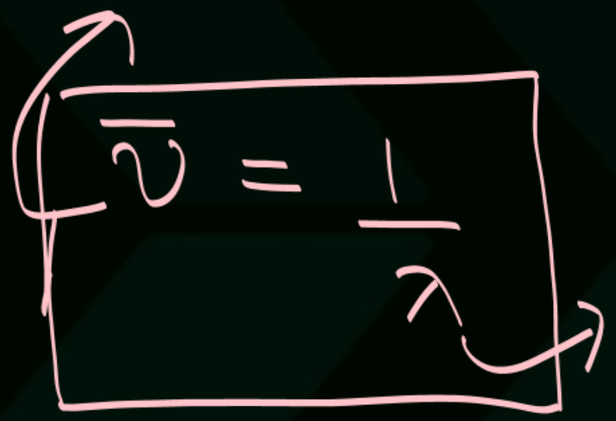
Class 11th | Chemistry

प्रारंभ BATCH

Unit : 1

Structure of Atom



$\bar{\nu}$ proportional λ ?

A) Directly

B) Inversely.

Lecture - 5

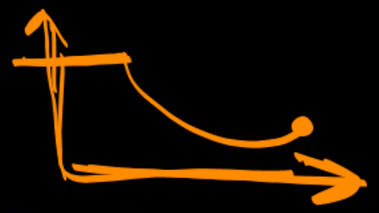
Properties of electromagnetic wave

- The oscillating electric and magnetic fields produced by oscillating charged particles are perpendicular to each other and both are perpendicular to the direction of propagation of the wave.

- Unlike sound waves or waves produced in water, electromagnetic waves do not require medium and can move in vacuum. It is now well established that there are many types of electromagnetic radiations, which differ from one another in wavelength (or frequency). These constitute which is called electromagnetic spectrum.

Electromagnetic Spectrum

- Different kinds of units are used to represent electromagnetic radiation.
- These radiations are characterised by the properties, namely, frequency (v) and wavelength (Λ).
- In vaccum all types of electromagnetic radiations, regardless of wavelength, travel at the same speed, i.e., 3.0×10^8 m/s (2.997925×10^8 m/s , to be precise). This is called speed of light and is given the symbol c.

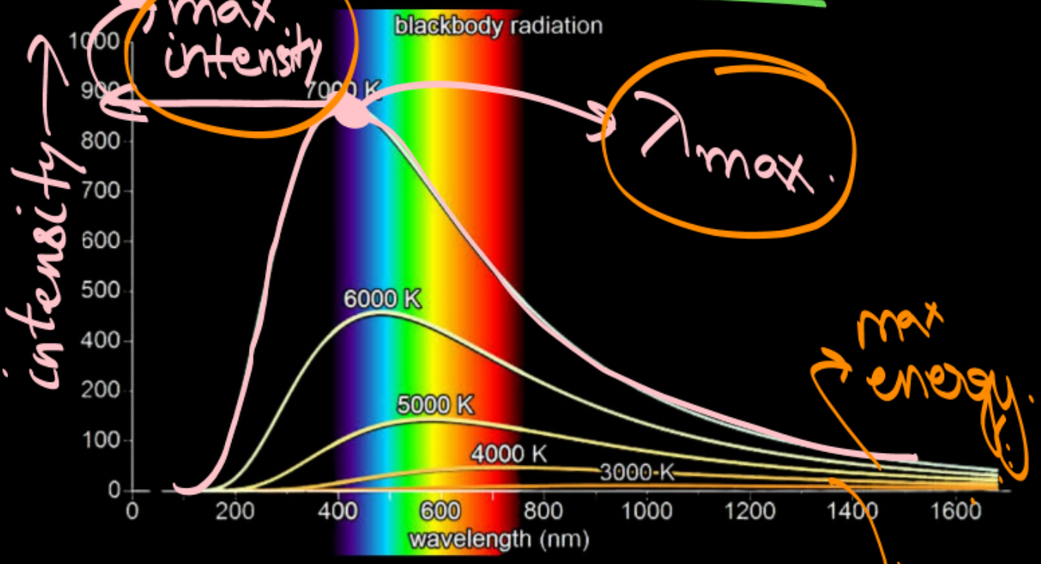


Iron Rod → Heat → Yellow, Orange, Red, Blue

Temp change ↓ increase.

