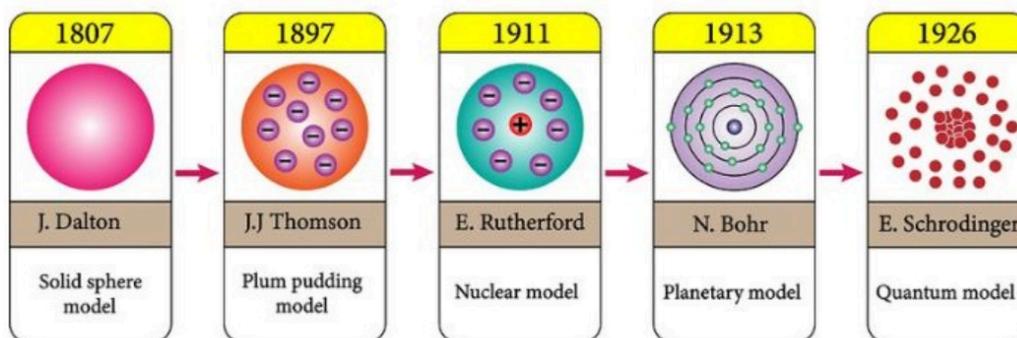


[VIDEO LINK](#)

Schrödinger's Quantum Mechanical Model of the Atom

- I. Reflect back on the models of that atom and how they were modified as time progressed.

ATOMIC MODELS



II. Bohr's Model

A. The Good:

1. His concept that electrons are quantized (specific amounts of energy).
2. Supported by emission spectra (specific lines of color).

B. The Not So Good:

1. His idea that electrons move in circular orbits.
2. In theory, as an electron moves in a circular path it should radiate energy continuously. So a continuous spectrum should be observed. Not seen.

III. Schrödinger's Model

A. Key Points

1. Bohr treated an electron strictly as a particle.
2. Developments in Quantum Mechanics especially by scientists [Heisenberg](#) (suggested viewing) and [De Broglie](#) (suggested viewing) helped Schrödinger to develop his Quantum Mechanical Model based on the dual nature of the electron. It is a particle BUT it also acts like a wave!

B. His [cat](#). (suggested viewing)

C. Schrödinger's Equation

Kinetic Energy + Potential Energy = E

Classical
Conservation of Energy
Newton's Laws

$$\frac{1}{2}mv^2 + \frac{1}{2}kx^2 = E$$

$$F = ma = -kx$$

Harmonic oscillator example.

Quantum
Conservation of Energy
Schrodinger Equation

The energy becomes the Hamiltonian operator

$$H\Psi = E\Psi$$

Wavefunction

Energy "eigenvalue" for the system.

The form of the Hamiltonian operator for a quantum harmonic oscillator.

$$H = \frac{p^2}{2m} + \frac{1}{2}kx^2$$

In making the transition to a wave equation, physical variables take the form of "operators".

$$p \rightarrow \frac{\hbar}{i} \frac{\partial}{\partial x}$$

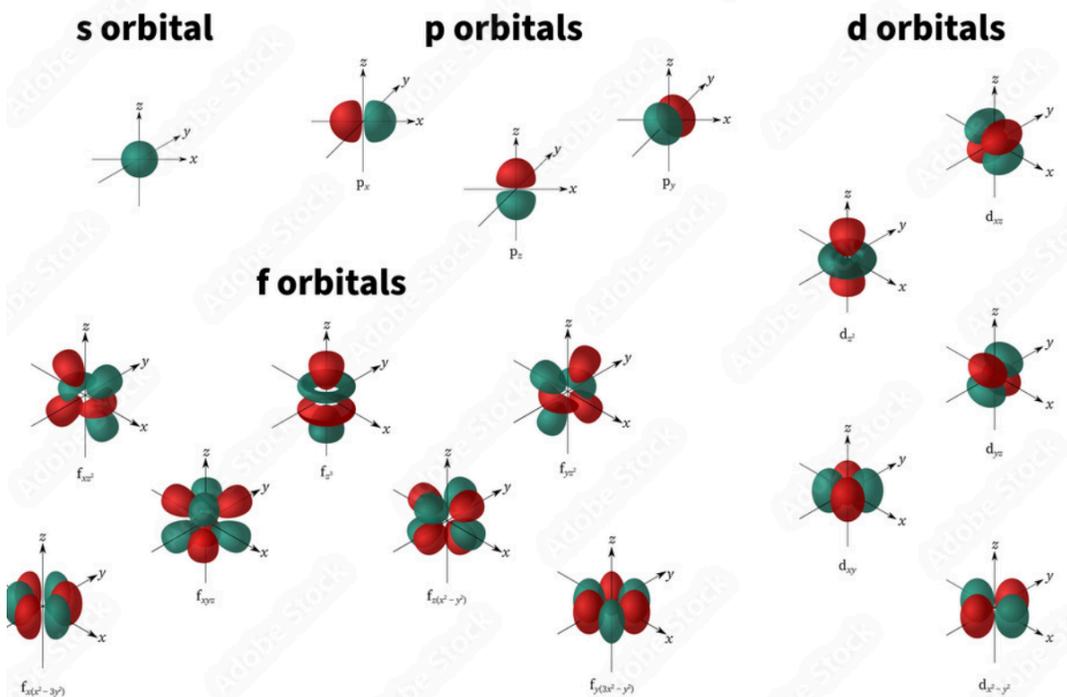
$$x \rightarrow x$$

$$H \rightarrow \frac{-\hbar^2}{2m} \frac{\partial^2}{\partial x^2} + \frac{1}{2}kx^2$$

