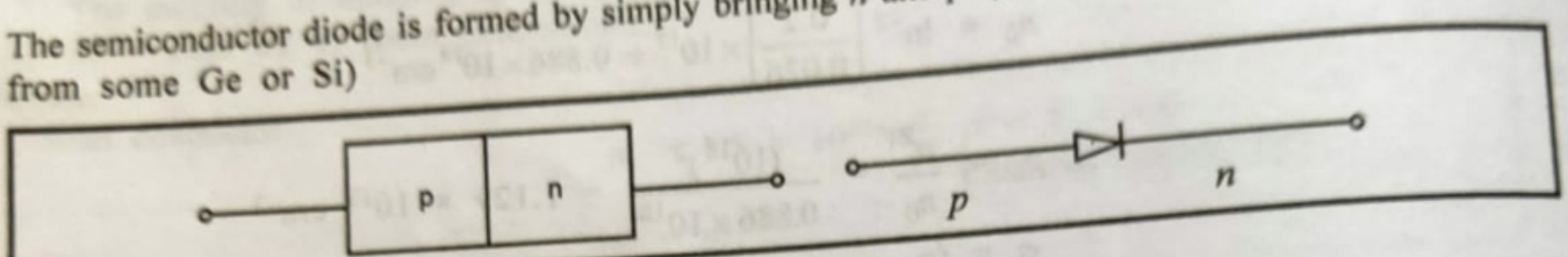
SEMICONDUCTOR DIODE

The semiconductor diode is formed by simply bringing n and p type materials together (constracted from some Ge or Si)



At the instant the two materials are "joined" the electrons and holes in the region of junction will combine resulting in a lack of carriers in the region near the junction.

This region of uncovered positive and negative ions is called the depletion region due to the depletion of carriers in this region.

(a) No bias ($V_n = 0$).

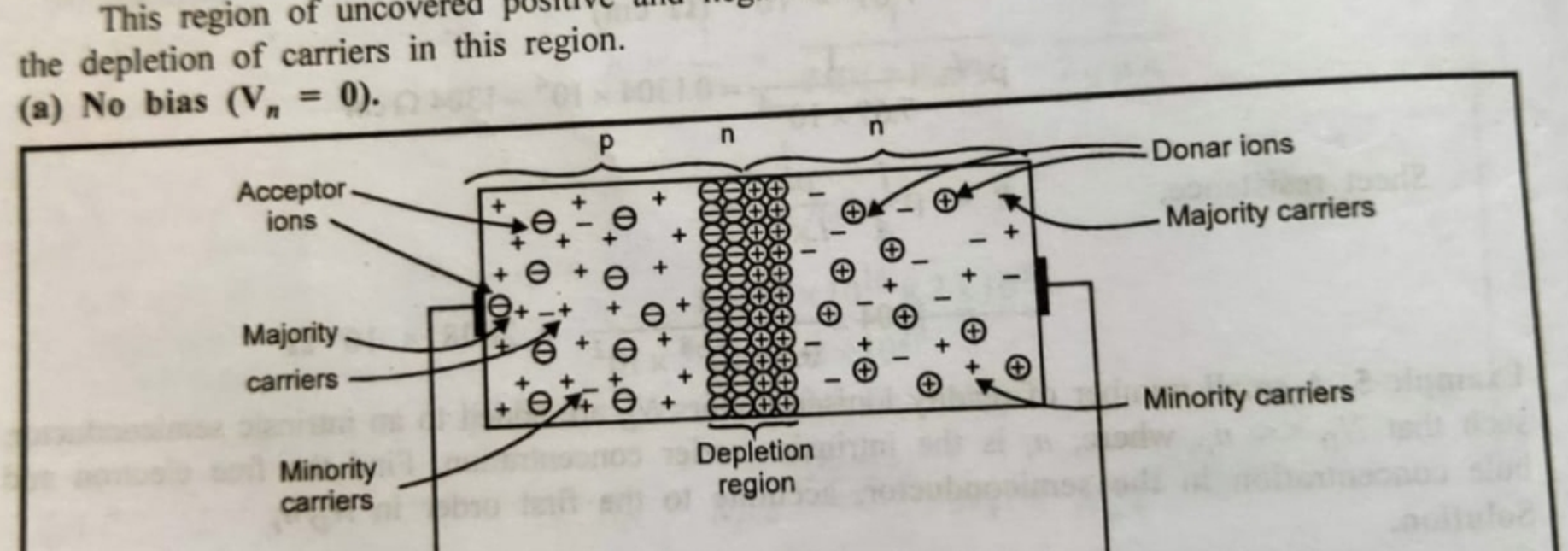


FIG. (a)

In the absence of an applied bias voltage, the net flow of charge in any one direction for a semiconductor is zero.

