

National Testing Agency

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Introduction To Quantum Physics and Its Applications

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Introduction To Quantum Physics and Its Applications-1

Section Id :	603489171
Section Number :	1
Section type :	Online

Mandatory or Optional :	Mandatory
Number of Questions :	50
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Section Marks :	100
Enable Mark as Answered Mark for Review and Clear Response :	Yes
Sub-Section Number :	1
Sub-Section Id :	603489308
Question Shuffling Allowed :	Yes

Question Number : 1 Question Id : 6034898419 Question Type : MCQ Option Shuffling : No Is Question Mandatory : No

Correct Marks : 2 Wrong Marks : 0

In this problem, h is the Planck's constant and k is the Boltzmann constant. For which of the following options, the energy density of black body radiation has the temperature dependence

$$u(\nu, T) \propto \exp(-h\nu/kT)$$

1. $h\nu > kT$
2. $h\nu \simeq kT$
3. $h\nu \ll kT$
4. for all ν

Options :

60348931635. 1

60348931636. 2

60348931637. 3

60348931638. 4

Question Number : 2 Question Id : 6034898420 Question Type : MCQ Option Shuffling : No Is Question Mandatory : No

Correct Marks : 2 Wrong Marks : 0

Given data: $hc = 1240 \text{ eV}\cdot\text{nm}$.

In a photoelectric experiment, a metal is exposed to light of wavelength 360 nm. The emitted photoelectrons are found to have a maximum kinetic energy of 1.1 eV. If the experiment is repeated with a light of wavelength 570 nm, we get

1. no photoelectrons
2. photoelectrons with maximum kinetic energy of 0.05 eV
3. photoelectrons with maximum kinetic energy of 0.10 eV
4. photoelectrons with maximum kinetic energy of 0.15 eV

Options :

60348931639. 1

60348931640. 2

60348931641. 3

60348931642. 4

Question Number : 3 Question Id : 6034898421 Question Type : MCQ Option Shuffling : No Is

Question Mandatory : No

Correct Marks : 2 Wrong Marks : 0

In the hydrogen atom spectrum, the ratio of the largest wavelength of the Lyman series to its smallest wavelength is

1. $4/3$
2. $9/5$
3. $9/4$
4. 4

Options :

60348931643. 1

60348931644. 2

60348931645. 3

60348931646. 4

Question Number : 4 Question Id : 6034898422 Question Type : MCQ Option Shuffling : No Is

Question Mandatory : No

Correct Marks : 2 Wrong Marks : 0

Two equal masses are connected by a spring. They rotate in circular orbits about their Center of Mass (CM). Each mass is at a distance r from the CM and experiences a force kr directed towards the CM, where k is a constant. If we apply the Bohr quantization condition to the angular momentum of this system, we will find that the quantized energy of the n th orbit is proportional to n . The radius of such an orbit varies with n as

1. $\sqrt{n}$
2. n
3. $1/\sqrt{n}$
4. $1/n$

Options :

60348931647. 1

60348931648. 2

60348931649. 3

60348931650. 4

Question Number : 5 Question Id : 6034898423 Question Type : MCQ Option Shuffling : No Is Question Mandatory : No

Correct Marks : 2 Wrong Marks : 0

In Bohr model of hydrogen atom, the speed of the electron in the n th orbit depends on n as

1. n^{-2}
2. n^{-1}
3. n
4. n^2

Options :

60348931651. 1

60348931652. 2

60348931653. 3

60348931654. 4

Question Number : 6 Question Id : 6034898424 Question Type : MCQ Option Shuffling : No Is Question Mandatory : No

Correct Marks : 2 Wrong Marks : 0

Muon is a particle with the same electric charge as the electron but whose mass is a hundred times larger than the electron mass. It can be bound to a proton to form a "muonic hydrogen atom". The radius of the ground state of ordinary hydrogen atom is 5×10^{-11} m. The radius (in meter) of the ground state of "muonic hydrogen atom" is

