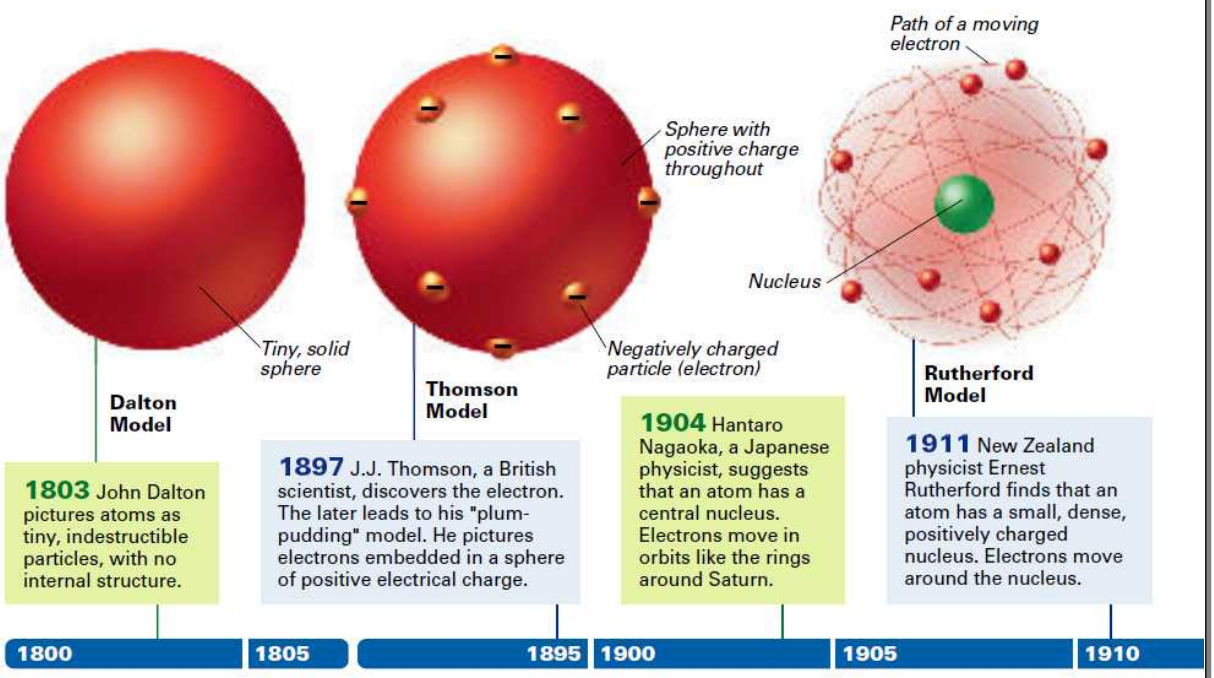
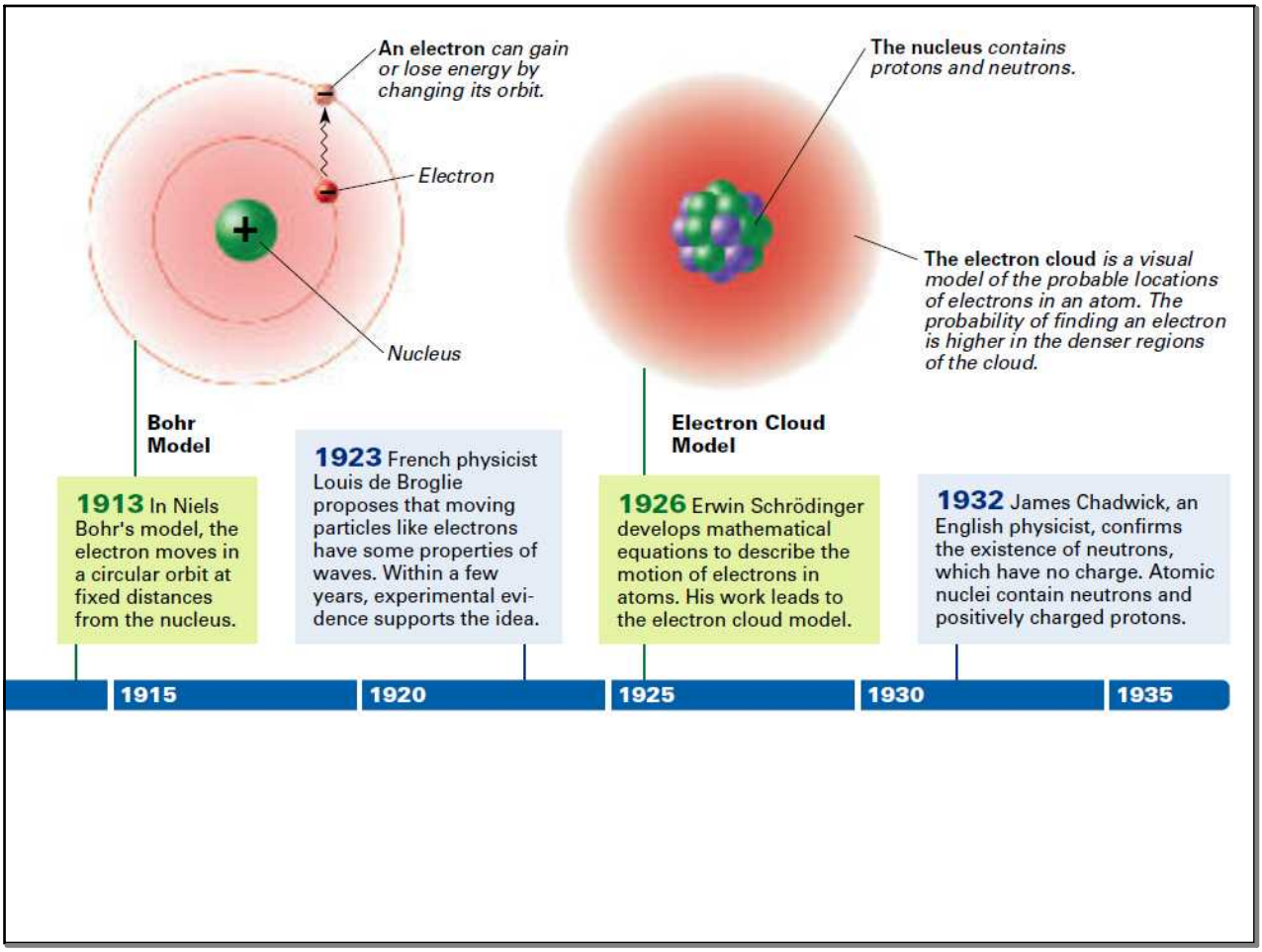
Section 5.1:Models of the Atom