Black Body Radiation

- An ideal body, which emits and absorbs radiations of all frequencies uniformly, is called a black body and the radiation emitted by such a body is called black body radiation.
- In practice, no such body exists. Carbon black approximates fairly closely to black body.
- The different colours that come out of the black body depends on it's temperature.



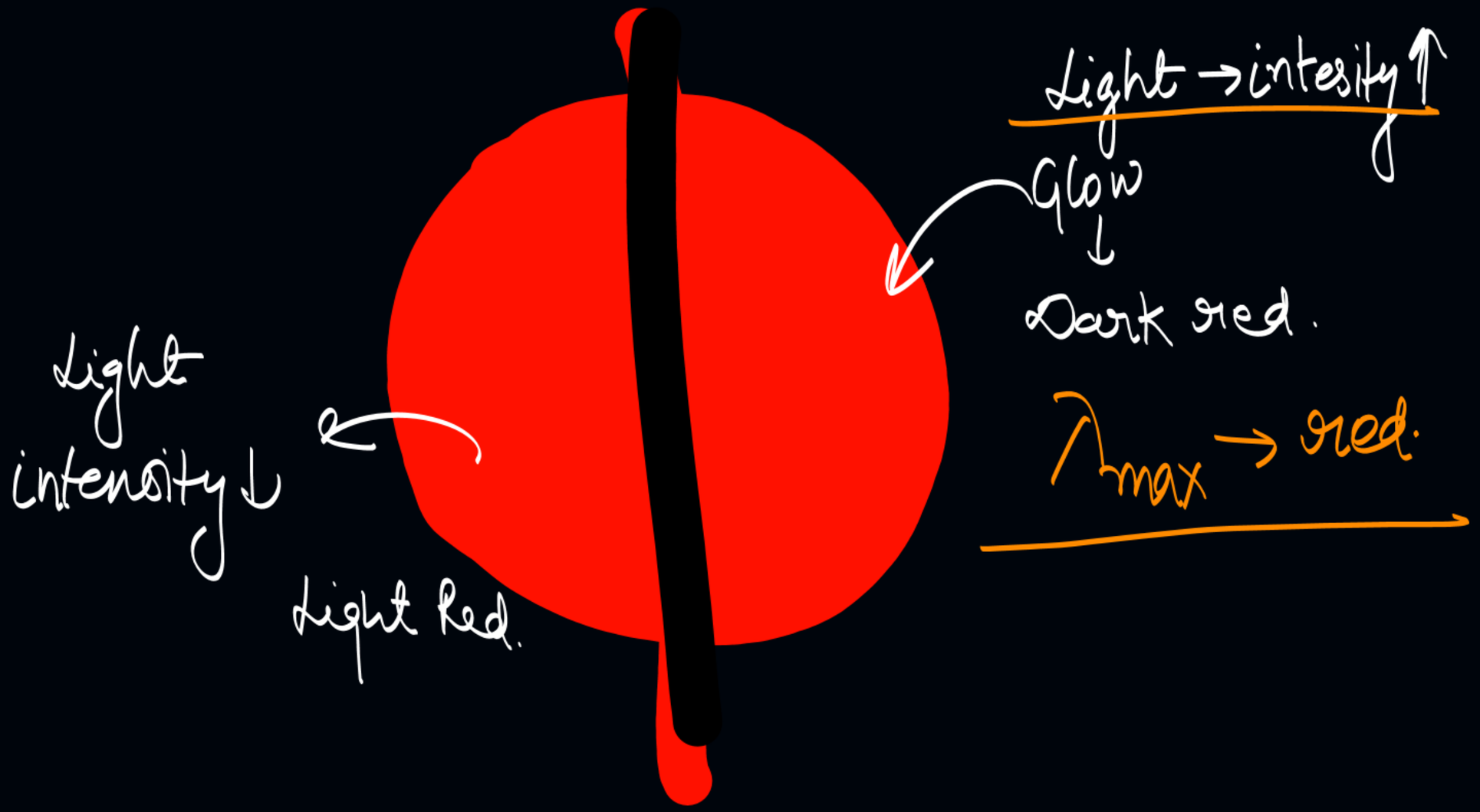
max intensity → ↗max.

max energy.