1. 5×10^{-13}
2. 5×10^{-12}
3. 5×10^{-10}
4. 5×10^{-9}

Options :

60348931655. 1

60348931656. 2

60348931657. 3

60348931658. 4

Question Number : 7 Question Id : 6034898425 Question Type : MCQ Option Shuffling : No Is Question Mandatory : No

Correct Marks : 2 Wrong Marks : 0

In a photoelectric experiment, a metal was exposed to radiation of different frequencies and the magnitude of the stopping voltage was measured for each frequency. A plot was made with the frequency on the x axis and the magnitude of the stopping voltage on the y axis. This plot is a straight line with

1. positive slope and negative y intercept
2. negative slope and negative y intercept
3. positive slope and positive y intercept
4. negative slope and positive y intercept

Options :

60348931659. 1

60348931660. 2

60348931661. 3

60348931662. 4

Question Number : 8 Question Id : 6034898426 Question Type : MCQ Option Shuffling : No Is

Question Mandatory : No

Correct Marks : 2 Wrong Marks : 0

Given Data: The Wien's displacement constant is 3×10^{-3} m-K. Living creatures have a body temperature of 300 K. The wavelength (in nanometers) at which the living creatures emit body heat is

1. 10,000
2. 1000
3. 100
4. 10

Options :

60348931663. 1

60348931664. 2

60348931665. 3

60348931666. 4

Question Number : 9 Question Id : 6034898427 Question Type : MCQ Option Shuffling : No Is

Question Mandatory : No

Correct Marks : 2 Wrong Marks : 0

Given data: $hc = 1240$ eV-nm.

In a photoelectric effect experiment, a metal is exposed to a radiation of wavelength 400 nm. The stopping potential in this experiment is measured to be V_0 . In a second experiment, the same metal is exposed to a radiation of wavelength 600 nm and the stopping potential is measured to be $V_0/3$. The work function of the metal (in eV) is

1. 1.55
2. 3.1
3. 0.52
4. 1.05

Options :

60348931667. 1

60348931668. 2

60348931669. 3

60348931670. 4

Question Number : 10 Question Id : 6034898428 Question Type : MCQ Option Shuffling : No Is Question Mandatory : No

Correct Marks : 2 Wrong Marks : 0

The wavelength of blue light is 500 nm and the wavelength of red light is 750 nm. Assume that the energy emission of a star can be treated as the energy emission of a blackbody. The ratio of the power emitted per unit area of a blue star to that of a red star is

1. $(3/2)^4$
2. $(3/2)^2$
3. $(2/3)^2$
4. $(2/3)^4$

Options :

60348931671. 1

60348931672. 2

60348931673. 3

60348931674. 4

Question Number : 11 Question Id : 6034898429 Question Type : MCQ Option Shuffling : No Is Question Mandatory : No

Correct Marks : 2 Wrong Marks : 0

Given Data: $hc = 1240 \text{ eV-nm}$ and the mass of an electron is $500,000 \text{ eV}/c^2$, where c is the speed of light.

An electron is accelerated through a potential difference of 200 V. The de-Broglie wavelength (in nm) of this electron, when it attains its maximum speed, is

1. 0.088
2. 0.115
3. 0.041
4. 0.057

Options :

60348931675. 1

60348931676. 2

60348931677. 3

60348931678. 4

Question Number : 12 Question Id : 6034898430 Question Type : MCQ Option Shuffling : No Is Question Mandatory : No

Correct Marks : 2 Wrong Marks : 0

Given Data: $hc = 1240$ eV-nm, Boltzmann constant $k_B = 8.6 \times 10^{-5}$ eV/K and the mass of a neutron is 10^9 eV/ c^2 , where c is the speed of light.

