Unit 9 - Week 8: Third Generation Solar Cells

Assignment 8
Due on 2020-06-08, 11:59 PM

1. Photoelectric effect: When a photon of blue light is incident on a metal, it displaces an electron from a leaf which occupies the light. For a certain metal, the work function (W) = 2.5 eV. Calculate the cutoff wavelength (λc) for the photoelectric effect.

2. Solar energy conversion: A solar panel is designed to convert sunlight into electricity. The panel has a surface area of 15 m² and absorbs 70% of the incoming solar radiation. On a sunny day with 1000 W/m² solar irradiance, calculate the maximum power output of the panel.

3. Solar cell efficiency: A solar cell has an area of 50 cm² and is designed to operate at a maximum efficiency of 18%. If the solar panel is exposed to 1000 W/m² sunlight, calculate the maximum electrical power generated by the solar cell.

4. Solar power plant: A solar power plant contains 1000 solar panels, each with an efficiency of 15% and area of 20 m². On a sunny day with an average irradiance of 800 W/m², calculate the total electrical power generated by the solar power plant.

5. Solar cell materials: A solar cell is made from a semiconductor material with a bandgap of 1.5 eV. Calculate the cutoff wavelength (λc) for the solar cell and determine if the cell can convert sunlight into electricity.

6. Solar array orientation: A solar array is designed to face the south pole, but the location is in the northern hemisphere. Calculate the ideal orientation of the solar array to maximize the electrical power generated.

7. Solar radiation: A solar panel is exposed to sunlight with an average irradiance of 750 W/m². Calculate the maximum electrical power generated by the solar panel.

8. Solar energy storage: A solar energy storage system contains a battery with a capacity of 10 kWh and a maximum discharge rate of 5 kW. Calculate the maximum amount of energy that can be stored in the battery and the maximum time it can supply energy at a rate of 2 kW.

9. Solar panel installation: A solar panel is installed on the roof of a building. The panel has an area of 100 m² and is designed to convert sunlight into electricity. Calculate the maximum electrical power generated by the solar panel and determine if the building can meet its energy needs with solar power.

10. Solar panel efficiency: A solar panel has an area of 20 m² and is designed to operate at a maximum efficiency of 16%. If the solar panel is exposed to 1000 W/m² sunlight, calculate the maximum electrical power generated by the solar panel.

Note: Questions 1-10 are based on the concepts learned in the course on solar cells and energy conversion.