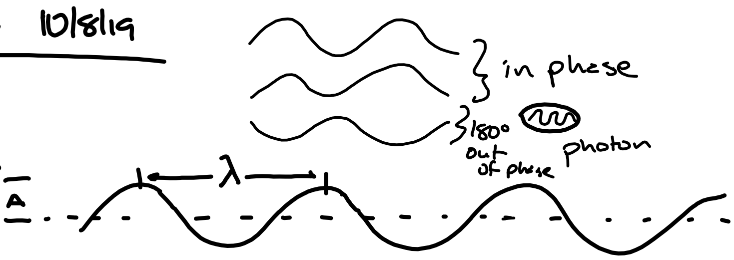
Tuesday 10/8/19

Waves



wavespeed = $\frac{\lambda}{\text{Period}}$

" " $= \lambda f$

$\lambda \nu$

lambda nu

frequency = $\frac{\text{cycles}}{\text{second}}$ Hertz

$\frac{1}{s} = s^{-1} = Hz$

period = $\frac{1}{\text{frequency}} = \frac{\text{seconds}}{\text{cycle}}$

lightspeed = $\lambda \nu$

Speed of light = 3.00×10^8 m/s

$$\frac{3.00 \times 10^8 \text{ m}}{1 \text{ s}} \times \frac{10^2 \text{ cm}}{1 \text{ m}} \times \frac{1 \text{ in}}{2.54 \text{ cm}} \times \frac{1 \text{ ft}}{12 \text{ in}} \times \frac{1 \text{ mi}}{5280 \text{ ft}} \times \frac{3600 \text{ s}}{1 \text{ hr}} = 6.71 \times 10^8 \frac{\text{mi}}{\text{hr}}$$

The energy of a photon $E = h\nu$

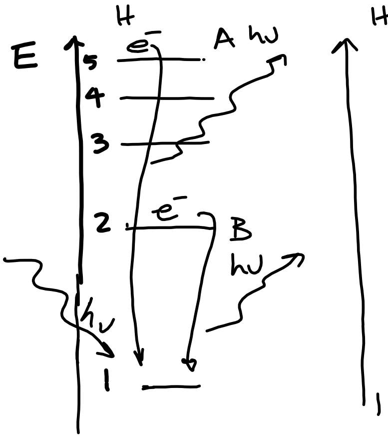
0 1

h = Planck's constant

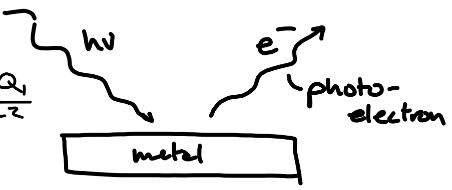
6.626×10^{-34} J·S

ν = 'nu', frequency in $\frac{1}{s}$

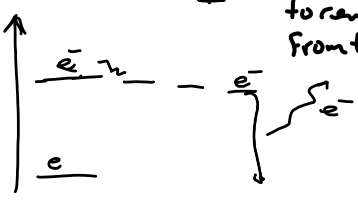
Electrons in H atom



$F = k\frac{Q Q_1}{r^2}$



Φ = the energy required to remove an e⁻ from the surface



wavespeed = $\lambda\nu$

speed and energy of a photon inversely

S.O.L → $c = \lambda\nu$ $E = h\nu$

$\nu = \frac{c}{\lambda}$

$$\boxed{E = \frac{hc}{\lambda}}$$

$y = m \cdot \frac{1}{x}$

Chem 1A Homework
for Mon 10/14

Read: 4.2
DO: 15-22 p.126

$F \propto d$

$F_A = 2.30 \times 10^{-8} N \quad d_A = 0.10 m$

$\div$

$F_B = 0.58 \times 10^{-8} N \quad d_B = 0.20 m$

$\frac{F_A}{F_B} = 4 \qquad \frac{d_A}{d_B} = \frac{1}{2}$

F_B is $\frac{1}{4}$ of $F_A \qquad d_B = \frac{1}{2}$ of d_A

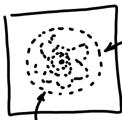
$F \propto \left(\frac{1}{d}\right)^2$

Wed 10/9/19

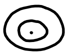
Current model of the atom

Since ~1926

E. Schröedinger



Bohr model 1916



Gravitational Force

$$F_g = G \frac{m_1 m_2}{r^2}$$

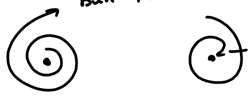
Coulomb's Law

$$F_E = k \frac{Q_1 Q_2}{r^2}$$

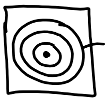
Å = angstrom

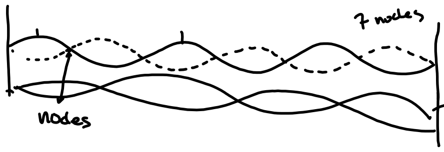
1×10^{-10} m

Inverse-squared laws



Bohr model 1918





Solutions to the Schröedinger wave equation give us 3+1 quantum numbers that describe, in general terms the energy and relative positions of electrons around atoms.

