

NEET PHYSICS

2 PAGE NOTES

Updated on: 11 Feb, 2024



- ✓ Latest Syllabus Based
- ✓ Chapter-wise
- ✓ Last 15 Years NEET PYQ Tagged
- ✓ Includes Important Q Types

My Social Networks-



physics_tcarmy



newtonsapple



a.sane.hurricane

Tamanna Chaudhary

MODERN PHYSICS

Dual Nature of Radiation and Matter

Types of Electronic Emission :

- A. Photoelectric : Light
- B. Thermal : Temperature
- C. Voltaic / Field Emission : ΔV and $\vec{E}$
- D. α Emission : Collision with e^- .

Photoelectric Effect

$E_i(\text{photons})$

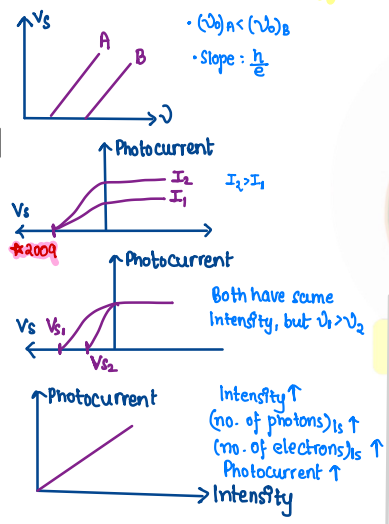


Workfunction, ω_0

$\lambda (\text{\AA}) = \frac{12400}{E(\text{eV})}$

1. Light made up of Photons
2. 1 photon $\rightarrow$ 1 e^-
3. Momentum of photon: $\frac{E}{c} \cdot \frac{h}{\lambda}$
4. Mass of a photon: $\frac{E}{c^2} = \frac{h}{\lambda c} \cdot \frac{P}{c}$
5. KE_e varies from 0 to max.

Graphs of Photoelectric Effect



Three Cases

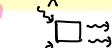
- $E_i > \omega_0$; $\nu_i > \nu_0$; $\lambda_i < \lambda_0$ ★2011, 2023
 $(KE_e) = E_i - \omega_0 = E(\nu_i - \nu_0)$ ★2011, 2018, 2020
- $E_i = \omega_0$; $h\nu_i = h\nu_0$; $\lambda_i = \lambda_0$
Photoelectric emission without Photocurrent
- $E_i < \omega_0$; $\nu_i < \nu_0$; $\lambda_i > \lambda_0$
No photoelectric emission

★2016



5eV $\rightarrow KE_e = 2\text{eV}$
6eV $\rightarrow V_s = ?$
3eV $\rightarrow V_s = 3\text{V}$

★2016



λ $\rightarrow V_s = V$ What is λ_0 ?
 λ $\rightarrow V_s = \frac{V}{4}$

$\frac{hc}{\lambda} - \frac{hc}{\lambda_0} = eV$; $\frac{hc}{2\lambda} - \frac{hc}{\lambda_0} = \frac{eV}{4}$
Multiply by 4 and equalize

6. Efficiency of Photoelectric emission : $< 1\%$
7. $KE_e = (e)(V_s)$ e.g. $KE_e = 4\text{eV}$
 $V_s = 4\text{V}$

(Incident) $\uparrow$

(E_{incident}) $\uparrow$
 $\downarrow$ $KE_e \uparrow$
 $\downarrow$ $V_s \uparrow$ ★2010

no. of photons falling on Is does not change
Photocurrent : Same

(Intensity) $\uparrow$

E_{photon} - Same
 $\downarrow$ (KE_e) - Same
 $\downarrow$ V_s - Same

(Photons - Is) $\uparrow$ ★2009
 $\downarrow$ (Electrons - Is) $\uparrow$
 $\downarrow$ Photocurrent $\uparrow$

★2016

$e^- (\text{mass}, m) \rightarrow E(\lambda_1)$
photon $\rightarrow E(\lambda_2)$

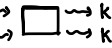
What is relationship b/w λ_1 and λ_2 ?