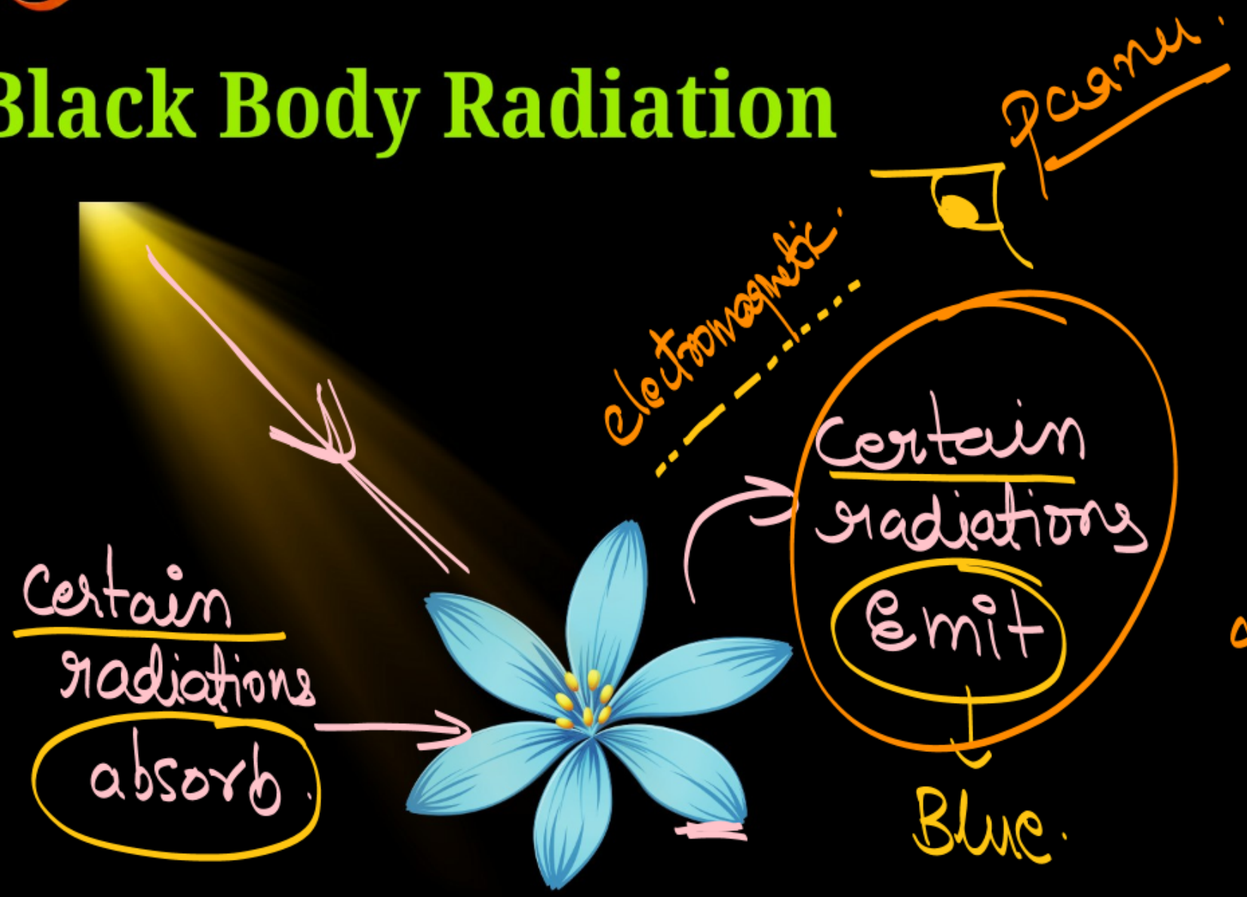
(iron rod)