Quantum #s

n = the Principal Q.N. n = 1 → ∞ (integers)

→ indicates overall energy and distance from nucleus

ℓ = angular momentum Q.N. ℓ = 0 → (n−1) (integers)

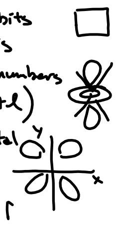
→ indicates the type of subshell the orbital inhabits

→ tells you what the shape of the orbital is

m_ℓ = magnetic quantum # m_ℓ = (−ℓ → +ℓ) (whole numbers)

→ tells the orientation in space of the orbital

→ which axis it inhabits.



m_s = spin Q.N. m_s = (−1/2, +1/2)

→ this one ensures that each orbital can hold only two e^-

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n	ℓ	m_ℓ	m_s	
1−∞	0−(n−1)	−ℓ → +ℓ	−1/2, +1/2	
1	0 − spherical (1s)	0	−1/2, +1/2	$2e^-$
2	0 − s (2s)	0	−1/2, +1/2	$2e^-$
	1 − p	−1 0 +1	(−1/2, +1/2)×3	$6e^-$
3	0 − s	#of orbs		
	1 − p	−1, 0, +1		
	2 − d	−2, −1, 0, 1, 2		$10e^-$
4	0 − s	0		$2e^-$
	1 − p	−1, 0, 1		$6e^-$
	2 − d	−2, −1, 0, 1, 2		$10e^-$
	3 − f	−3, −2, −1, 0, 1, 2, 3		$14e^-$ $32e^-$

Monday 10/14/19

Quantum #s and the shapes of atomic orbitals.

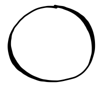
→ Quantum #s

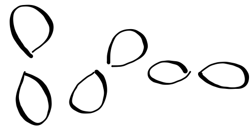
tells you

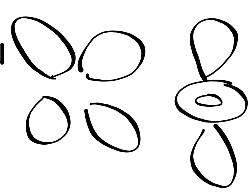
principal QN n — relative distance from nucleus

$[1 \to \infty]$ — relative energy of electrons in that level.

→ angular momentum QN → l — $[0 \to (n-1)]$

$l = 0$: 1s →  $l = 0$: 2s 

2p → ($l = 1$)  3p 

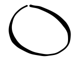
3d → ($l = 2$)  + 3 others 4d 

→ tells shape of orbitals

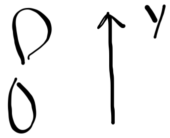
→ what type of sublevel the electron is in

→ magnetic QN. $m_l (-l \to +l)$

— tells the orientation in space of the orbitals in a sublevel

for 1s → $l = 0$ $m_l = 0$ → 

for 2p → $l = 1$ m_l

-1 → 

0 → 

+1 → 

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m_s $+1/2, -1/2$

↳ tells the magnetic spin-state of the e^-

→ really sets the max occupancy of an orbital @ $2e^-$

Electron Configurations

3 Rules for assigning electron configurations for atoms in the ground-state.

① Aufbau Rule

→ lowest energy orb.s fill 1st

② Pauli Exclusion Principle

→ no two electrons can be described by the same 4 quantum #s

→ this means $2e^-$ max / orbital

③ Hund's Rule (ski-trip)

→ degenerate orbitals fill singly first electrons pair after

E ↑

3s $\boxed{\uparrow}$

2p $\boxed{\uparrow\downarrow}$ $\boxed{\uparrow\downarrow}$ $\boxed{\uparrow\downarrow}$ for Na $1s^2 2s^2 2p^6 3s^1$

2s $\boxed{\uparrow\downarrow}$

1s $\boxed{\uparrow\downarrow}$

ROYGBIV

λ = longest

ν = smallest

λ = shortest

ν = highest

frequency 'nu'

$$\boxed{E = h\nu \qquad c = \lambda\nu \qquad E = \frac{hc}{\lambda}}$$

$c = 3.00 \times 10^{8}\ m/s$

$h = 6.626 \times 10^{-34}\ J \cdot s$

$1\ nm = 1 \times 10^{-9}\ m$

$1\ m = 1 \times 10^{9}\ nm$