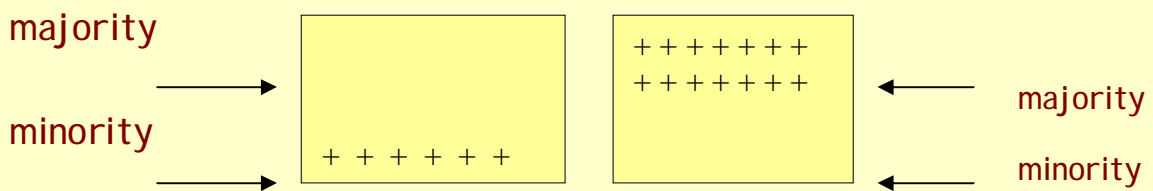


experiment 1

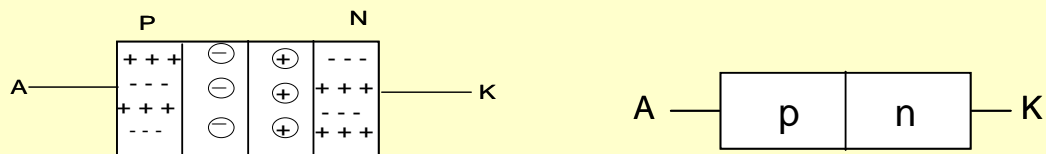
Subject: Diode characteristics

Introduction:-

- 1) Semiconductor devices have four electrons in the outer shell of its atom.
- 2) If pure semiconductor has been doped with (pentavalent) elements so the result will be (n- type) semiconductor
- 3) If pure semiconductor has been doped with (trivalent) elements so the result will be (p- type) semiconductor



Semiconductor devices:-



As (diode , BJT , FET , thyristor ,)

Diode :-

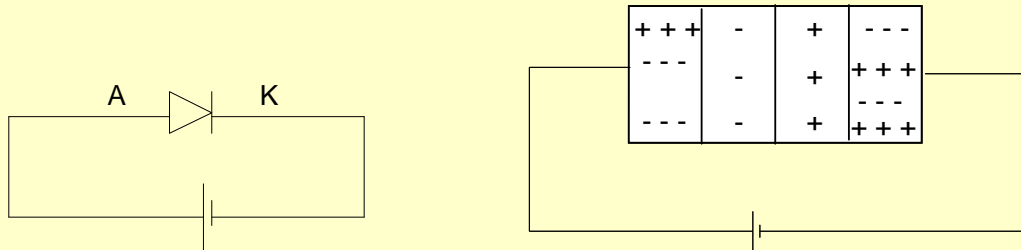
- # It is a combination of P & N materials which lets the majority carriers to flow only in one direction.
- # Holes are in P_ side and electrons are in N_ side but some holes & some free electrons try to move through the junction and recombine in a region called (depletion region).
- # as depletion region is performed, a voltage drop across depletion layer appears and prevents holes or free electrons from moving (prevent current from passing)
- # to pass a current through the junction we must connect a battery to overcome this voltage drop.

Note :-

At room temperature (25 C) silicon has 0.7v but germanium has 0.3 v

Biassing

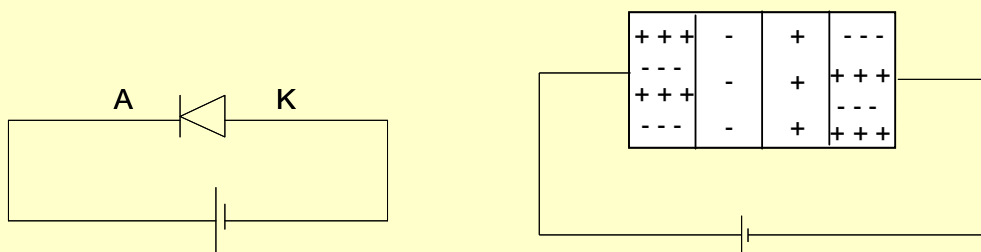
Forward biasing



Battery repel (push) holes and electrons , or we can say that electrons in N_ type repel with negative terminal of battery and holes in P_ type repel with positive terminals of battery. and so, a current pass from anode to cathode .

when a battery is large enough to overcome the barrier potential a continuous current can exist because holes & free electrons will cross the junction in large number.

Reverse biasing



the positive terminal of the battery attracts with the negative charge of N _type also the negative terminal of the battery attracts with the positive charge of P _type & a very small current passes due to minority carriers

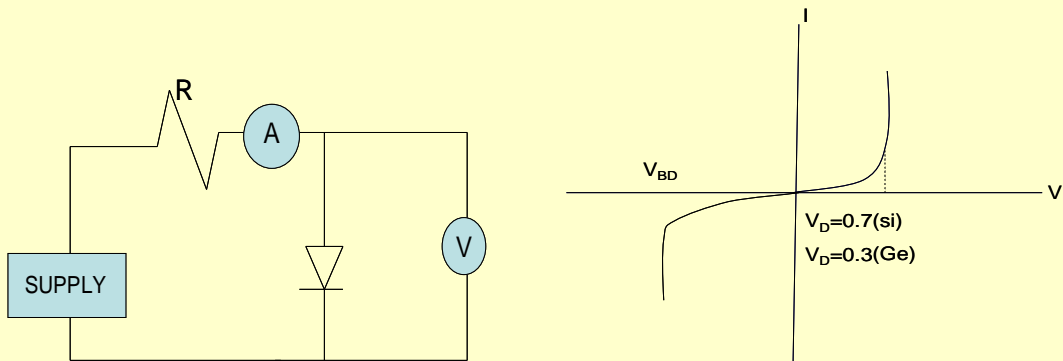
the diode undergo negative potential of the battery up to a certain value according to diode's type

this value is called VBD (break down voltage)

