Class 11th | Chemistry

प्रारंभ BATCH

Unit : 1

Structure of Atom

Lecture - 6

Question

The Vividh Bharati station of All India Radio, Delhi, broadcasts on a frequency of 1,368 kHz (kilo hertz). Calculate the wavelength of the electromagnetic radiation emitted by transmitter. Which part of the electromagnetic spectrum does it belong to?

frequency (ν) = unit → Hz → s^{-1}

$\nu = 1368$ kHz → $\times 10^3$, $\lambda = ?$, $c = 3 \times 10^8$ m/s (speed of light)

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

$$\lambda = \frac{3 \times 10^8 \text{ m s}^{-1}}{1368 \times 10^3 \text{ s}^{-1}}$$

$\lambda = 219.3$ m Ans.

→ Radiowave wavelength.

Question

Calculate (a) wavenumber and (b) frequency of yellow radiation having wavelength 5800 Å.

$\bar{\nu}$ → reciprocal of wavelength ν

$1\,Å = 10^{-10}\,m$

$\lambda = 5800\,Å$

$= 5800 \times 10^{-10}\,m$

$\bar{\nu} = \frac{1}{\lambda} \Rightarrow \bar{\nu} = \frac{1}{5800 \times 10^{-10}}$

$\bar{\nu} = 1.724 \times 10^{6}\,m^{-1}$

$\nu = \frac{c}{\lambda}$ → c: $3 \times 10^{8}\,m/s$; λ: 5800

ν Ans: $5.1 \times 10^{14}\,s^{-1}$

Killiar.

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Next Toppers

$\nu > \nu_0$ K.E. ↑

$\nu_0 \rightarrow$ min Energy e^- bond break

$\nu = \nu_0 \rightarrow e^-$ nucleus / metal surface

Einstein's Photoelectric Equation

The total energy of the incoming photon (E) must be equal to the minimum energy required to eject the electron from the metal (Φ) + kinetic energy of the ejected electron (K.E.).

In the photoelectric effect, the work function (Φ) is **the minimum amount of energy needed to eject an electron from a metal surface**. It represents the strength of the bond holding electrons to the metal's lattice. This energy is specific to each material and is directly related to the threshold frequency of light required to initiate the photoelectric effect.

$$E = \text{Threshold Energy} + K.E.$$

$\phi \rightarrow$ work function.

$$E = T.E. + K.E$$

$$\phi = h\nu_0$$

work function.

$$E = h\nu$$

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

Kilian.

$$h\nu = h\nu_0 + \frac{1}{2}mv^2$$

$\downarrow$

$\nu - \nu_0$

$$\nu > \nu_0$$

$\downarrow$ T.E.

$$h(\nu - \nu_0) = h\nu_0 + \frac{1}{2}mv^2$$

$h \rightarrow 6.626 \times 10^{-34}$ JS.

$h \downarrow$ plank's constent

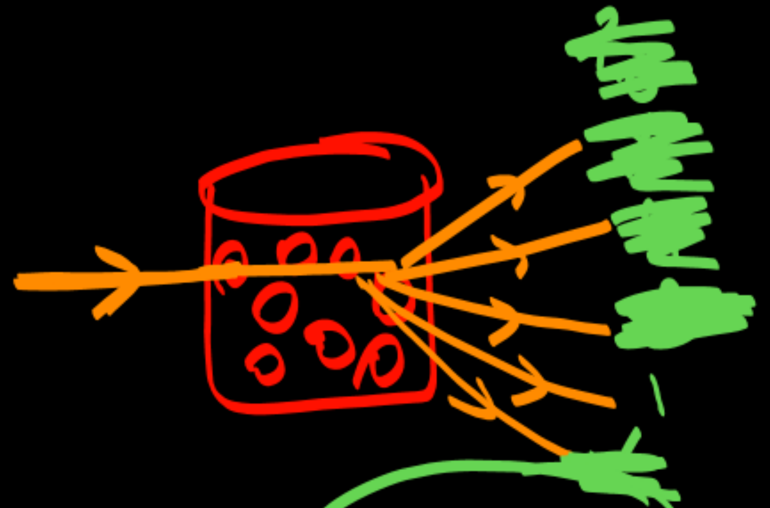
$\nu \rightarrow$ incident Radiation freq

$(\nu - \nu_0) \rightarrow$ T.E.