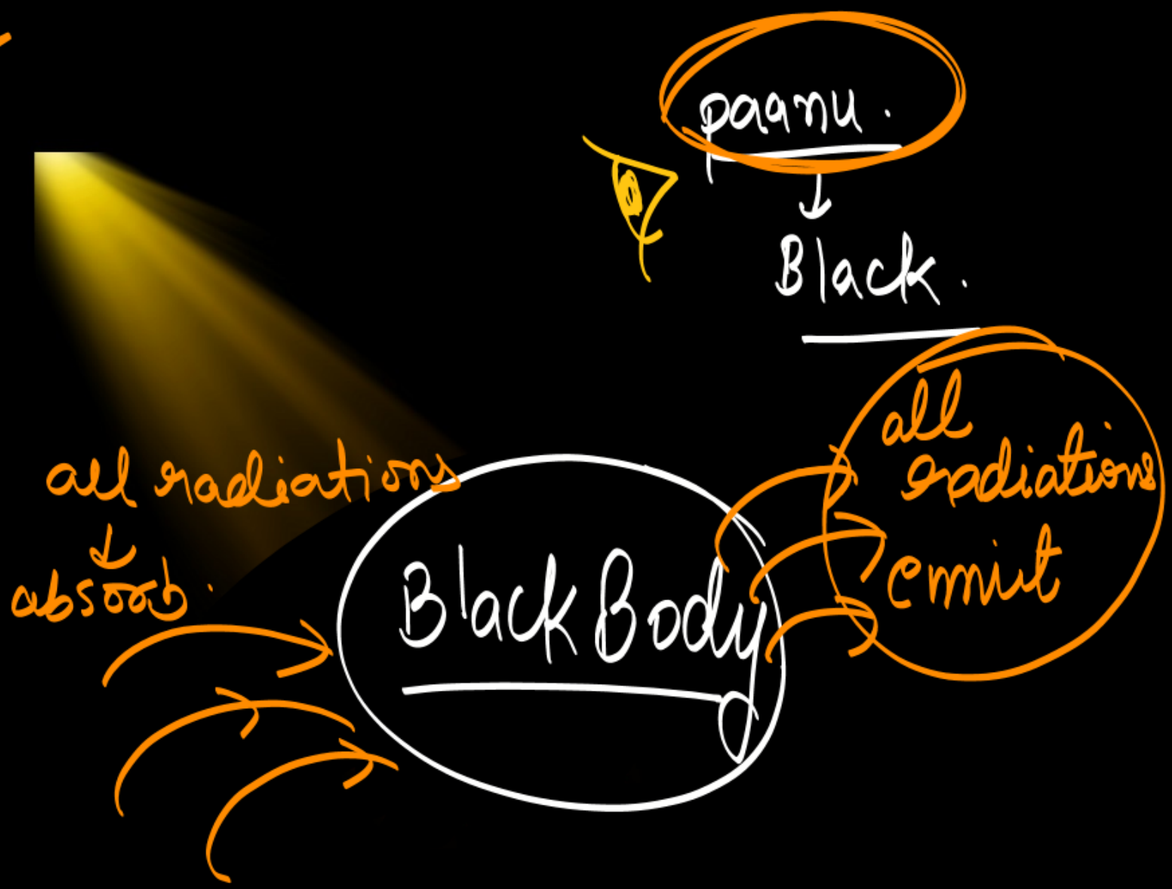
intensity ↑ → ↗↑

wavelength → smaller energy


Light → intesity ↑
Glow
Dark red.
λmax → red.
Light
intensity ↓
Light Red.

Black Body Radiation





Reflects blue light but absorbs other radiations.
This increases jiggling motion of electron (electrons are accelerated) & it releases thermal radiation & the temperature remains the same.

Black Body Radiation

- Blackbody spectrum depends only on the temperature of the object, and not on what it is made of.
- As the temperature of an object increases, it emits more blackbody energy at all wavelengths.
- As the temperature of an object increases, the peak wavelength of the blackbody spectrum becomes shorter (blue).
- The blackbody spectrum always becomes small at the left-hand side (the short wavelength, high frequency side).

