Quantum Mechanics - the study of the behavior of very small things. (like an e⁻!)

Quantum Scientist	Theory/ Experiment	How to Remember (Memory Tool)
Max Planck	• "Quanta" discrete amount of energy ↑ $E = h\nu$ ↑	discrete amt. of steps to walk the planck
Einstein	• Photons - packets of light that are particles travelling in waveform. • Photoelectric Effect	
Bohr	• Worked with the line spectra for Hydrogen & Helium • discovered Energy levels (n)	bohring
Compton	photons → e⁻ e⁻ e⁻ e⁻ → e⁻ • proved that photons are particles when photons collided w/ e⁻	Compton Collision
DeBroglie	• <u>Dual Nature</u> - all matter has mass (particle) & waveform, the larger the particle the less you can see the waveform (vibration)	De-Dual
Heisenburg	• <u>Uncertainty Principle</u>: it is impossible to simultaneously measure speed (momentum) & location. * You must choose one or the other to study *	

Pauli

- Pauli Principle: the two e⁻ that share an orbital must have opposite spins.

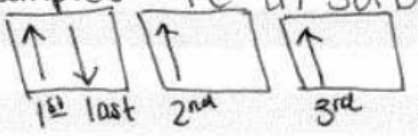
written as: $+\frac{1}{2}, -\frac{1}{2}$ or ↑↓

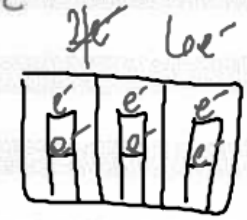
Hund

Hund's Rule

- e⁻ must be placed w/ topspin ($+\frac{1}{2}$ or ↑) in each available orbital before the second e⁻ can be added

