Quantum Mechanical Atom

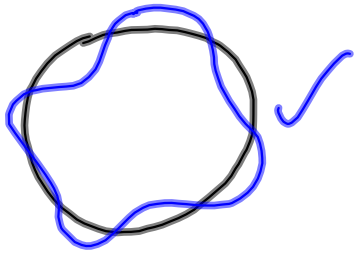
Are electrons particles or waves?

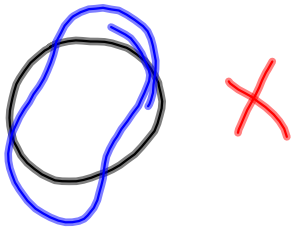
- very small
- very fast

- mass
- predict motion (momentum)

- no mass
-

Wave Mechanical Model





Quantum Mechanical

- electrons have quanta of energy

Heisenberg Uncertainty Principle

- you cannot detect position and momentum of the electron.
- Use the term "orbital"
  - 90% probability of e^- location

see p.137

Electron Configuration

- Symbols are used to show electron location. (which orbital)
- Aufbau (building-up)
  - e^-'s fill the lowest E level (orbitals) first.
  - $n = 1, 2, 3, 4 \ldots$

$$\#e^- = 2n^2$$

n	$\#e^-$
1	2
2	8
3	18
4	32

Electron sub-levels

→ E

s p d f (orbitals)

↓ ↓ ↓ ↓

1 3 5 7 → $2e^-$/orbital (max.)

$\#e^-$ 2 6 10 14 (use this later for diagonal rule)

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Writing Electron Configuration

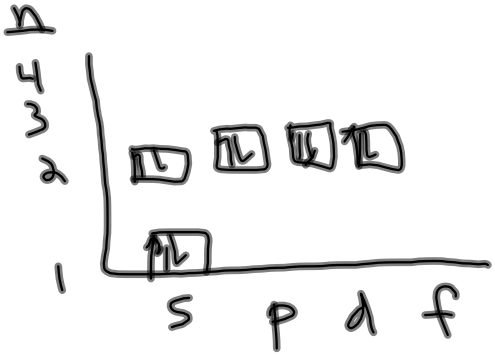
Bohr

e.g. $_1H - 1s^1$

n

sub-level

e^-



Ground state configuration

$_2He - 1s^2$

$_3Li - 1s^2 2s^1$

$_4Be - 1s^2 2s^2$

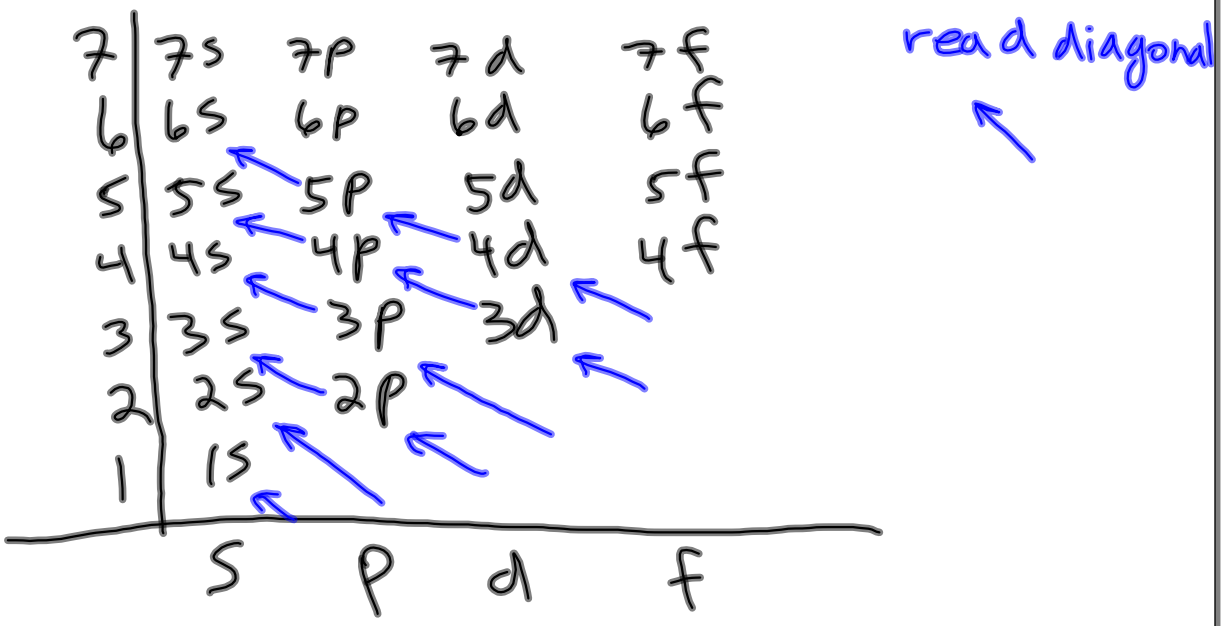
$_5B - 1s^2 2s^2 2p^1$

$_6C - 1s^2 2s^2 2p^2$

$_{10}Ne - 1s^2 2s^2 2p^6$

Diagonal Rule

Used for multi-electron atoms.
Electrons in the atom interact & orbitals "overlap" in energy.
Different order for filling orbitals.



e.g. $_{26}Fe - 1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^6$

$_{51}Sb - 1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^{10} 4p^6 5s^2 4d^{10} 5p^3$

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or $[Kr]\, 5s^2 4d^{10} 5p^3$

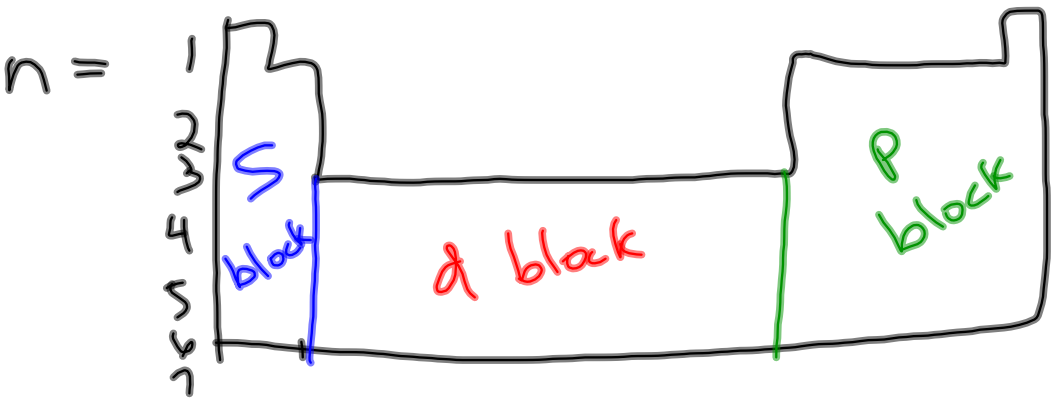
Electron Configuration and the Periodic Table

$_{6}C - 1s^2 2s^2 2p^2$

$_{14}Si - 1s^2 2s^2 2p^6 3s^2 3p^2$

$_{32}Ge - 1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^{10} 4p^2$

Similar outer orbital config.



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