

International Advanced Research Centre for Powder Metallurgy and New Materials ARCI

Notations :

- 1.Options shown in green color and with ✓ icon are correct.
- 2.Options shown in red color and with ✗ icon are incorrect.

Scientist B SRF JRF Physical Sciences

PART A

Question Number : 1 Question Id : 8616631301 Question Type : MCQ Option Shuffling : Yes
Display Question Number : Yes Is Question Mandatory : No Calculator : Normal Option
Orientation : Vertical

Correct Marks : 3 Wrong Marks : 1

Let V be a vector space of polynomials of degree at most 3 over the field of real numbers. Which of the following sets forms a basis for V ?

Options :

1. ✖ $\{1, x, x^2, x^3+1\}$

2. ✔ $\{1, x, x^2, x^3\}$

3. ✖ $\{1, x, x^2, x+1\}$

4. ✖ $\{x, x^2, x^3\}$

Question Number : 2 Question Id : 8616631302 Question Type : MCQ Option Shuffling : Yes Display Question Number : Yes Is Question Mandatory : No Calculator : Normal Option Orientation : Vertical Correct Marks : 3 Wrong Marks : 1

If A is a 2 x 2 matrix such that $\text{Trace}(A) = 6$ and $|A| = 12$, then $\text{Trace}(A^{-1})$ is

Options :

1. ✖ $1/6$

2. ✖ $1/3$

3. ✔ $1/2$

4. ✖ 1

Question Number : 3 Question Id : 8616631303 Question Type : MCQ Option Shuffling : Yes Display Question Number : Yes Is Question Mandatory : No Calculator : Normal Option Orientation : Vertical Correct Marks : 3 Wrong Marks : 1

If $x^2+y^2+z^2 = xy+yz+zx$ and $x=1$, then find the value of $\frac{10x^4+5y^4+7z^4}{13x^2y^2+6y^2z^2+3z^2x^2}$?

Options :

1. ✖ 2

2. ✖ 0

3. ✔ 1

4. ✖ -1

Question Number : 4 Question Id : 8616631304 Question Type : MCQ Option Shuffling : Yes
Display Question Number : Yes Is Question Mandatory : No Calculator : Normal Option
Orientation : Vertical
Correct Marks : 3 Wrong Marks : 1

Write the order and degree of the following equation

$$y'' + b^2x = 0$$

Options :

1. ✖ 2, 2

2. ✔ 2, 1

3. ✖ 1, 1

4. ✖ 1, 2

Question Number : 5 Question Id : 8616631305 Question Type : MCQ Option Shuffling : Yes
Display Question Number : Yes Is Question Mandatory : No Calculator : Normal Option
Orientation : Vertical
Correct Marks : 3 Wrong Marks : 1

Find the correct relation for polar form of Cauchy-Riemann equations

Options :

1. ✖ $\frac{\partial u}{\partial \theta} = \frac{1}{\theta} \frac{\partial v}{\partial r}$

2. ✖ $\frac{\partial u}{\partial r} = r \frac{\partial v}{\partial \theta}$

3. ✖ $\frac{\partial u}{\partial r} = \frac{1}{\theta} \frac{\partial v}{\partial r}$

4. ✔ $\frac{\partial u}{\partial \theta} = -r \frac{\partial v}{\partial r}$

Question Number : 6 Question Id : 8616631306 Question Type : MCQ Option Shuffling : Yes
Display Question Number : Yes Is Question Mandatory : No Calculator : Normal Option
Orientation : Vertical
Correct Marks : 3 Wrong Marks : 1

The residues of a function $f(z) = \frac{1}{(z-4)(z+1)^3}$ are

Options :

1. ✖ $-\frac{1}{125}$ and $-\frac{1}{27}$

2. ✔ $\frac{1}{125}$ and $-\frac{1}{125}$

3. ✖ $-\frac{1}{27}$ and $\frac{1}{5}$

4. ✖ $\frac{1}{125}$ and $-\frac{1}{5}$

Question Number : 7 Question Id : 8616631307 Question Type : MCQ Option Shuffling : Yes
Display Question Number : Yes Is Question Mandatory : No Calculator : Normal Option
Orientation : Vertical
Correct Marks : 3 Wrong Marks : 1

Sum and product of a complex number and its conjugate complex are

Options :

1. ✖ Real and imaginary respectively

2. ✖ Both imaginary

3. ✖ Imaginary and real respectively

4. ✔ Both real

Question Number : 8 Question Id : 8616631308 Question Type : MCQ Option Shuffling : Yes
Display Question Number : Yes Is Question Mandatory : No Calculator : Normal Option
Orientation : Vertical
Correct Marks : 3 Wrong Marks : 1

What is the result of the inverse Laplace transform of $F(s) = 1/s$?

Options :

1. ✖ e^{-at}

2. ✔ $u(t)$

3. ✖ $\sin(at)$

4. ✖ $\cos(at)$

Question Number : 9 Question Id : 8616631309 Question Type : MCQ Option Shuffling : Yes
Display Question Number : Yes Is Question Mandatory : No Calculator : Normal Option
Orientation : Vertical

Correct Marks : 3 Wrong Marks : 1

A periodic function $f(x) = x^2$ for $-\pi < x < \pi$ is expanded in a Fourier series.
Which of the following statements is correct?

Options :

1. ✔ Coefficients of all the sine terms are zero

2. ✖ The first term in the series is $-\pi/3$

3. ✖ The second term in the series is $-4\cos(x)$

4. ✖ Coefficients of all the cosine terms are zero

Question Number : 10 Question Id : 8616631310 Question Type : MCQ Option Shuffling : Yes
Display Question Number : Yes Is Question Mandatory : No Calculator : Normal Option
Orientation : Vertical

Correct Marks : 3 Wrong Marks : 1

Let γ be the positively oriented circle in the complex plane given by $\{z \in \mathbb{C} : |z-1| = 1\}$.

Then $\frac{1}{2\pi i} \int_{\gamma} \frac{dz}{(z^3-1)}$ equals

1. ✖ 3

2. ✔ $1/3$

3. ✖ 2

4. ✖ $\frac{1}{2}$

Question Number : 11 Question Id : 8616631311 Question Type : MCQ Option Shuffling : Yes
Display Question Number : Yes Is Question Mandatory : No Calculator : Normal Option
Orientation : Vertical

Correct Marks : 3 Wrong Marks : 1

D'Alembert's principle is given by

Options :

1. ✔ $\sum_i (F_i^{(a)} - \dot{p}_i) \delta r_i = 0$

2. ✖ $\sum_i (F_i^{(a)} + \dot{p}_i) \delta r_i = 0$

3. ✖ $\sum_i (F_i^{(a)} - \dot{p}_i) \delta r_i = 1$

4. ✖ $\sum_i (F_i^{(a)} + \dot{p}_i) \delta r_i = 1$

Question Number : 12 Question Id : 8616631312 Question Type : MCQ Option Shuffling : Yes
Display Question Number : Yes Is Question Mandatory : No Calculator : Normal Option
Orientation : Vertical

Correct Marks : 3 Wrong Marks : 1

If $F_1(Q, q) = Qq$ is the generating function of a canonical transformation from (p, q) to (P, Q) , then which one of the following relations is correct?