The temperature inside a nuclear reactor is about 600 K. A neutron emitted in such a reactor moves through it with random thermal motion and eventually comes out of it. The de-Broglie wavelength (in nm) of such a neutron is

1. 0.122
2. 0.172
3. 0.061
4. 0.086

Options :

60348931679. 1

60348931680. 2

60348931681. 3

60348931682. 4

Question Number : 13 Question Id : 6034898431 Question Type : MCQ Option Shuffling : No Is Question Mandatory : No

Correct Marks : 2 Wrong Marks : 0

Given Data: $hc = 1240$ eV-nm.

The life-time of a pion is 26 nano-seconds. The minimum quantum mechanical uncertainty in the measurement of its energy (in eV) is

1. 1.3×10^{-8}
2. 1.3×10^{-11}
3. 1.3×10^{-5}
4. 1.3×10^{-2}

Options :

60348931683. 1

60348931684. 2

60348931685. 3

60348931686. 4

Question Number : 14 Question Id : 6034898432 Question Type : MCQ Option Shuffling : No Is Question Mandatory : No

Correct Marks : 2 Wrong Marks : 0

Given Data: $hc = 1240$ eV-nm and the mass of a potassium atom is 40×10^9 eV/ c^2 , where c is the speed of light.

An X-ray diffraction experiment, using X-rays of wavelength 0.1 nm, measures the position of potassium atoms in a crystal. The minimum quantum mechanical uncertainty in the energy (in eV) of the potassium atoms, due to this measurement, is

1. 1.25×10^{-5}
2. 0.0125
3. 12.5
4. 1,250

Options :

60348931687. 1

60348931688. 2

60348931689. 3

60348931690. 4

Question Number : 15 Question Id : 6034898433 Question Type : MCQ Option Shuffling : No Is Question Mandatory : No

Correct Marks : 2 Wrong Marks : 0

Consider a finite potential well, extending from $x = -L/2$ to $x = L/2$. Its depth is such that it has two energy eigenstates. Which of the following statements is correct?

1. The ground state is a symmetric function and the excited state is an anti-symmetric function.
2. Both the ground state and the excited state are symmetric functions.
3. Both the ground state and the excited state are anti-symmetric functions.
4. The ground state is an anti-symmetric function and the excited state is a symmetric function.

Options :

60348931691. 1

60348931692. 2

60348931693. 3

60348931694. 4

Question Number : 16 Question Id : 6034898434 Question Type : MCQ Option Shuffling : No Is Question Mandatory : No

Correct Marks : 2 Wrong Marks : 0

A particle is bound in an infinite potential well extending from $x = 0$ to $x = L$. Which of the following statement is correct?

1. The probability of finding the particle near the end points, $x = 0$ and $x = L$, is close to zero.
2. The probability of finding the particle in the left half is equal to finding it in the right half.
3. The probability of finding the particle near the middle, $x = L/2$, is always the maximum.
4. There is non-zero probability to find the particle at every intermediate point within the well.

Options :

60348931695. 1

60348931696. 2

60348931697. 3

60348931698. 4

Question Number : 17 Question Id : 6034898435 Question Type : MCQ Option Shuffling : No Is Question Mandatory : No

Correct Marks : 2 Wrong Marks : 0

If the width of an infinite potential well is increased from L to $2L$, the energy eigenvalues of the new well will be

1. one quarter of the original eigenvalues
2. one half of the original eigenvalues
3. double the original eigenvalues
4. four times the original eigenvalues

Options :

60348931699. 1

60348931700. 2

60348931701. 3

60348931702. 4

Question Number : 18 Question Id : 6034898436 Question Type : MCQ Option Shuffling : No Is Question Mandatory : No

Correct Marks : 2 Wrong Marks : 0

Which of the following statements is **NOT** true for the energy eigenstates of an infinite potential well extending from $x = 0$ to $x = L$?

1. They all have maximum value at $x = L/2$
2. They all have the same normalization constant.
3. They all vanish at $x = 0$ and at $x = L$.
4. They are either symmetric or anti-symmetric about the point $x = L/2$.