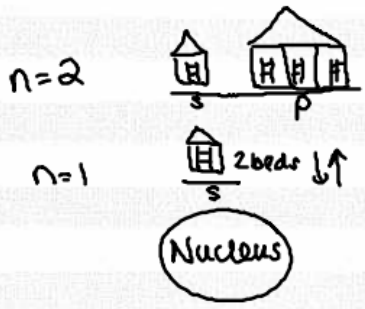
Example: 4e⁻ in 3 orbitals

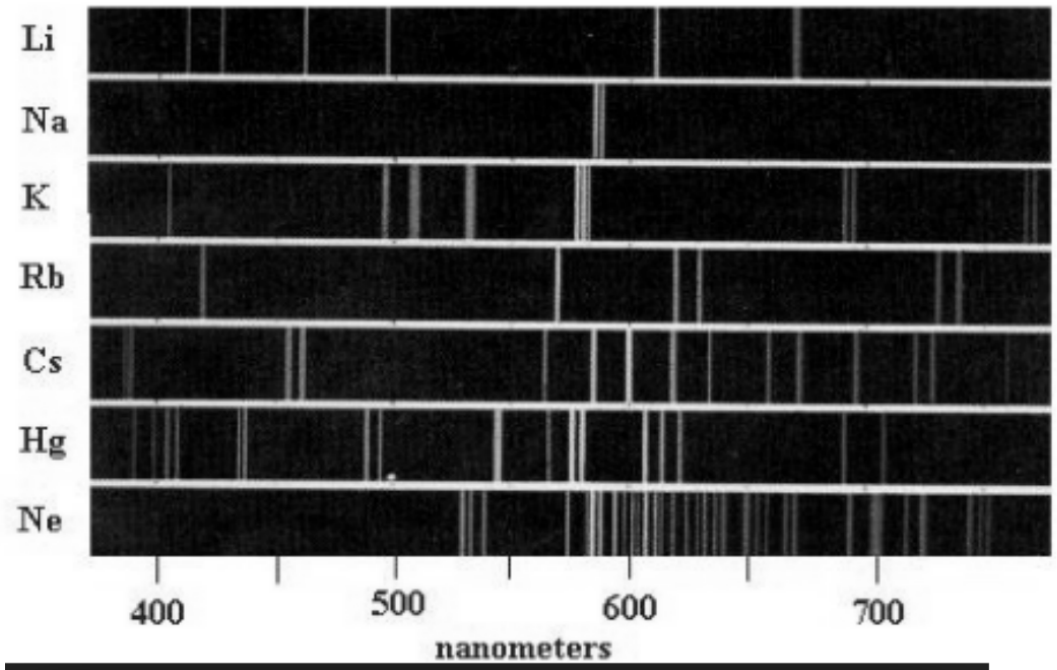


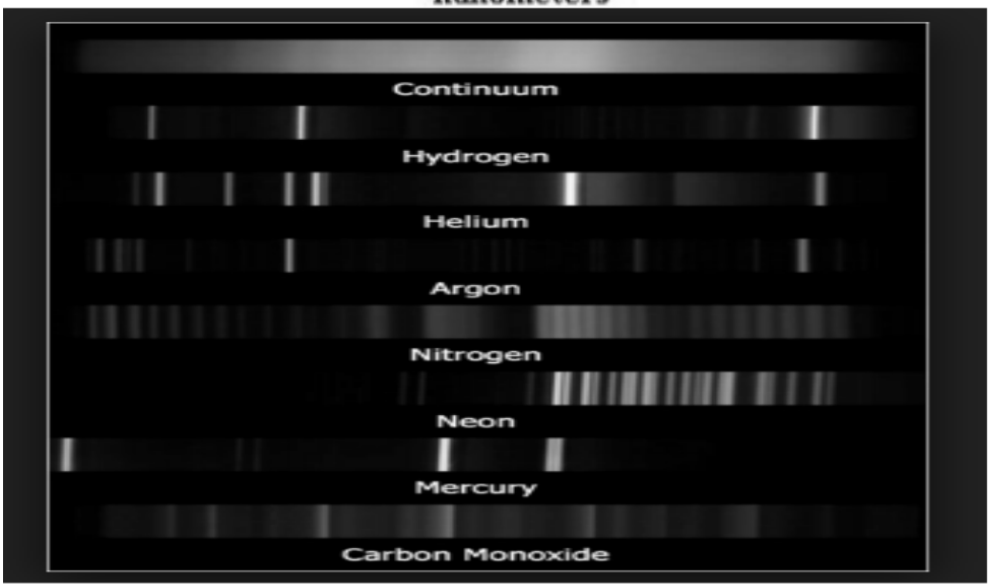


Aufbau

- Aufbau Principle: in the ground state of an atom e⁻ fill orbitals of the lowest available energy requirement before filling higher energy requirements




Li
Na
K
Rb
Cs
Hg
Ne
400
500
600
700
nanometers


Continuum
Hydrogen
Helium
Argon
Nitrogen
Neon
Mercury
Carbon Monoxide

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Bohr	• Worked with the Line spectra for Hydrogen & Helium • discovered Energy levels (n)	Bohr-ring
Compton	photons → e⁻ e⁻ e⁻ e⁻ → e⁻	Compton collision Not straight outta Compton
	• proved that photons are particles when photons collided w/ e⁻	
DeBroglie	• Dual Nature - all matter has mass (particle) & waveform, the larger the particle the less you can see the waveform (vibration)	De-Dual Down to Earth DeBroglie
Heisenberg	• Uncertainty Principle: it is impossible to simultaneously measure speed (momentum) & location. * You must choose one or the other to study *	Heisen → high speed berg → location Iceberg - frozen atom

Pauli

- **Pauli Principle**: the two e⁻ that share an orbital must have opposite spins.

written as: $+\frac{1}{2}, -\frac{1}{2}$ or ↑↓

Hund

- e⁻ must be placed w/ topspin ($+\frac{1}{2}$ or ↑) in each available orbital before the second e⁻ can be added