I -V characteristic curve

To plot I -V ch/s curve

1) Design this circuit



The ammeter is used to measure the diode current

The voltmeter is used to measure the voltage across diode

2) Plot the relation between I & V to get the shown curve.

Notes:-

\$- the resistor R is used to

- Limit current in circuit since the input voltage varies (not constant)

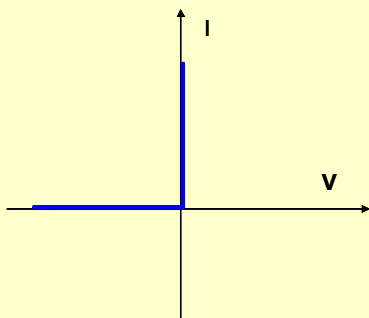
The diode approximations

1- ideal

The diode has two equivalent circuit

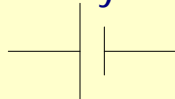
- it acts as short circuit when it is connected in forward bias direction (—)

- it acts as open circuit when it is connected in reverse bias direction (— —)

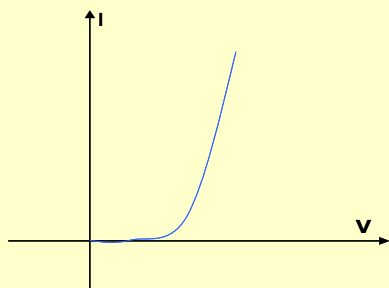


The second approximation

-Diode acts as a battery when it is connected in forward bias direction



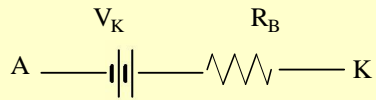
-Diode acts as open circuit when it is connected in reverse bias direction (— —)



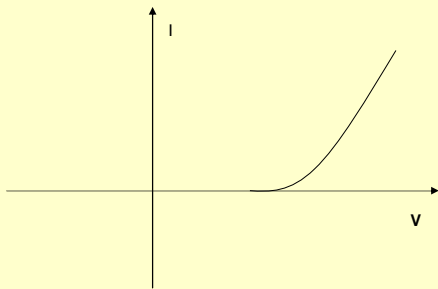
but almost no current passes through it.

The third approximation

- In forward biasing diode acts as battery followed by series resistance (bulk resistance)

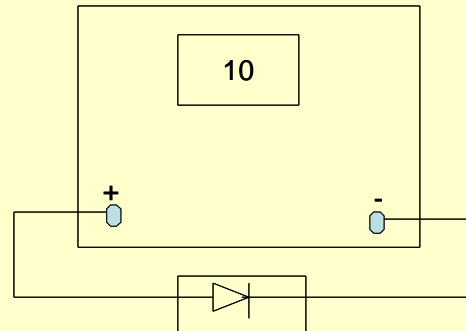


- In reverse biasing diode acts open circuit + battery + R

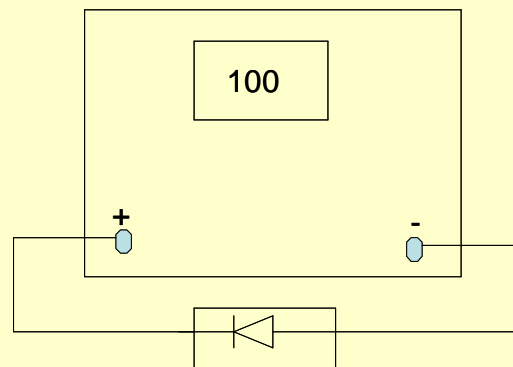


How to test the diode

When it connected with a voltmeter in forward direction so it gives (low resistance)



When it connected with a voltmeter in reverse direction so it gives (large resistance)

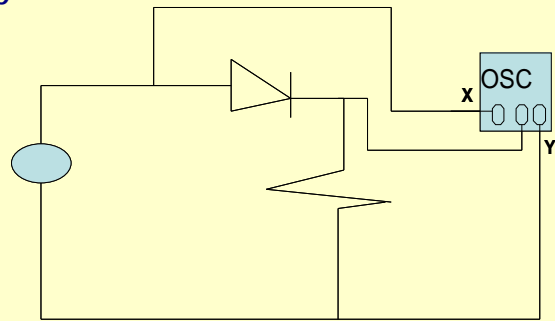


How to connect the previous circuit with oscilloscope

- our oscilloscope is dual channel

1- let X-axis (channel 1) for diode and (channel 2) for resistance

2- press (x-y) plot to display the two functions



Note :-

Why the curve is reversed ?

- the voltage on terminal of R1 is negative so on Y-axis is the spot goes down wards while voltage on diode is positive direction

