

**IQRA NATIONAL UNIVERSITY**

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**DEP**: BS(SE)

**SUBJECT**: Applied Physics

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**SEMESTER**: summer

**Q no1:**

**A: Explain the phenomena of electron hole pair recombination?**

**ANSWER:**

**Recombination of Electron and Hole:**

* When some external energy is supplied to a semiconductor, the electron of the valence band is lifted to the conduction band and become free leaving behind the holes in the valence band. The orbit of the conduction band in which free electrons are moving is larger as compared to the orbit of the valence band in which the holes are formed.
* The one atom of the conduction band orbit may intersect with the hole orbit of another atom. As a result of this intersection, the conduction band electron falls into a hole. This merging of the free electron and a hole is called Recombination of Electron and Hole.When the recombination takes place, the hole does not move anywhere, it just disappears.
* This recombination process takes place continuously in a semiconductor and fills every hole. However, the incoming heat energy keeps producing new holes by lifting valence electrons up to the conduction band forming electron-hole pair. The creation of electron-hole pairs and their recombination goes on continuously.
* The average timing between the creation and the disappearing of an electron-hole pair is termed as Lifetime. The lifetime varies from nanoseconds to several microseconds depending upon the various factors such as shape, size, crystal structure of the semiconductor material.

**Q no 1:**

**B:What happens to the barrier potential when the temperature increases?**

**ANSWER:**

Barrier potential is inversely proportional to the temperature. Higher the temperature, greater will be the mobility of charge carriers and lower potential difference across the junction can break the potential barrier. But as the temperature lowers, kinetic energy of charge carriers decreases and higher will be the value of potential barrier.

**Q no 2:**

**A: Explain the difference between majority and minority carriers? Explain the majority and minority carriers in n-type and P-type semiconductors?**

**ANSWER:**

**Majority and Minority Carriers:**

* In an n-type semiconductor, the electrons are the majority carriers whereas, the holes are the minority carriers. In the p-type semiconductor material, the holes are the majority carriers, whereas, the electrons are the minority carriers.
* In n-type semiconductors they are electrons, while in p-type semiconductors they are holes.

**Majority and Minority Carriers in n-type:**

When silicon or germanium doped with pentavalent atoms in an n-type semiconductor. The n stand for negative charge on electron. The electrons are called the majority carriers in n-type. Although the majority of current carriers in n-type are electrons. There are also few holes that are created when electron hole pair thermally generated. Holes in n-type material are called minority carriers.

**Majority and Minority Carriers in p-type:**

When silicon or germanium doped with trivalent atoms are called p-type semiconductor. Holes can be thought as of positive charges because the absence of electron leaves a net positive charge on the atom. The holes are the majority carriers in p-type material. Although the majority of current carriers in p-type are holes. There are also few electrons that are created when electron hole pair thermally generated. Electrons in p-type material are called minority carriers.

**Q no 2 :**

**B:When does reverse breakdown occur in a diode?**

**ANSWER :**

Normally the reverse current is so small that it can be neglected. However if the external reverse bias voltage increases to a value called the breakdown voltage. The reverse current will drastically increase.

**Q no 3:**

**A: Find the difference between electric potential energy and electric potential?**

**ANSWER :**

 **Difference Between Electric Potential and Electric Potential Energy:**

* The basic difference between electric potential and electric potential energy is that Electric potential at a point in an electric field is the amount of work done to bring the unit positive charge from infinity to that point, while electric potential energy is the energy that is needed to move a charge against the electric field.
* The gravitational potential at a point in the gravitational field is the gravitational potential energy of a unit mass placed at that point. In this way, the electric potential at any point in the electric field is the electric potential energy of a unit positive charge at that point.
* If W is the work done in moving a unit positive charge q from infinity to a certain point in the field, the electric potential V at this point is given by:

 V = W/q

* It implies that electric potential is measured relative to some reference point and like potential energy we can measure only the change in potential between two points.
* Electric potential is the scalar quantity. Its unit is volt which is equal to joule per coulomb (J/C).

**Q no 3:**

**B:How to find the potential difference between any two points in the electric field lines?**

**ANSWER:**

 Potential difference is the difference in electric potential between two points in space. That's really all it is. It is also measured in Joules per coulomb, but this is usually shortened to a different unit: volts. The electric potential difference between two sides of a battery is what makes electricity flow around a circuit. A 12V battery, for example, has a difference in potential of 12 Joules per coulomb on the two sides of the battery.