SRNK GOVT.DEGREE COLLEGE

BANSWADA

NAAC ACCREDITED WITH 'B' GRADE

PHYSICS PROJECT

ON

EFFECTS OF AMOUNT AND WAVELENGTH OF LIGHT ON A SOLAR CELL

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INTRODUCTION:

SOLAR ENERGY: The energy derived from the sun's radiation. It is used on earth in many ways.

SOLAR CELL: It is an electrical device that converts the light energy directly into electricity by the photovoltaic effect, which is a physical and chemical phenomenon.

Solar cell is made out of n- type and p-type semi-conductor material that use visual light spectrum to generate electricity.

Solar radiation with wavelengths of 380 nm to 750 nm (violet to red) strike the material with enough energy to knock electrons from their weak bonds and create an electric current.

SUN LIGHT: Is broken into three major components.

- Visible Light – 0.4 and 0.8 micro meters
- Ultra violet - shorter than 0.4 micro meters
- Infra radiation – longer than 0.8 micro meters

Solar Energy Is Of Two Types

- Photovoltaic solar energy
- Solar thermal energy

  The shorter the wavelength of incident light, the higher the frequency of the light and more energy is possessed by ejected electrons. In the same way, photovoltaic cells are sensitive to wavelength and respond better to sun light in some parts of the spectrum than others.

AIMS AND OBJECTIVES:

To demonstrate how the amount and wavelength of light affects a solar cell.

- It is used to convert light source into electrical energy.
- It is environmental friendly and save resources.
- To determine spectral irradiance.
- Solar cells are used in power farms to provide electricity to large area of solar panels.

METHODOLGY:

The experiment method is used to determine huge amount of energy generated from sun per every second. The energy released from the sun travels through space as radiation. It is distributed on the solar panels across different wavelengths (λ).

MATERIALS AND EQUIPMENTS:

- Solar cell
- Two pieces enamelled or plastic coated wire (8-10 inches [20-25 cm] each)
- Electric motor
- Soldering gun
- Solder (rosin core)
- Sand paper
- Knife or wire stripper (optional)
- 6-inch (15-cm) diameter cardboard circle
- Utility knife
- Glue (hot or white)
- Plastic wheel with axle hole in centre
- Black marking pen

- Stop watch
- One sheet of black construction paper
- Several sheets of coloured transparency film in a variety of colours.
- Paper and pencil or pen.

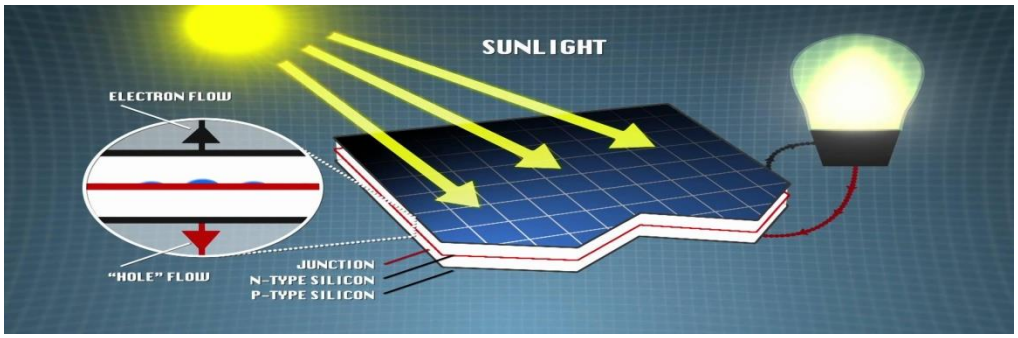
RESOURCES:

Solar cells, wheels, and motors are available from science supply stores and hoppy shops. Soldering guns and solder are available at hardware stores. Transparency film is available at hobby shops and office supply stores.