Options :

1. ✔ $\frac{p}{P} = -\frac{Q}{q}$

2. ✖ $\frac{P}{p} = -\frac{Q}{q}$

3. ✖ $\frac{p}{P} = \frac{Q}{q}$

4. ✖ $\frac{P}{p} = \frac{Q}{q}$

Question Number : 13 Question Id : 8616631313 Question Type : MCQ Option Shuffling : Yes Display Question Number : Yes Is Question Mandatory : No Calculator : Normal Option Orientation : Vertical Correct Marks : 3 Wrong Marks : 1

A symmetric top has principal moments of inertia $I_1 = I_2 = \frac{2\alpha}{3}$, $I_3 = 2\alpha$ about a set of principal axes 1, 2, 3 respectively, passing through its center of mass, where α is a positive constant. There is no force acting on the body and the angular speed of the body about the 3-axis is $\omega_3 = 1/8$ rad/s. With what angular frequency in rad/s does the angular velocity vector $\vec{\omega}_1$ precess about the 3-axis?

Options :

1. ✖ 7

2. ✖ 5

3. ✖ 3

4. ✔ 2

Question Number : 14 Question Id : 8616631314 Question Type : MCQ Option Shuffling : Yes Display Question Number : Yes Is Question Mandatory : No Calculator : Normal Option Orientation : Vertical Correct Marks : 3 Wrong Marks : 1

Two identical particles of rest mass m_0 approach each other with equal and opposite velocity $v = 0.5c$, where c is the speed of light. The total energy of one particle as measured in the rest frame of the other is $E = \alpha m_0 c^2$. The value of α (up to one decimal digit) is

Options :

1. ✖ 2.7

2. ✔ 1.7

3. ✖ 3.1

4. ✖ 4.2

Question Number : 15 Question Id : 8616631315 Question Type : MCQ Option Shuffling : Yes Display Question Number : Yes Is Question Mandatory : No Calculator : Normal Option Orientation : Vertical

Correct Marks : 3 Wrong Marks : 1

A constant force F is applied to a relativistic particle of rest mass m . If the particle starts from rest at $t = 0$, its speed after a time t is

Options :

1. ✖ $\frac{Ft}{m}$

2. ✖ $c \tanh \frac{Ft}{mc}$

3. ✔ $\frac{Fct}{\sqrt{F^2t^2 + m^2c^2}}$

4. ✖ $\frac{m}{Ft}$

Question Number : 16 Question Id : 8616631316 Question Type : MCQ Option Shuffling : Yes Display Question Number : Yes Is Question Mandatory : No Calculator : Normal Option Orientation : Vertical

Correct Marks : 3 Wrong Marks : 1

If the Lagrangian of a particle moving in one dimension is given by $L = \left(\frac{\dot{x}^2}{2}\right) - V(x)$, the Hamiltonian is

Options :

1. ✔ $\frac{1}{2} (\dot{x}p^2) + V(x)$

2. ✖ $\dot{x}p^2 - V(x)$

3. ✖ $\frac{1}{2} (\dot{x}p^2) - V(x)$

4. ✖ $\frac{1}{2} \dot{x}^2 + V(x)$

Question Number : 17 Question Id : 8616631317 Question Type : MCQ Option Shuffling : Yes
Display Question Number : Yes Is Question Mandatory : No Calculator : Normal Option
Orientation : Vertical

Correct Marks : 3 Wrong Marks : 1

The time period of a particle of mass m , undergoing small oscillations around $x = 0$, in the potential $V = V_0 \cosh (x/L)$, is

Options :

1. ✓ $2\pi \sqrt{\frac{mL^2}{V_0}}$

2. ✗ $\pi \sqrt{\frac{mL^2}{V_0}}$

3. ✗ $2\pi \sqrt{\frac{L^2}{mV_0}}$

4. ✗ $2 \sqrt{\frac{mL^2}{V_0}}$

Question Number : 18 Question Id : 8616631318 Question Type : MCQ Option Shuffling : Yes
Display Question Number : Yes Is Question Mandatory : No Calculator : Normal Option
Orientation : Vertical

Correct Marks : 3 Wrong Marks : 1

In central force motion which one of the following physical quantities is conserved?

Options :

1. ✗ Kinetic energy

2. ✗ Linear momentum

3. ✓ Angular momentum

4. ✗ Total energy

Question Number : 19 Question Id : 8616631319 Question Type : MCQ Option Shuffling : Yes
Display Question Number : Yes Is Question Mandatory : No Calculator : Normal Option
Orientation : Vertical
Correct Marks : 3 Wrong Marks : 1

A particle placed on the surface of a sphere is expressed as $r^2 - a^2 \geq 0$, is an example of the constraint

Options :

1.  Rheonomic
2.  Nonholonomic
3.  Holonomic
4.  Rheonomic and Holonomic

Question Number : 20 Question Id : 8616631320 Question Type : MCQ Option Shuffling : Yes
Display Question Number : Yes Is Question Mandatory : No Calculator : Normal Option
Orientation : Vertical
Correct Marks : 3 Wrong Marks : 1

If a function f is a constant of motion, what is its Poisson bracket with the Hamiltonian H ?

Options :

1.  $\{f, H\} = 1$
2.  $\{f, H\} = H$
3.  $\{f, H\} = 0$
4.  $\{f, H\} = f$

Question Number : 21 Question Id : 8616631321 Question Type : MCQ Option Shuffling : Yes
Display Question Number : Yes Is Question Mandatory : No Calculator : Normal Option
Orientation : Vertical
Correct Marks : 3 Wrong Marks : 1

The electric field intensity on the surface of a charged conductor is

Options :

1. ✖ Directed tangentially to the surface
2. ✖ Directed at an angle of 45° to the surface
3. ✔ Directed normally to the surface
4. ✖ Zero

Question Number : 22 Question Id : 8616631322 Question Type : MCQ Option Shuffling : Yes
Display Question Number : Yes Is Question Mandatory : No Calculator : Normal Option
Orientation : Vertical
Correct Marks : 3 Wrong Marks : 1

Which one of the following is the Maxwell's equation that confirms the absence of magnetic monopoles? ($\mathbf{E}$, $\mathbf{B}$ are in vector form)

Options :

1. ✖ $\nabla \cdot \mathbf{E} = \rho / \epsilon_0$
2. ✔ $\nabla \cdot \mathbf{B} = 0$
3. ✖ $\nabla \times \mathbf{E} = - \partial \mathbf{B} / \partial t$
4. ✖ $\nabla \times \mathbf{E} = \partial \mathbf{B} / \partial t$

Question Number : 23 Question Id : 8616631323 Question Type : MCQ Option Shuffling : Yes
Display Question Number : Yes Is Question Mandatory : No Calculator : Normal Option
Orientation : Vertical
Correct Marks : 3 Wrong Marks : 1

The Poynting theorem is a mathematical statement for the conservation of

Options :