$\lambda_1 = \frac{h}{\sqrt{2me}}$; $E = \frac{hc}{\lambda_2}$

★2015 $\lambda_i = 500\text{nm}$
 $\omega_0 = 2.28\text{eV}$
[de-broglie] emitted e^- ?

1. $E_i = \left(\frac{12400}{500}\right)\text{eV} = 2.48\text{eV}$
2. $KE_e = (2.48 - 2.28) = 0.2\text{eV}$
3. $\lambda_e = \frac{h}{\sqrt{2mE_k}}$

★2015



λ $\rightarrow KE = E$
 λ $\rightarrow KE = 3E$

What is ω_0 ?

$\frac{hc}{\lambda} - \omega_0 = E$; $\frac{2hc}{\lambda} - \omega_0 = 3E$
Multiply by 3 and equalize

★2015 λ $\rightarrow V_s = 3V_0$
★2022 2λ $\rightarrow V_s = V_0$

What is λ_0 ?

$\frac{hc}{\lambda} - \frac{hc}{\lambda_0} = 3eV_0$; $\frac{hc}{2\lambda} - \frac{hc}{\lambda_0} = eV_0$
Multiply by 3 and Equalize

★2014 (E_{incident}) $\uparrow$ by 20%
★2009 $KE_e = (0.5 \rightarrow 0.8\text{eV})$. ω_0 ?

$E - \omega_0 = 0.5e$
 $1.2 - \omega_0 = 0.8e$
Multiply by $\frac{e}{8}$ and equalize

★2012 200W Bulb ; $\lambda = 0.64\mu\text{m}$
★2021 $\eta = 25\%$ 50W $\eta_{ls} = \frac{hc}{6 \times 10^{-7}}$
What is (n photons) Is?

★2012 1eV $\rightarrow$ Speed, v_1
★2011 2.5eV $\rightarrow$ Speed, v_2
 $\omega_0 = 0.5\text{eV}$
 $\frac{(1-0.5)}{(2.5-0.5)} = \frac{KE_1}{KE_2} = \frac{v_1^2}{v_2^2}$



★ When distance b/w source of light and metal surface [a → n.a]

Intensity $[I \rightarrow \frac{I}{n^2}]$

Photocurrent $[i \rightarrow \frac{i}{n^2}]$

★ 2010

I → no. of photons : N
→ KE of photoelectrons : K.

2I → no. of photons : 2N
→ KE of photoelectrons : K

De-Broglie - Wavelength

★ 2022

$$\lambda_d = \frac{h}{P} = \frac{h}{\sqrt{2mE_k}} = \frac{h}{\sqrt{2me.V_a}}$$

★ 2015

★ 2021

Ek to, bina fullstop, tu saath reh, warna negativity acati hai

A. $\lambda_{e^-} = \frac{12.27 \text{ \AA}}{\sqrt{V_a}}$

★ 2020

★ 2019

★ 2011

B. $\lambda_{\text{proton}} = \frac{0.286 \text{ \AA}}{\sqrt{V_a}}$

Proton to Epstein: Chi

C. $\lambda_{\text{neutron}} = \frac{0.286 \text{ \AA}}{\sqrt{E_k(\text{eV})}}$

D. $\lambda_{\text{deuteron}} = \frac{0.202 \text{ \AA}}{\sqrt{V_a}}$

Due to shunya trauma, I'm strong.

★ 2014

KE particle (E → 16E)

How does λ_{de} change?