Options :

60348931703. 1

60348931704. 2

60348931705. 3

60348931706. 4

Question Number : 19 Question Id : 6034898437 Question Type : MCQ Option Shuffling : No Is Question Mandatory : No

Correct Marks : 2 Wrong Marks : 0

A particle is in an energy eigenstate of an infinite potential well extending from $x = 0$ to $x = L$.

Which of the following statements is true?

1. A measurement of its momentum can lead to one of only two possible values.
2. A measurement of its energy can lead to one of many possible values
3. The expectation value of the position can have a values other than $L/2$.
4. The expectation value of the momentum can have a non-zero value.

Options :

60348931707. 1

60348931708. 2

60348931709. 3

60348931710. 4

Question Number : 20 Question Id : 6034898438 Question Type : MCQ Option Shuffling : No Is

Question Mandatory : No

Correct Marks : 2 Wrong Marks : 0

A particle bound in an infinite potential well extending from $x = 0$ to $x = L$. It has the wave function $\psi(x) = N \sin^2(\pi x/L)$, where N is the normalization constant. Which of the following statements is true?

1. The particle can be found in any one of the states symmetric about $x = L/2$
2. The particle is always to be found in the ground state.
3. The particle can be found either in the ground state or in the first excited state.
4. The particle can be found in any one of the energy eigenstates.

Options :

60348931711. 1

60348931712. 2

60348931713. 3

60348931714. 4

Question Number : 21 Question Id : 6034898439 Question Type : MCQ Option Shuffling : No Is

Question Mandatory : No

Correct Marks : 2 Wrong Marks : 0

A particle bound in an infinite potential well extending from $x = 0$ to $x = L$. Consider the function $f(x) = x$ for the range $x \in (0, L)$. This function can **not** be a wave function for the above particle because

1. it does not vanish at $x = L$
2. it is not continuous in the range $x \in (0, L)$
3. it is not differentiable in the range $x \in (0, L)$
4. It can not be normalized

Options :

60348931715. 1

60348931716. 2

60348931717. 3

60348931718. 4

Question Number : 22 Question Id : 6034898440 Question Type : MCQ Option Shuffling : No Is

Question Mandatory : No

Correct Marks : 2 Wrong Marks : 0

Consider the function $f(x) = -1$ in the range $x \in (-L, 0)$ and $f(x) = +1$ for the range $x \in (0, L)$, and zero otherwise. The modulus of the Fourier transform is

1. $2 [\cos(kL) - 1]/k$
2. $2 [\sin(kL) - 1]/k$
3. $[\cos(kL) - 1]/k$
4. $[\sin(kL) - 1]/k$

Options :

60348931719. 1

60348931720. 2

60348931721. 3

60348931722. 4

Question Number : 23 Question Id : 6034898441 Question Type : MCQ Option Shuffling : No Is

Question Mandatory : No

Correct Marks : 2 Wrong Marks : 0

Consider the function $f(x) = -1$ in the range $x \in (0, L)$ and $f(x) = +1$ for the range $x \in (L, 2L)$, and zero otherwise. The modulus of the Fourier transform is

1. $2 [\cos(kL) - 1]/k$
2. $2 [\sin(kL) - 1]/k$
3. $[\cos(kL) - 1]/k$
4. $[\sin(kL) - 1]/k$

Options :

60348931723. 1

60348931724. 2

60348931725. 3

60348931726. 4

Question Number : 24 Question Id : 6034898442 Question Type : MCQ Option Shuffling : No Is Question Mandatory : No

Correct Marks : 2 Wrong Marks : 0

For a wave packet, the group velocity v_g is twice the phase velocity v_p for each value of wave number k . The angular frequency ω depends on k as

1. $\omega \propto k^2$
2. $\omega \propto k^{1.5}$
3. $\omega \propto k$
4. $\omega \propto k^{0.5}$

Options :