IV. Orbitals and Quantum Numbers

A. What is an Orbital?

Atomic Orbitals: s, p, d, and f



- B. The Principal Quantum Number
 - 1. Symbol
 - 2. Mathematical values
 - 3. What it describes
 - 4. Hotel Analogy

- C. The Angular Momentum Quantum Number
 - 1. Symbol
 - 2. Mathematical values
 - 3. What it describes
 - 4. Hotel analogy

- D. Magnetic Quantum Number
 - 1. Symbol
 - 2. Mathematical values
 - 3. What it describes
 - 4. Hotel analogy

- E. Electron Spin Quantum Number
 - 1. Symbol
 - 2. Mathematical values
 - 3. What it describes
 - 4. Hotel analogy

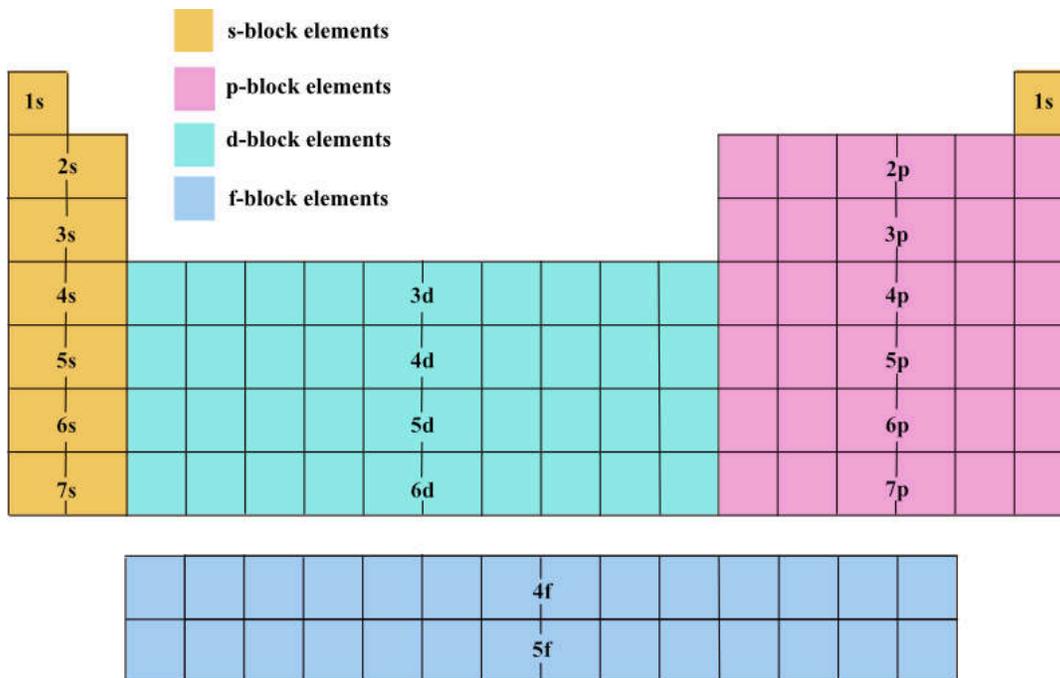
V. Types of problems

- A. Given that $n=8$, what values can l have?

- B. Given that $l=6$, what values can m_l have?

- C. Determine which sets of quantum numbers are not possible
 - 1. $n=3$ $l=2$ $m_l=-1$ $m_s= +\frac{1}{2}$
 - 2. $n=4$ $l=1$ $m_l= 0$ $m_s= -\frac{1}{2}$
 - 3. $n=6$ $l=7$ $m_l=-5$ $m_s= +\frac{1}{2}$
 - 4. $n=5$ $l=4$ $m_l= 5$ $m_s= -\frac{1}{2}$

VI. Where are we going?



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Dr. Anne O'Connor

Element	Electron Configuration	Element	Electron Configuration
H	$1s^1$	Na	$1s^2 2s^2 2p^6 3s^1$
He	$1s^2$	Mg	$1s^2 2s^2 2p^6 3s^2$
Li	$1s^2 2s^1$	Al	$1s^2 2s^2 2p^6 3s^2 3p^1$
Be	$1s^2 2s^2$	Si	$1s^2 2s^2 2p^6 3s^2 3p^2$
B	$1s^2 2s^2 2p^1$	P	$1s^2 2s^2 2p^6 3s^2 3p^3$
C	$1s^2 2s^2 2p^2$	S	$1s^2 2s^2 2p^6 3s^2 3p^4$
N	$1s^2 2s^2 2p^3$	Cl	$1s^2 2s^2 2p^6 3s^2 3p^5$
O	$1s^2 2s^2 2p^4$	Ar	$1s^2 2s^2 2p^6 3s^2 3p^6$
F	$1s^2 2s^2 2p^5$	K	$1s^2 2s^2 2p^6 3s^2 3p^6 4s^1$
Ne	$1s^2 2s^2 2p^6$	Ca	$1s^2 2s^2 2p^6 3s^2 3p^6 4s^2$