**Object :** *To study the characteristic curve of solar cell.*

**Apparatus Required :** Solar cell, millivoltmeter, micrometer and variable load.

**Theory :** A solar cell is the photo-voltaic device which converts the solar energy radiations directly into the electrical energy with an efficiency of the order of 10%. It is basically a P-N junction with a large surface area which operates at the zero bias voltage.

When solar radiations fall at the junction, electron-hole pair are formed in both sides of junction due to breaking of covalent bonds.

Now due to accumulation of holes in P region and electrons in N region, a voltage is developed across the junction which makes the P-N junction in forward bias condition. As a result, a current I begins to flow from P region to N region, through the junction. When no load is connected in the circuit, the forward current I balances the current $I_g$ due to sweep of electrons and holes at the junction. But when an external load $R_L$ is connected between P and N sides of solar cell, a current $I_L$ begins to flow through the load which develops a potential difference $V_L$ across the load and thus light (or solar) energy is converted into the electrical energy.

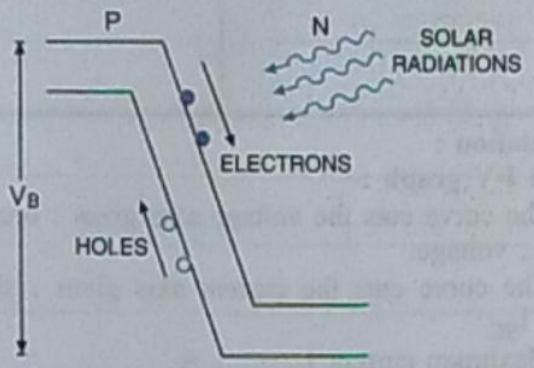


**Fig. 63. Absorption of solar radiation**

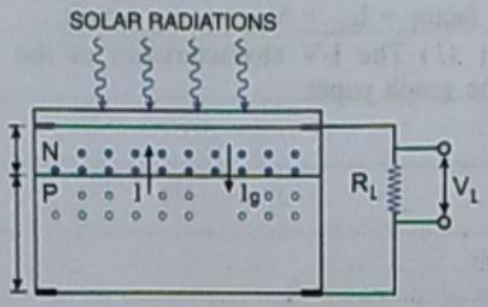


**Fig. 64. P-N junction after being illuminated with solar radiations**

**Procedure** : (1) The circuit is connected as shown in Fig. 64.

(2) Note down the voltage at maximum load *i.e.*, when current = 0. This gives the open circuit voltage $V_{OC}$.

(3) The load is reduced in steps and corresponding voltage and current are noted down. Take 8-10 readings.

(4) Minimise the load and note down the short circuit current $I_{SC}$ *i.e.*, the current when V = 0.

(5) A graph for current versus voltage is drawn (Fig. 65)

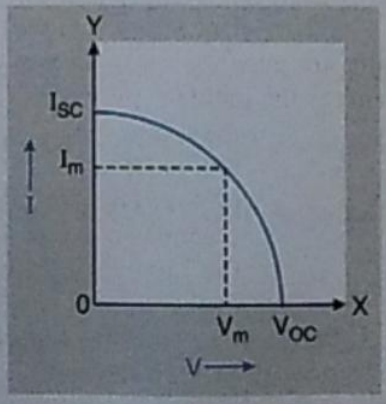


**Fig. 65. I-V graph of solar cell**

(6) Find $I_m$, $V_m$, $I_{SC}$ and $V_{OC}$ from I-V graph.

(7) Calculate fill factor for a given solar cell.

**Observations :**

| S.No. | Voltage across solar cell (in volt) | Current in the circuit (in μA) |
|---|---|---|
| 1. | | |
| 2. | | |
| 3. | | |
| 4. | | |
| 5. | | |
| 6. | | |
| 7. | | |
| 8. | | |
| 9. | | |
| 10. | | |

**Calculation :**

**From I-V graph :**

(1) The curve cuts the voltage axis gives : open circuit = $V_{oC}$ = ..... voltage.

(2) The curve cuts the current axis gives : short circuit current = $I_{SC}$

(3) Maximum current $I_m$ = ..... A

(4) Maximum voltage $V_m$ = ..... volt

(5) Fill factor = $I_{SC} \times V_{oC}$ = ..... A volt.

**Result :** (1) The I-V characteristics of the solar cell is shown on the graph paper.

(2) The efficiency of a given solar cell $\eta$ = ..... %.

(3) Fill factor of given solar cell = ..... .

**Precautions :** (1) The positive terminal of solar cell should be connected to positive terminals of voltmeter and ammeter.

(2) After doing experiment switch off the circuit.