60348931727. 1

60348931728. 2

60348931729. 3

60348931730. 4

Question Number : 25 Question Id : 6034898443 Question Type : MCQ Option Shuffling : No Is Question Mandatory : No

Correct Marks : 2 Wrong Marks : 0

For a wave packet, the group velocity v_g and the phase velocity v_p are always in the same direction but the magnitude of v_g is smaller than the magnitude of v_p , for each value of wave number k . From this we can conclude that the angular frequency ω

1. increases with k but more slowly than a linear relation
2. increases with k linearly
3. increases with k but faster than a linear relation
4. has a non-monotonic relation with k

Options :

60348931731. 1

60348931732. 2

60348931733. 3

60348931734. 4

Question Number : 26 Question Id : 6034898444 Question Type : MCQ Option Shuffling : No Is Question Mandatory : No

Correct Marks : 2 Wrong Marks : 0

Two operators $\hat{A}$ and $\hat{C}$ commute i.e. $[\hat{A}, \hat{C}] = 0$ and the observables corresponding to these operators are 'a' and 'c' respectively. This implies

1. 'a' and 'c' can not be simultaneously measured.
2. 'a' and 'c' can be simultaneously measured.
3. 'a' can be measured and 'c' cannot be measured.
4. 'c' can be measured and 'a' cannot be measured.

Options :

60348931735. 1

60348931736. 2

60348931737. 3

60348931738. 4

Question Number : 27 Question Id : 6034898445 Question Type : MCQ Option Shuffling : No Is Question Mandatory : No

Correct Marks : 2 Wrong Marks : 0

For any operator $\hat{A}$ and a wavefunction ψ , if $\hat{A}\psi = a\psi$ (where "a" is a number), then ψ is called

1. the eigenfunction of $\hat{A}$
2. the eigenvalue of $\hat{A}$
3. the probability density of $\hat{A}$
4. the normalization of $\hat{A}$

Options :

60348931739. 1

60348931740. 2

60348931741. 3

60348931742. 4

Question Number : 28 Question Id : 6034898446 Question Type : MCQ Option Shuffling : No Is Question Mandatory : No

Correct Marks : 2 Wrong Marks : 0

Given, Planck's constant, $h=4.136 \times 10^{-15}$ eV.sec

The zero point energy (in eV) for a simple harmonic oscillator with frequency $\nu=290$ THz is

1. 0.6
2. 1.2
3. 2.2
4. 3.2

Options :

60348931743. 1

60348931744. 2

60348931745. 3

60348931746. 4

Question Number : 29 Question Id : 6034898447 Question Type : MCQ Option Shuffling : No Is Question Mandatory : No

Correct Marks : 2 Wrong Marks : 0

The quantized energy levels of a particle of mass m moving in a three dimensional potential well of length 'L' is given by $E = \frac{\pi^2 \hbar^2}{2mL^2} (n_x^2 + n_y^2 + n_z^2)$. If the energy of the particle is $\frac{27\pi^2 \hbar^2}{2mL^2}$, the degeneracy associated with this energy is

1. 6
2. 8
3. 4
4. 3

Options :

60348931747. 1

60348931748. 2

60348931749. 3

60348931750. 4

Question Number : 30 Question Id : 6034898448 Question Type : MCQ Option Shuffling : No Is Question Mandatory : No

Correct Marks : 2 Wrong Marks : 0

A particle is in the ground state of a quantum oscillator. An experiment measured its position and found it to be at the origin. The next experiment measured its energy. The probability of finding the particle in its first excited state is

1. 1.0
2. 0.5
3. 0.25
4. 0.0

Options :

60348931751. 1

60348931752. 2

60348931753. 3

60348931754. 4

Question Number : 31 Question Id : 6034898449 Question Type : MCQ Option Shuffling : No Is Question Mandatory : No

Correct Marks : 2 Wrong Marks : 0

For a free electron in one dimension, the density of states $n(E)$ depends on energy (E) as