$\lambda_d \propto \frac{1}{\sqrt{E}} \therefore \lambda \rightarrow \frac{\lambda}{4}$

E. $\lambda_{\alpha\text{-particle}} = \frac{0.101 \text{ \AA}}{\sqrt{V_a}}$

F. $\lambda_{\text{gas-molecule}} = \frac{h}{\sqrt{3mk_b.T}}$

NEWTON'S APPLE



α -Particle Scattering Experiment

- 0.14% - $\delta > 1^\circ$ - Repulsive force by nucleus
0.0135% - $\delta > 90^\circ$ - Mass concentrated in nucleus
99.86% - Undeflected - lot of empty space
- $N(\theta) = \frac{Z^2}{\sin^4(\frac{\theta}{2}) \cdot E_{K2}}$; Impact Parameter, $b = \frac{1}{4\pi\epsilon_0} \cdot \frac{Ze^2 \cot(\frac{\theta}{2})}{E_K}$
- Distance of Closest approach, r : $\star 2016$
 $\frac{1}{2} m_p v_p^2 = \frac{1}{4\pi\epsilon_0} \cdot \frac{Z e^2 q}{r}$ $\star 2010$

Electron Revolving in H atom



$$F_e = F_c \quad \frac{1}{4\pi\epsilon_0} \cdot \frac{e^2}{r^2} = \frac{mv^2}{r} \Rightarrow KE = \frac{1}{2}mv^2 = \frac{e^2}{8\pi\epsilon_0 r}$$

$$\Rightarrow TE = -KE = \frac{(-e^2)}{8\pi\epsilon_0 r}$$

$$\Rightarrow PE = 2TE = \frac{(-e^2)}{4\pi\epsilon_0 r}$$

$\therefore TE = -x$
 $KE = x$
 $PE = -2x$

Spectral Series | Lines

Series	Longest 1st line	2nd line	λ shortest last line
Lyman ($n=1$)	$1 \leftrightarrow 2$	$1 \leftrightarrow 3$	$1 \leftrightarrow \infty$
Balmer ($n=2$)	$2 \leftrightarrow 3$	$2 \leftrightarrow 4$	$2 \leftrightarrow \infty$
Paschen ($n=3$)	$3 \leftrightarrow 4$	$3 \leftrightarrow 5$	$3 \leftrightarrow \infty$
Brackett ($n=4$)	$4 \leftrightarrow 5$	$4 \leftrightarrow 6$	$4 \leftrightarrow \infty$
P Fund ($n=5$)	$5 \leftrightarrow 6$	$5 \leftrightarrow 7$	$5 \leftrightarrow \infty$

Two types of QuestionsTo calculate λ for a particular transitionRatio of λ photons $\star 2016$ 2012 2023
 2013 2011 $\Rightarrow$ No. of Spectral Lines : $\frac{(n_2 - n_1)(n_2 - n_1 + 1)}{2}$ $\star 2014$ $n_{initial} = 1$ $\lambda_{photon \text{ absorbed}} = 975 \text{ \AA}$

no. of spectral lines?

- Given (eV) = $\frac{12400}{975} = 12.71 \text{ eV}$
- $E_f = 0.88 \text{ eV}$ ($n=4$)
- $n_o = \frac{(4-1)(4-1+1)}{2}$

Bohr's Model of Atom $\rightarrow$ Only for one electron system $\star 2020$

- Circular, Stationary orbits
- $n\left(\frac{h}{2\pi}\right) = \vec{L}_n = m v_n r_n$
- e^- jumps $\hookrightarrow E_1 \Rightarrow E_2 \Rightarrow$ Change in Energy : Energy of Photon associated $\star 2011, 2010, 2022$ $\star 2023$ $\star 2015$
- $E_n = E_o \cdot \frac{Z^2}{n^2}$ $[122at do na do]$
 $E_o = (-13.6 \text{ eV})$
- $r_n = r_o \cdot \frac{n^2}{Z}$ $[RantuuZ]$
 $(r_o = 0.53 \text{ \AA})$
- $v_n = v_o \cdot \frac{Z}{n}$ $[Vazan]$
 $(v_o = 2.2 \times 10^6 \text{ m/s})$
- $T = \frac{1}{\nu} = \frac{2\pi}{\omega} \propto \frac{n^3}{Z^2}$ $[Teeno ke teeno, 122at do]$
- $I [\text{Current}] \propto \frac{Z^2}{n^3}$ $[122at do, naht to, current padega]$
- $\vec{B}_{\text{centre}} \propto \frac{Z^3}{n^5}$ $[Bazzali se naach]$
- Magnetic Moment, $\vec{M} \propto n$ $[Man ka moment]$