1. ✖ charge
2. ✖ momentum
3. ✖ energy states
4. ✔ electromagnetic energy

Question Number : 24 Question Id : 8616631324 Question Type : MCQ Option Shuffling : Yes
Display Question Number : Yes Is Question Mandatory : No Calculator : Normal Option
Orientation : Vertical

Correct Marks : 3 Wrong Marks : 1

The radius R of a loop carrying a current I is doubled, $R \rightarrow 2R$ while the current is halved $I \rightarrow (I/2)$. The magnetic moment M of the current loop is then

Options :

1. ✖ $M/2$

2. ✔ $2M$

3. ✖ $M/4$

4. ✖ M

Question Number : 25 Question Id : 8616631325 Question Type : MCQ Option Shuffling : Yes
Display Question Number : Yes Is Question Mandatory : No Calculator : Normal Option
Orientation : Vertical

Correct Marks : 3 Wrong Marks : 1

If an electromagnetic wave is propagating in a medium with permittivity ϵ and permeability μ , then $\sqrt{\frac{\mu}{\epsilon}}$ represents the

Options :

1. ✖ refractive index of the medium

2. ✔ intrinsic impedance of the medium

3. ✖ square of refractive index of the medium

4. ✖ energy density present in the medium

Question Number : 26 Question Id : 8616631326 Question Type : MCQ Option Shuffling : Yes
Display Question Number : Yes Is Question Mandatory : No Calculator : Normal Option
Orientation : Vertical

Correct Marks : 3 Wrong Marks : 1

The electrostatic potential at a point due to a charge of $50 \mu\text{C}$ at a distance of 15 cm from it is determined to be

(Given, permittivity of free space is $\epsilon_0 = 8.854 \times 10^{-12} \text{ C}^2 \text{ N}^{-1} \text{ m}^{-2}$)

Options :

1. ✓ $3 \times 10^6 \text{ V}$
2. ✗ $3 \times 10^{-6} \text{ V}$
3. ✗ $1.5 \times 10^{-6} \text{ V}$
4. ✗ $1.5 \times 10^6 \text{ V}$

Question Number : 27 Question Id : 8616631327 Question Type : MCQ Option Shuffling : Yes
Display Question Number : Yes Is Question Mandatory : No Calculator : Normal Option
Orientation : Vertical
Correct Marks : 3 Wrong Marks : 1

A sphere of radius $2R$ has uniform charge density ρ . The difference in the electrostatic potential at $r = R$ and $r=0$ from the centre is

Options :

1. ✗ $(-\rho r^2) / \epsilon_0$
2. ✓ $(-\rho r^2) / (6\epsilon_0)$
3. ✗ $(\rho r^2) / \epsilon_0$
4. ✗ $(\rho r^2) / (6\epsilon_0)$

Question Number : 28 Question Id : 8616631328 Question Type : MCQ Option Shuffling : Yes
Display Question Number : Yes Is Question Mandatory : No Calculator : Normal Option
Orientation : Vertical
Correct Marks : 3 Wrong Marks : 1

LASER source can produce nearly parallel beam of light with high intensity. If a 2 kW laser beam is made to concentrate by a lens into a cross-sectional area of 10^{-6} cm^2 , then the value of the Poynting vector is calculated to be

Options :

1. ✓ $2 \times 10^{13} \text{ W/m}^2$
2. ✗ $2 \times 10^{14} \text{ W/m}^2$
3. ✗ $2 \times 10^{18} \text{ W/m}^2$
4. ✗ $2 \times 10^{12} \text{ W/m}^2$

Question Number : 29 Question Id : 8616631329 Question Type : MCQ Option Shuffling : Yes
Display Question Number : Yes Is Question Mandatory : No Calculator : Normal Option
Orientation : Vertical

Correct Marks : 3 Wrong Marks : 1

The degree of polarization for ordinary light reflected from glass, with a refractive index of 1.5, at an incident angle of 45° is

Options :

1. ✗ 28.1%
2. ✓ 83.3 %
3. ✗ 2.81%
4. ✗ 8.33%

Question Number : 30 Question Id : 8616631330 Question Type : MCQ Option Shuffling : Yes
Display Question Number : Yes Is Question Mandatory : No Calculator : Normal Option
Orientation : Vertical

Correct Marks : 3 Wrong Marks : 1

The skin depth of a conductor with attenuation constant of 7 neper/m is

Options :

1. ✗ 7 units
2. ✗ $(1/49)$ units
3. ✓ $(1/7)$ units

4. ✖ 49 units

Question Number : 31 Question Id : 8616631331 Question Type : MCQ Option Shuffling : Yes Display Question Number : Yes Is Question Mandatory : No Calculator : Normal Option Orientation : Vertical

Correct Marks : 3 Wrong Marks : 1

The error in the measurement of the lifetime of an atom is 2×10^{-2} sec. What is the minimum uncertainty in its energy in eV?

Options :

1. ✖ 2.1×10^{-15} eV

2. ✖ 8.0×10^{-15} eV

3. ✔ 1.6×10^{-14} eV

4. ✖ 4.8×10^{-14} eV

Question Number : 32 Question Id : 8616631332 Question Type : MCQ Option Shuffling : Yes Display Question Number : Yes Is Question Mandatory : No Calculator : Normal Option Orientation : Vertical

Correct Marks : 3 Wrong Marks : 1

The wave function (ψ) in the Schrödinger equation represents

Options :

1. ✖ The potential energy of the particle

2. ✖ The kinetic energy of the particle

3. ✔ The probability amplitude of the particle's location

4. ✖ The total energy of the system

Question Number : 33 Question Id : 8616631333 Question Type : MCQ Option Shuffling : Yes Display Question Number : Yes Is Question Mandatory : No Calculator : Normal Option Orientation : Vertical

Correct Marks : 3 Wrong Marks : 1

For a harmonic oscillator, the ground state energy according to quantum theory is

Options :

1. ✖ 0

2. ✖ $\hbar\omega$

3. ✔ $\frac{1}{2} \hbar\omega$

4. ✖ $\frac{3}{2} \hbar\omega$

Question Number : 34 Question Id : 8616631334 Question Type : MCQ Option Shuffling : Yes Display Question Number : Yes Is Question Mandatory : No Calculator : Normal Option Orientation : Vertical

Correct Marks : 3 Wrong Marks : 1

What is the quantum mechanical operator for angular momentum in the x-direction (L_x)?

Options :

1. ✖ $L_x = -i\hbar (z \frac{\partial}{\partial x} - x \frac{\partial}{\partial z})$

2. ✔ $L_x = -i\hbar (y \frac{\partial}{\partial z} - z \frac{\partial}{\partial y})$

3. ✖ $L_x = -i\hbar (x \frac{\partial}{\partial y} - y \frac{\partial}{\partial x})$

4. ✖ $L_x = -i\hbar (y \frac{\partial}{\partial z} - y \frac{\partial}{\partial y})$

Question Number : 35 Question Id : 8616631335 Question Type : MCQ Option Shuffling : Yes Display Question Number : Yes Is Question Mandatory : No Calculator : Normal Option Orientation : Vertical

Correct Marks : 3 Wrong Marks : 1

Is the wavefunction, $\phi(x) = e^{ikx}$ an eigenfunction of the kinetic energy operator T? If yes, what is its eigenvalue?

