Optical Properties:—

Tuesday, March 30, 2021 1:25 PM

Two different phenomena

- Surface Plasmon resonance (Metals)
- Increased energy level spacing → (Semiconductors)

(i) Surface Plasmons Resonance →

Charge of e^- = -1.6×10^{-19} Coulomb

Charge of p^+ = $+1.6 \times 10^{-19}$ Coulomb

atom — ion

Neutral — Not neutral

$_6C^{12}$ → No. of e^- = 6 → $6 \times -1.6 \times 10^{-19}$ C

" " p^+ = 6 → $6 \times +1.6 \times 10^{-19}$ C

Net Charge of $_6C^{12}$ ⇒ total charg of e^- + totale charge of p^+

⇒ $-6 \times 1.6 \times 10^{-19} + 6 \times 1.6 \times 10^{-19} = 0$

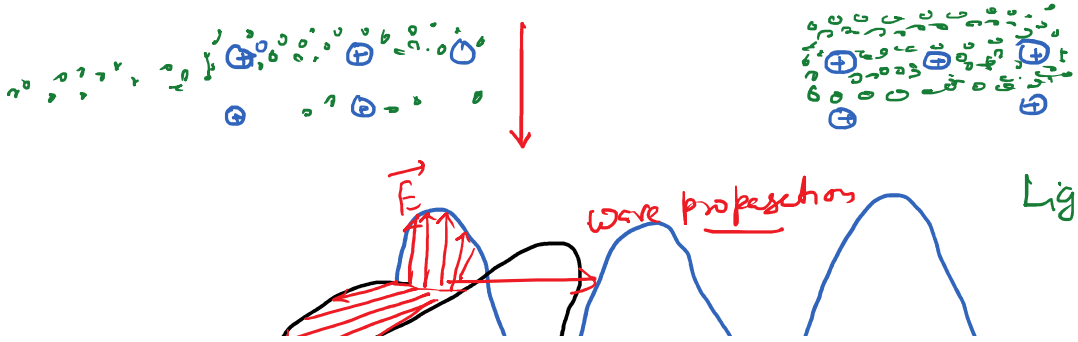
↳ solid, liquid and gas — 3 states of matter

↳ Plasma — 4th state matter

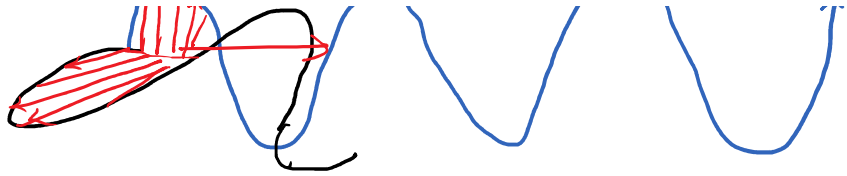
↳ Collection of ions and electrons

⇒ ionized gas ⇔ Plasma

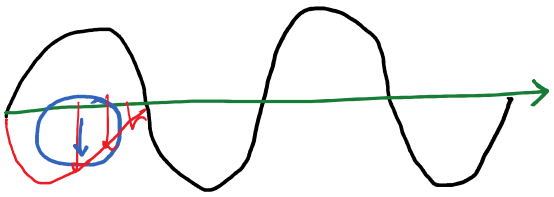
↳ Metals ⇒ Are they good conductors of Electricity



Light is basic example of oscillating electric field



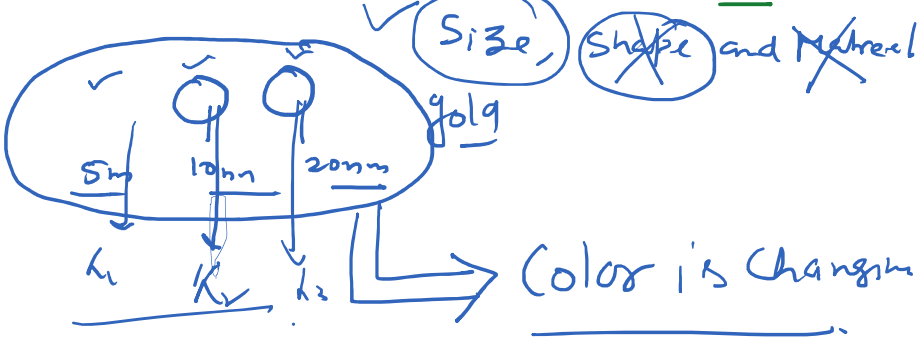
of oscillating Electric field



↳ If the Electric field is Oscillating (like Photon) then sea of e⁻s will oscillate too.

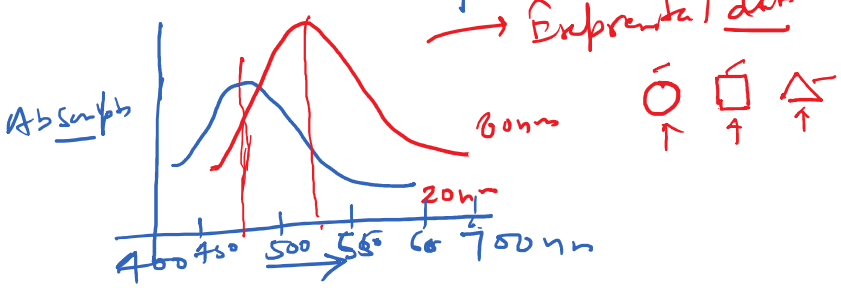
These oscillations are quantised and ~~see~~ resonate at specific frequencies. Such oscillations are called plasmons.

↳ Resonance →



Au nano material :—

Size		Peak Wavelength (SPR)
5 nm	—	512-520 nm
10 nm	—	" nm
15 nm	—	520 nm
20 nm	—	524 nm



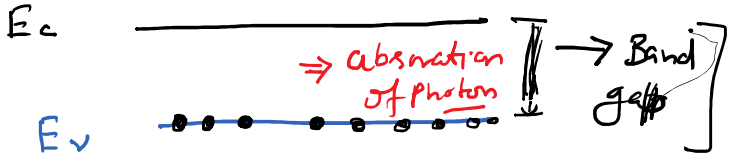
(ii) Increment in band gap :— Semiconductor

(i) ... the valence band ... to the

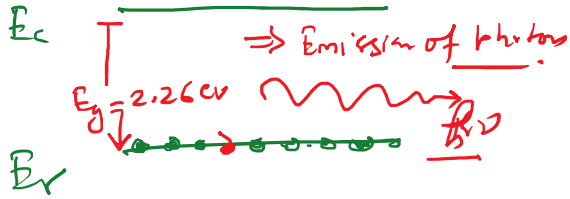
(i) In semiconductors, the **valance band** corresponds to the ground state of the valance electrons.

(ii) **Conduction band** corresponds to excited states where electrons are free to move about in the material and and participate in conduction.

(iii) In order for conduction to take place, e^- must be excited out of the valence band, across the band gap, into conduction band. This process is known as carrier generation



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



$$\lambda = \frac{4.13 \times 10^{-15}\ eV \times 2.998 \times 10^{8}\ m/s}{2.26\ eV}$$

$$\boxed{\lambda = 550\ nm} \longrightarrow \text{green light}$$