

TOPIC:

Clean energy

AIM:

To draw the I-V characteristics of a solar cell and to find out its efficiency and fill factor.

APPARATUS

REQD.:

- Solar cell (p-n junction diode)
- Light source (100 W bulb)
- Ammeter
- Voltmeter
- Load circuit
- Connecting wires

FORMULAE

USED:

The maximum power generated :  $P_{max} = V_{mp} \cdot i_{mp}$ ,

where,  $V_{mp}$  and  $i_{mp}$  are the current and voltage values corresponding to maximum power.

$$FF = \frac{V_{mp} \cdot i_{mp}}{V_{oc} \cdot i_{sc}}$$

$$\eta = \frac{P_{max}}{A_c \cdot \Omega}, \quad \text{where,}$$

$A_c \rightarrow$  area of solar cell

$\Omega \rightarrow$  incident intensity

Exp. 9

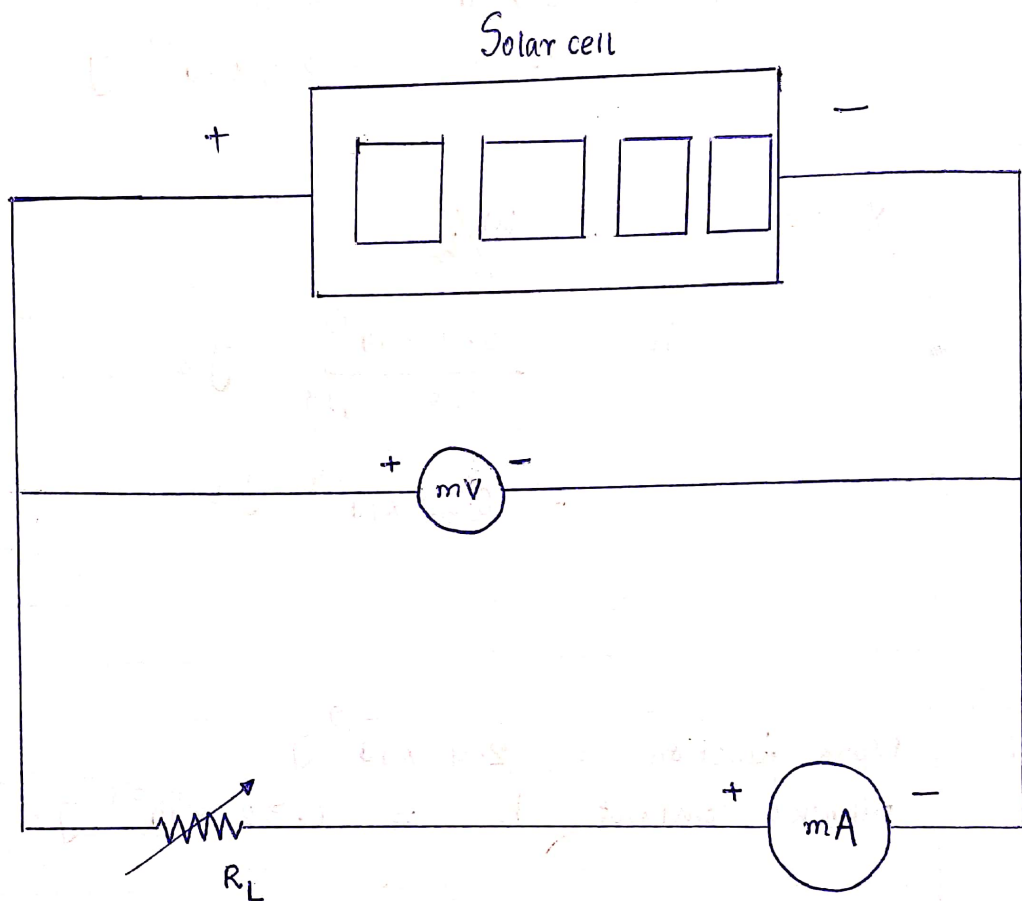
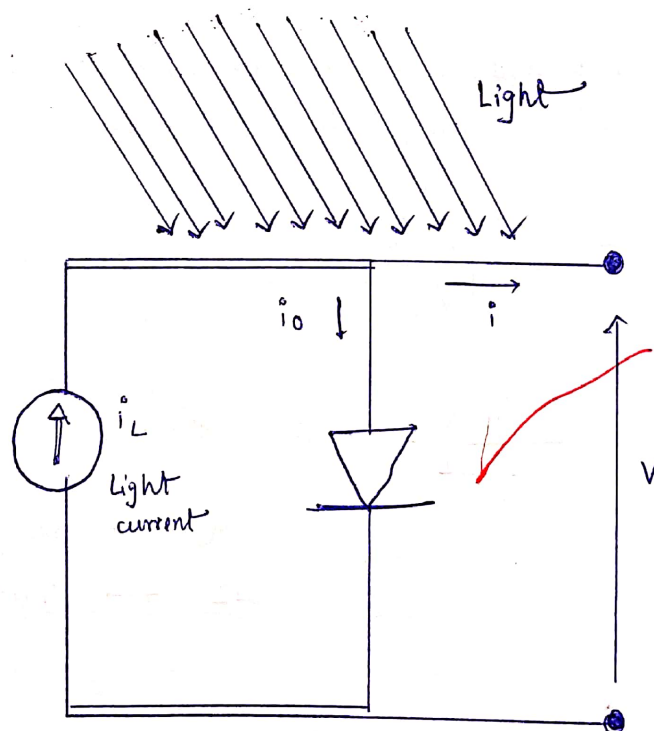
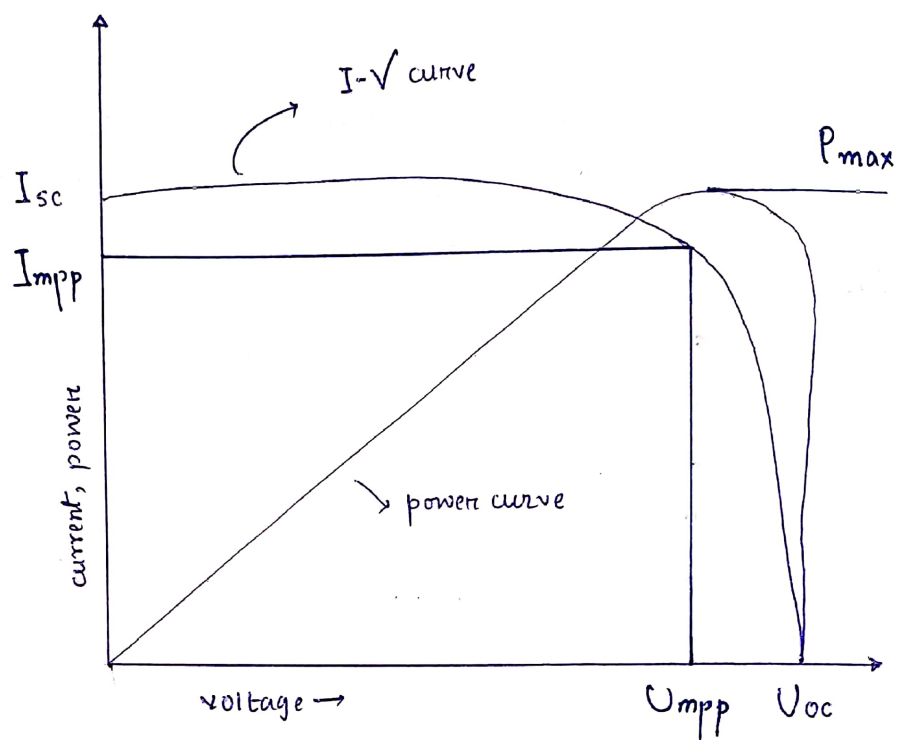