$m \rightarrow$ mass

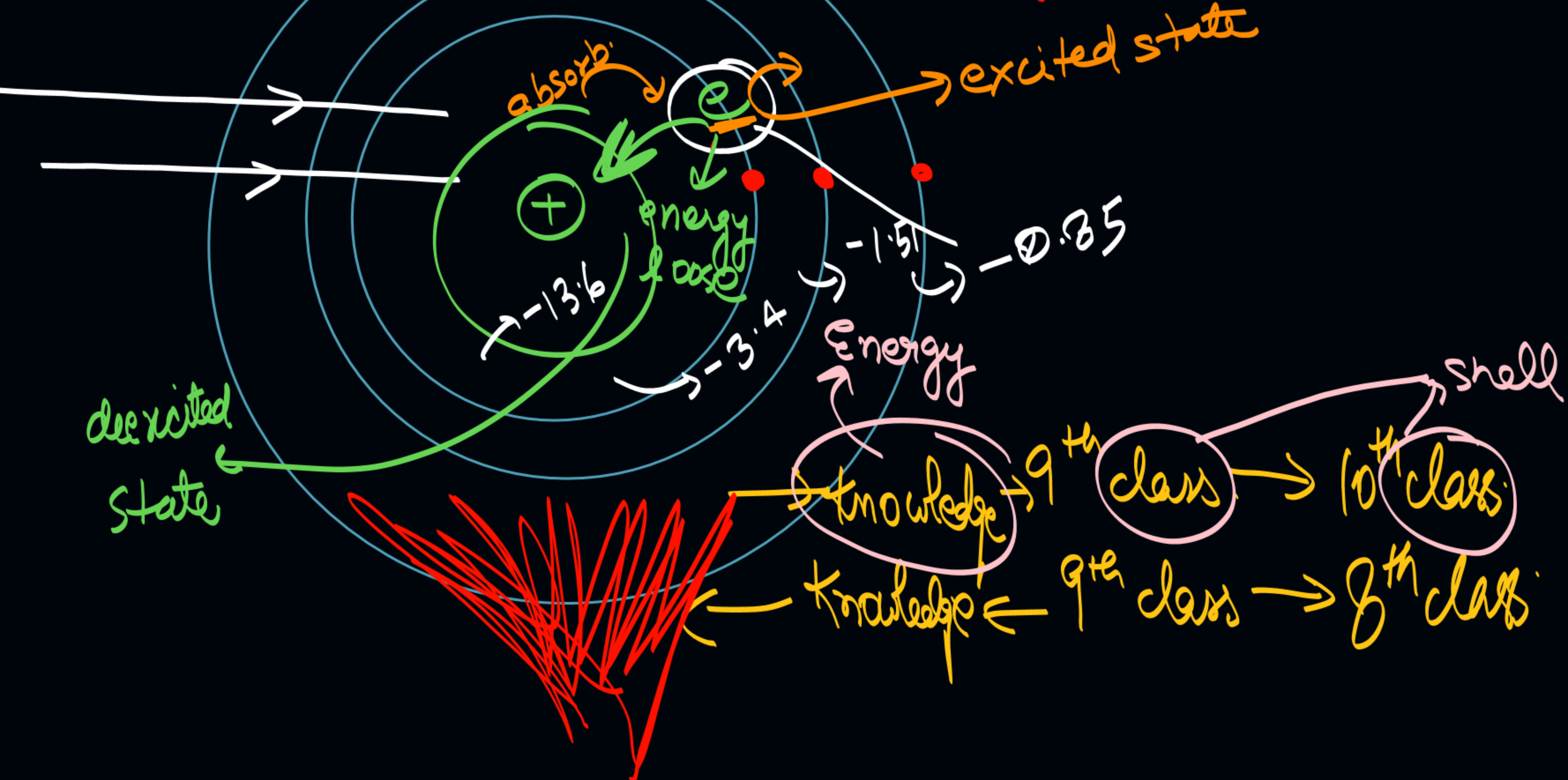
$v \rightarrow$ velocity.

Emission & Absorption Spectra



- The spectrum of radiation emitted by a substance that has absorbed energy is called an ***Emission Spectrum***.
- Atoms, molecules or ions that have absorbed radiation are said to be "excited".
- To produce an emission spectrum, energy is supplied to a sample by heating it or irradiating it and the wavelength (or frequency) of the radiation emitted, as the sample gives up the absorbed energy, is recorded.
- The study of emission or absorption spectra is referred to as spectroscopy.
- The spectrum of the visible light, was continuous as all wavelengths (red to violet) of the visible light are represented in the spectra.