Particle Nature of Electromagnetic Radiation: Planck's Quantum Theory $E = h\nu$

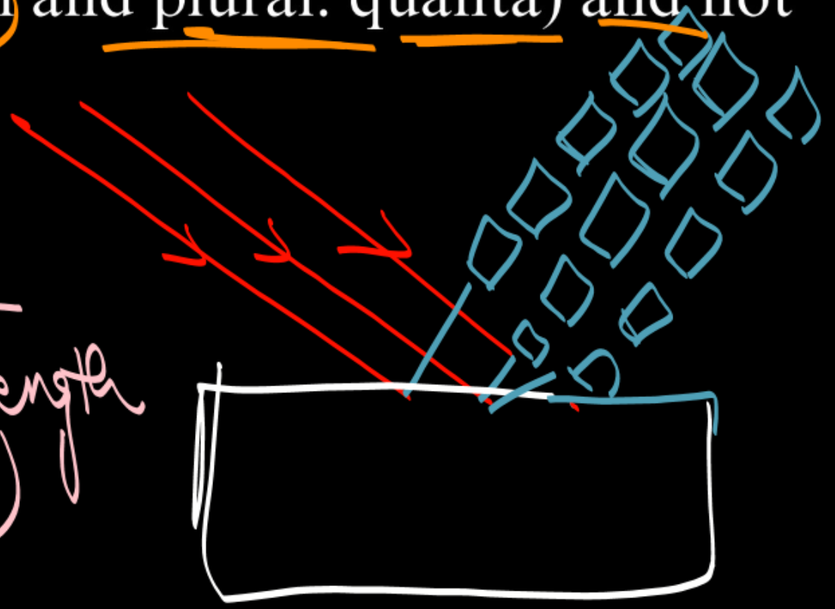
- The nature of emission of radiation from hot bodies *(black-body radiation)* ejection of electrons from metal surface when radiation strikes it *(photoelectric effect)* variation of heat capacity of solids as a function of temperature.
- Line spectra of atoms with special reference to hydrogen. These phenomena indicate that the system can take energy only in discrete amounts.
- All possible energies cannot be taken up or radiated.

Plank's Quantum Theory

Light → wave
→ particle nature

The radiant energy or electromagnetic radiation is emitted or absorbed discontinuously in the form of small discrete packets of energy (singular: quantum and plural: quanta) and not continuously.

Energy of photon $\propto \frac{1}{\text{wavelength } (\lambda)}$



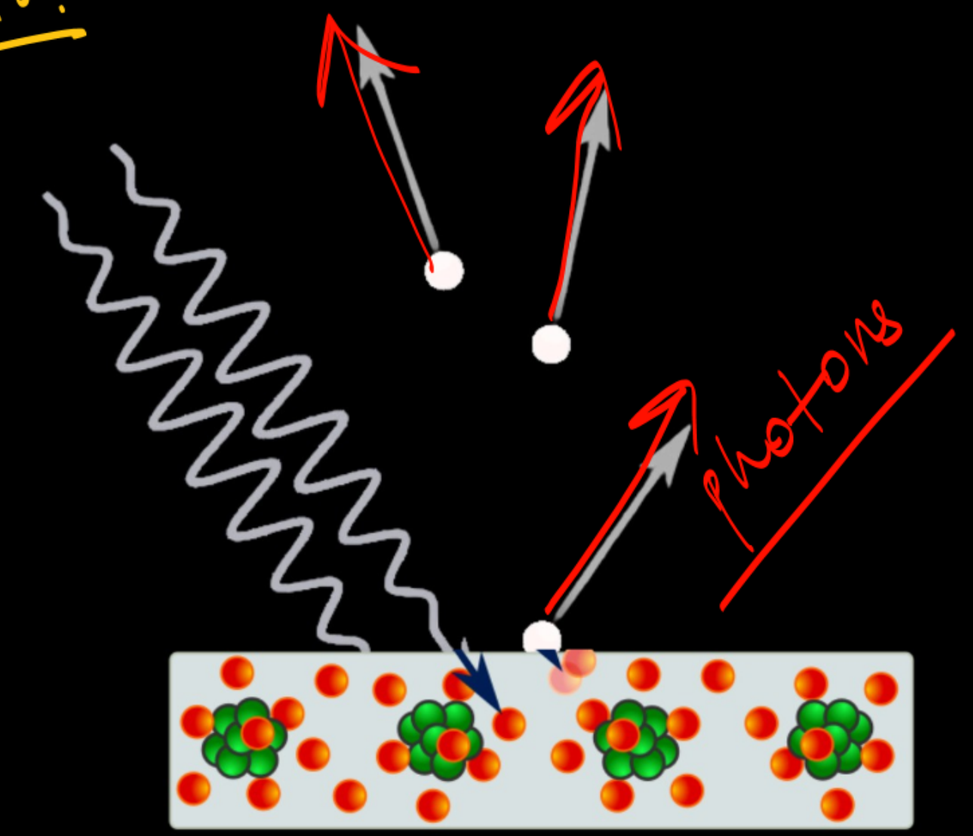
Energy of photon = Frequency of photon

Diff Freq.
↓
Diff Energy.

