X

Unit 2 - Self-assessment before course start

Register for Certification exam

Course outline

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Self-assessment before course start

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Assessment 0

The due date for submitting this assignment has passed.
As per our records you have not submitted this assignment. **Due on 2019-01-31, 23:59 IST.**

Instructions:

1. All questions carry equal mark.

2. All symbols have their usual meanings.

3. Only one of the options is correct.

Note:

Marks obtained in this quiz will NOT be counted towards your final score. This quiz is only for self-assessment purposes before you start the course.

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; c = 3 x 10^8 m/s

1) Which of the following does not change when light travels from a rarer medium (say air) to a denser medium (say glass)? ***1 point***

- Speed
- Frequency
- Wavelength
- Both frequency and wavelength

No, the answer is incorrect.
Score: 0

Accepted Answers:
Frequency

2) When unpolarized light is incident (from air) on the surface of a material at an angle of ***1 point***

- $\sqrt{2}$
- $4/3$

No, the answer is incorrect.
Score: 0

Accepted Answers:
$\sqrt{3}$

3) Unpolarized light of intensity Io is passed through a polarizer and then through an analyzer whose pass axis is at an angle 45° to the axis of the polarizer. What is the intensity of light coming out of the analyzer? ***1 point***

- $I_0/2$
- $I_0/3$
- $I_0/4$
- $I_0/8$

No, the answer is incorrect.
Score: 0

Accepted Answers:
$I_0/4$

4) In the Young's double slit experiment setup, it is observed that the fringe pattern shifts by one fringe width, when a thin transparent sheet is introduced in front of one of the slits. What is the thickness of the sheet? (Give: refractive index of sheet = 1.5, λ=0.5 μm) ***1 point***

- 1 μm
- 1/2 μm
- 1/3 μm
- 2 μm

No, the answer is incorrect.
Score: 0

Accepted Answers:
1 μm

5) A laser emits at 633 nm with a rate of 1.1×1016 photon emissions per second. The beam is focused to a spot of radius 1 μm. Assuming no loss due to the optical arrangement, the intensity of the spot is approximately ***1 point***

- 0.1 GW/m^2
- 1 GW/m^2
- 10 GW/m^2
- 100 GW/m^2

No, the answer is incorrect.
Score: 0

Accepted Answers:
1 GW/m^2

6) A quantum particle m is confined in 1 dimensional potential well of width L, with infinite potential outside the well. What is the energy of the particle if it occupies the first excited state? ***1 point***

- $\frac{h^2}{2mL^2}$
- $\frac{h^2}{4mL^2}$
- $\frac{h^2}{8mL^2}$
- $\frac{h^2}{mL^2}$

No, the answer is incorrect.
Score: 0

Accepted Answers:
$\frac{h^2}{2mL^2}$

7) Which of the following is an implication of the Heisenberg's uncertainty principle? ***1 point***

- The position of a particle can never be known with 100% certainty.
- The momentum of a particle can never be known with 100% certainty.
- The position and momentum of a particle can never be simultaneously known with 100% certainty.
- None of the options are correct.

No, the answer is incorrect.
Score: 0

Accepted Answers:
The position and momentum of a particle can never be simultaneously known with 100% certainty.

8) Find the minimum de-Broglie wavelength of electrons which are emitted from a metal surface of work function 3 eV, when photons of energy 4 eV are incident on it. ***1 point***

- 1.23 μm
- 1.23 nm
- 2.46 μm
- 2.46 nm

No, the answer is incorrect.
Score: 0

Accepted Answers:
1.23 nm

9) What happens to the Fermi level if an intrinsic semiconductor is n doped? ***1 point***

- Fermi level shifts towards the conduction band.
- Fermi level does not change.
- Fermi level shifts towards the valence band.
- Fermi level can shift towards either of the bands depending on the doping concentration.

No, the answer is incorrect.
Score: 0

Accepted Answers:
Fermi level shifts towards the conduction band.

10) A particular semiconductor has a bandgap energy of 1.24 eV. What is the maximum wavelength of light that can be absorbed by the semiconductor? **1 point**

- 1 μm
- 1.24 μm
- 1.5 μm
- 2 μm

No, the answer is incorrect.
Score: 0

Accepted Answers:
1 μm

11) A semiconductor has intrinsic carrier density of $3*10^{13}$ /cc and is n doped with a doping concentration of $2*10^{16}$ /cc. What is the concentration of holes after doping? **1 point**

- $3*10^{13}$ /cc
- $4.5*10^{16}$ /cc
- $4.5*10^{10}$ /cc
- $3*10^{18}$ /cc

No, the answer is incorrect.
Score: 0

Accepted Answers:
$4.5*10^{10}$ /cc

12) The band gap of red, blue, and green LEDs are E_r, E_b, and E_g, respectively. Which of the following is true? **1 point**

- $E_r > E_b > E_g$
- $E_b > E_r > E_g$
- $E_b > E_g > E_r$
- $E_g > E_b > E_r$

No, the answer is incorrect.
Score: 0

Accepted Answers:
$E_b > E_g > E_r$

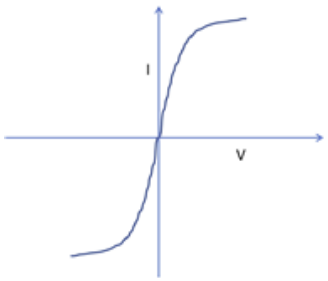
13) Which of the following statements is FALSE regarding Light Emitting Diodes (LEDs)? **1 point**

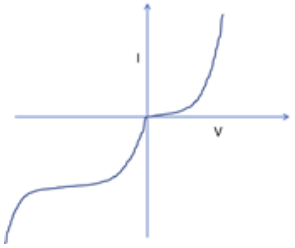
- LEDs are more energy efficient that fluorescent lamps.
- LED is less directional than LASER.
- LED's output power does not depend on temperature.
- LEDs are not monochromatic.

