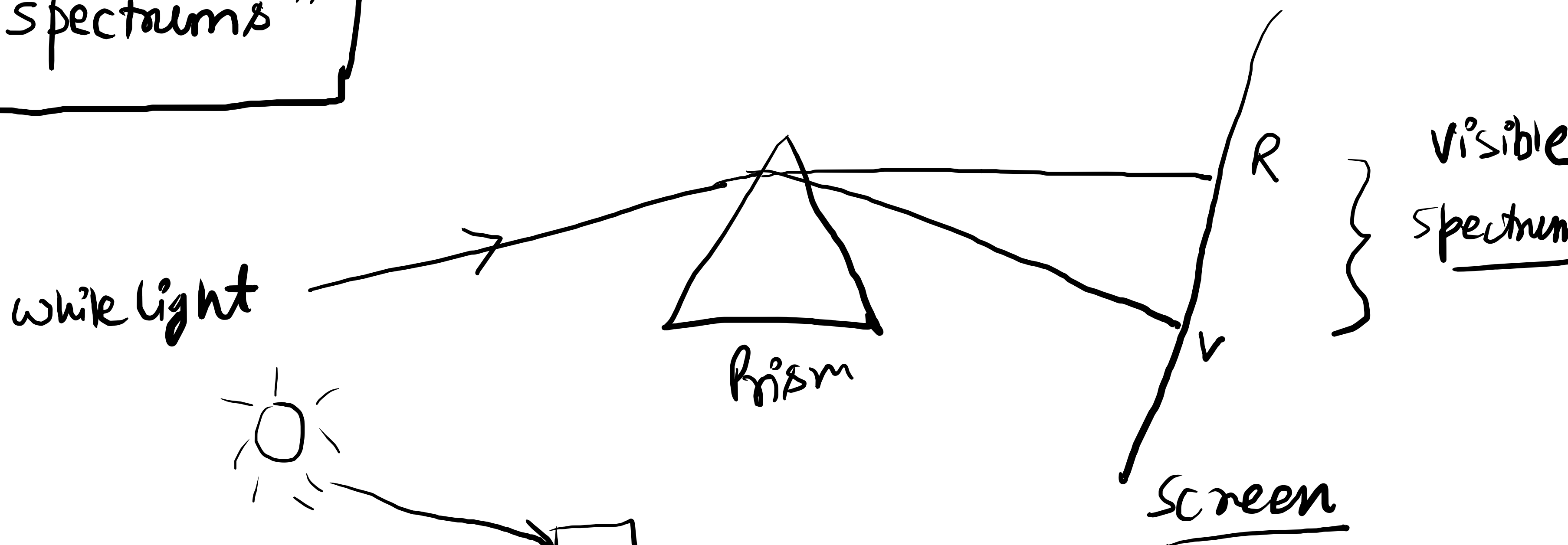
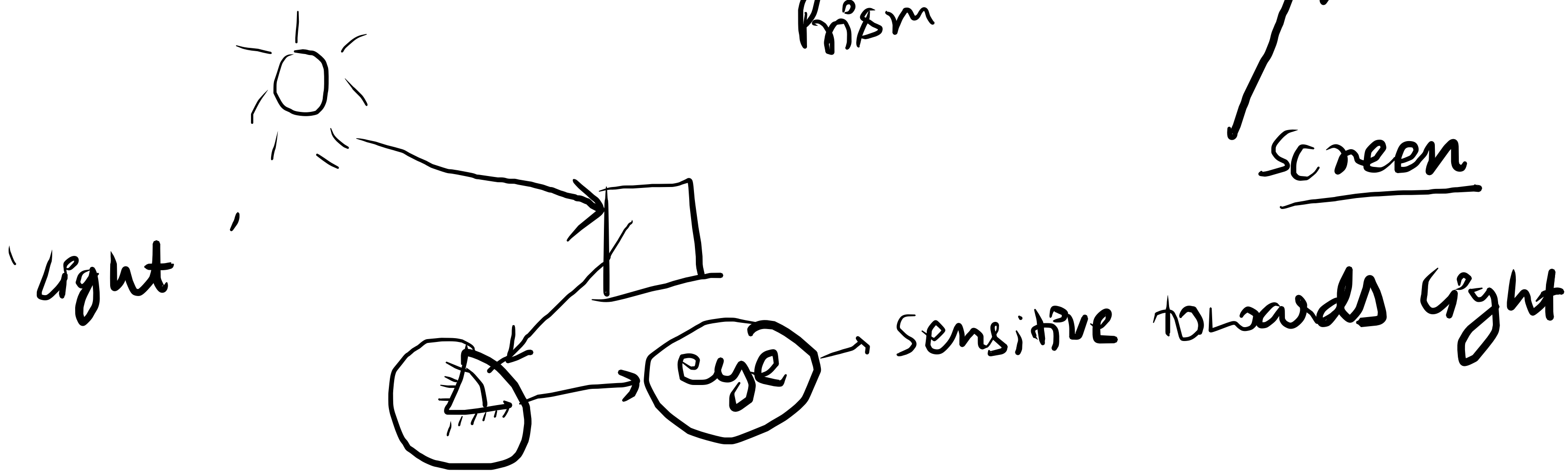
Atomic Structure :

