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NPTEL

Courses » **Semiconductors Optoelectronics**

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Unit 3 - Week 1

**Register for
Certification exam**

Course outline

How to access the portal

Self-assessment before course start

Week 1

- Context, Scope and Contents of the Course
- Energy Bands in Solids
- E-k Diagram - The Band Structure
- The Density of States
- The Density of States ρ(k), ρ(E)
- Density of States in a Quantum Well Structure
- Quiz : Assessment 1
- Solutions of Assessment 1

Week 2

Assessment 1

The due date for submitting this assignment has passed.
As per our records you have not submitted this assignment.   **Due on 2019-02-13, 23:59 IST.**

Instructions:

1. Answer **all** questions; all questions carry equal mark.

2. All symbols have their usual meanings.

3. Only one of the options is correct

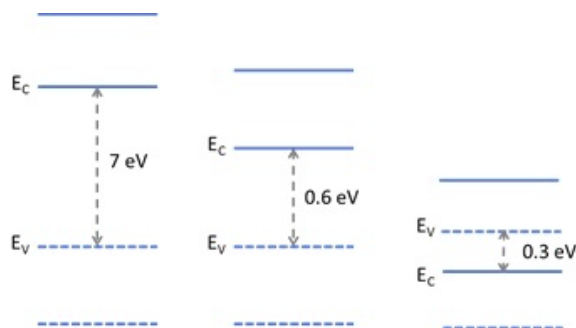4. You can see the correct answers after the last date of submission.

Note:

Marks obtained in this quiz will be counted towards your final score. You can take the quiz and submit it any number of times, and the latest submitted answers will be taken as your final submission.

Physical Constants:

m_e= 9.11 x 10^{-31} kg; h = 6.627 x 10^{-34}Js; e = 1.602 x 10^{-19} C; k_B = 1.38 x 10^{-23} J/K **Invalid HTML tag: tag name o:p is not allowed**

1) At room temperature, the energy band diagram of 3 materials the shown in figures (i), (ii)   **1 point**
and (iii). Which one of the following statements is correct?

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Week 6

Week 7

Week 8

Week 9

Week 10

Week 11

Week 12

Exam Instructions

Lecture Transcripts

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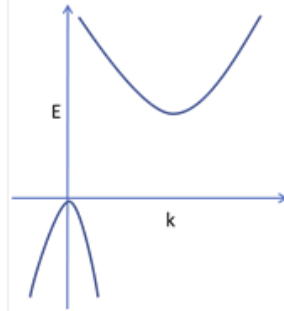○ (i) is metal, (ii) is semiconductor, and (iii) is insulator.

No, the answer is incorrect.
Score: 0

Accepted Answers:
(i) is insulator, (ii) is semiconductor, and (iii) is metal.

2) What can you infer about the semiconductor material from the given **1 point** E-k diagram?

○ It is a direct bandgap semiconductor with effective electron mass greater than hole mass.

○ It is an indirect bandgap semiconductor with effective electron mass lesser than hole mass.

○ It is an indirect bandgap semiconductor with effective electron mass greater than hole mass.

○ It is a direct bandgap semiconductor with effective electron mass lesser than hole mass.

No, the answer is incorrect.
Score: 0

Accepted Answers:
It is an indirect bandgap semiconductor with effective electron mass greater than hole mass.

3) Consider an electron in the conduction band of a semiconductor with de-Broglie wavelength **1 point** 3.8 nm. What is the kinetic energy of the electron? (Assume that the effective mass of electron = m_e, the rest mass)

○ 0.1 eV

○ 0.2 eV

○ 10 eV

○ 1 eV

No, the answer is incorrect.
Score: 0

Accepted Answers:
0.1 eV

4) Calculate the *density of states* in the 1st sub-band of the conduction band, for a quantum   **1 point** well of thickness 5 nm. Given: electron mass = $0.07m_e$

○ $5.84*10^{19}$ /cc-eV

○ $8.41*10^{41}$ /m^{3}J

○ $8.41*10^{33}$ /cc-eV

○ $5.84*10^{13}$ /m^{3}J

No, the answer is incorrect.
Score: 0

Accepted Answers:
$5.84*10^{19}$ /cc-eV

5) Consider a piece of semiconductor having the dimensions $L_x \times L_y \times L_z$ as 5 mm $\times$ 2   **1 point**
mm $\times$ 1 mm. In the k-space, the smallest k-vector with all three components
non-zero $(k_x, k_y, k_z \neq 0)$ is—

    ◯   (5π, 2π, π) mm^{-1}

    ◯   (0.2π, 0.5π, π) mm^{-1}

    ◯   (π, 2π, 5π) mm^{-1}

    ◯   (π, 0.2π, 0.5π) mm^{-1}

No, the answer is incorrect.
Score: 0

Accepted Answers:
(0.2π, 0.5π, π) mm^{-1}

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