1. $n(E) \propto \sqrt{E}$
2. $n(E) \propto 1/\sqrt{E}$
3. $n(E) \propto \text{constant}$
4. $n(E) \propto E$

Options :

60348931755. 1

60348931756. 2

60348931757. 3

60348931758. 4

Question Number : 32 Question Id : 6034898450 Question Type : MCQ Option Shuffling : No Is Question Mandatory : No

Correct Marks : 2 Wrong Marks : 0

A thermodynamics system comprises of 4 non-degenerate energy levels with energies 0, E, 2E and 3E. The number of ways 3 distinguishable particles can be arranged in these levels such that the total energy of the system is 4E is

1. 9
2. 10
3. 12
4. 6

Options :

60348931759. 1

60348931760. 2

60348931761. 3

60348931762. 4

Question Number : 33 Question Id : 6034898451 Question Type : MCQ Option Shuffling : No Is Question Mandatory : No

Correct Marks : 2 Wrong Marks : 0

A thermodynamics system comprises of 4 non-degenerate energy levels with energies 0, E, 2E and 3E. The number of ways 3 indistinguishable particles can be arranged in these levels such that the total energy of the system is 5E is

1. 1
2. 2
3. 3
4. 5

Options :

60348931763. 1

60348931764. 2

60348931765. 3

60348931766. 4

Question Number : 34 Question Id : 6034898452 Question Type : MCQ Option Shuffling : No Is Question Mandatory : No

Correct Marks : 2 Wrong Marks : 0

For an ideal Fermi gas in three dimension, the electron momentum at the Fermi surface (p_F) is related to the electron concentration (n) as

1. $p_F \propto n$
2. $p_F \propto n^{1/2}$
3. $p_F \propto n^{1/3}$
4. $p_F \propto n^{1/4}$

Options :

60348931767. 1

60348931768. 2

60348931769. 3

60348931770. 4

Question Number : 35 Question Id : 6034898453 Question Type : MCQ Option Shuffling : No Is Question Mandatory : No

Correct Marks : 2 Wrong Marks : 0

In an intrinsic insulator, the valence band is

1. fully occupied
2. fully empty
3. half filled
4. half charged

Options :

60348931771. 1

60348931772. 2

60348931773. 3

60348931774. 4

Question Number : 36 Question Id : 6034898454 Question Type : MCQ Option Shuffling : No Is Question Mandatory : No

Correct Marks : 2 Wrong Marks : 0

Given, mass of electron = 9.1×10^{-31} Kg, reduced Planck constant = 1.05×10^{-34} J.sec

An electron tunnels through a 0.25 nm gap from a metal to a scanning tunneling microscope (STM) probe. If the work function of the metal is 16.0 eV, the probability of tunneling is (consider electron kinetic energy to be negligibly small as compared to barrier height)

1. 3.4×10^{-5}
2. 1.5×10^{-4}
3. 3.4×10^{-3}
4. 1.5×10^{-2}

Options :

60348931775. 1

60348931776. 2

60348931777. 3

60348931778. 4

Question Number : 37 Question Id : 6034898455 Question Type : MCQ Option Shuffling : No Is Question Mandatory : No

Correct Marks : 2 Wrong Marks : 0

The first excited state of a harmonic oscillator is given by $\psi(x) = A x e^{-ax^2}$, where

$a = \frac{m\omega}{2\hbar}$. The expectation value of x^2 is

1. $\frac{3\hbar}{2m\omega}$
2. $\frac{2\hbar}{3m\omega}$
3. 0
4. $\frac{\hbar}{m\omega}$

Options :

60348931779. 1

60348931780. 2

60348931781. 3

60348931782. 4

Question Number : 38 Question Id : 6034898456 Question Type : MCQ Option Shuffling : No Is Question Mandatory : No