"spectrums"





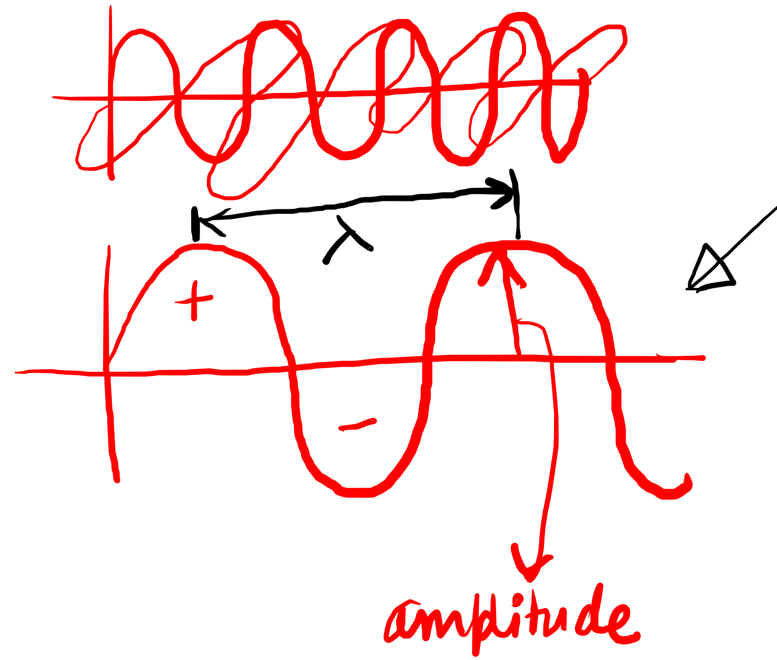
eye → Light Sensitive

└→ E.M.R.