Every shell has different Energy.



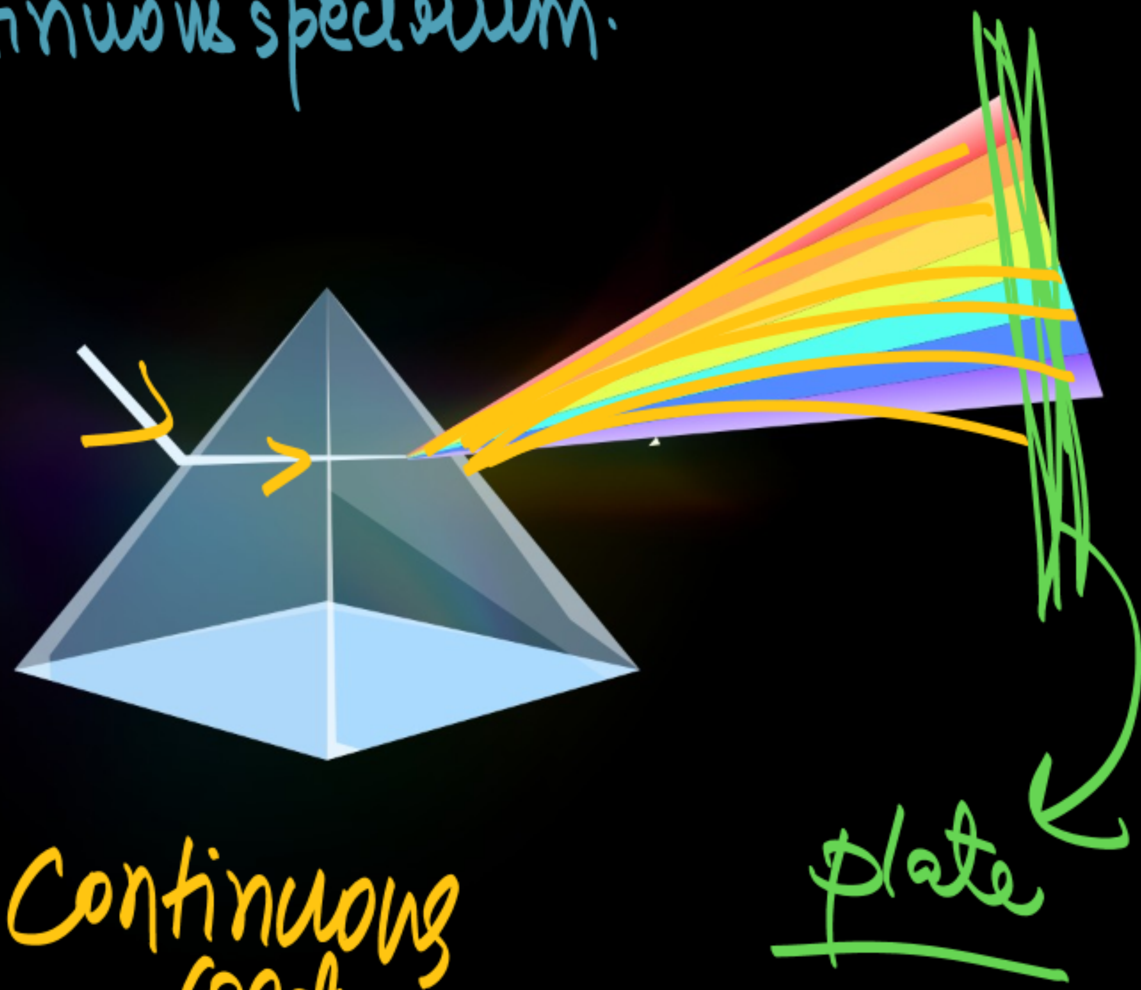
Emission Spectrum

Continuous spectrum

Line / Discontinuous spectrum.

When radiation emitted from a source like Sun, hot bulb or from a gas/matter whose electrons are excited by electrical or heat energy is passed directly through a prism and received on a photographic plate is called emission spectrum.

Depending upon the source of radiation, emission spectra is classified into (a) Continuous (b) Line or Discontinuous Spectra



Continuous spectrum.