Photoelectric Effect

Kiliar.

- In 1887, H. Hertz performed a very interesting experiment in which electrons (or electric current) were ejected when certain metals (for example potassium, rubidium, caesium etc.) were exposed to a beam of light. The phenomenon is called Photoelectric Effect.

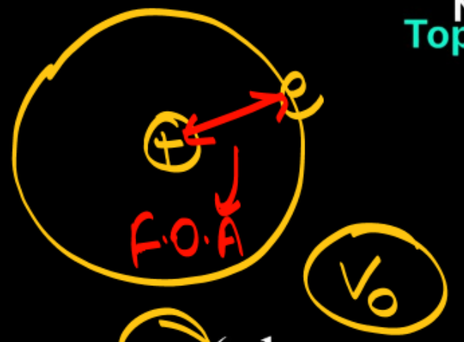


Observations of Photoelectric Effect

- The electrons are ejected from the metal surface as soon as the beam of light strikes the surface, i.e., there is no time lag between the striking of light beam and the ejection of electrons from the metal surface.

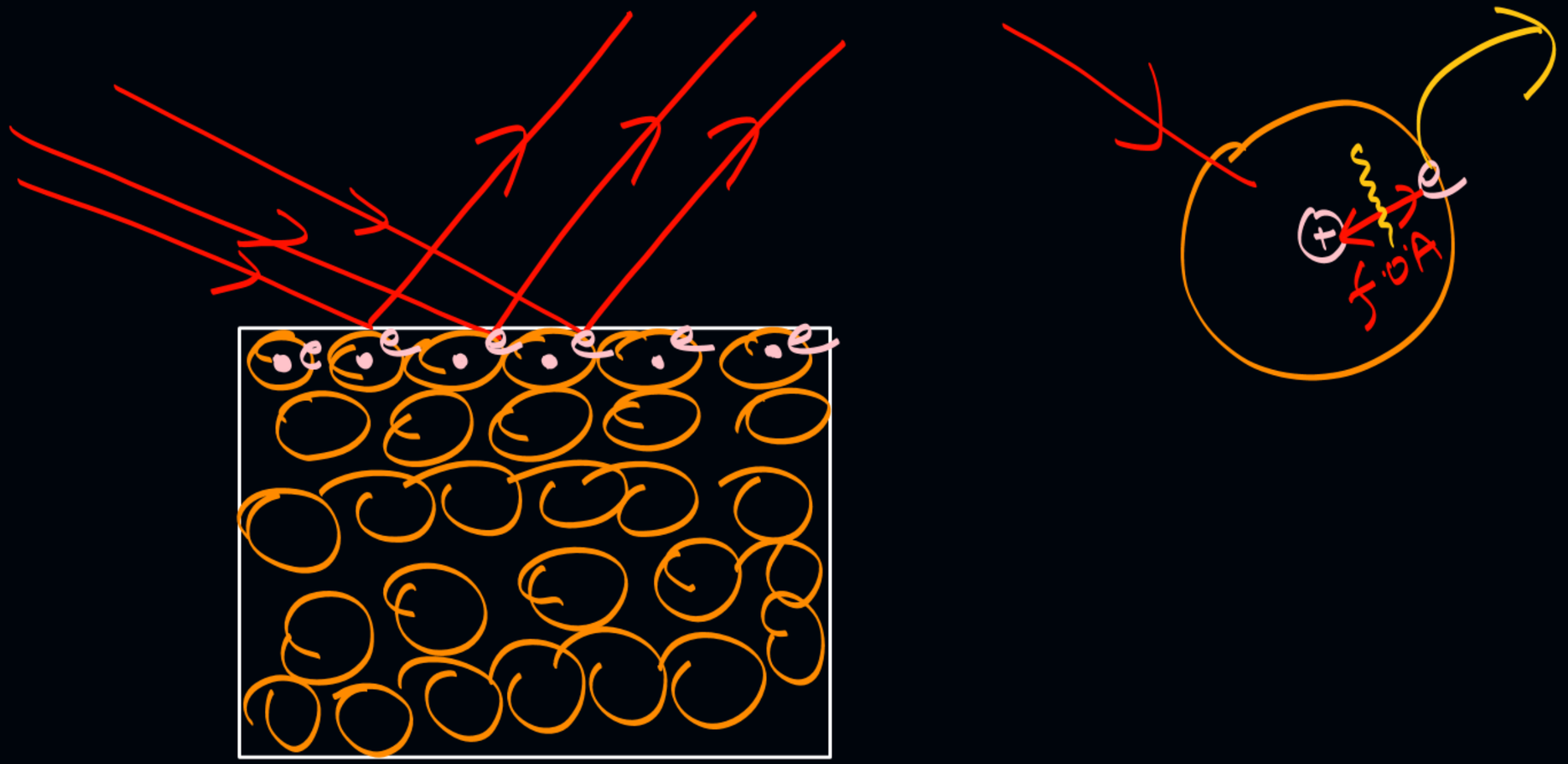
- The number of electrons ejected is proportional to the intensity or brightness of light.