Correct Marks : 2 Wrong Marks : 0

Consider a particle confined in an asymmetric 3D Harmonic oscillator potential

$$V(x,y,z) = (1/2)m\omega^2(x^2 + 4y^2 + 9z^2).$$

The ground state energy of the particle is

1. $0.5\hbar\omega$
2. $\hbar\omega$
3. $2\hbar\omega$
4. $3\hbar\omega$

Options :

60348931783. 1

60348931784. 2

60348931785. 3

60348931786. 4

Question Number : 39 Question Id : 6034898457 Question Type : MCQ Option Shuffling : No Is Question Mandatory : No

Correct Marks : 2 Wrong Marks : 0

Given mass of an electron = 9.1×10^{-31} Kg, reduced Planck constant, $\hbar = 1.05 \times 10^{-34}$ J.sec

A 0.1 eV electron impacts on a potential barrier of height 4.0 eV. The quantum mechanical penetration depth (in nanometer) of the electron is

1. 0.0098
2. 0.098
3. 0.98
4. 9.8

Options :

60348931787. 1

60348931788. 2

60348931789. 3

60348931790. 4

Question Number : 40 Question Id : 6034898458 Question Type : MCQ Option Shuffling : No Is Question Mandatory : No

Correct Marks : 2 Wrong Marks : 0

Given, mass of electron = 9.1×10^{-31} Kg, reduced Planck constant, $\hbar = 6.58 \times 10^{-16}$ eV.sec

The density and atomic weight of Copper (Cu) are 8.96 gm/cc and 63.54 respectively. The Fermi energy (in eV) of Cu is

1. 7.06
2. 5.06
3. 3.06
4. 1.06

Options :

60348931791. 1

60348931792. 2

60348931793. 3

60348931794. 4

Question Number : 41 Question Id : 6034898459 Question Type : MCQ Option Shuffling : No Is Question Mandatory : No

Correct Marks : 2 Wrong Marks : 0

For a Fermion, the probability that an allowed state is occupied if it lies above the Fermi level by $2k_B T$ is

1. 0.00012
2. 0.0012
3. 0.012
4. 0.12

Options :

60348931795. 1

60348931796. 2

60348931797. 3

60348931798. 4

Question Number : 42 Question Id : 6034898460 Question Type : MCQ Option Shuffling : No Is Question Mandatory : No

Correct Marks : 2 Wrong Marks : 0

Given, mass of electron = 9.1×10^{-31} Kg, charge of electron, $e = 1.6 \times 10^{-19}$ C

An electron is subjected to an electric field of 10 Vm^{-1} . If the inter-collision time is 3.0×10^{-14} sec, the drift velocity (in cm/sec) of the electron will be

1. 0.526
2. 5.26
3. 0.926
4. 9.26

Options :

60348931799. 1

60348931800. 2

60348931801. 3

60348931802. 4

Question Number : 43 Question Id : 6034898461 Question Type : MCQ Option Shuffling : No Is Question Mandatory : No

Correct Marks : 2 Wrong Marks : 0

The resistivity and Hall coefficient of a certain material are $1.72 \times 10^{-8} \Omega\text{m}$ and

$1.1 \times 10^{-10} \text{ m}^3\text{C}^{-1}$ respectively. The electron mobility (in $\text{m}^2\text{V}^{-1}\text{s}^{-1}$) is

1. 6.4
2. 0.64
3. 0.064
4. 0.0064

Options :

60348931803. 1

60348931804. 2

60348931805. 3

60348931806. 4

Question Number : 44 Question Id : 6034898462 Question Type : MCQ Option Shuffling : No Is Question Mandatory : No

Correct Marks : 2 Wrong Marks : 0

Given, the charge of the electron, $e = 1.6 \times 10^{-19} \text{ C}$

The Hall coefficient of a certain material is $1.1 \times 10^{-10} \text{ m}^3\text{C}^{-1}$. The electron density of this material (in m^{-3}) is