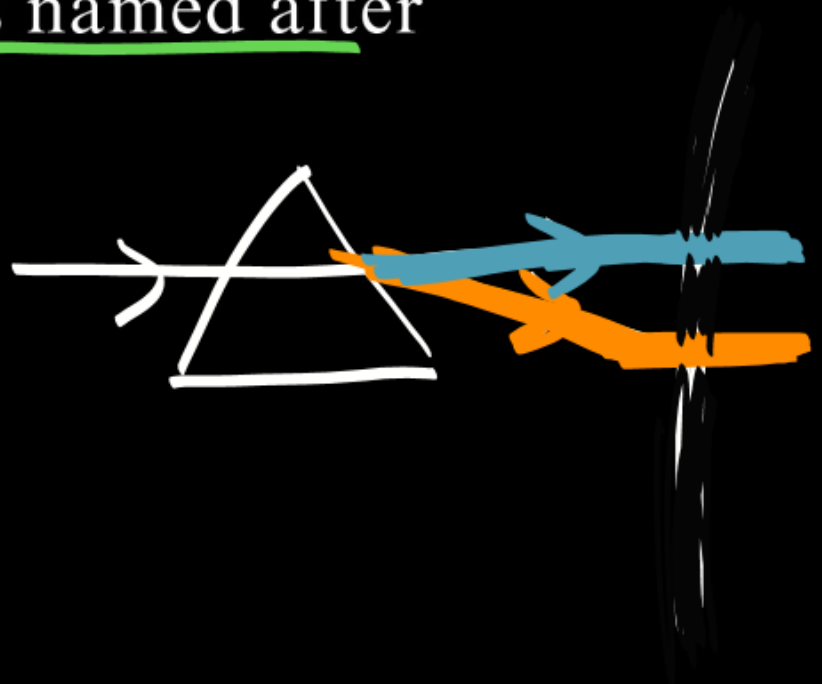
all colour of light are obtained.

few radiations are observed.

Line Spectrum of Hydrogen

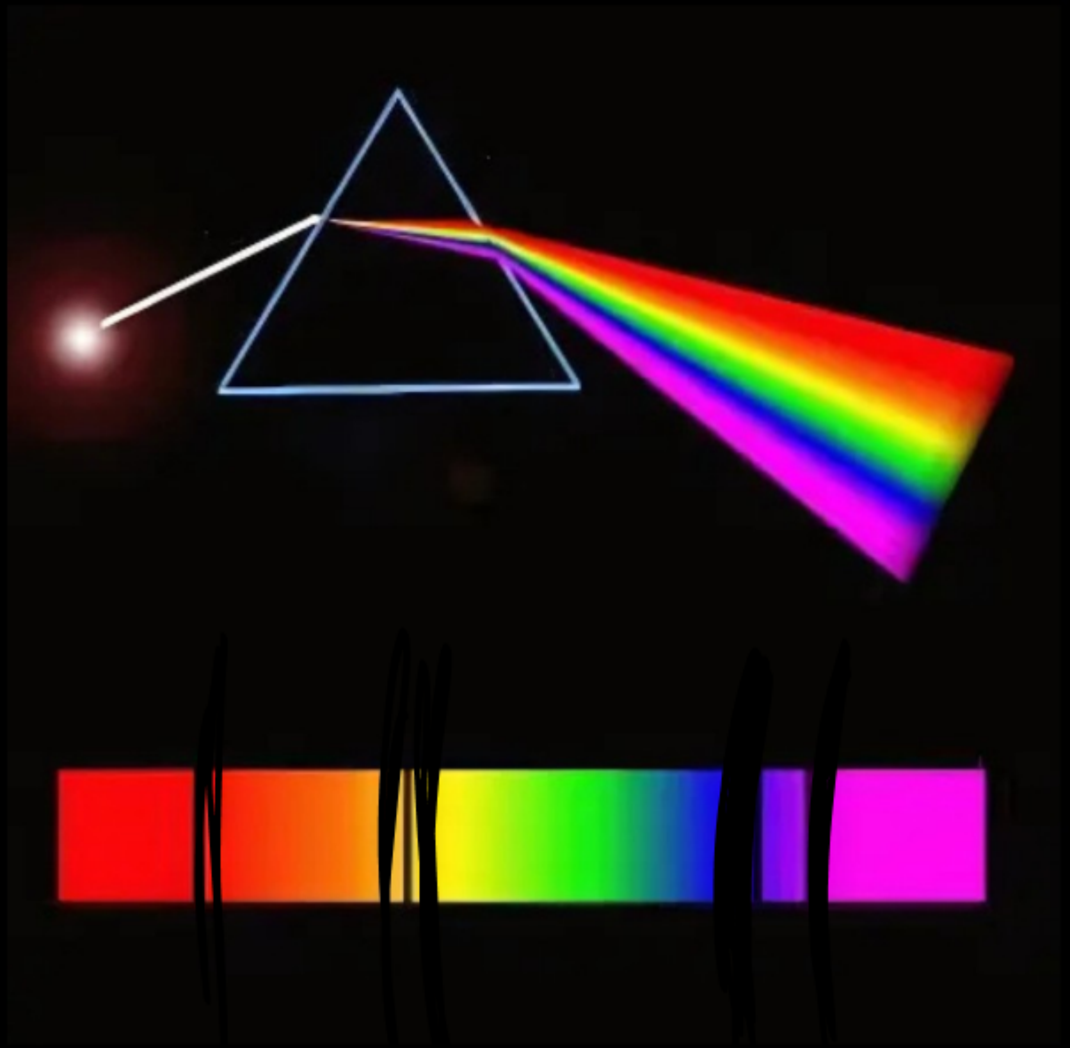
- When an electric discharge is passed through gaseous hydrogen, the H2 molecules dissociate and the energetically excited hydrogen atoms produced emit electromagnetic radiation of discrete frequencies.
- The hydrogen spectrum consists of several series of lines named after their discoverers.