11. When $n \uparrow$: $E_{\text{less}} \ominus : E \uparrow$
 $PE_{\text{less}} \ominus : PE \uparrow$
 $KE_{\text{less}} \ominus : KE \downarrow$
 $E_{\text{gap}} \downarrow$

12. $n_{\text{higher}} \rightarrow n_{\text{lower}}$
 $E_{\text{gap}} : E_{\text{photon emitted}}$
 $n_{\text{lower}} \rightarrow n_{\text{higher}}$
 $E_{\text{gap}} : E_{\text{photon absorbed}}$

 $\star 2016$

$$\bar{\nu} (\text{Wave Number}) = \frac{1}{\lambda_{\text{photon}}} = \frac{R}{109677 \text{ cm}^{-1}} \left[\frac{1}{n_1^2} - \frac{1}{n_2^2} \right] Z^2 \quad (n_2 > n_1)$$

 $\star 2012$ H-atom $(n=5 \rightarrow n=1)$

Wavelength due to photon emission?

- $\frac{1}{\lambda} = R \left(\frac{1}{1^2} - \frac{1}{5^2} \right) = R \left(\frac{24}{25} \right)$
- $\vec{p}_{\text{photon}} = \frac{h}{\lambda} = \frac{24 R h}{25}$
- $|\vec{p}_{\text{photon}}| = |\vec{p}_{\text{atom}}|$
 $\frac{24 R h}{25} = m v$



Important terms

- $m_{neutron} \approx m_{proton} = 1.67 \times 10^{-27} \text{ kg}$
- $1 \text{ amu} = 1.67 \times 10^{-27} \text{ kg}$
- Representation of Nucleus: ^Z_X
Mass no. Z Atomic no. X

- **Isotopes:** n protons (Same) [Z_{same}]
- **Isobars:** n nucleons (Same) [A_{same}]
- **Isotones:** n neutrons (Same)

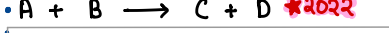
$m_1 (\%)$
 $m_2 (\%)$
 $m_3 (\%)$
 $\Rightarrow m_{av} = \frac{m_1x + m_2y + m_3z}{(x+y+z)}$

Formation of Nucleus and Nuclear Reactions

- nucleons $\rightarrow$ Nucleus. $\star 2013, 2011, 2010$
- ✓ $m_{\text{system}} \downarrow$: Mass defect $\star 2020$
 $BE = \Delta mc^2$
 $931 \text{ MeV} \rightarrow 1 \text{ amu}$
- ✓ Released : BE
- BE↑; more Released; More stable the nucleus
- BE per nucleon
 $\rightarrow A < 30$ [Small] $\rightarrow$ fusion
 $\rightarrow 30 < A < 80$ [Almost Constant]
Maximum: Fe (8.75 MeV)
 $\rightarrow A > 170$ [Small] $\rightarrow$ fission

• Packing fraction : $\frac{\Delta m}{A}$

$\star 2020$ - Conservatⁿ of A and Z



m_A	m_B	m_C	m_D	Mass
BE_A	BE_B	BE_C	BE_D	Binding E
E_A	E_B	E_C	E_D	E possessed

E Released : $(m_A + m_B - m_C - m_D) c^2$
 $(BE_C + BE_D - BE_A - BE_B)$ $\star 2014, 2010, 200$
 $(E_A + E_B - E_C - E_D)$