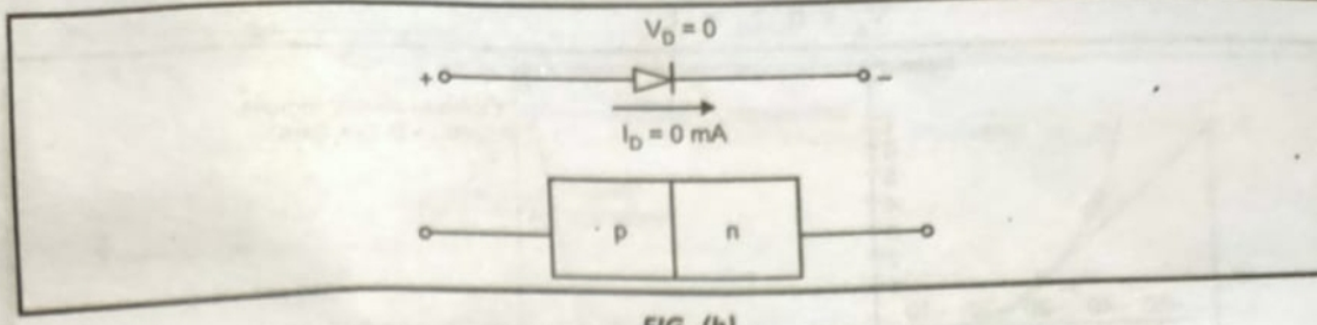


FIG. (b)

(b) Reverse bias condition ($V_D < 0$ V). If an external voltage V is applied across *p-n*-junction such that positive terminal to *n*-type and negative terminal to *p*-type material, depletion layer will be increased. This widening of depletion layer will establish too great a ba for the majority carrier to overcome $I_s = -0.1$ μA

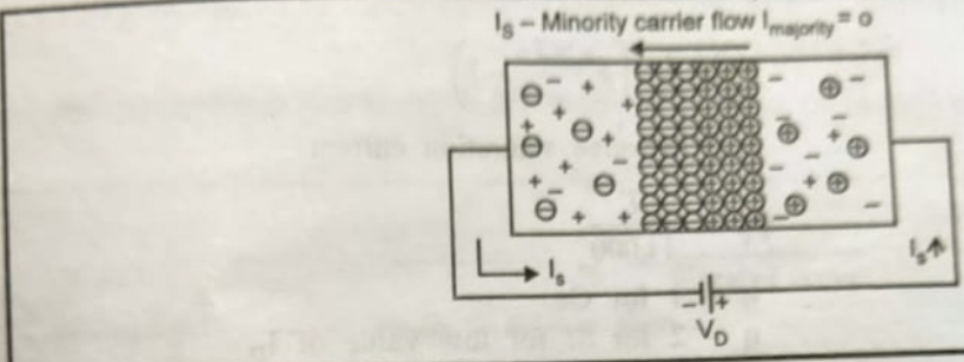


FIG. Reverse bias circuit

The number of minority carrier however, that find themselves entering the depletion will not change.

(c) Forward bias condition. A forward bias condition is established by applying the +ve te to *p*-type material and -ve terminal to the *n*-type.

