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Courses » Fundamentals of semiconductor devices

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Unit 14 - Opto-electronic devices: Solar cells and photo- detectors

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Week 10 Assignment

The due date for submitting this assignment has passed.

As per our records you have not submitted this **Due on 2019-04-10, 23:59 IST.**
assignment.

1) Consider a silicon n+p junction solar cell with a 1 cm^2 surface area and $NA = 10^{15}/\text{cm}^3$ **2 points**
. Calculate I_L (light current) and V_{oc} (open circuit voltage).

Assume $D_n = 35 \text{ cm}^2/\text{sec}$, $\tau_n = 2.57 \mu \text{ sec}$ and $GL = 2.7 \times 10^{19} \text{ cm}^3 \text{ sec}^{-1}$, $V_T = 25.86 \times 10^{-3}$, $n_i = 1.5 \times 10^{10}$

- $I_L = 1.33 \times 10^{-10} \text{ A}$, $V_{oc} = 0.505 \text{ V}$
- $I_L = 40.95 \text{ mA}$, $V_{oc} = 0.505 \text{ V}$
- $I_L = 1.33 \times 10^{-10} \text{ A}$, $V_{oc} = 0.852 \text{ V}$
- $I_L = 40.95 \text{ mA}$, $V_{oc} = 0.852 \text{ V}$

No, the answer is incorrect.

Score: 0

Accepted Answers:

$I_L = 40.95 \text{ mA}$, $V_{oc} = 0.505 \text{ V}$

2) Photodiodes operate by absorption of photons or charged particles and generate a flow of **2 points**
current in an external circuit, _____ to the incident power. The light is absorbed _____ with
distance and is _____ to the absorption coefficient.

- Proportional, exponentially, proportional
- Proportional, logarithmically, inversely proportional
- Inversely proportional, exponentially, unrelated
- None of the above

No, the answer is incorrect.

Score: 0

Accepted Answers:

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Opto-electronic devices: Solar cells and photo-detectors

- Solar cell basics
- Solar cell (contd.)
- Solar cell: Shockley Quiesser Limit
- Basics of photodetectors
- Photodetectors: figures of merit and types of devices
- Junction photodetectors
- Quiz : Week 10_Assignment
- Assignmnet 10_Solutions

Opto-electronic devices: Light Emitting Diodes (LED)

Applications of transistors and basics of microelectronic fabrication

Which of the following is correct.?

- All the above statements are correct.
- All the above statements are wrong
- Only statement (2) is correct
- Statement (1) and (2) are correct

No, the answer is incorrect.

Score: 0

Accepted Answers:

Only statement (2) is correct

4) Consider the following statements:

- (1) Photodetectors are always noisier than solar cells.
- (2) The theoretical responsivity of UV detector is always lower than that of IF (infra-red) detectors. (assuming $QE=1$ and no gain in both the cases.)
- (3) Silicon can be used as detector to detect wavelength of 300nm.

1 point

Which of the following is correct.?

- All the above statements are correct
- All the above statements are wrong.
- Only statement (1) is correct
- Only statement (2) is correct.

No, the answer is incorrect.

Score: 0

Accepted Answers:

All the above statements are correct

5) A solar cell has $V_{oc} = 0.7V$. Which of the following statements is correct?

1 point

- Germanium can be used to make such a solar cell.
- It is possible to estimate the fill factor of the solar cell without knowing any other parameter
- Short circuit current of the solar cell can be estimated from this information.
- All the above statements are incorrect.

No, the answer is incorrect.

Score: 0

Accepted Answers:

It is possible to estimate the fill factor of the solar cell without knowing any other parameter

6) A solar cell is illuminated uniformly by monochromatic light of wavelength 500nm and intensity $25mW/cm^2$. What is the upper limit to short circuit current output of the cell if its bandgap is 1.5eV?

1 point

- $10mA/cm^2$
- $100mA/cm^2$
- $50mA/cm^2$
- $5mA/cm^2$

No, the answer is incorrect.

Score: 0

Accepted Answers:

$10mA/cm^2$

7) Why are photodetectors inherently noisier than solar cells?

1 point

- Load Resistance in photodetector is much lower than in solar cell resulting in lower equivalent circuit resistance.
- Thermal noise in Photodetector varies inversely as the resistance, leading to more noise in detectors.
- Noise is higher for Higher Bandwidth.
- All the above

No, the answer is incorrect.

Score: 0

Accepted Answers:

All the above

8) A photodetector can have 100% efficiency. Choose the correct statement.

1 point

- Photodetector detects photons of particular wavelength only.
- Detectors are reverse-biased during operation and this can lead to internal gain.
- Both Statement (a) and (b) are correct
- Both statement (a) and (b) are incorrect.

No, the answer is incorrect.

Score: 0

Accepted Answers:

Both Statement (a) and (b) are correct

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