



VIVA - VOCE

Q.1. What is the Objective of Experiment?

Ans. The objective of our experiment is to find out the energy gap of a semiconductor by four probe method.

Q.2. What is four probe method ?

Ans. In four probe method there is a set of four probes. Outer pair is used for passing current through the semiconductor and inner pair is used for measuring potential difference. By using suitable relationship we can measure resistivity of the given semiconductor.

Q.3. What is resistance?

Ans. The opposition offered to flow of current is called resistance. It is measured in ohm.

Q.4. What is resistivity ?

Ans. The resistance of solid of unit area of cross-section and unit length is called resistivity. It is measured in ohm-cm.

Q.5. What are the factors that controls resistivity of a semiconductor ?

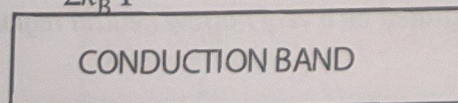
Ans. Temperature and band gap.

Q.6. How does resistivity of a semi-conductor varies with rise in temperature ?

Ans. It decreases with rise in temperature of a semi-conductor.

Q.7. How does band gap determine the resistivity of a semiconductor ?

Ans. As $\log_e \rho = \frac{E_g}{2k_B T} + \log_e C$



VALENCE BAND

n-type

$$\rho = C \exp. (E_g / k_B T)$$

i.e., if band gap increases, logarithmic of resistivity increases.

Q.8. Between Ge & Si which is more conducting at room temperature ?

Ans. The band gap of Ge = 0.7 eV.

The band gap of Si = 1.1 eV.

As band gap of Ge is low so Ge is more conducting at room temperature.

Q.9. From experimental results, how will you come to know whether the given material is intrinsic or extrinsic ?

Ans. If the graph between $\log r$ and $1/T$ is a straight line then given semi-conductor is pure or intrinsic and if it becomes curved at moderate temperature and at higher temperature then it is extrinsic.

Q.10. What is Fermi level ?

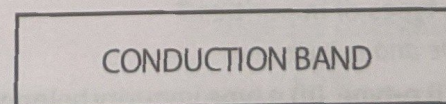
Ans. The top most filled level at 0K is called fermi level.

Q.11. Why semi-conductor behaves as insulator at 0 K ?

Ans. At 0 K there is no electron in the conduction band. Moreover electrons in the valence band do not have that much energy to shift over of conductor band hence conduction band empty and semi-conductor behaves as insulator at 0 K.

Q.12. What is position of fermi level in p-type and n-type semiconductor material ?

Ans. In n-type semiconductor the concentration of electrons is more so Fermi level is nearer to conduction band.



VALENCE BAND

p-type

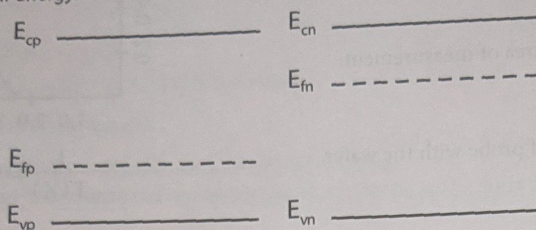
Whereas in p-type semi-conductor the concentration of holes is higher so fermi level is nearer to valence band.

Q.13. Do you know about intrinsic and extrinsic semiconductor ?

Ans. A pure or natural semiconductor is called an intrinsic semiconductor e.g., silicon and germanium. But it has small electrical conductivity. In order to increase the conductivity of a pure semi-conductor, either some pentavalent (like arsenic) or trivalent (like boron) impurity is added to it, the resulting semiconductor is called an extrinsic semiconductor.

Q.14. What is Fermi-energy ?

Ans. The energy corresponding to top most filled level at 0K is called Fermi energy.



Q.17. How do you differentiate between a conductor, an insulator and a semiconductor in relation to energy gap ?

Ans. In conductors either the valence and conduction bands overlap each other or conduction band is partially filled. In insulators, there is a large band gap between valence and conduction bands, while in semi-conductors this band gap is not too large so that at room temperature the thermal energy gained by some of the electrons in the valence band is sufficient to make them to cross the energy gap and jumps over to conduction band.

Q.18. What is a semiconductor ?

Ans. It is a substance with conduction properties between metals and insulators.

Q.19. What is meant by intrinsic semiconductor ?

Ans. A pure semiconductor completely free from impurities is called intrinsic semiconductor.

Q.20. What is the order of energy gap in a pure semiconductor ?

Ans. 1 eV.

Q.21. What do you mean by an extrinsic semiconductor ?

Ans. It is a semiconductor to which an impurity from group 13 or group 15 has been added.

Q.22. What do you mean by a doped semiconductor ?

Ans. It is a semiconductor to which an impurity from group 13 or group 15 has been added.

Or

Extrinsic semiconductor is called doped semiconductor.

Q.23. What is doping ?

Ans. It is the process of addition of impurity to a pure semiconductor in order to alter its conduction properties.

Q.24. What are two different types of impurities ?

Ans. The impurities are p-type and n-type.

Q.25. To which group does a (i) p-type, (ii) n type impurity belong ?

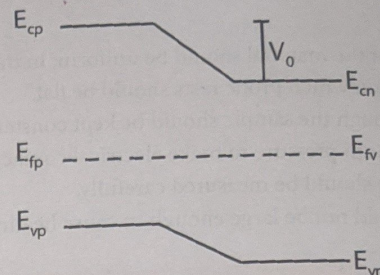
Ans. p-type impurity belongs to group 13 and n-type to group 15.

Q.15. What is the position of Fermi level in intrinsic semiconductor ?

Ans. In case of intrinsic semi-conductor, the position of fermi-level is exactly half way between top of valence band and bottom of conduction band.

Q.16. How fermi-level is adjusted in P-N junction diode ?

Ans. A fermi-level is adjusted in such away that there is no gradient along the fermi-level because gradient mean net current flow in equilibrium condition which is not possible.



Q.26. What are the charge carriers in a pure semiconductor.

Ans. A pure semiconductor has electrons and holes as charge carriers. Their number densities are equal.

Q.27. What are the charge carriers in n-type semiconductor ?

Ans. In n-type semiconductor, electrons are majority charge carriers and holes are minority charge carriers.

Q.28. What is the effect of temperature on conductivity of a semiconductor ?

Ans. It increases with rise in temperature.

Q.29. What is junction diode ?

Ans. Junction diode is formed when a p-type semiconductor is in intimate contact with n-type semiconductor.

Q.30. What is meant by forward bias ?

Ans. pn junction is said to be forward biased when p-region is connected to positive terminal and n-region to the negative terminal of battery.

Q.31. What is meant by reverse bias ?

Ans. Try yourself.

Q.32. What is knee voltage ?

Ans. In a forward biased pn junction, the voltage at which there is a sudden increase in current with a small increase in voltage is called knee voltage.

Q.33. What do you mean by reverse breakdown ?

Ans. For a certain value of reverse potential applied to a p-n junction, there is a sudden sharp increase in current. This is called reverse breakdown.

Q.34. What is a zener diode ?

Ans. It is a diode specially designed to operate in reverse breakdown region. The p and n regions are heavily doped and are separated by a very narrow neutral region.