- Dalton, Thompson & Rutherford all made great discoveries in the development of atomic structure
- 1913, Neils Bohr proposed that e^- could only exist in certain very specific energy levels, or orbits, around the nucleus.
- when an e^- receives energy from some source, it can move up to a higher orbit
- once their (excited state) the atom becomes unstable and the e^- immediately try to return to their original orbit.
- in order to return, they must give off the energy they absorbed to rise up

Quantum Mechanical Model

- ***determines the allowed energies an electron can have and how likely it is to find the electron in various locations around the nucleus.***
- ***each energy sublevel corresponds to an orbital of a different shape, which describes where the electron is likely to be found.***




An electron can gain or lose energy by changing its orbit.
Electron
Nucleus
The nucleus contains protons and neutrons.
The electron cloud is a visual model of the probable locations of electrons in an atom. The probability of finding an electron is higher in the denser regions of the cloud.
Bohr Model
Electron Cloud Model
1913 In Niels Bohr's model, the electron moves in a circular orbit at fixed distances from the nucleus.
1923 French physicist Louis de Broglie proposes that moving particles like electrons have some properties of waves. Within a few years, experimental evidence supports the idea.
1926 Erwin Schrödinger develops mathematical equations to describe the motion of electrons in atoms. His work leads to the electron cloud model.
1932 James Chadwick, an English physicist, confirms the existence of neutrons, which have no charge. Atomic nuclei contain neutrons and positively charged protons.
1915
1920
1925
1930
1935