$$1/\lambda = RZ^2(1/n_1^2 - 1/n_2^2) \quad R = 1.097 \times 10^7 \, m^{-1}$$



Absorption Spectrum

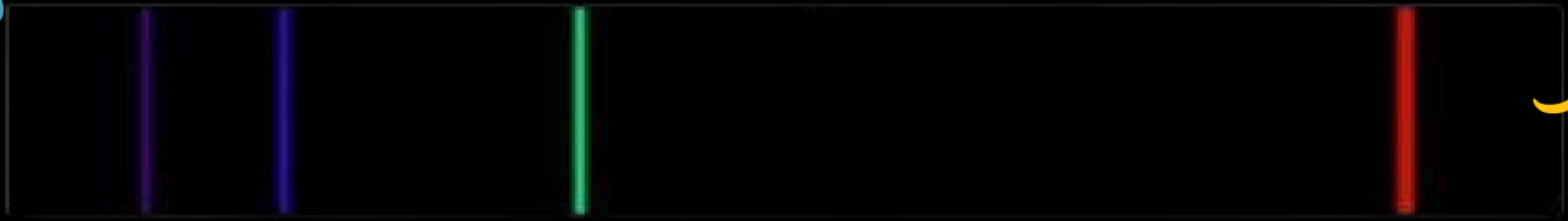
When white light is first passed the solution or vapours of a chemical substance and then analysed in(spectroscope some dark lines are observed at the same place where coloured lines were obtained in the emission spectrum.