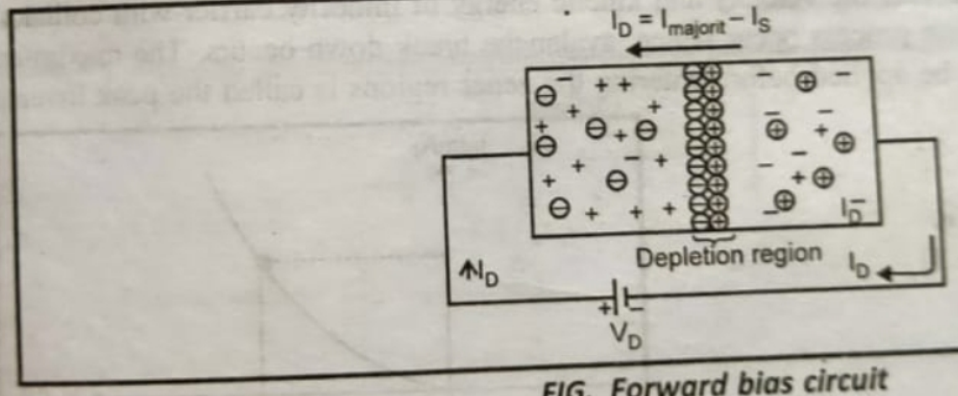


FIG. Forward bias circuit

The application of a forward bias potential will pressure electrons in the *n*-type and holes in the *p*-type material with the ions near the boundary and reduce the widt depletion region.

As the applied bias increases in magnitude the depletion region will continue to in width until a flood of electrons can pass through the junction, resulting in an expone in current as shown in Fig. the forward bias region of the characteristic.

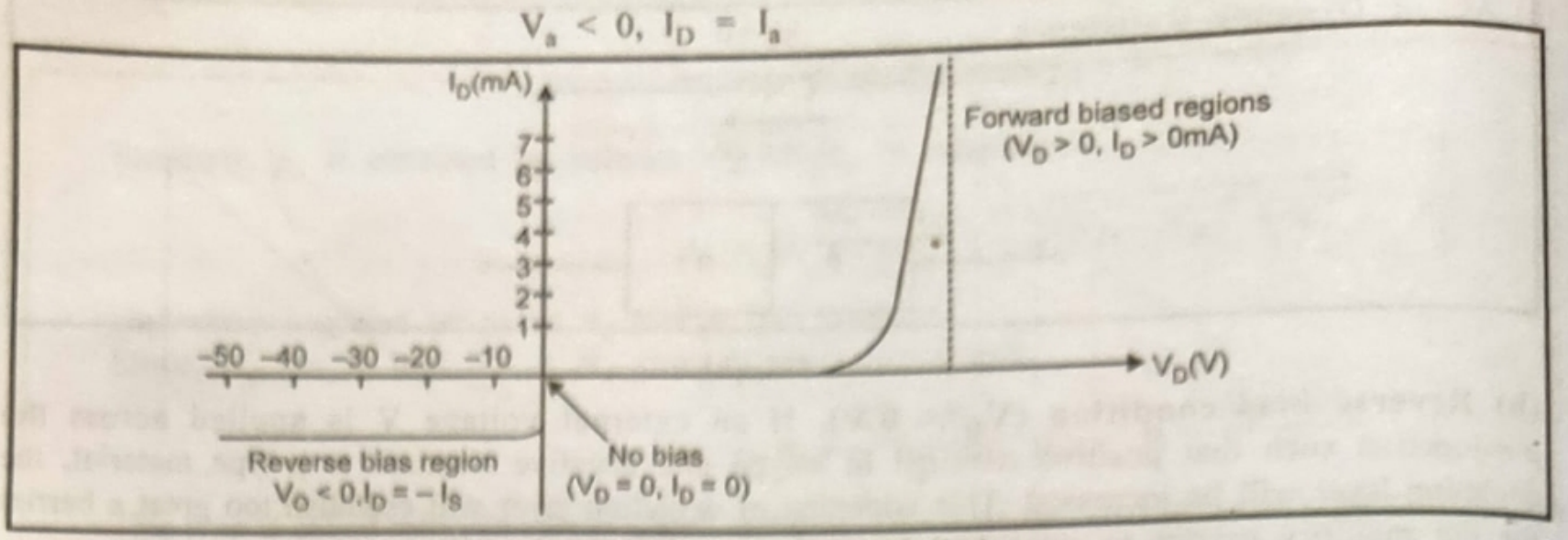


FIG. V.I. characteristic of diode

I_D is given as

$$I_D = I_S \left(e^{V_D/\eta V_T} - 1 \right)$$

I_S = Reverse saturation current

$$V_T = \frac{T}{11{,}000};$$

η = 1 for Ge

η = 2 for Si for low value of I_D

η = 1 for both Ge < Si for high current

Zener Region