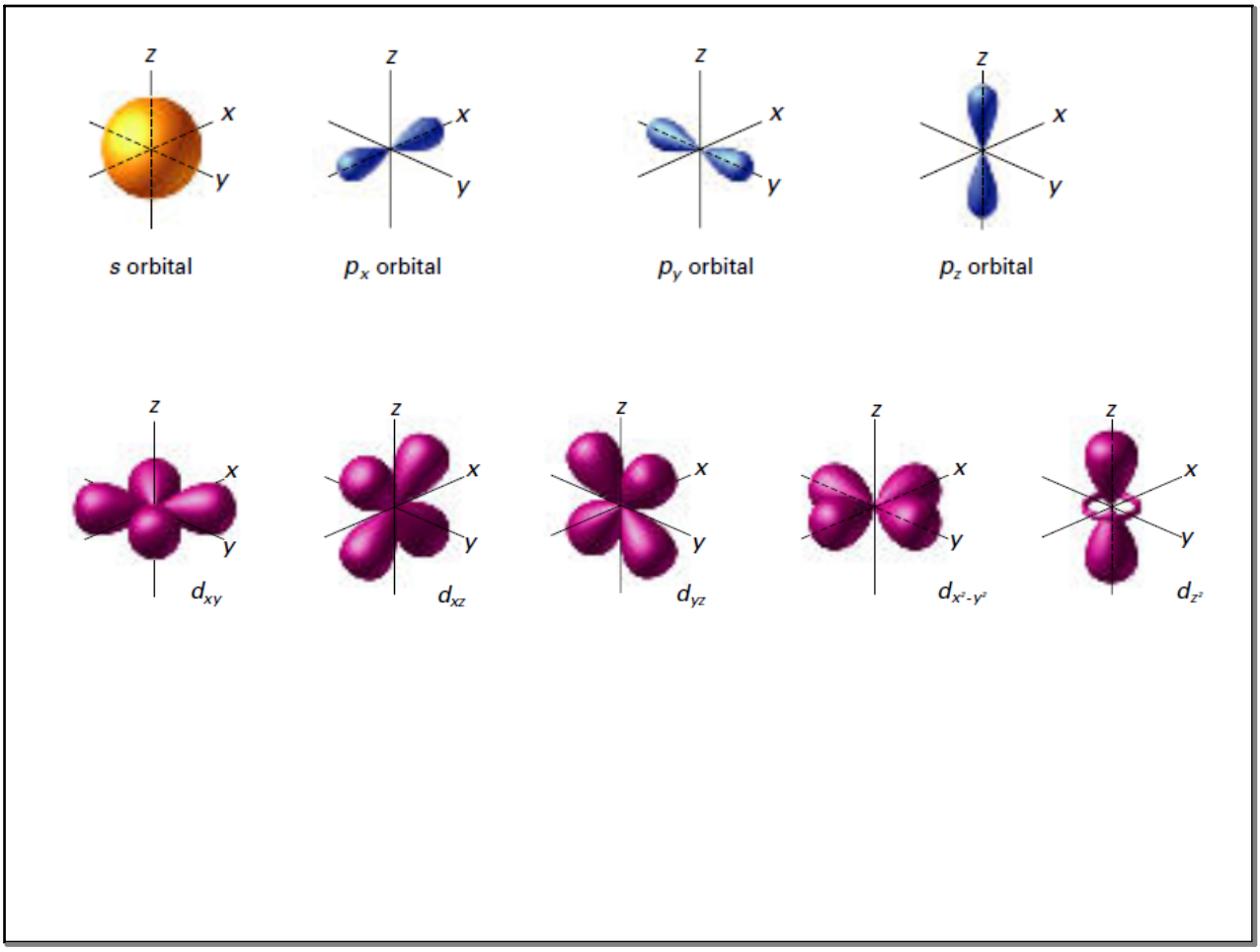

z
x
y
s orbital
p_x orbital
p_y orbital
p_z orbital
d_{xy}
d_{xz}
d_{yz}
$d_{x^2-y^2}$
d_{z^2}

Table 5.1

Summary of Principal Energy Levels, Sublevels, and Orbitals

Principal energy level	Number of sublevels	Type of sublevel
$n = 1$	1	1*s* (1 orbital)
$n = 2$	2	2*s* (1 orbital), 2*p* (3 orbitals)
$n = 3$	3	3*s* (1 orbital), 3*p* (3 orbitals), 3*d* (5 orbitals)
$n = 4$	4	4*s* (1 orbital), 4*p* (3 orbitals), 4*d* (5 orbitals), 4*f* (7 orbitals)

Table 5.2

Maximum Numbers of Electrons

Energy level *n*	Maximum number of electrons
1	2
2	8
3	18
4	32