α -Decay

$^A_Z X \rightarrow ^{A-4}_{Z-2} Y + ^4_2 \alpha$

In Heavy Nuclei

$\star 2011, 2009$

β^- -decay

$n \rightarrow p + e^- + \bar{\nu}$

$^A_Z X \rightarrow ^A_{Z+1} Y + e^- + \bar{\nu}$

In Nuclei : $n_p > n_n$

β^+ Decay

$p \rightarrow e^+ + n + \nu$

$^A_Z X \rightarrow ^A_{Z-1} Y + e^+ + \nu$

In nuclei : $n_p > n_n$

γ -Decay

$X \rightarrow X + \gamma$

(High E) (Low E)

$\star A$ and Z Remain Same

All About Nucleus and Nuclear force

- Nuclear Mass $\propto A$
- Nuclear Volume $\propto A$
- Nuclear Radius $\propto A^{1/3} \Rightarrow R_A = R_0 A^{1/3}$ [$R_0 = 1.5 \text{ fm}$] $\star 2015, 2012, 2022$
- Nuclear Density $\propto A^0 \Rightarrow \rho_{\text{constant}} = 2.27 \times 10^{17} \text{ units}$
- Quark $\rightarrow$ up ($+\frac{2}{3}$)
down ($-\frac{1}{3}$)
3-quark System
Neutron (udd) Proton (uud)
- Nuclear force:
 1. Short range, strongest force
 2. Independent of charge. $\rightarrow \pi^+/\pi^- (n-p)$
 3. Due to π mesons $\rightarrow \pi^0 (n-n, p-p)$ Yukawa theory
 4. Non-Central, Depends on spin.
 5. Generally Attractive. $r = 0.8 \text{ fm}$ [starts -repulsive] ; $r = 0.4 \text{ fm}$ [Very repulsive]

Radioactivity

- Properties of Radioactive Substance:
 1. Affect Photographic plate
 2. Ionize the gas
 3. Penetrate the matter
- Radioactive law:
 - $\rightarrow \frac{-dN}{dt} = \lambda N$
 - $\rightarrow N_t = N_0 \cdot e^{-\lambda t}$
 - $\ln \left(\frac{N_0}{N_t} \right) = \lambda t$
 - $\rightarrow t = \frac{2.303}{\lambda} \cdot \log \left[\frac{N_0}{N_t} \right]$
 - $\rightarrow$ If $\frac{N_0}{N_t} = 2^n \Rightarrow t = n \cdot t_{1/2}$
 - $\rightarrow t_{1/2} = \frac{0.693}{\lambda}$
 - $T = \frac{1}{\lambda}$
- Radioactive emitance : α, β, γ .

α -particle	β -particle	γ -Ray
He^{4+} mass : $4m$ Charge : $+2e$	e^- mass : m_e Charge : $(-e)$	Electro-magnetic waves
Penetration Power : $\gamma > \beta > \alpha$		Ionizing Power : $\alpha > \beta > \gamma$

Nuclear Reaction and Reactor

$\star 2011$ To overcome Repulsion

Fuel ($^{235}_{92}\text{U}$)

Once the fuel get activated, chain reactⁿ starts

On an average, 2.5n are emitted

Activated by Bombarding n (High Ek) with slow moving neutrons (Low Ek)

Moderators

- ✓ low A
- ✓ Not absorb neutrons
- ✓ D_2O , Graphite

Control Rods (Maintains Absorbed with Emitted)

- ✓ $k > 1$: Ready to explode
- ✓ $k < 1$: Come to halt
- ✓ $k = 1$: Critical State.
- ✓ Rods of Cadmium and Boron

Enuclear Released

Absorbed by Coolants (H_2O)

Generator $\leftarrow$ Turbine $\leftarrow$ Water Vapours

Coupled with

Peculiar PYQs

★ 2016

$$t_{1/2} = 30 \text{ minutes}$$

$$t \text{ b/w } \begin{cases} 40\% \text{ Decay } (t_1) \\ 85\% \text{ Decay } (t_2) \end{cases}$$

$$t = t_2 - t_1$$

$$= \frac{2.303}{\lambda} \left[\log \left[\frac{10}{6} \right] - \log \left[\frac{20}{3} \right] \right]$$

$$= \frac{2.303 \cdot t_{1/2}}{0.693} \left[(\log 10 - \log 6) - (\log 20 - \log 3) \right]$$

★ 2010

$$(t=0) \rightarrow N_0$$

$$(t=5 \text{ min}) \rightarrow \frac{N_0}{e}$$

What is $t_{1/2}$?

