

# Unit 12 - Week 11

## Course outline

### How to access the portal?

Week 1

Week 2

Week 3

Week 4

Week 5

Week 6

Week 7

Week 8

Week 9

Week 10

Week 11

○ Calculating Allowed Energy Bands and Forbidden Band Gaps

○ Bands; Free Electron Approximation, Tight Binding Approximation

○ Semiconductors

○ Quiz : Assignment 11

Week 12

Week 13

VIDEO DOWNLOAD

Text Transcripts

## Assignment 11

The due date for submitting this assignment has passed.  
As per our records you have not submitted this assignment.

**Due on 2019-10-16, 23:59 IST.**

**Note :** More than one answer may be right. Partial marks awarded if only some of the correct answers are selected. No marks awarded if even one of the wrong answers is selected

1) Band gap is calculated by solving \_\_\_\_\_ equation at  $x = 0$  for potential  $V = 0$  and  $V = V_0$  in nearly free electron approximation with the condition \_\_\_\_\_ assuming that \_\_\_\_\_ and it's \_\_\_\_\_ are continuous at  $x = 0$ . **0 points**

- Time dependent Schrodinger, slope, wave function
- Time independent Schrodinger, wave function, slope
- Time dependent Schrodinger, slope, wave function
- Time independent Schrodinger, slope, wave function

**No, the answer is incorrect.**  
**Score: 0**

**Accepted Answers:**  
*Time independent Schrodinger, wave function, slope*

2) In band structure vs pressure diagram, let's assume  $P_1$ ,  $P_2$  and  $P_3$  are three different pressure values where,  $P_1 > P_2 > P_3$ . The likely variation in properties as pressure changes from  $P_1$  to  $P_2$  to  $P_3$  is **1 point**

- Insulator, Semiconductor, Metal
- Metal, Semiconductor, Insulator
- Metal, Insulator, Semiconductor
- Semiconductor, Metal, Insulator

**No, the answer is incorrect.**  
**Score: 0**

**Accepted Answers:**  
*Metal, Semiconductor, Insulator*

3) A semiconductor component based circuit might fail in a spacecraft entering Jupiter due to \_\_\_\_\_. **1 point**

- Low Temperature
- Low Pressure
- High pressure
- High Temperature and Low Pressure

**No, the answer is incorrect.**  
**Score: 0**

**Accepted Answers:**  
*High pressure*

4) If band gaps are considered at three different interatomic distances  $x_1$ ,  $x_2$ ,  $x_3$ , where  $x_1 < x_2 < x_3$ . The relative bandgaps will be such that **1 point**

- Band gap at  $x_2$  distance will be wider than  $x_1$  but narrower than  $x_3$ .
- Band gap at  $x_2$  distance will be narrower than  $x_3$  and narrower than  $x_1$ .
- Band gap at  $x_2$  distance will be wider than  $x_3$  but narrower than  $x_1$ .
- Band gap at  $x_2$  distance will be wider than  $x_3$  and wider than  $x_1$ .

**No, the answer is incorrect.**  
**Score: 0**

**Accepted Answers:**  
*Band gap at  $x_2$  distance will be wider than  $x_1$  but narrower than  $x_3$ .*

5) Free electron approximation and Tight binding approximation lead to the same result but are originated based on different concept. Later concept is based on \_\_\_\_\_ approximation is not so relevant for \_\_\_\_\_ system. **1 point**

- Strong atomic bonding, Metallic
- Metallic bonding, Metallic
- Metallic bonding, Insulator
- Strong atomic binding, semiconductor

**No, the answer is incorrect.**  
**Score: 0**

**Accepted Answers:**  
*Strong atomic bonding, Metallic*

6) Match the Following: **0 points**

<b>(A)</b>	Si	<b>(i)</b>	Intrinsic semiconductor with band gap 0.7 eV
<b>(B)</b>	InSb	<b>(ii)</b>	Arsenic doped semiconductor
<b>(C)</b>	CdS	<b>(iii)</b>	Intrinsic semiconductor with band gap 1.1 eV
<b>(D)</b>	n-Si	<b>(iv)</b>	Gallium doped semiconductor
<b>(E)</b>	p-Si	<b>(v)</b>	II B – IV A compound
<b>(F)</b>	Ge	<b>(vi)</b>	Intrinsic semiconductor compound

- A (iii), B(vi), C(v), D(i), E(iv), F(ii)
- A (iii), B(vi), C(iv), D(ii), E(v), F(i)
- A (iii), B(v), C(vi), D(ii), E(iv), F(i)
- A (iii), B(vi), C(v), D(ii), E(iv), F(i)

**No, the answer is incorrect.**  
**Score: 0**

**Accepted Answers:**  
*A (iii), B(vi), C(v), D(ii), E(iv), F(i)*

7) Charge carrier concentration vs temperature plot consist of \_\_\_\_\_ region(s) and \_\_\_\_\_ region(s) in case of intrinsic and extrinsic semiconductors respectively. **1 point**

- Four, Three
- Three, Two
- One, Three
- One, Two

**No, the answer is incorrect.**  
**Score: 0**

**Accepted Answers:**  
*One, Three*

8) Average electronic conductivity of a metallic system is \_\_\_\_\_ the semiconductor. **1 point**

- Lesser than
- More than
- Equal to
- Equivalent to

**No, the answer is incorrect.**  
**Score: 0**

**Accepted Answers:**  
*More than*

9) When Brillouin zone boundaries appear at different distances for different direction, that implies \_\_\_\_\_. **1 point**

- Material can only be a metal.
- Interatomic distances are different in different directions.
- Material is of anisotropic nature.
- Material can only be a semiconductor.

**No, the answer is incorrect.**  
**Score: 0**

**Accepted Answers:**  
*Interatomic distances are different in different directions.  
Material is of anisotropic nature.*

10) GaAs is \_\_\_\_\_ type \_\_\_\_\_ band gap semiconductor. **1 point**

- Intrinsic, Indirect
- Intrinsic, Direct
- Extrinsic, Indirect
- Extrinsic, Direct

**No, the answer is incorrect.**  
**Score: 0**

**Accepted Answers:**  
*Intrinsic, Direct*