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The p-n-p Transistor

The p-n-p transistor is shown in fig.(a). Here, the emitter-base junction (or simply emitter junction) is forward biased. Obviously, this junction has low impedance as the forward bias helps the movement of the holes in p-type & of electrons in n-type towards the emitter junction. The collector-base junction (or simply the collector junction) on the other hand is reverse biased and has high impedance because reverse bias does not allow the holes in p-type and the electrons in n-type to move towards the collector junction.

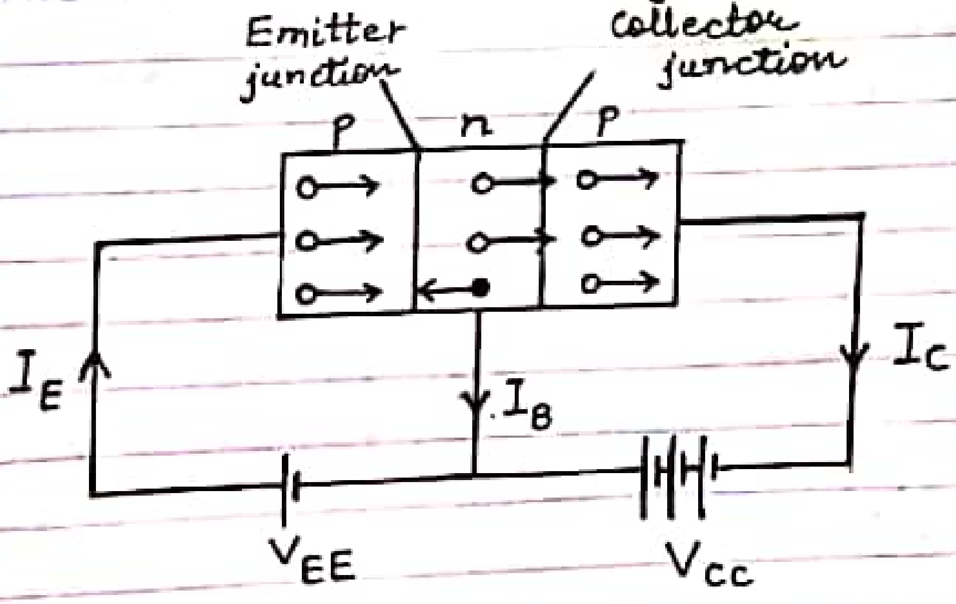

Fig. - (a)

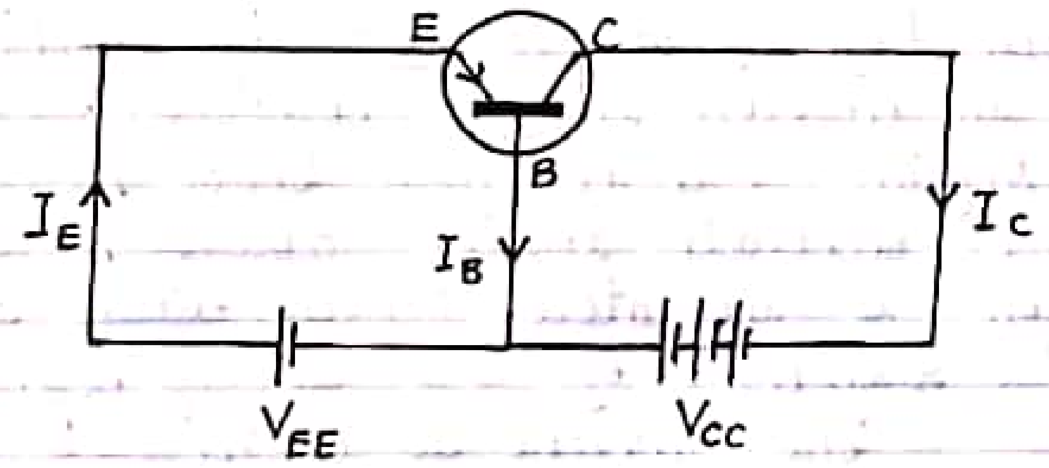

Fig-(b.)

With the emitter junction forward biased, the holes in the emitter and the electrons in the base, begin to move towards this junction, the holes being repelled by the positive terminal and the electrons by the negative terminal of the battery V_{EE} (emitter voltage). On reaching the emitter junction, a small fraction (about 5%) of the total number of holes combines with electrons in the base to get neutralized. As the base region is extremely thin and only slightly doped, the collector which is at very high negative potential ~~while~~ will collect almost all the holes. As each hole reaches the collector electrode, an electron is emitted from the battery V_{CC} (collector voltage) and neutralizes the hole.

For each hole that is lost by combination with an electron in the collector and base region, a covalent bond near the emitter electrode breaks down and an electron is liberated which enters the positive terminal of the battery V_{EE}. Thus:
The current is carried by holes in the crystal and by the electrons in the external circuit.

It is clear that

$$I_E = I_C + I_B \quad — (1)$$

where I_E = emitter current

I_C = collector current

I_B = base current.

It should be noted that I_C and I_E flow in opposite directions in the base as shown in fig. (b).