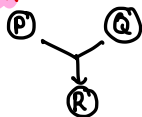
$$N_t = N_0 \cdot e^{-\lambda t}$$

$$e^{-1} = e^{-\lambda t}$$

$$\lambda = \frac{\ln(2)}{t_{1/2}} = \frac{1}{t}$$

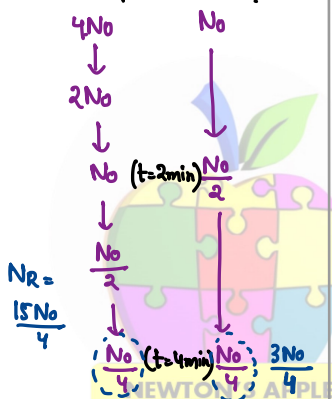
$$t_{1/2} = 5 \log_e(2) \text{ minutes}$$

★ 2011



$$t=0 \quad 4N_0 \quad N_0$$

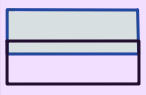
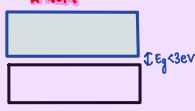
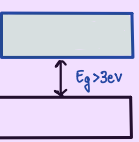
$$t_{1/2} = 1 \text{ min} \quad t_{1/2} = 2 \text{ min}$$

When $N_P = N_Q$, N_R ?

When a solid is made up of closely packed atoms, energy levels of single atom splits → Due to merging and splitting of outer energy levels → Two Energy Bands are formed

Energy Band Theory

— - Conduction Band
— - Valence Band

Metals	Semil-Conductors	Insulators
 VB overlaps with CB. So, it is easier for charge carriers to jump to CB and contribute in conductivity ★ 2005 - Comparison of E_g	★ 2012  $E_g < 3\text{eV}$ - At 0K, CB is completely empty. $T > 0\text{K}$ (Room temperature), CB is partially filled. - When $TT, \sigma \uparrow$ ★ 2020 - In Intrinsic: $n_e = n_h = n_i$ - By doping, n_e or $n_h \uparrow$ but their product remains same. $n_i^2 = n_e \cdot n_h$	 $E_g > 3\text{eV}$ large E_g b/w the CB and VB. On increasing T, charge carriers jump from VB to CB, thus $\downarrow$ or $\uparrow$ conductivity. ★ 2022

Intrinsic Semiconductor

- ✓ without doping
- ✓ G-14 Solid Block
- ✓ few holes and electrons present due to thermal aberration.

Extrinsic Semiconductor

N-type	★ 2013 ★ 2011, 2010	P-type
G-15 ⊗ charged	Impurity added ★ 2019	G-13 ⊗ charged
electrons (-)	Majority CC	holes (+)
Neutral	Charge on Semiconductor	Neutral

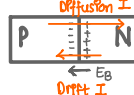
- While doping, it must be taken care that the size of dopant atoms (impurity) is comparable to the size of Semiconductor atoms (G-14)
- Mobility of electrons: $\frac{V_e}{E} = \mu_e$
- ★ 2021
- Mobility of Holes: $\frac{V_h}{E} = \mu_h$
- Conductivity
 $= e[n_e \mu_e + n_h \mu_h]$

Semiconductor Diode

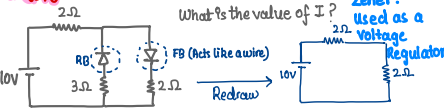
⇒ Making of a diode:

- n and p : Put together**
Diffusion of e^- ($n \rightarrow p$)
 h^+ ($p \rightarrow n$)
due to concentration gradient
↓
Diffusion Current
- Potential Attained**
P (attains lower V)
N (attains higher V)

Barrier electric field produced that resists diffusion current.