Options :

1. ✖ No, it is not an eigenfunction
2. ✖ Yes, it is an eigenfunction with eigenvalue $\frac{\hbar^2}{2m}$
3. ✖ Yes, it is an eigenfunction with eigenvalue $i\hbar m$
4. ✔ Yes, it is an eigenfunction with eigenvalue $\frac{\hbar^2 k^2}{2m}$

Question Number : 36 Question Id : 8616631336 Question Type : MCQ Option Shuffling : Yes
 Display Question Number : Yes Is Question Mandatory : No Calculator : Normal Option
 Orientation : Vertical
 Correct Marks : 3 Wrong Marks : 1

The Schrodinger equation for a particle within the box simplifies to: $-\frac{\hbar^2}{2m} \frac{\partial^2 \varphi}{\partial x^2} = E\varphi$. What form of wavefunction satisfies this equation and all other conditions for a particle in a box?

Options :

1. ✖ $\varphi(x) = A \cos(kx)$
2. ✔ $\varphi(x) = A \cos(kx) + B \sin(kx)$
3. ✖ $\varphi(x) = e^{kx}$
4. ✖ $\varphi(x) = 0$

Question Number : 37 Question Id : 8616631337 Question Type : MCQ Option Shuffling : Yes
 Display Question Number : Yes Is Question Mandatory : No Calculator : Normal Option
 Orientation : Vertical
 Correct Marks : 3 Wrong Marks : 1

If a quantum state is given by $|\psi\rangle = \alpha|0\rangle + \beta|1\rangle$, and it is properly normalized, which of the following is true?

Options :

1. ✖ $\alpha^2 + \beta^2 = 0$

2. ✓ $|\alpha|^2 + |\beta|^2 = 1$

3. ✗ $\langle 0 | \psi \rangle = 1$

4. ✗ $\langle 1 | 0 \rangle = 1$

Question Number : 38 Question Id : 8616631338 Question Type : MCQ Option Shuffling : Yes
 Display Question Number : Yes Is Question Mandatory : No Calculator : Normal Option
 Orientation : Vertical
 Correct Marks : 3 Wrong Marks : 1

The expectation value of an observable represented by the operator A in a state $|\psi\rangle$ is given by

Options :

1. ✓ $\langle \psi | A | \psi \rangle$

2. ✗ $\langle \psi | A | A | \psi \rangle$

3. ✗ $\langle \psi | \psi \rangle$

4. ✗ $|\langle \psi | A | \psi \rangle|^2$

Question Number : 39 Question Id : 8616631339 Question Type : MCQ Option Shuffling : Yes
 Display Question Number : Yes Is Question Mandatory : No Calculator : Normal Option
 Orientation : Vertical
 Correct Marks : 3 Wrong Marks : 1

$\psi = A \sin \theta \exp(i\Phi)$, where A is a constant, is an eigenfunction of L^2 and L_z .
 Then, the eigen values of L^2 and L_z are respectively,

Options :

1. ✓ $2\hbar^2, \hbar$

2. ✗ $\hbar^2, 2\hbar$

3. ✗ $2\hbar^2, 2\hbar$

4. ✖ $2\hbar, \hbar$

Question Number : 40 Question Id : 8616631340 Question Type : MCQ Option Shuffling : Yes
Display Question Number : Yes Is Question Mandatory : No Calculator : Normal Option
Orientation : Vertical

Correct Marks : 3 Wrong Marks : 1

The differential scattering cross-section $\sigma(\theta)$, for scattering of a particle of mass m by the δ -function potential $V(r) = g \delta(r)$ (where g - is a constant), with scattering amplitude,

$$f(\theta) = -\frac{m}{2\pi\hbar^2} \int \exp(iq \cdot r') V(r') d\tau', \text{ using Born approximation is}$$

Options :

1. ✖ $-\frac{m^2 g^2}{2\pi\hbar^2}$

2. ✖ $-\frac{m^2 \hbar^2}{2\pi g^2}$

3. ✖ $\frac{m^2 g^2}{4\pi\hbar^2}$

4. ✔ $\frac{m^2 g^2}{4\pi^2 \hbar^4}$

Question Number : 41 Question Id : 8616631341 Question Type : MCQ Option Shuffling : Yes
Display Question Number : Yes Is Question Mandatory : No Calculator : Normal Option
Orientation : Vertical

Correct Marks : 3 Wrong Marks : 1

Consider black body radiation contained in a cavity whose walls are at temperature T . The radiation is in equilibrium with the walls of the cavity. If the temperature of the walls is increased to $2T$ and the radiation is allowed to come to equilibrium at the new temperature, the entropy of the radiation increases by a factor of

Options :

1. ✖ 16

2. ✔ 8

3. ✖ 4

4. ✖ 2

Question Number : 42 Question Id : 8616631342 Question Type : MCQ Option Shuffling : Yes
Display Question Number : Yes Is Question Mandatory : No Calculator : Normal Option
Orientation : Vertical

Correct Marks : 3 Wrong Marks : 1

The free energy difference between the superconducting and the normal states of a material is given by $\Delta F = f_S - f_N = \alpha |\psi|^2 + \frac{\beta}{2} |\psi|^4$ where ψ is an order parameter and α and β are constants so that $\alpha > 0$ in normal and $\alpha < 0$ in the superconducting state, while $\beta > 0$ always, minimum value of ΔF is

Options :

1. ✖ $-\frac{3\alpha^2}{2\beta}$

2. ✖ $-\frac{5\alpha^2}{2\beta}$

3. ✖ $-\frac{\alpha^2}{\beta}$

4. ✔ $-\frac{\alpha^2}{2\beta}$

Question Number : 43 Question Id : 8616631343 Question Type : MCQ Option Shuffling : Yes
Display Question Number : Yes Is Question Mandatory : No Calculator : Normal Option
Orientation : Vertical

Correct Marks : 3 Wrong Marks : 1

Ten grams of ice at 0°C is added to a beaker containing 30 grams of water at 25°C . What is the final temperature of the system when it comes to thermal equilibrium? (The specific heat of water is $1\text{ cal/gm}^\circ\text{C}$ and latent heat of melting of ice is 80 cal/gm)

Options :

1. ✔ 0°C

2. ✖ 7.5°C

3. ✖ 12.5°C

4. ✖ -1.25⁰ C

Question Number : 44 Question Id : 8616631344 Question Type : MCQ Option Shuffling : Yes
Display Question Number : Yes Is Question Mandatory : No Calculator : Normal Option
Orientation : Vertical
Correct Marks : 3 Wrong Marks : 1

Consider the melting transition of ice into water at constant pressure. Which of the following thermodynamic quantities does not exhibit a discontinuous change across the phase transition?