Observations of Photoelectric Effect



- For each metal, there is a characteristic minimum frequency, ν_0 (also known as threshold frequency) below which photoelectric effect is not observed. At a frequency $\nu > \nu_0$ the ejected electrons come out with certain kinetic energy.

- The kinetic energies of these electrons increase with the increase of frequency of the light used.



Max Plank. (Quantum Theory).

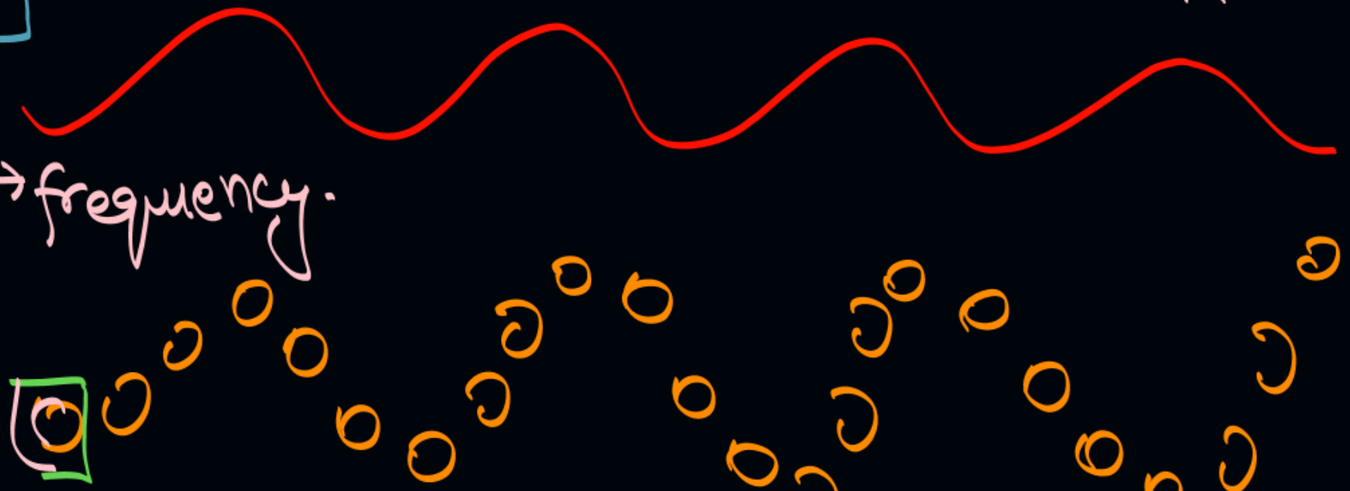
Kiliar.

$E \propto \nu$

$E = nh\nu$ → frequency.