Hunds Rule

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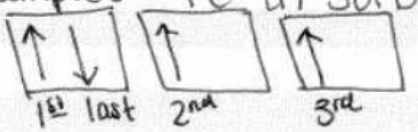
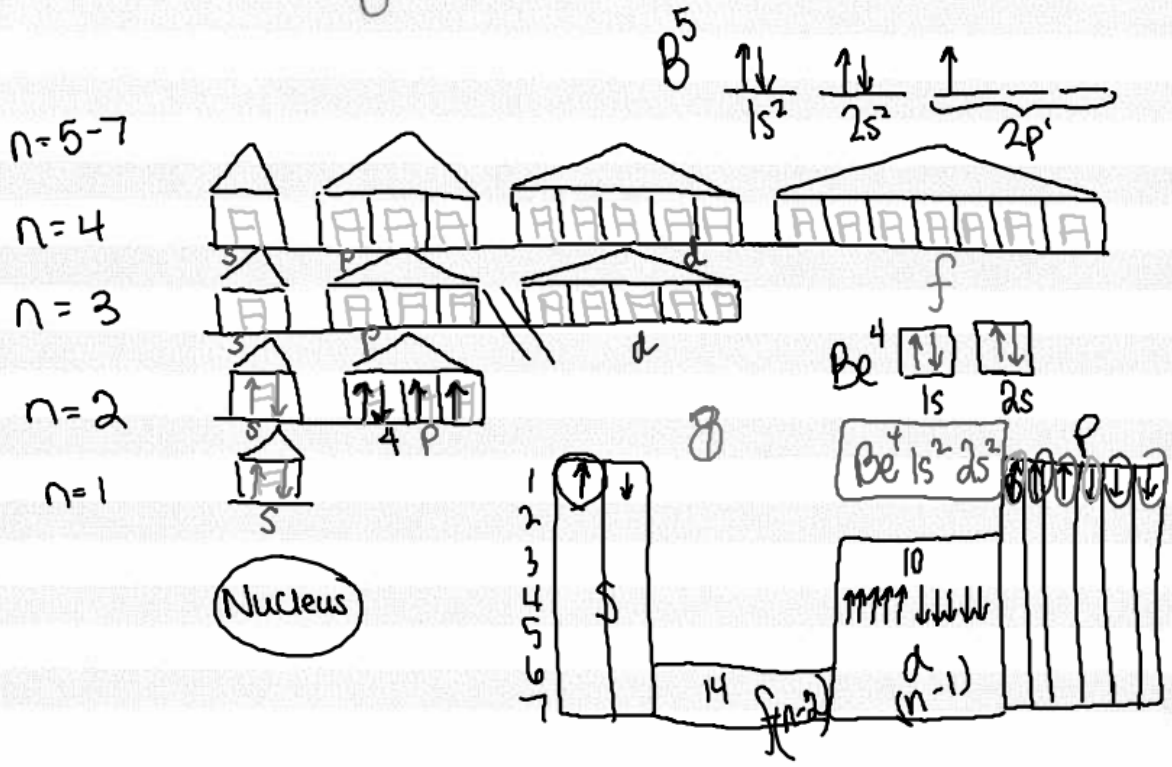
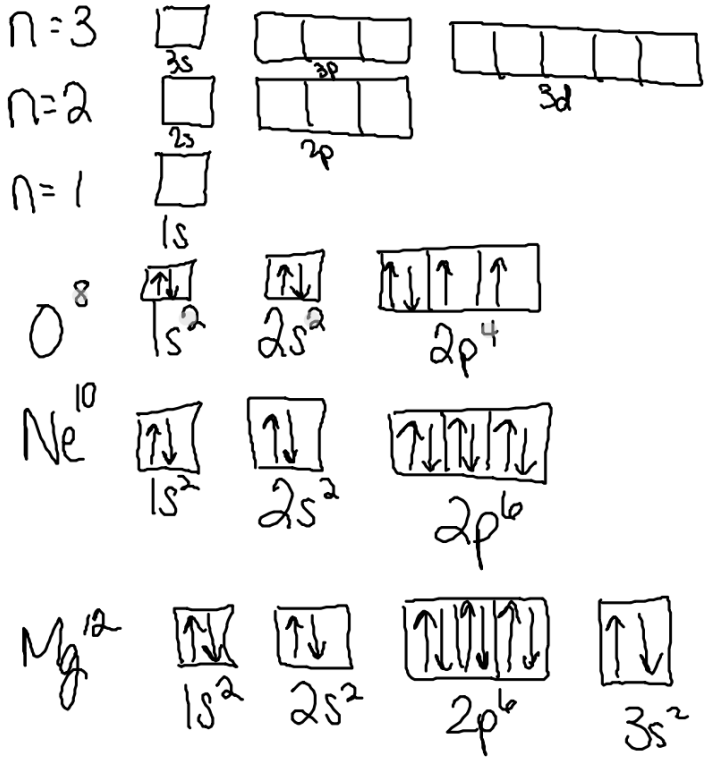
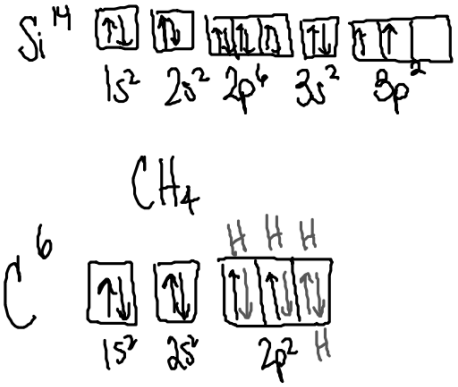


