are represented as _____ above the sublevel.

- The _____ are represented by _____. There can only be one ____ arrow and one _____ arrow in each _____.

- **Sample Problems**
- Write the arrow electron configuration for the following:
- B

- N

- V

- Zn

- **Practice Problems**
- Write the arrow electron configuration for the following:
- Ti

- S

- Se

- When you write the electron configuration in _____ form, the number of _____ in each sublevel is written as a _____.
- You fill in the _____ in the same order, but after you _____ the sublevels in _____ order.
- Ex: 1s, 2s, 2p, 3s, 3p, 4s, 3d

- **Sample Problem**
- Write the standard electron configuration for the following:
- F

- Ni

- Ga

- **Practice Problems**
- Write the standard electron configuration for the following:
- Ca

- Ag
- Al

- When writing electron configurations for large atoms, it is quicker to use the _____ _____.
- The noble gas configuration only includes the _____ before the element and the _____ incomplete energy level.

- **Sample Problem (Honors)**
- Write the noble gas configuration for the following:
- Te

- Y

- Ca

- **Practice Problems (Honors)**

- Write the noble gas configuration for the following elements:
- Fe

- Si

- K

- Sublevels are the _____ when they are _____ or exactly _____.
- This causes electrons to _____ to different sublevels to make the atom more _____.
- This _____ does not happen until the _____ energy level.
- There are only ___ exceptions that you need to memorize.

- **Sample Problem**
- Write the standard electron configuration for chromium.

- **Practice Problem**

- Write the standard electron configuration for copper.

- Do not use the exception for any element except ___ and ___.

- **Section 5.2 Assessment**

1. What are the three rules for writing the electron configuration of elements?

2. Explain why the actual electron configurations for some elements differ from those assigned using the Aufbau principle.
3. Arrange the following sublevels in order of increasing energy: 2p, 4s, 3s, 3d, and 3p.

4. Why does one electron in a potassium atom go into the fourth energy level instead of squeezing into the third energy level along with the eight already there?

- **Quantum Numbers (Honors)**
- _____ are a set of ___ numbers that can describe any _____.
- The four numbers are represented by letters: _____.
- ___ is the _____(1, 2, 3, 4, 5, 6, 7)
- ___ is the _____ (s = 0, p = 1, d = 2, f = 3, g = 4)
- __ is the _____.

0 -1 0 1

s p

-2 -1 0 1 2 -3 -2 -1 0 1 2 3

d f

- __ is the _____ (= 1/2, = -1/2)

- **Sample Exercise (Honors)**
- Write the quantum numbers for the following electrons:

1st –

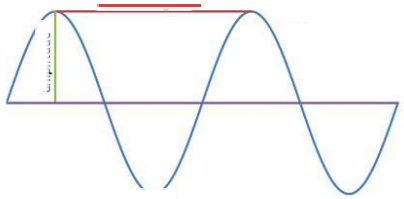
2nd-

3rd-

- **Practice Problems (Honors)**
- Write the quantum numbers for the following electrons:
- the last electron in Mn

- The 6th electron

- **Section 5.3 – Physics and the Quantum Mechanical Model**
- There are 4 properties of a wave that you need to be able to identify.
- The _____ is the _____ point of a wave.
- The _____ is the _____ point of a wave.
- The _____ the distance between the _____ and the _____.
- The _____ is the distance between _____ or two troughs.



- The _____ is the number of _____ that pass a given point in a certain amount of _____.
- _____ is measured in _____. A hertz is ____.

$c = \lambda v$

c = speed of light (3.00×10^8 m/s)

λ =

v =

- **Sample Problem**
- Calculate the wavelength of the yellow light emitted by a sodium lamp which has a frequency of 5.10×10^{14} Hz.

- **Practice Problem**
- What is the frequency of radiation with a wavelength of 5.00×10^{-8} m?

- All electromagnetic waves travel at the same _____, so as wavelength _____, frequency _____.
- The _____ is the set of specific _____ that are emitted when an element is electrified.
- The atomic emission spectra is _____ for each element just like _____ for humans.
- Atoms can emit _____ when you add heat, _____, or reaction energy.
- The electrons start at _____. When they absorb energy, they _____ to a higher energy level (excited state).
- They have to _____ the energy to fall back to _____, and they lose some of that energy in the form of _____.
- Atoms emit light when the electrons _____ to ground state.

- **Section 5.3 Assessment**

1. How are wavelength and frequency of light related?

2. Describe the cause of atomic emission spectrum of an element.