Fig. Study of I-V characteristics of a solar cell



I-V characteristics of a solar cell

TABLE :

$I_{sc} = 13 \text{ mA}$

$V_{oc} = 1.5 \text{ V}$

$A_c = 22.75 \times 10^{-4} \text{ m}^2$

Distance (x) = 5 cm

Intensity of light = 25 W/m<sup>2</sup>

Load  
Resistance

Current

Voltage

Power

10  $\Omega$ 

13 mA

0.1 V

1.3 mW

22  $\Omega$ 

13 mA

0.25 V

3.25 mW

33  $\Omega$ 

13 mA

0.4 V

5.2 mW

47  $\Omega$ 

12 mA

0.55 V

6.6 mW

68  $\Omega$ 

11 mA

0.7 V

7.7 mW

82  $\Omega$ 

10 mA

0.8 V

8.8 mW

100  $\Omega$ 

10 mA

0.9 V

9 mW

150  $\Omega$ 

8 mA

1.15 V

9.2 mW

220  $\Omega$ 

6 mA

1.25 V

7.5 mW

470  $\Omega$ 

3 mA

1.4 V

4.2 mW

Teacher's Signature \_\_\_\_\_



## OBSERVATION:

1. For distance,  $x_1 = 5 \text{ cm}$ 

$$i_{mp} = 8.6 \text{ mA}$$

$$V_{mp} = 0.78 \text{ V}$$

$$P_{max} = 8.6 \times 10^{-3} \times 0.78 \text{ W} = 6.708 \times 10^{-3} \text{ W}$$

$$\Omega = 251 \text{ W/m}^2$$

$$A_c = 22.75 \times 10^{-4} \text{ m}^2$$

## RESULT:

I-V characteristics of the solar cell were studied and the maximum power generated, FF and efficiency were calculated for 2 different source — cell distances.

For,  $x_1 = 5 \text{ cm}$ 

$$\text{Efficiency, } \eta = \frac{1.17\%}{3.8\%} = 2\%$$

$$\text{FF} = \frac{0.344}{0.844} = 0.4$$

$$\eta = \frac{P_{max}}{A \times \Omega}$$

$$= \frac{6.708 \times 10^{-3}}{22.75 \times 10^{-4} \times 251}$$

$$= \frac{0.038}{3.8\%} = 1.17\%$$

$$\frac{1.17\%}{3.8\%}$$

$$\frac{9}{10}$$



$X = 0.112 \rightarrow 5 \text{ units} = 1V$   
 $Y = 0.112 \rightarrow 2 \text{ units} = 2 \text{ mA}, 2 \text{ mW}$