▷ Amplitude → intensity

Amp ↓ Amp ↑

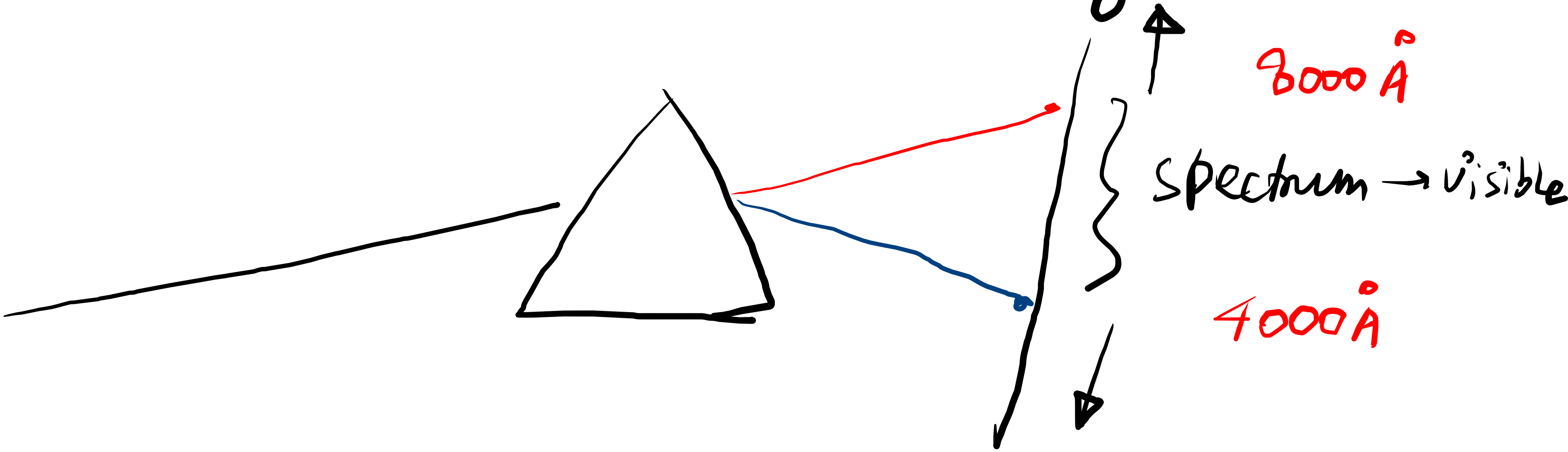
Brightness



λ = wavelength

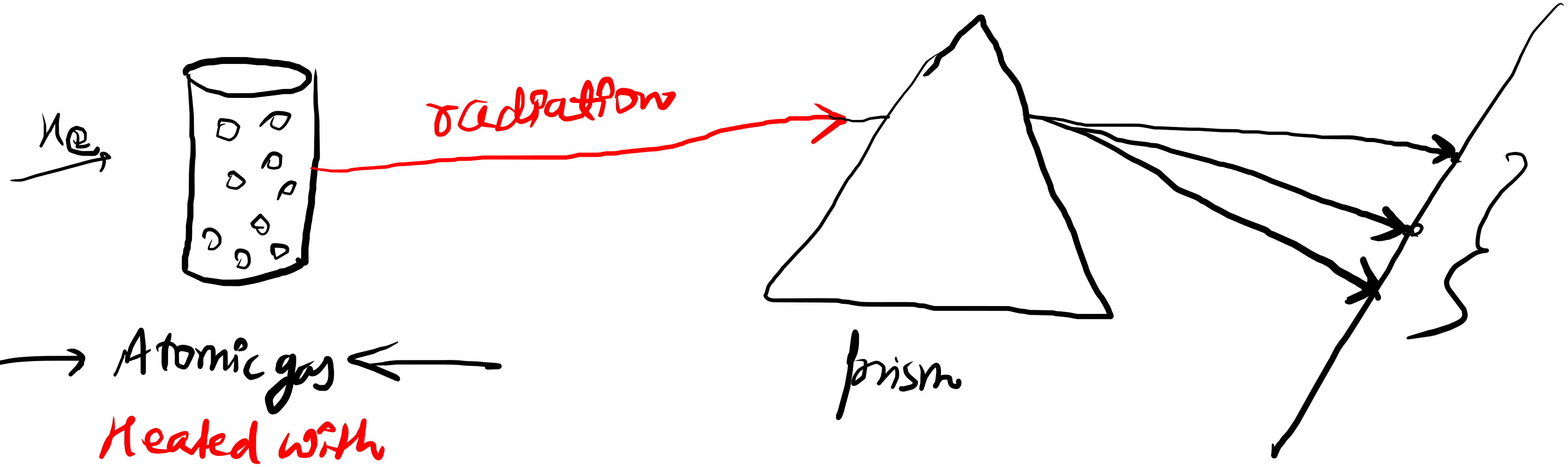
▷ wavelength → Colour of Light →

* if any radiation's wavelength falls under the range of <u>4000 Å</u> to <u>8000 Å</u> then this radiation will be visible to our eye.



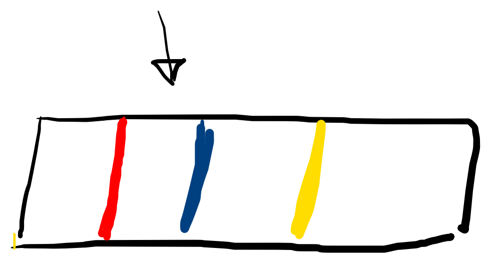
* $1 \text{ Å} = 10^{-10} \text{ m}$

① Emission spectrum:



Heated with electric current

↳ ionisation



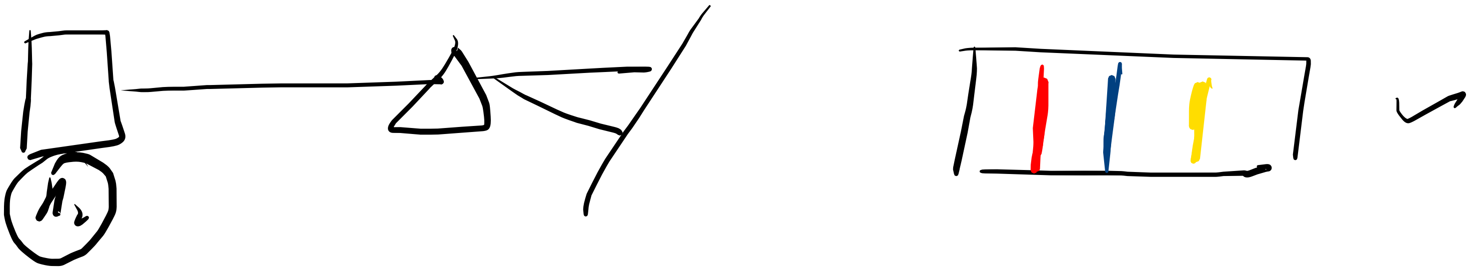
Discrete spectrum / Line spectrum

* only some specific wavelength were present on screen.

* every gas has a ch. emission spectrum

*

My exp:

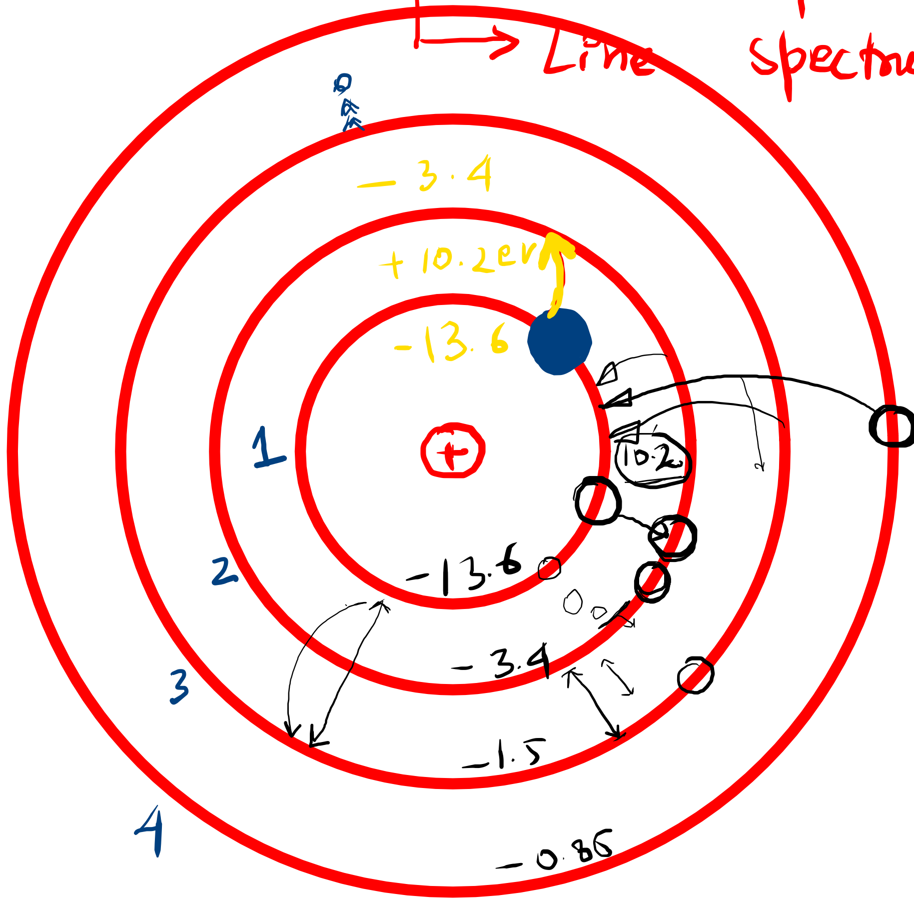


your exp:

Explanation for Emission spectrum

→ Discrete spectrum
→ Line spectrum

H-atom $Z=1$



$-13.6 \; (+10.2) = -3.4$

Bohr's atomic radius:

$$E = -13.6 \frac{Z^2}{n^2}$$

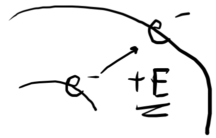
$E_1 = -13.6 \text{ eV}$

$E_2 = -3.4 \text{ eV}$

$E_3 = -1.51 \text{ eV}$

$E_4 = -0.85 \text{ eV}$

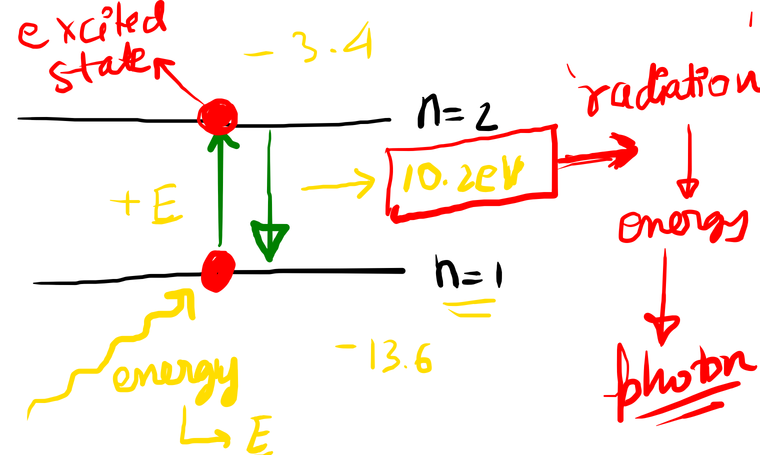
① on heating e^- absorbs energy and jumps to higher energy level.



② e^- is very unstable in Higher energy levels. (excited state)

③ e^- falls back (de excite) to a lower energy level. emitting the energy in form of radiation. (photon)

④ Energy of such photons = diff. in energy of two orbits involved in transition



$$E_p = E_{n_2} - E_{n_1}$$

$$= -3.4 - (-13.6)$$

$$E = +10.2\,eV$$

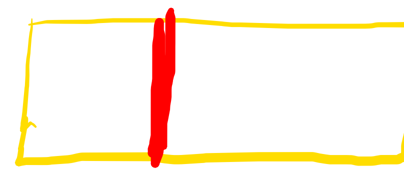
$E = \frac{hc}{\lambda}$

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

$E \propto \frac{1}{\lambda}$

10.2 → ?

4000 Å - 6000 Å



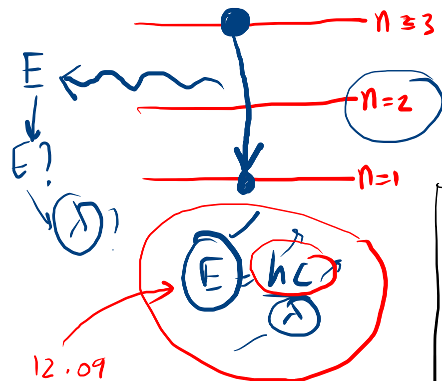
emission spectrum

Q: find the energy and wavelength of photon emitted when an e^- in H-atom makes transition from $n=3$ to $n=1$.

Soln

$E_{photon} = E_{n_2} - E_{n_1}$

$= E_{n_3} - E_{n_1}$



$E_n = -13.6 \frac{z^2}{n^2}$ eV

$= \left[-13.6 \frac{(1)^2}{(3)^2}\right] - \left[-13.6 \times \frac{(1)^2}{(1)^2}\right]$

$E_{photon} = \frac{-13.6}{9} + 13.6 = -1.51 + 13.6 = \underline{12.09 \text{ eV}}$

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

$\lambda = \frac{6.626 \times 10^{-34} \text{ J.s} \times 3 \times 10^8 \text{ m/s}}{12.09 \times 1.6 \times 10^{-19} \text{ J}}$

Use this

$\lambda (\text{Å}) = \frac{12375}{E \text{ (eV)}}$

E ✓
λ ?

$\lambda = \frac{12375}{12.09} \approx 1024 \text{ Å}$

Short cut formula for finding λ of emitted photon

* $E_{photon} = E_{n_2} - E_{n_1}$

$$\frac{hc}{\lambda} = -13.6\frac{z^2}{n_2^2} - \left(-13.6\frac{z^2}{n_1^2}\right)$$

$$\frac{hc}{\lambda} = 13.6\, z^2\left[\frac{1}{n_1^2} - \frac{1}{n_2^2}\right]$$ ✓

$$\frac{1}{\lambda} = \frac{13.6}{hc} z^2\left[\frac{1}{n_1^2} - \frac{1}{n_2^2}\right]$$

$\frac{13.6}{hc}$ → Rydberg's Const. → $1.09 \times 10^7\ m^{-1}$

$$\boxed{\frac{1}{\lambda} = R \cdot z^2\left[\frac{1}{n_1^2} - \frac{1}{n_2^2}\right]}$$