Options :

1. ✖ Internal energy

2. ✖ Entropy

3. ✖ Helmholtz free energy

4. ✔ Gibbs free energy

Question Number : 45 Question Id : 8616631345 Question Type : MCQ Option Shuffling : Yes
Display Question Number : Yes Is Question Mandatory : No Calculator : Normal Option
Orientation : Vertical
Correct Marks : 3 Wrong Marks : 1

A system of N classical non-interacting particles, each of mass m, is at a temperature T and is confined by the external potential $V(r) = \frac{1}{2} Ar^2$ (where A is a constant) in three dimensions. The internal energy of the system is

Options :

1. ✔ $3 Nk_B T$

2. ✖ $\frac{3}{2} Nk_B T$

3. ✖ $N(2mA)^{\frac{3}{2}} k_B T$

4. ✖ $N \sqrt{\frac{A}{m}} \ln(k_B T/m)$

Question Number : 46 Question Id : 8616631346 Question Type : MCQ Option Shuffling : Yes
Display Question Number : Yes Is Question Mandatory : No Calculator : Normal Option
Orientation : Vertical

Correct Marks : 3 Wrong Marks : 1

A thermodynamic function $G(T, P, N) = U - TS + PV$, is given in terms of the internal energy U , temperature T , entropy S , pressure P , volume V and the number of particles N . Which of the following relations is true? (In the following μ is the chemical potential.)

Options :

1. ✖ $S = \frac{\partial G}{\partial T} \Big|_{N, P}$

2. ✔ $S = - \frac{\partial G}{\partial T} \Big|_{N, P}$

3. ✖ $V = \frac{\partial G}{\partial T} \Big|_{N, P}$

4. ✖ $\mu = - \frac{\partial G}{\partial N} \Big|_{P, T}$

Question Number : 47 Question Id : 8616631347 Question Type : MCQ Option Shuffling : Yes
Display Question Number : Yes Is Question Mandatory : No Calculator : Normal Option
Orientation : Vertical

Correct Marks : 3 Wrong Marks : 1

During Bose-Einstein condensation all the atoms fall back to the _____

Options :

1. ✔ Ground state

2. ✖ Highest Exited state

3. ✖ First exited state

4. ✖ Meta stable state

Question Number : 48 Question Id : 8616631348 Question Type : MCQ Option Shuffling : Yes
Display Question Number : Yes Is Question Mandatory : No Calculator : Normal Option
Orientation : Vertical

Correct Marks : 3 Wrong Marks : 1

The Fermi-Dirac distribution function is

Options :

1. ✖ $f(E) = \frac{1}{e^{\frac{E-E_F}{kT}}}$
2. ✖ $f(E) = \frac{1}{e^{\frac{E-E_F}{kT}} - 1}$
3. ✔ $f(E) = \frac{1}{e^{\frac{E-E_F}{kT}} + 1}$
4. ✖ $f(E) = \frac{1}{e^{\frac{E-E_F}{kT}} + k}$

Question Number : 49 Question Id : 8616631349 Question Type : MCQ Option Shuffling : Yes
Display Question Number : Yes Is Question Mandatory : No Calculator : Normal Option
Orientation : Vertical

Correct Marks : 3 Wrong Marks : 1

Which of the following is an example of a second-order phase transition?

Options :

1. ✖ Melting ice into water.
2. ✖ Boiling of water into steam.
3. ✔ Transition of a ferromagnetic material to its paramagnetic state near the Curie temperature.
4. ✖ Sublimation of dry ice

Question Number : 50 Question Id : 8616631350 Question Type : MCQ Option Shuffling : Yes
Display Question Number : Yes Is Question Mandatory : No Calculator : Normal Option
Orientation : Vertical

Correct Marks : 3 Wrong Marks : 1

Which statement best describes the microscopic behavior of particles in a solid?

Options :

1. ✖ Particles are far apart and move freely.
2. ✖ Particles are closely packed but can move past each other.

3. ✖ Particles are randomly arranged and collide with high energy.
4. ✔ Particles are fixed in position and vibrate about their fixed points.

Question Number : 51 Question Id : 8616631351 Question Type : MCQ Option Shuffling : Yes Display Question Number : Yes Is Question Mandatory : No Calculator : Normal Option Orientation : Vertical

Correct Marks : 3 Wrong Marks : 1

L-S coupling occurs often in

Options :

1. ✔ Lighter atoms
2. ✖ Heavier atoms
3. ✖ All atoms
4. ✖ Molecular level

Question Number : 52 Question Id : 8616631352 Question Type : MCQ Option Shuffling : Yes Display Question Number : Yes Is Question Mandatory : No Calculator : Normal Option Orientation : Vertical

Correct Marks : 3 Wrong Marks : 1

The normal Zeeman effect is

Options :

1. ✖ not a confirmation of space quantization
2. ✔ a confirmation of space quantization
3. ✖ observed only in atoms with an even number of electrons
4. ✖ observed only in atoms with an odd number of electrons

Question Number : 53 Question Id : 8616631353 Question Type : MCQ Option Shuffling : Yes Display Question Number : Yes Is Question Mandatory : No Calculator : Normal Option Orientation : Vertical

Correct Marks : 3 Wrong Marks : 1

The vibrational transitions in a molecule are accompanied with an energy change of

Options :

1. ✖ 0.05 eV
2. ✖ 10 eV
3. ✔ 0.1 eV
4. ✖ 5 eV

Question Number : 54 Question Id : 8616631354 Question Type : MCQ Option Shuffling : Yes
Display Question Number : Yes Is Question Mandatory : No Calculator : Normal Option
Orientation : Vertical

Correct Marks : 3 Wrong Marks : 1

Which of the following transition is not possible?

Options :

1. ✖ ${}^2d_{3/2} \rightarrow {}^2p_{1/2}$
2. ✔ ${}^2d_{3/2} \rightarrow {}^2s_{1/2}$
3. ✖ ${}^2p_{1/2} \rightarrow {}^2s_{1/2}$
4. ✖ ${}^2f_{5/2} \rightarrow {}^2d_{5/2}$

Question Number : 55 Question Id : 8616631355 Question Type : MCQ Option Shuffling : Yes
Display Question Number : Yes Is Question Mandatory : No Calculator : Normal Option
Orientation : Vertical

Correct Marks : 3 Wrong Marks : 1

A laser operating with a wavelength of 740 nm has a coherence time of

4×10^{-5} s. Given speed of light is 3×10^8 m/s. This laser beam will have the coherence length of

Options :

1. ✔ 12 km
2. ✖ 22 km

3. ✖ 24 km

4. ✖ 44 km

Question Number : 56 Question Id : 8616631356 Question Type : MCQ Option Shuffling : Yes Display Question Number : Yes Is Question Mandatory : No Calculator : Normal Option Orientation : Vertical Correct Marks : 3 Wrong Marks : 1

The relaxation process that involves energy transfer from the excited nuclei to the surrounding molecular environment / lattice, is known as

Options :

1. ✖ Dipole-dipole relaxation

2. ✖ T_2 relaxation

3. ✔ T_1 relaxation

4. ✖ Chemical shift anisotropy

Question Number : 57 Question Id : 8616631357 Question Type : MCQ Option Shuffling : Yes Display Question Number : Yes Is Question Mandatory : No Calculator : Normal Option Orientation : Vertical Correct Marks : 3 Wrong Marks : 1

Light having the wavelength of $1.5 \mu\text{m}$ is incident on a material with a characteristic Raman frequency of 20×10^{12} Hz. Given speed of light is 3×10^8 m/s. This will cause a Stokes shifted line having the wavelength of

Options :

1. ✖ $1.97 \mu\text{m}$

2. ✖ $1.87 \mu\text{m}$

3. ✖ $1.76 \mu\text{m}$

4. ✔ $1.67 \mu\text{m}$

Question Number : 58 Question Id : 8616631358 Question Type : MCQ Option Shuffling : Yes
Display Question Number : Yes Is Question Mandatory : No Calculator : Normal Option
Orientation : Vertical

Correct Marks : 3 Wrong Marks : 1

Calculate the efficiency of a He-Ne laser, if it produces an output of 5 mW when it is operated with a current of 10 mA at 3 kV.