Continuous Spectrum

Absorption Spectrum

Line Emission Spectrum



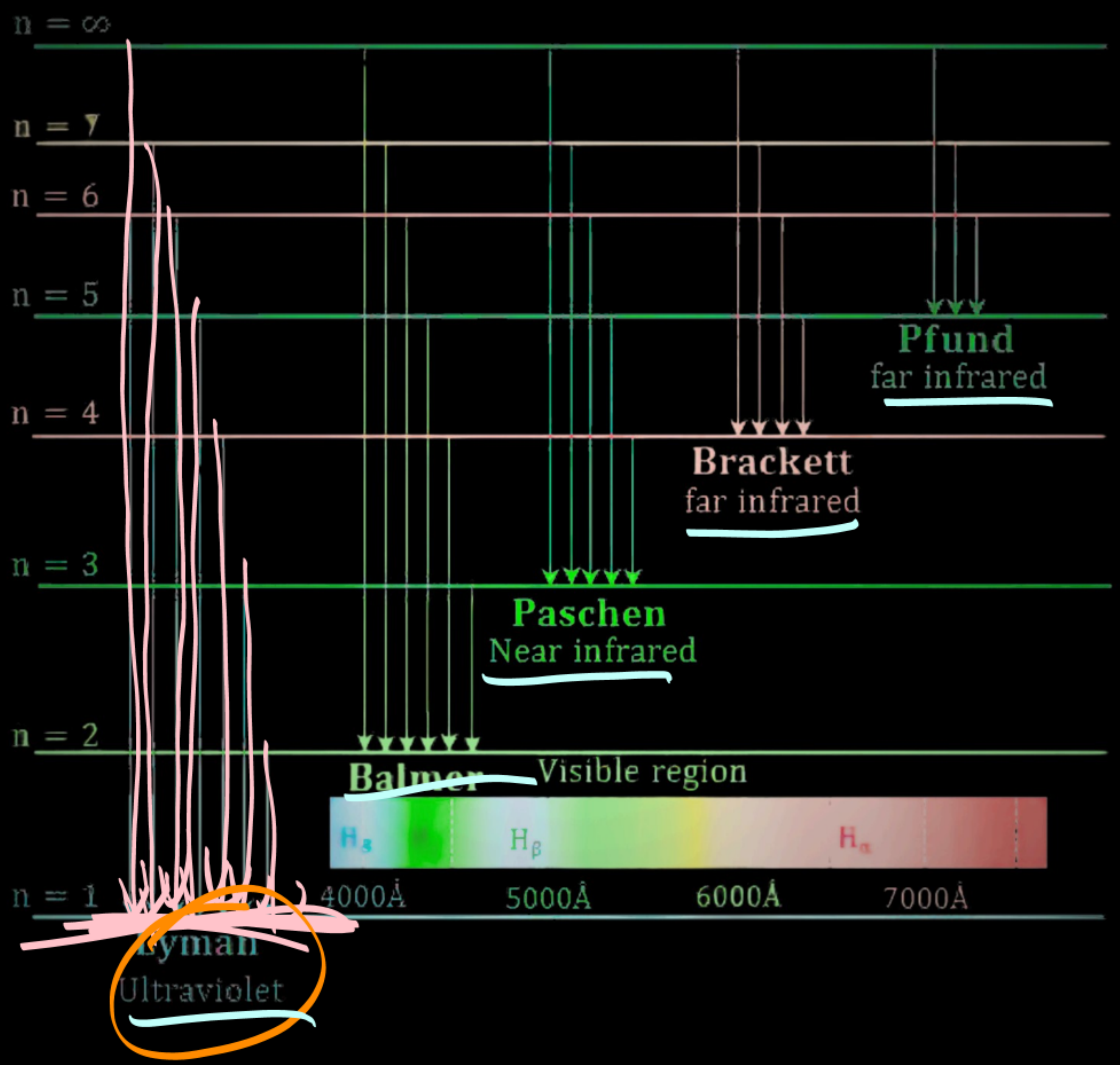
Emission Spectrum

confuse ×

Stable

9th

Ground State



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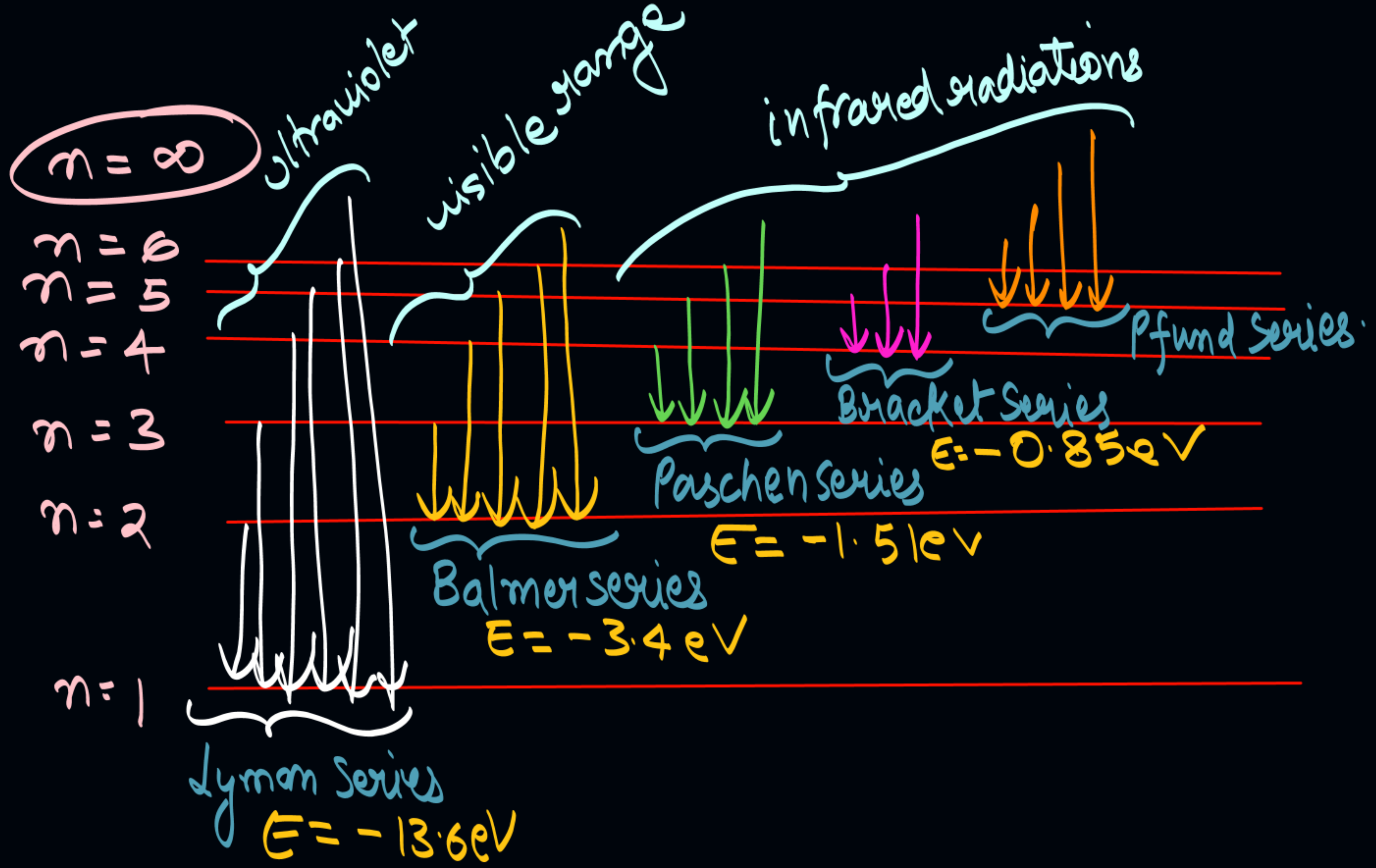

n = ∞
n = 6
n = 5
n = 4
n = 3
n = 2
n = 1
ultraviolet
visible range
infrared radiations
Lyman Series
E = -13.6eV
Balmer series
E = -3.4 eV
Paschen series
E = -1.51eV
Bracket Series
E = -0.85eV
Pfund Series.

Series	Discovered by	regions	$n_2 \rightarrow n_1$	Number of lines
lyman	lyman	U.V. region	$n_2 = 2, 3, 4 \ldots$ / $n_1 = 1$	$n_2 - 1$
Balmer	Balmer	Visible region	$n_2 = 3, 4, 5 \ldots$ / $n_1 = 2$	$n_2 - 2$
Paschen	Paschen	Infra red (I.R.)	$n_2 = 4, 5, 6 \ldots$ / $n_1 = 3$	$n_2 - 3$
Bracket	Bracket	I.R. region	$n_2 = 5, 6, 7 \ldots$ / $n_1 = 4$	$n_2 - 4$
Pfund	Pfund	I.R. region	$n_2 = 6, 7, 8 \ldots$ / $n_1 = 5$	$n_2 - 5$
Humphery	Humphery	far I.R. region	$n_2 = 7, 8, 9 \ldots$ / $n_1 = 6$	$n_2 - 6$

$$\frac{1}{\lambda} = RZ^2\left(\frac{1}{n_1^2} - \frac{1}{n_2^2}\right)$$

- λ → wavelength
- R → Rydberg constant $(1.097 \times 10^{-3} m^{-1})$
- Z → atomic Number
- n_1 → pe
- n_2 → se

jis pe e^- ayega → n_1

jis se e^- ayega → n_2

$$1/R = 911 \mathring{A}$$

Homework.

↓

Previous 3 lec

↓

Revise

Notes | video fast.

Khatam !
Tata !!
Bye-Bye !!!

Fir Mileinge...

Kiliar?

Next class - Monday