QUANTUM

$E = h\nu$
$c = \lambda\nu$ } E of photon

VIS λ 400-780nm

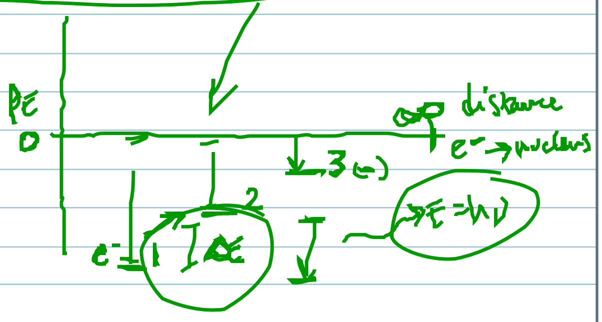
$c = 2.998 \times 10^8$ m/s $= 2.998 \times 10^{17}$ nm/s
1×10^9 nm $= 1$ m

$F = \frac{kQ_1Q_2}{r^2}$

e⁻'s closer to the nucleus experience a greater attractive force

→ Planck
→ Bohr

$E_n = (-)\frac{2.178 \times 10^{-18} J}{n^2}$



e⁻'s further from the nucleus have a less (-) E
"higher E"

⟹ it takes less E to remove an e⁻ further from nucleus (IE, PES)

e⁻ configurations

Heisenberg → uncertainty

Pauli ⟹ max 2e⁻/orbital ; opposite spin → $+\frac{1}{2}$, $-\frac{1}{2}$
↑ ↓

Hund's Rule ⟹ 1e⁻/orbital in a set before second

minimize e⁻/e⁻ repulsion ↓E

Shroedinger ⟹ orbitals / probabilities
e⁻ E levels → sublevels (orbitals)

Aufbau → "ground up" lowest E fills first

QUANTUM

$E = h\nu$
$c = \lambda\nu$ } E of proton

VIS λ 400 - 780nm

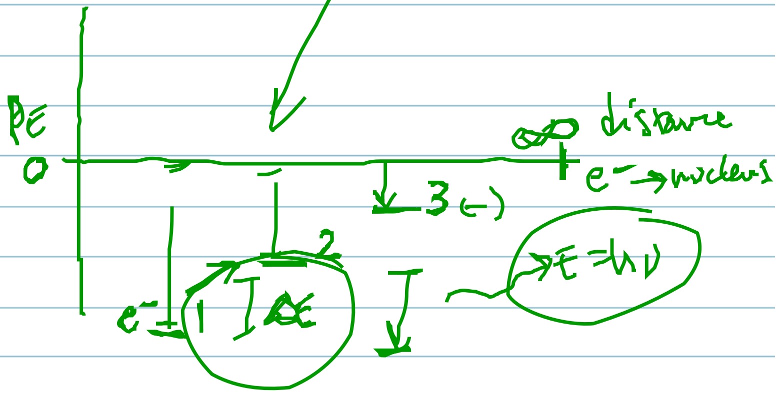
$c = 2.998 \times 10^{8} m/s = 2.998 \times 10^{17} nm/s$
$1 \times 10^{9} nm = 1 m$

$F = \frac{kQ_1Q_2}{r^2}$

e⁻'s closer to the nucleus experience a greater attractive force

Planck
Bohr

$E_n = \frac{-2.178 \times 10^{-18} J}{n^2}$



e⁻'s further from the nucleus have less (-) E
"higher E"

⟹ it takes less E to remove an e- further from nucleus (IE, PES)

e- configurations

Heisenberg ⟶ uncertainty

Pauli ⟹ max 2e⁻/orbital ; opposite spin ⟶ $+\frac{1}{2}$, $-\frac{1}{2}$
↑ ↓

Hund's Rule ⟹ 1e⁻/orbital in a set before second

minimize e⁻/e⁻ repulsion ↓E

Shroedinger ⟹ orbitals / probabilities

e⁻ E levels ⟶ sublevels (orbitals)

Aufbau ⟶ "growing up" lowest E fills first valence

Fe $[Ar]\,4s^2\,3d^6$ ground state

$[Ar]\,4s^1\,3d^7$ "excited state"

Fe^{2+} $[Ar]\,3d^6$ always lose s before d's } t. metals

Fe^{3+} $[Ar]\,3d^5$

paramagnetic / diamagnetic

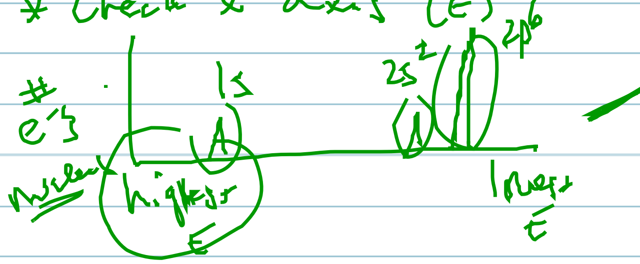
✓ ⊘

unpaired e's $3d^6$ ⇅ ↿ ↿ ↿ ↿ 3d

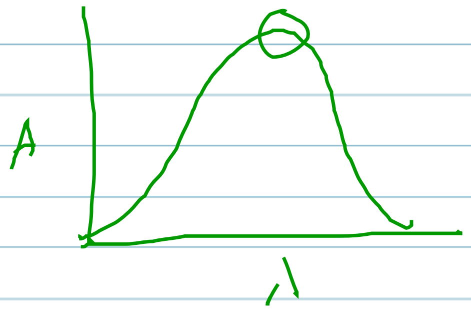
SPECTROSCOPY (ν's)

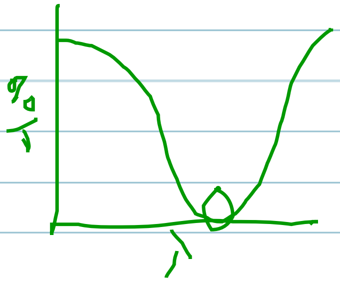
↑ν → ↓ν X-rays UV P.E.S. ⇒ electronic arrangement — transitions

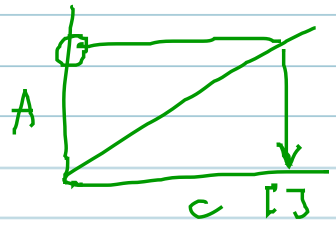
* check x axis (E)



Vis ⇒ colorimetry Beer's Law $A = abc$ $A \propto c$ COLORED SOLN's + transition metals



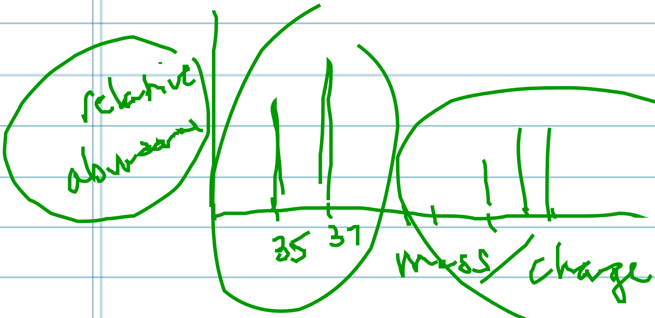




microwave → rotations
IR → vibrations
} structure

MASS SPECTROSCOPY

$\bar{x}$ atomic mass of element



* watch for diatomics

Cl_2 ^{37}Cl ^{35}Cl

35×2 → 70
35+37 → 72
~~37~~ 37×2 → 74

isotope mass × % abundance =
" " =
" " =
+ $\boxed{\quad\quad}$ average atomic mass

amu