Options :

1. ☒ 0.0166 %
2. ☐ 1.66 %
3. ☐ 16.6 %
4. ☐ 0.00166%

Question Number : 59 Question Id : 8616631359 Question Type : MCQ Option Shuffling : Yes
Display Question Number : Yes Is Question Mandatory : No Calculator : Normal Option
Orientation : Vertical

Correct Marks : 3 Wrong Marks : 1

Which among the following is commonly employed as a detector crystal in ESR spectrometer?

Options :

1. ☐ Quartz rectifier
2. ☐ Gallium rectifier
3. ☒ Silicon tungsten rectifier
4. ☐ Boron nitride rectifier

Question Number : 60 Question Id : 8616631360 Question Type : MCQ Option Shuffling : Yes
Display Question Number : Yes Is Question Mandatory : No Calculator : Normal Option
Orientation : Vertical

Correct Marks : 3 Wrong Marks : 1

The number of allowed EPR lines probable for a metal ion with 3 unpaired electrons and exhibiting a nuclear spin (I) of (7/2) is

Options :

1. ✖ 8
2. ✔ 24
3. ✖ 32
4. ✖ 16

Question Number : 61 Question Id : 8616631361 Question Type : MCQ Option Shuffling : Yes
Display Question Number : Yes Is Question Mandatory : No Calculator : Normal Option
Orientation : Vertical

Correct Marks : 3 Wrong Marks : 1

If the radius of an atom in a simple cubic crystal is 'r', the body diagonal of the unit cell is

Options :

1. ✖ $r\sqrt{3}$
2. ✔ $2r\sqrt{3}$
3. ✖ $4r\sqrt{3}$
4. ✖ $3r/4$

Question Number : 62 Question Id : 8616631362 Question Type : MCQ Option Shuffling : Yes
Display Question Number : Yes Is Question Mandatory : No Calculator : Normal Option
Orientation : Vertical

Correct Marks : 3 Wrong Marks : 1

Hydrogen bonds are stronger than

Options :

1. ✔ Van der Waals bonds
2. ✖ Ionic bonds
3. ✖ Metallic bonds
4. ✖ Covalent bonds

Question Number : 63 Question Id : 8616631363 Question Type : MCQ Option Shuffling : Yes
Display Question Number : Yes Is Question Mandatory : No Calculator : Normal Option
Orientation : Vertical

Correct Marks : 3 Wrong Marks : 1

The interaction between Cooper paired electrons is

Options :

1. ☒ Attractive
2. ☐ Repulsive
3. ☐ Zero
4. ☐ Infinite

Question Number : 64 Question Id : 8616631364 Question Type : MCQ Option Shuffling : Yes
Display Question Number : Yes Is Question Mandatory : No Calculator : Normal Option
Orientation : Vertical

Correct Marks : 3 Wrong Marks : 1

In a pure semiconductor with an energy gap of 0.65 eV and $N_c = 2.5 \times 10^{25} \text{ m}^{-3}$,
the density of holes at 27 °C (i.e. 300 K) is

(Given: Boltzmann constant, $k = 8.617 \times 10^{-5} \text{ eV/K}$)

Options :

1. ☒ $9.575 \times 10^{19} \text{ m}^{-3}$
2. ☐ $1.25 \times 10^{14} \text{ m}^{-3}$
3. ☐ $3.7 \times 10^{24} \text{ m}^{-3}$
4. ☐ $2.8 \times 10^{14} \text{ m}^{-3}$

Question Number : 65 Question Id : 8616631365 Question Type : MCQ Option Shuffling : Yes
Display Question Number : Yes Is Question Mandatory : No Calculator : Normal Option
Orientation : Vertical

Correct Marks : 3 Wrong Marks : 1

The radius of the neon is 0.158 nm. Its electronic polarizability is,

(Given, permittivity of free space is $\epsilon_0 = 8.854 \times 10^{-12} \text{ C}^2 \text{ N}^{-1} \text{ m}^{-2}$)

Options :

1. ✖ $5.838 \times 10^{-40} \text{ F m}^2$

2. ✔ $4.388 \times 10^{-40} \text{ F m}^2$

3. ✖ $5.838 \times 10^{-20} \text{ F m}^2$

4. ✖ $1.388 \times 10^{-40} \text{ F m}^2$

Question Number : 66 Question Id : 8616631366 Question Type : MCQ Option Shuffling : Yes
Display Question Number : Yes Is Question Mandatory : No Calculator : Normal Option
Orientation : Vertical

Correct Marks : 3 Wrong Marks : 1

In a simple cubic lattice $d_{100} : d_{110} : d_{111}$ is

Options :

1. ✖ $\sqrt{6} : \sqrt{3} : \sqrt{4}$

2. ✖ $6:3:4$

3. ✖ $6:3:2$

4. ✔ $\sqrt{6} : \sqrt{3} : \sqrt{2}$

Question Number : 67 Question Id : 8616631367 Question Type : MCQ Option Shuffling : Yes
Display Question Number : Yes Is Question Mandatory : No Calculator : Normal Option
Orientation : Vertical

Correct Marks : 3 Wrong Marks : 1

Calculate the mobility of electrons in copper if the number of electrons per unit volume is 9×10^{28} and conductivity of copper is $6 \times 10^7 (\Omega \cdot m)^{-1}$. Given: Charge of electron : $1.6 \times 10^{-19} C$.

Options :

1. ✓ $4.16 \times 10^{-3} m/V.s$
2. ✗ $5.16 \times 10^{-3} m/V.s$
3. ✗ $4.16 \times 10^{-2} m/V.s$
4. ✗ $5.16 \times 10^{-2} m/V.s$

Question Number : 68 Question Id : 8616631368 Question Type : MCQ Option Shuffling : Yes
Display Question Number : Yes Is Question Mandatory : No Calculator : Normal Option
Orientation : Vertical

Correct Marks : 3 Wrong Marks : 1

If the number density of a free electron gas changes from 10^{28} to 10^{26} electrons/ m^3 , the value of plasma frequency changes from $5.7 \times 10^{15} Hz$ to

Options :

1. ✗ $5.7 \times 10^{14} Hz$
2. ✓ $5.7 \times 10^{13} Hz$
3. ✗ $5.7 \times 10^{16} Hz$
4. ✗ $5.7 \times 10^{17} Hz$

Question Number : 69 Question Id : 8616631369 Question Type : MCQ Option Shuffling : Yes
Display Question Number : Yes Is Question Mandatory : No Calculator : Normal Option
Orientation : Vertical

Correct Marks : 3 Wrong Marks : 1

If the number of atoms in the domain in ferromagnetic iron, in the form of a cube of side length $1 \mu m$, is 8.65×10^{10} atoms and dipole moment of each iron atom is $9.27 \times 10^{-24} A.m^2$, calculate the maximum Magnetization of the domain.