- 1. 5.65×10^{28}
- 2. 9.65×10^{28}
- 3. 5.65×10^{30}
- 4. 9.65×10^{30}

Options :

60348931807. 1

60348931808. 2

60348931809. 3

60348931810. 4

Question Number : 45 Question Id : 6034898463 Question Type : MCQ Option Shuffling : No Is Question Mandatory : No

Correct Marks : 2 Wrong Marks : 0

Given, m_e = mass of electron, reduced Planck constant, $\hbar = 1.05 \times 10^{-34} \text{ J.sec}$

The E-k dispersion relation for an electron in a 1-dimensional infinite solid is given by $E(k) = E_0[1 - \cos(ka)]$, where $E_0 = 1 \text{ eV}$ and $a = 1.0 \text{ nm}$. The effective mass of this electron at $k = (\pi/6) \text{ (nm)}^{-1}$ is

- 1. $0.009m_e$
- 2. $0.09m_e$
- 3. $0.9m_e$
- 4. $9m_e$

Options :

60348931811. 1

60348931812. 2

60348931813. 3

60348931814. 4

Question Number : 46 Question Id : 6034898464 Question Type : MCQ Option Shuffling : No Is Question Mandatory : No

Correct Marks : 2 Wrong Marks : 0

Given Boltzmann constant = $8.6 \times 10^{-5} \text{ eV K}^{-1}$

If n_A and n_B are the electron densities in the conduction bands of two materials 'A' (with band gap, $E_g=1.22 \text{ eV}$) and 'B' (with $E_g=1.0 \text{ eV}$) at 400 K, the ratio (n_B/n_A) is

1. 0.242

2. 2.42

3. 24.2

4. 242

Options :

60348931815. 1

60348931816. 2

60348931817. 3

60348931818. 4

Question Number : 47 Question Id : 6034898465 Question Type : MCQ Option Shuffling : No Is Question Mandatory : No

Correct Marks : 2 Wrong Marks : 0

A piece of n-type silicon contains $1.21 \times 10^{23} \text{ m}^{-3}$ phosphorous impurity atoms. If the intrinsic electron concentration in silicon at room temperature is $1.1 \times 10^{17} \text{ m}^{-3}$, the carrier (hole) concentration

(in m^{-3}) at room temperature will be

1. 10^9
2. 10^{10}
3. 10^{11}
4. 10^{12}

Options :

60348931819. 1

60348931820. 2

60348931821. 3

60348931822. 4

Question Number : 48 Question Id : 6034898466 Question Type : MCQ Option Shuffling : No Is

Question Mandatory : No

Correct Marks : 2 Wrong Marks : 0

A current of 1.6×10^{-11} Amp flows through a silicon p-n junction at temperature 27°C . The current (in mA) for a forward bias of 0.5 V will be

1. 394
2. 39.4
3. 3.94
4. 0.394

Options :

60348931823. 1

60348931824. 2

60348931825. 3

60348931826. 4

Question Number : 49 Question Id : 6034898467 Question Type : MCQ Option Shuffling : No Is

Question Mandatory : No

Correct Marks : 2 Wrong Marks : 0

If q , k_B and T are charge, Boltzmann constant and absolute temperature, the unit of $(k_B T)/q^2$ will be

1. $V \text{ (Coulomb)}^{-1}$
2. $\text{Joule (Coulomb)}^{-1}$
3. $V^{-1} \text{ (Coulomb)}^{-1}$
4. Joule

Options :

60348931827. 1

60348931828. 2

60348931829. 3

60348931830. 4

Question Number : 50 Question Id : 6034898468 Question Type : MCQ Option Shuffling : No Is Question Mandatory : No

Correct Marks : 2 Wrong Marks : 0

Drift current in metals depends upon

1. only the electric field
2. only the carrier concentration gradient
3. both the electric field and carrier concentration
4. neither the electric field nor the carrier concentration gradient

Options :

60348931831. 1

60348931832. 2

60348931833. 3

60348931834. 4