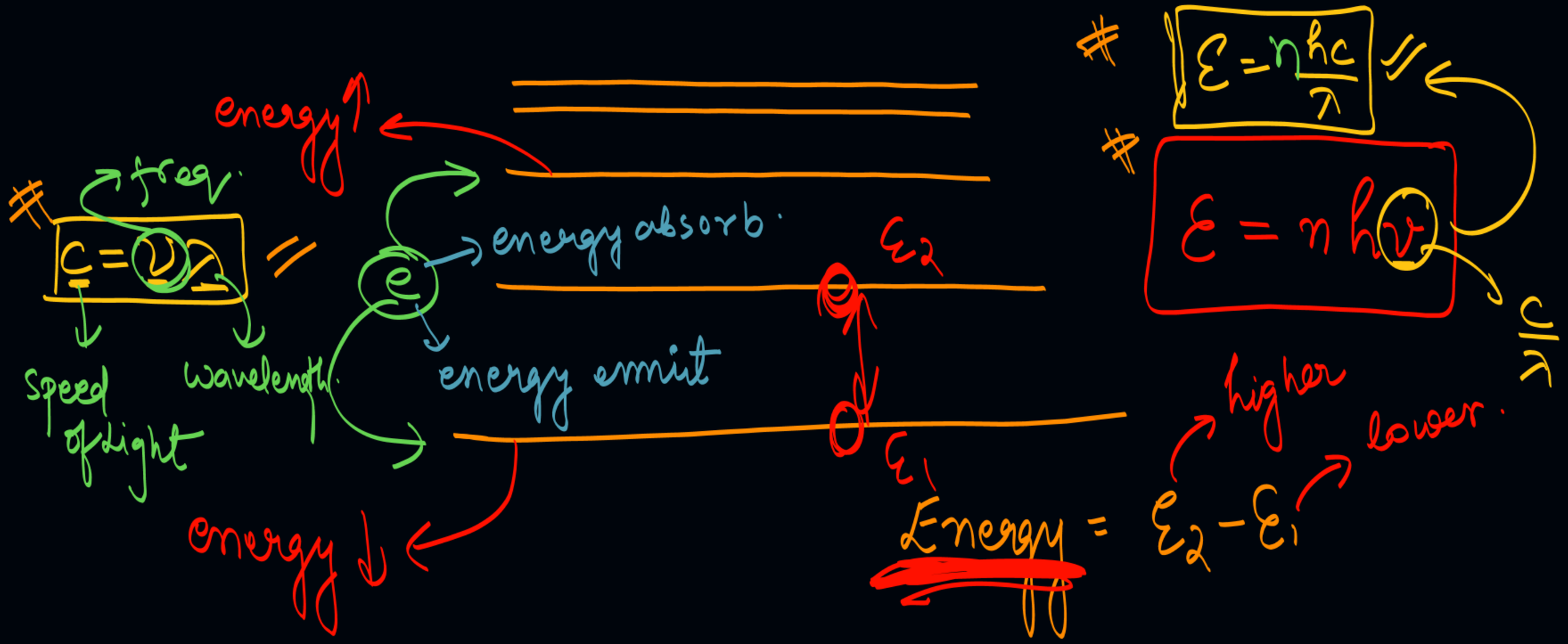
- E → Energy
- n → integer
- h → plank's constant 6.626×10^{-34} Js

E.M.R → form of wave.



quata photon.

E.M.R → form of particle


energy ↑
freq.
c = νλ
Speed of light
wavelength
energy absorb.
energy emit
energy ↓
ε₂
ε₁
Energy = ε₂ − ε₁
higher
lower.
ε = nhc/λ
ε = nhν
c/λ

Development leading to Bohr's Atomic Model

- Atom has a centre called nucleus . Electrons revolve only in fixed circular orbits with fixed energy & fixed velocity .
- Quantisation condition- Electrons revolve only in those circular orbits for which their angular momentum is an integral multiple of $h/2\pi$.

Angular momentum is defined as: The property of any rotating object given by moment of inertia times angular velocity.

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- Energy is emitted or absorbed only when an electron Jumps from higher energy level to lower energy level and vice-versa.
- del E = E2 – E1 = hv = hc / lamda is known as
- Bohr's frequecy rule ($h = 6.62607015 \times 10^{-34}$) J s
- The most stable state of an atom is its ground state or normal state.

Next Toppers

Khatam !
Tata !!
Bye-Bye !!!

Fir Mileinge...