Options :

1. ✖ $8 \times 10^6 \text{ A/m}$
2. ✖ $8 \times 10^7 \text{ A/m}$
3. ✔ $8 \times 10^5 \text{ A/m}$
4. ✖ $8 \times 10^8 \text{ A/m}$

Question Number : 70 Question Id : 8616631370 Question Type : MCQ Option Shuffling : Yes Display Question Number : Yes Is Question Mandatory : No Calculator : Normal Option Orientation : Vertical

Correct Marks : 3 Wrong Marks : 1

A voltage of 6 microvolts is applied across a Josephson junction. Calculate the frequency of the ac signal emitted by the junction.

Given :

Charge of the electron: $1.6 \times 10^{-19} \text{ C}$,

Planck's constant: $6.626 \times 10^{-34} \text{ J s}$

Options :

1. ✖ $2.897 \times 10^{10} \text{ Hz}$
2. ✖ $3.897 \times 10^9 \text{ Hz}$
3. ✖ $3.897 \times 10^{10} \text{ Hz}$
4. ✔ $2.897 \times 10^9 \text{ Hz}$

Question Number : 71 Question Id : 8616631371 Question Type : MCQ Option Shuffling : Yes Display Question Number : Yes Is Question Mandatory : No Calculator : Normal Option Orientation : Vertical

Correct Marks : 3 Wrong Marks : 1

Where will the position of the Fermi level of the n-type semiconductor material be when $N_D = N_A$?

Options :

1. ✔ E_c

2. ✖ E_v

3. ✖ E_n

4. ✖ E_{fi}

Question Number : 72 Question Id : 8616631372 Question Type : MCQ Option Shuffling : Yes
Display Question Number : Yes Is Question Mandatory : No Calculator : Normal Option
Orientation : Vertical

Correct Marks : 3 Wrong Marks : 1

If the top of the valence band and the bottom of the conduction band occur for the same momentum, which of the following event occurs?

Options :

1. ✖ Indirect recombination takes place

2. ✖ Heat is absorbed during recombination

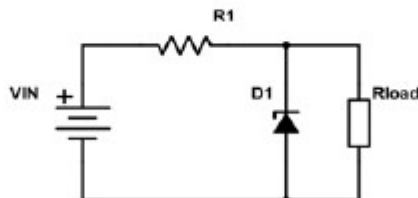
3. ✔ Direct recombination takes place

4. ✖ Heat is generated during recombination

Question Number : 73 Question Id : 8616631373 Question Type : MCQ Option Shuffling : Yes
Display Question Number : Yes Is Question Mandatory : No Calculator : Normal Option
Orientation : Vertical

Correct Marks : 3 Wrong Marks : 1

If the input voltage is 5 volts and load voltage is 3 volts, resistance R_1 as 4Ω , then what will be the diode current for the circuit in the figure below?



Options :

1. ✖ 0.2 A

2. ✔ 0.5 A

3. ✖ 1.0 A

4. ✖ 1.2 A

Question Number : 74 Question Id : 8616631374 Question Type : MCQ Option Shuffling : Yes
Display Question Number : Yes Is Question Mandatory : No Calculator : Normal Option
Orientation : Vertical

Correct Marks : 3 Wrong Marks : 1

Pure silicon at 300 K has equal electron (n_e) and hole (n_h) concentration of $1.5 \times 10^{16} \text{ m}^{-3}$. Doping by Indium increases n_h to $4.5 \times 10^{22} \text{ m}^{-3}$. Then n_e in the doped silicon is

Options :

1. ✖ $9 \times 10^{16} \text{ m}^{-3}$

2. ✖ $5 \times 10^6 \text{ m}^{-3}$

3. ✔ $5 \times 10^9 \text{ m}^{-3}$

4. ✖ $9 \times 10^5 \text{ m}^{-3}$

Question Number : 75 Question Id : 8616631375 Question Type : MCQ Option Shuffling : Yes
Display Question Number : Yes Is Question Mandatory : No Calculator : Normal Option
Orientation : Vertical

Correct Marks : 3 Wrong Marks : 1

For operation as an amplifier, the base of an n-p-n transistor must be

Options :

1. ✔ Positive with respect to the emitter

2. ✖ Negative with respect to the emitter

3. ✖ Positive with respect to the collector

4. ✖ 0 V

Question Number : 76 Question Id : 8616631376 Question Type : MCQ Option Shuffling : Yes
Display Question Number : Yes Is Question Mandatory : No Calculator : Normal Option
Orientation : Vertical

Correct Marks : 3 Wrong Marks : 1

What will be the analog output voltage produced by a D/A converter whose output range is 0 to 10 V and whose input binary number is 10111100 (for a 8-bit DAC)

Options :

1. ✖ 3.75 V

2. ✖ 5.12 V

3. ✔ 7.34 V

4. ✖ 9.94 V

Question Number : 77 Question Id : 8616631377 Question Type : MCQ Option Shuffling : Yes Display Question Number : Yes Is Question Mandatory : No Calculator : Normal Option Orientation : Vertical

Correct Marks : 3 Wrong Marks : 1

The amplifier gain in an oscillator is 50. What should be the percentage feedback for sustained oscillations?

Options :

1. ✖ 0.2%

2. ✔ 2%

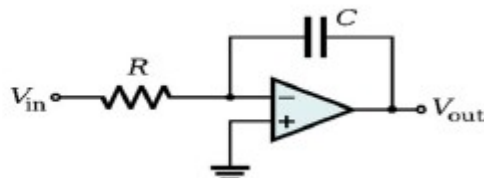
3. ✖ 0.02%

4. ✖ 0.4%

Question Number : 78 Question Id : 8616631378 Question Type : MCQ Option Shuffling : Yes Display Question Number : Yes Is Question Mandatory : No Calculator : Normal Option Orientation : Vertical

Correct Marks : 3 Wrong Marks : 1

What is the application of the given circuit using the operational amplifier in the right-side figure?