- Drift current Generated:**
Holes (near junction) : (towards P)
 e^- (near junction) : (towards N)

★ 2014 ★ 2021
lies b/w 0.1V to 0.3V
Barrier Potential = $E_b(d)$

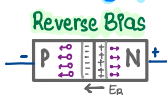
⇒ Breakdown and V-I Characteristics

- Breakdown of Reverse Biasing**
 - Zener Breakdown: When doping is high.
 - Avalanche Breakdown: When doping is low.
- In Reverse biasing, R_{high} but at breakdown $\Rightarrow R=0$**
 $\Delta V = 0$
V constant across the diode
★ 2021
Zener: used as a voltage Regulator


⇒ Biasing of a Diode:

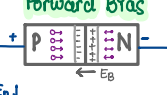
★ 2017, 2016, ★ 2022

Reverse Bias



- ✓ $E_b \downarrow$, Current due to minority CC
- ✓ Width of Depletion Region Increases. ★ 2020

Forward Bias



- ✓ $E_b \downarrow$
- ✓ Width of Depletion Region decreases.
- ✓ Current due to majority CC

Important devices:

- LED**
 - forward biased
 - 
 - [Heavily doped]
 - Energy released at junction $\rightarrow$ light
 - $I_{\text{forward}} \uparrow \rightarrow$ Intensity $\uparrow$
 - Used in remote control, burglar alarms, communication systems.
- Solar Cell**
 - No Biasing
 - 
 - Upper layer - thin
 - Photons directly fall in the depletion region.
 - CC move under influence of E_b
- Photodiode**
 - Reverse Biased
 - 
 - ↓
 - Same process, like in Solar cell. The process is simply accelerated by Reverse biasing

★2015 ★2022

Rectifier

1. Half Wave Rectifier:

$V_{input} = V_{output}$
 $I_{input} = I_{output}$

2. Full Wave Rectifier:

$V_{output} = 2V_{input}$
 $I_{output} = \frac{I_{input}}{2}$

Transistors

★2020

⇒ Making

Emitter: Highly doped, Moderate width, Forward Biased
Base: Lightly doped, thin
Collector: Moderately doped, thick, Reverse Biased

so that majority charge carriers can be pushed towards Base
Base is lightly doped, so it won't be able to recombine with all CC coming from emitter
To attract majority CC that base couldn't recombine with.

$I_E = I_B + I_C$

E C E
B B

⇒ NPN - CB transistor

$V_{EE} = V_i = V_{BE} + I_E R_E$
 $V_{CC} = V_o + I_C R_C$
 $\alpha = \frac{I_C}{I_E}$
 $V_o = V_{CB}$

⇒ NPN - CE transistor

$V_{BB} = V_i = I_B R_B + V_{BE}$
 $V_{CC} = I_C R_C + V_o$
 $V_o = V_{CC} - I_C R_C$
 $\beta = \frac{I_C}{I_B}$
 $I_C = I_o$
 $V_o = V_{CE}$

★2018,
★2017, 2016, 2013, 2012, 2009

1. Current Gain, $\beta = \frac{I_C}{I_B}$

2. Voltage Gain, $V_g = \frac{V_{CE}}{V_{BB}}$

3. Resistance Gain, $R_g = \frac{R_C}{R_B}$

4. Power Gain $= V_g \beta = \frac{V_g^2}{R_g} = \beta^2 R_g$

1. $V_i = 0$ V_o (Maximum)
As long as, $I_C = 0$
[The transistor : Cut off state]

2. $V_i \uparrow$; $I_C \uparrow$; $V_o \downarrow$
Active State : Amplifier

3. V_o becomes so small that, further change in V_i will bring non-linear change in V_o
Transistor → Saturation state

★2012

Works as a switch

Switched off $(I_o)_{low}$

Switched ON $(I_o)_{high}$