Photo Diode :-

"A photo diode is the semiconductor device which converts light energy into electrical energy.

Light Emitting Diode :- (LED)

The light Emitting Diode is the device which gives off visible light when it is energized.

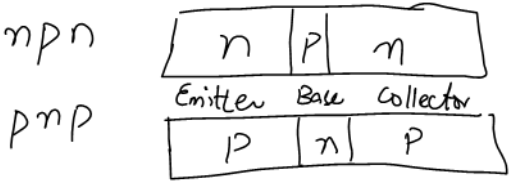
Solar Cell :-

A solar cell is a photo diode that is used to convert solar light energy into electrical energy.

Solid State Detectors :-

Solid state detectors are the semi-conductor devices used to detect radio-active radiations.

Transistors :-

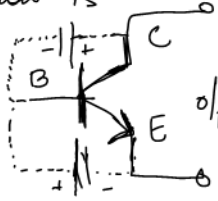


Transistor is a three terminal device formed either by sandwitching n-Type semi-conductors b/w two p-types or vice versa.

The junction of base and emitter is called base-emitter (BE). where as

the junction of base & collector is called Base-Collector (BC) junction.

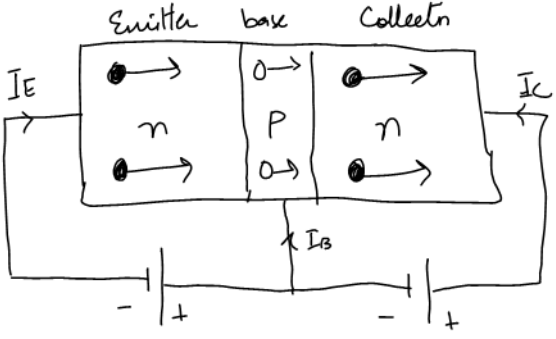
The (BE) junction is forward biased where as (BC) junction is reversed biased.



Charge of emitter migrates towards emitter junction forming emitter current (I_E). As base is a little doped and thin, therefore only a few charges of emitter current will be neutralized by base and equal amount of charge will come from the source forming base current (I_B). Due to electrostatic repulsion of another source charge from base will migrate towards the collector and form collector current (I_C).

$$I_E = I_B + I_C$$

npn Transistor :-



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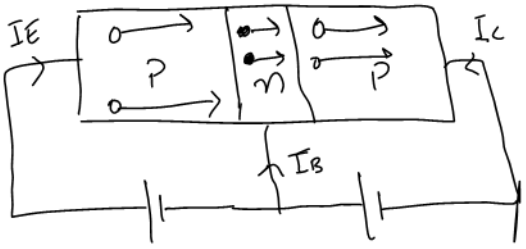
flows in the circuit.

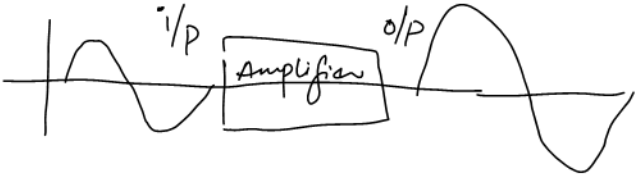
pnp transistor :



Holes of emitter migrates towards emitter junction forming emitter current (I_E). As base is a little doped and thin, therefore only a few holes of emitter current will be neutralized by base and equal amount of charge will come from the source forming base current (I_B). Due to electrostatic repulsion of another source charge from base will migrate towards the collector and form collector current (I_C). In this way almost the entire emitter current flows in the collector circuit.

Transistor as an Amplifier :

Amplifier is a device which raises the strength of weak input signal at output.



The weak signal, which is to be amplified is applied at base-emitter junction, which is forward biased and is taken at base-collector. By increasing the potential at V_{BE}, thickness of the base emitter junction decrease, thus decreasing Collector current (I_C) which increases the strength of the weak i/p signal at the o/p.

Numerical

16.21

$t = 0.05\ \mu s = 5 \times 10^{-8}$ sec

$\lambda = 2.5\ cm = 2.5 \times 10^{-2}\ m$

$\nu = ?$, Number of waves $= n = ?$

$C = 3 \times 10^8\ m/s$

Solⁿ

$C = \nu\lambda$

$$\nu = \frac{3 \times 10^8}{2.5 \times 10^{-2}}$$

$$\boxed{\nu = 1.2 \times 10^{10}\ Hz}$$

Time period

$$T = \frac{1}{\nu} = \frac{1}{1.2 \times 10^{10}}$$

$$T = 8.33 \times 10^{-4}\ sec$$

$$n = \frac{t}{T}$$

$$= \frac{5 \times 10^{-3}}{8.33 \times 10^{-4}}$$

$$n = 600 \text{ waves}$$

2007 - $\varepsilon_0 = 8.85 \times 10^{-12} \ C^2/Nm^2$

$\mu_0 = 4\pi \times 10^{-7} \ Tm/A$

$$\text{Velocity} = \frac{1}{\sqrt{\mu_0 \varepsilon_0}}$$

$$c = \frac{1}{\sqrt{(4\pi \times 10^{-7})(8.85 \times 10^{-12})}}$$

$$C = \frac{1}{3.34 \times 10^{-9}}$$

$$C = 2.99 \times 10^{8}$$

$$\boxed{C = 3 \times 10^{8}\ m/s}$$

16.3 — $T = 1ns = 1 \times 10^{-9}\ sec$

$$V = C = 3 \times 10^{8}\ m/s$$

(a) freq:-

$$T = 1/\nu \Rightarrow \nu = 1/T$$

$$\nu = 1/1 \times 10^{-9}$$

$$\boxed{\nu = 10^{9}\ Hz}$$

(b) $\lambda = ?$

$$c = \nu \lambda$$

$$\lambda = \frac{3 \times 10^8}{10^9}$$

$$\boxed{\lambda = 0.3 \text{ m}}$$