Office Hours 2/17

Energy of a Photon

EQUATIONS

$E = h\nu$

$c = \lambda\nu$

$\Downarrow$

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

E: energy (J)
h: Planck's constant (6.626×10^{-34} J·s)
ν: frequency (1 Hz = $1 s^{-1}$)
λ: wavelength (m)
c: speed of light ($3 \times 10^8 \frac{m}{s}$)

CONVERSIONS

(M)	macro-	1000000 m
(k)	kilo-	1000 m
(h)	hecto-	100 m
(da)	deca-	10 m
(m)	**meter**	1 m
(d)	deci-	0.1 m
(c)	centi-	0.01 m
(m)	milli-	0.001 m
(M)	micro-	0.000001 m
(n)	nano-	0.000000001 m

$E_{photon} = h\nu = \frac{hc}{\lambda}$ (Joules)

$E_{mol\ photons} = E_{photon} \times \underbrace{\text{Avogadro's \#}}_{(6.022 \times 10^{23}\ mol^{-1})} = \frac{hcN_A}{\lambda}$ (Joules per mol)

$30\ mm \times \frac{1\ m}{1000\ mm} = 0.03$ meters

$30\ km \times \frac{1000\ m}{1\ km} = 30000\ m$

$$600\ \text{MM} \times \frac{1\ \text{m}}{10^{6}\ \text{MM}}$$

$$600\ \text{MM} \times \frac{10^{-6}\ \text{m}}{1\ \text{MM}}$$

.000600 m

769

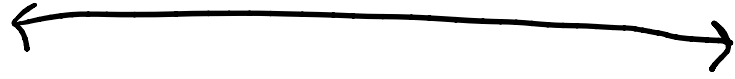
$$700\ m \times \frac{1\ Mm}{10^{-6}\ m}$$

$$700\ m \times \frac{10^{6}\ Mm}{1\ m}$$

$$663\ nm \times \frac{10^{-6}\ m}{1\ nm} \qquad 0.000663$$

$$E = \frac{hc}{\lambda} \rightarrow \frac{J \cdot s}{m}$$

short λ
high ν
high E



long λ
low ν
low E

γ | x-rays | UV | VIS | IR | micro | radio

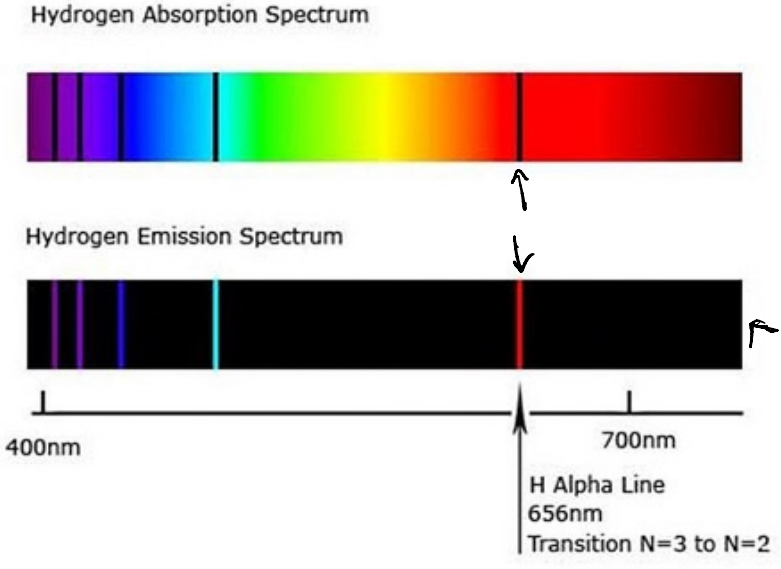
V I B G Y O R

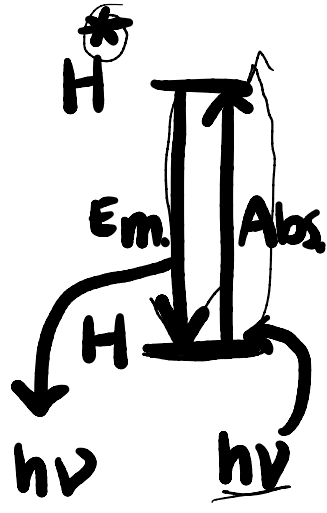
ionizes

excites

vibrates

rotates





Balmer series: when $n > 2$ to $n = 2$ (Vis).

Lyman series: when $n > 1$ to $n = 1$ (UVs).

* Quantum Numbers *

n: principle quantum number
(main energy level)
↳ comes from horizontal rows in ptable.
1, 2, 3, 4, 5, 6, 7

SIZE

l: angular momentum QN.
(shape of orbital / subshell)
↳ 0 to n-1

0, 1, 2, 3, 4, 5, (6)
↓ ↓ ↓ ↓
s p d f

correspond to sections on ptable - we'll learn later.

SHAPE

Orbital notation: uses n & ℓ

If $n=2$ & $\ell=1$, you'd say that electron is in the 2p orbital.

m_ℓ: magnetic quantum number
(possible orbitals in subshell)

↳ $\pm \ell$ values & 0

$(2\ell+1)$

So, if $\ell=3$ $\quad (2(3)+1)=7$

m_ℓ: $-3, -2, -1, 0, 1, 2, 3$

ORIENTATION

m_s: spin quantum number
(direction of spin)

↳ $\pm \frac{1}{2}$ always

SPIN DIRECTION