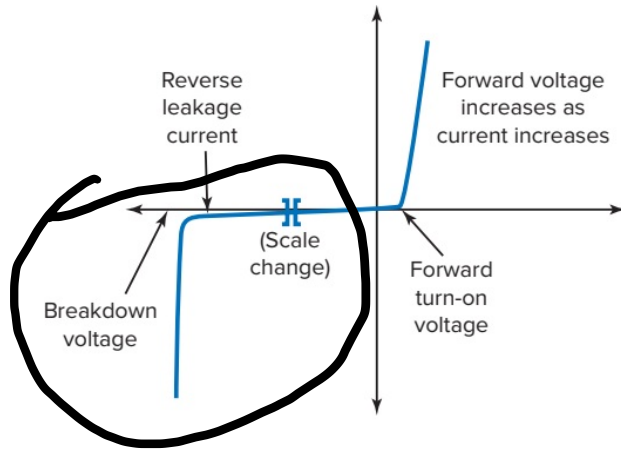
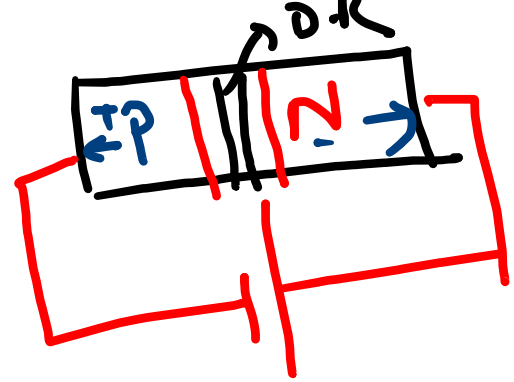


# P-N junction in reverse bias.



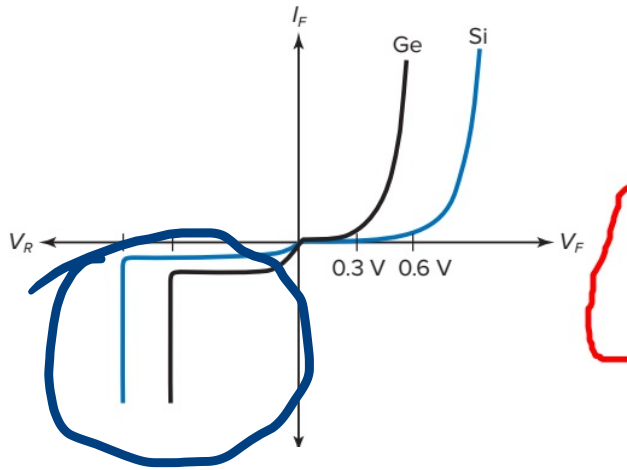
In reverse bias the depletion region widens & the barrier potential increases majority charge carriers cannot cross the junction.



In the ideal diode there is no current in the reverse bias, but in real diode there is a small current, ( $\mu A$ ) due to minority charge ( $e^-$ s in p) (holes in n) carrier that cross the barrier due to thermal motion.



In the reverse bias the small current flowing due to minority charge carriers is called **Leakage current** : **Dark current**

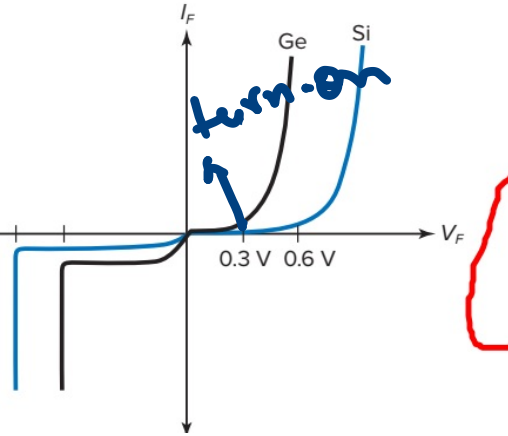


Reverse  
bias



Si has been observed to have a low value of leakage current, compared to Ge. So Si is preferred more in application.

What will happen when the reverse bias voltage is continuously increased?

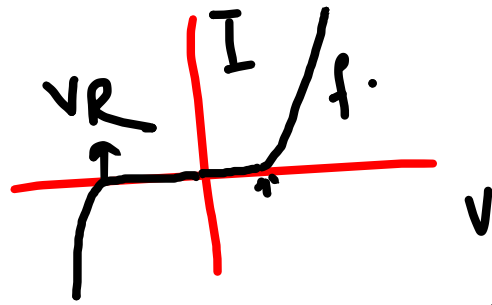




At a certain value of the reverse voltage

$V_R$  the reverse

current will show a rapid and sudden increase. In this case also the current becomes / increases independent of voltage.



Why & How?

The voltage  $V_R$  at which the current (leakage) starts to increase rapidly is called Reverse breakdown voltage.

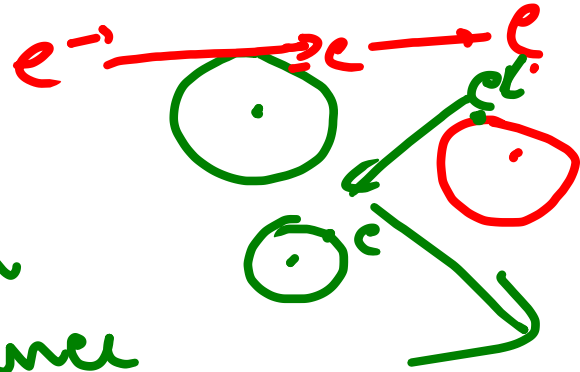


breakdown!.

The breakdown voltage is also called  
avalanche voltage

Avalanche!.

Due to high voltage the electrons gain energy and are accelerated, these electrons with high KE, collide with the valence electrons of nearby atoms & knock out their electrons. Thus due to





Large number of collisions charge carriers are formed and then the current increases.

Avalanche voltage for Si is above 50V to 1000V, if the current is not reverse after the breakdown is not controlled then, the diode will be damaged, due to heat.



Some diodes are prepared for avalanche breakdown at a fixed voltage.

In case of ordinary diode, high reverse voltage is concentrated at one point that causes heating and damage.

Avalanche diode can be used to absorb the high voltage occur for short time, and undergoes breakdown, thus it remaining circuit is protected.



So Avalanche diode is like a shock.  
-absorber in electronics.

Avalanche diodes have many advantages

- They have increased reliability in cases where high voltages appear for short time
- They can withstand large values of transient voltages.
- They are faster than Zener diodes, metal tubes.



→ Avalanche diodes are used in protection against lightning and surge (sudden increase in voltage)

Si is preferred for Avalanche diode.

free wheeling diode: In inductive circuit there are sudden increase in voltage. Avalanche diodes are used to control these sudden high voltages.