Aufbau

- **Aufbau Principle**: in the ground state of an atom e⁻ fill orbitals of the lowest available energy requirement before filling higher energy requirements




n=3
n=2
n=1
3s
3p
3d
2s
2p
1s
O 8
1s2
2s2
2p4
Ne 10
1s2
2s2
2p6
Mg 12
1s2
2s2
2p6
3s2


Si 14
1s2 2s2 2p6 3s2 3p2
CH4
C 6
H H H
H
1s2 2s2 2p2

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Bohr	• Worked with the line spectra for Hydrogen & Helium • discovered Energy levels (n)	Bohr-ring
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	• proved that photons are particles when photons collided w/ e⁻	
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Heisenburg	• Uncertainty Principle: it is impossible to simultaneously measure speed (momentum) & location. * You must choose one or the other to study *	Heisen-speed burg - location

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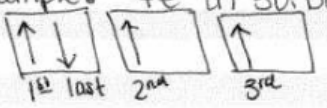

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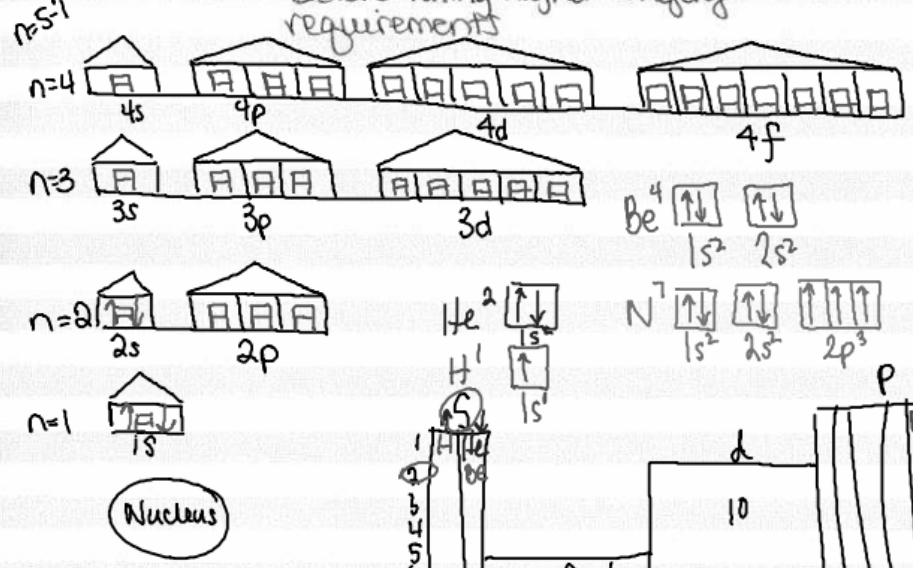

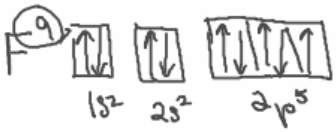

Ne 10 ↑↓ ↑↓ ↑↓ ↑↓ ↑↓
1s² 2s² 2p⁶