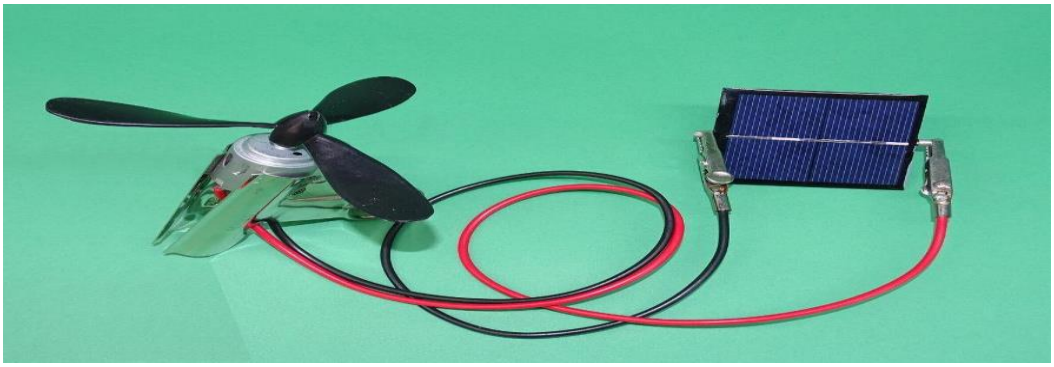
PROCESS:

Setting up the Experiment

- Strip the ends of each coated wire exposing about 1 inch (2.5 cm) of the metal. If the wire is plastic coated, use a knife or wire stripper to remove the plastic. If the wire enamelled, sand the ends to expose the wire ends.
- Plug in the soldering gun to heat it up.
- Melt a drop of solder onto one of the leads on the solar cell. Quickly place the end of one of the stripped wires in the drop of molten solder. Add a tiny drop of solder on top of the wire, making sure the wire is completely surrounded by the solder.



- Repeat the process with the other wire.
- Let the solder cool completely for 10 minutes. Gently pull on the wires to make sure that both are securely attached.
- Melt a drop of solder onto one of the leads on the motor. Quickly place the end of one of the wires attached to the solar cell in the drop of molten solder. Add a tiny drop of solder on top of the wire, making sure the wire is completely surrounded by the solder.
- Repeat the process with the other wire.
- Let the solder cool completely for 10 minutes. Gently pull on the wires to make sure that both are securely attached.
- Attach the plastic wheel to the motor by gently pushing the wheel onto the shaft of the motor. Be careful not to chip the solder or break the wires.
- Glue a 6-inch (15-minutes) diameter cardboard circle on the face of the wheel.



SOLAR CELL WITH MOTOR

- Mark a small dot on the edge of the cardboard wheel. This dot will be used as a frame of reference to measure the speed that the wheel is spinning

DOING THE EXPERIMENT:

1. Place the solar cell, motor, and wheel in bright sunlight. Observe the spinning motion. (if the motor does not spin the wheel, check the wire connections. It may be necessary to resolder the connections.)
2. Using the stopwatch and watching the dot, count the number of spins in 15 seconds. Multiply this number by 4 to obtain the number of spins per minute. Record the spinning rate on a piece of paper.

AFFECTS OF A SOLAR CELL:

1. Shade one area of the solar cell with the black construction paper. Diagram the portion of the cell shaded and record observations on a piece of paper.
2. Repeat the experiment shading different areas and amounts of the solar cell.

The Wavelength of Solar Light (λ) = $\frac{\text{light velocity}}{\text{Frequency}}$

$$\lambda = \frac{c}{n}$$

Where C= Velocity of Light= 3×10^8 m/sec
n = frequency of light = no of rotations per unit time period

$$n = 1/T$$

T = time period of rotation of wheel cardboard

ADVANTAGES:

1. Zero energy-production costs.
2. Less energy is lost during long distance transport.
3. It is clean and non-polluting energy source.
4. It is renewable energy.
5. It does not produce noise for electricity generation.
6. It requires very little maintenance.
7. Long lifetime.
8. Reduce electricity bills.

CONCLUSION:

1. Solar cells more effectible for electrical power distribute in large area of panels.
2. These solar cells can inculcate to develop the semi-conductor devices.
3. This cell can also distinguish between any spectral lines.

REFERENCE:

1. The physics of solar cells.
2. Fundamentals of solar cells.
3. Indian Institute of Technology – Mumbai.

https://www.sciencedirect.com › book › solar-cells