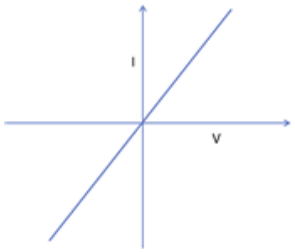
No, the answer is incorrect.
Score: 0

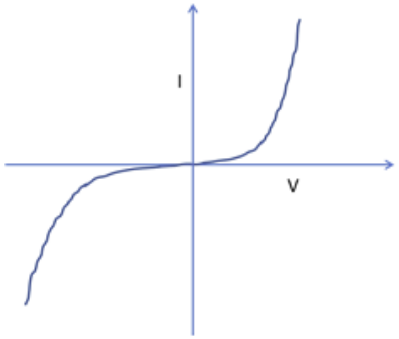
Accepted Answers:
LED's output power does not depend on temperature.

14) Identify the diagram corresponding to the I-V characteristic of a typical p-n junction diode. **1 point**



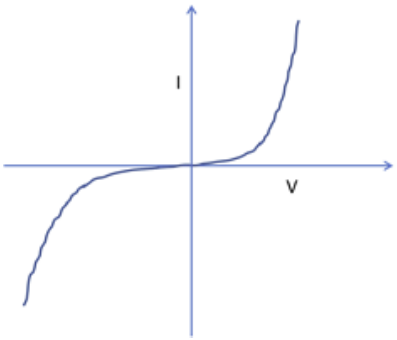






No, the answer is incorrect.
Score: 0

Accepted Answers:



15) Zener diode is usually used as ***1 point***

- Voltage regulator
- Half-Wave rectifier
- Full-Wave rectifier
- Voltage amplifier

No, the answer is incorrect.
Score: 0

Accepted Answers:
Voltage regulator

16) Which of the following statements is true? **1 point**

- An amplifier necessarily requires feedback.
- An oscillator necessarily requires feedback.
- Both amplifier and oscillator necessarily require feedback.
- Both amplifier and oscillator do not necessarily require feedback.

No, the answer is incorrect.
Score: 0

Accepted Answers:
An oscillator necessarily requires feedback.

17) A particular radio station has a bandwidth allocation of 1 MHz in the RF region. If the maximum frequency components of the signals to be transmitted is 20 kHz, what is the maximum number of channels possible for transmission? (Assume double side band transmission system). **1 point**

- 10
- 20
- 25
- 50

No, the answer is incorrect.
Score: 0

Accepted Answers:
25

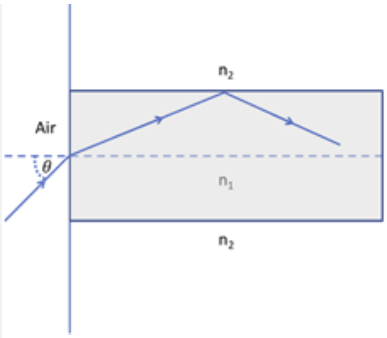
18) Consider a beam of light travelling from a medium of refractive index n_1 to a medium of refractive index n_2 ($n_1 > n_2$). What is the minimum angle of incidence such that no light is transmitted into the second medium? **1 point**

- $\sin^{-1}(n_2/n_1)$
- $\tan^{-1}(n_2/n_1)$
- $\cos^{-1}(n_2/n_1)$
- $\tan^{-1}(n_1/n_2)$

No, the answer is incorrect.
Score: 0

Accepted Answers:
$\sin^{-1}(n_2/n_1)$

19) The core of an optical fiber is made of a material of refractive index n_1 and the cladding is made of material with refractive index n_2. What is the maximum angle θ (see figure) for which light will be guided inside the core? **1 point**



- $\sin^{-1}\sqrt{n_1^2 - n_2^2}$
- $\cos^{-1}\sqrt{n_1^2 - n_2^2}$
- $\tan^{-1}\sqrt{n_1^2 - n_2^2}$
- $\sin^{-1}(n_2/n_1)$

No, the answer is incorrect.
Score: 0

Accepted Answers:
$\sin^{-1}\sqrt{n_1^2 - n_2^2}$

20) The electric field of an electromagnetic wave in vacuum is $\vec{E} = 10\hat{x}e^{-i(\omega t+kz)}$.The direction of the magnetic field $\vec{B}$, the direction of propagation of the wave, and the plane of polarization are respectively *1 point*

- $\hat{y}$, $\hat{z}$, yz plane
- $\hat{y}$, $-\hat{z}$, xz plane
- $-\hat{y}$, $\hat{z}$, yz plane
- $-\hat{y}$, $-\hat{z}$, xz plane

No, the answer is incorrect.
Score: 0

Accepted Answers:
$-\hat{y}$, $-\hat{z}$, xz plane

End