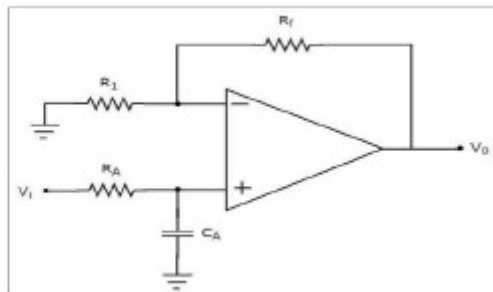


Options :

1. ✖ Differentiator
2. ✔ Integrator
3. ✖ Precision rectifier
4. ✖ Summing amplifier

Question Number : 79 Question Id : 8616631379 Question Type : MCQ Option Shuffling : Yes
 Display Question Number : Yes Is Question Mandatory : No Calculator : Normal Option
 Orientation : Vertical
 Correct Marks : 3 Wrong Marks : 1

In the given circuit using op-amp, $R_f = 10 \text{ k}\Omega$, $R_1 = 10 \text{ k}\Omega$, $C_A = 0.01 \text{ }\mu\text{F}$, $R_A = 15.9 \text{ k}\Omega$. The circuit will be



Options :

1. ✖ A high pass filter with a cut-off frequency 2 kHz and pass-band gain 1
2. ✖ A high pass filter with a cut-off frequency 1 kHz and pass-band gain 2
3. ✖ A low pass filter with a cut-off frequency 2 kHz and pass-band gain 1
4. ✔ A low pass filter with a cut-off frequency 1 kHz and pass-band gain 2

Question Number : 80 Question Id : 8616631380 Question Type : MCQ Option Shuffling : Yes
 Display Question Number : Yes Is Question Mandatory : No Calculator : Normal Option
 Orientation : Vertical
 Correct Marks : 3 Wrong Marks : 1

If $J = K$ (J and K are shorted) in a JK flip-flop, what circuit is made

Options :

1. ✖ SR flip-flop

2. ✖ Shorted JK flip-flop
3. ✖ D flip-flop
4. ✔ T flip-flop

Question Number : 81 Question Id : 8616631381 Question Type : MCQ Option Shuffling : Yes
Display Question Number : Yes Is Question Mandatory : No Calculator : Normal Option
Orientation : Vertical

Correct Marks : 3 Wrong Marks : 1

Atoms with nuclear spin equal to $(1/2)$ cannot have

Options :

1. ✖ Fine structure
2. ✔ Electric quadrupole moment
3. ✖ Dipole interaction between atoms
4. ✖ Magnetic interactions

Question Number : 82 Question Id : 8616631382 Question Type : MCQ Option Shuffling : Yes
Display Question Number : Yes Is Question Mandatory : No Calculator : Normal Option
Orientation : Vertical

Correct Marks : 3 Wrong Marks : 1

Nuclei that are β^- emitters lie

Options :

1. ✔ Below the line of β -stability
2. ✖ Above the line of β -stability
3. ✖ On the line of β -stability
4. ✖ Under the $N = Z$ line

Question Number : 83 Question Id : 8616631383 Question Type : MCQ Option Shuffling : Yes
Display Question Number : Yes Is Question Mandatory : No Calculator : Normal Option
Orientation : Vertical

Correct Marks : 3 Wrong Marks : 1

Which one among the following is not used as a moderator in a nuclear reactor?

Options :

1. ✖ D_2O

2. ✖ H_2O

3. ✔ Al

4. ✖ C

Question Number : 84 Question Id : 8616631384 Question Type : MCQ Option Shuffling : Yes
Display Question Number : Yes Is Question Mandatory : No Calculator : Normal Option
Orientation : Vertical

Correct Marks : 3 Wrong Marks : 1

The mean momentum of a nucleon in a nucleus with mass number A varies as

Options :

1. ✖ A^2

2. ✖ $A^{1/2}$

3. ✖ $A^{-2/3}$

4. ✔ $A^{-1/3}$

Question Number : 85 Question Id : 8616631385 Question Type : MCQ Option Shuffling : Yes
Display Question Number : Yes Is Question Mandatory : No Calculator : Normal Option
Orientation : Vertical

Correct Marks : 3 Wrong Marks : 1

A neutron passing through a detector is detected because of

Options :

1. ✖ The electron-hole pair it generates

- The secondary particles produced in a nuclear reaction in the detector medium.
2. ✓
 3. ✗ Ionization it produces
 4. ✗ Scintillation it generates

Question Number : 86 Question Id : 8616631386 Question Type : MCQ Option Shuffling : Yes
Display Question Number : Yes Is Question Mandatory : No Calculator : Normal Option
Orientation : Vertical

Correct Marks : 3 Wrong Marks : 1

The binding energy per nucleon of helium nucleus is 7 MeV and that of deuteron is 1 MeV. This implies that

Options :

1. ✗ Deuteron nucleus is more stable
2. ✓ Helium nucleus is more stable
3. ✗ Both are equally stable
4. ✗ Both are unstable

Question Number : 87 Question Id : 8616631387 Question Type : MCQ Option Shuffling : Yes
Display Question Number : Yes Is Question Mandatory : No Calculator : Normal Option
Orientation : Vertical

Correct Marks : 3 Wrong Marks : 1

Half-life of a radioactive material is 4 days. After 20 days, the fraction of the material that remains without decaying will be

Options :

1. ✓ $\frac{1}{32}$
2. ✗ $\frac{1}{16}$
3. ✗ $\frac{1}{20}$

4. ✖ $\frac{1}{4}$

Question Number : 88 Question Id : 8616631388 Question Type : MCQ Option Shuffling : Yes
Display Question Number : Yes Is Question Mandatory : No Calculator : Normal Option
Orientation : Vertical

Correct Marks : 3 Wrong Marks : 1

Quarks are supposed to exist in the following number of flavours

Options :

1. ✖ 2

2. ✔ 6

3. ✖ 4

4. ✖ 16

Question Number : 89 Question Id : 8616631389 Question Type : MCQ Option Shuffling : Yes
Display Question Number : Yes Is Question Mandatory : No Calculator : Normal Option
Orientation : Vertical

Correct Marks : 3 Wrong Marks : 1

Calculate the distance of closest approach when an alpha particle of kinetic energy 6.5 MeV strikes a nucleus of atomic number 50.

Given: Permittivity of free space (ϵ_0) is $8.854 \times 10^{-12} \text{ C}^2 / \text{Nm}^2$.

Options :

1. ✖ 1.022 fm

2. ✔ 0.022 fm

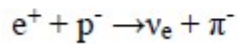
3. ✖ 4.022 fm

4. ✖ 2.022 fm

Question Number : 90 Question Id : 8616631390 Question Type : MCQ Option Shuffling : Yes
Display Question Number : Yes Is Question Mandatory : No Calculator : Normal Option
Orientation : Vertical

Correct Marks : 3 Wrong Marks : 1

What is the law due to which the following reaction is forbidden?



Options :

1. ✖ Law of electron number conservation
2. ✖ Law of muon number conservation
3. ✔ Law of baryon number conservation
4. ✖ Law of momentum energy conservation

PART B

Question Number : 91 Question Id : 8616631391 Question Type : MCQ Option Shuffling : Yes
Display Question Number : Yes Is Question Mandatory : No Calculator : Normal Option
Orientation : Vertical
Correct Marks : 3 Wrong Marks : 1

In the question below given four statements followed by three Conclusions number I, II and III. You have to take the given statements to be true even if they seem to be at variance from commonly known facts. Read all the conclusions and then decide which of the given conclusions logically follows from the given statements despite gardening commonly known facts.

Statements: Some plates are spoons.
 All spoons are forks.
 All forks are bowls.
 Some bowls are utensils.

Conclusions: I. Some plates are bowls.
 II. All spoons are bowls.
 III. Some forks are utensils.

Options :

1. ✖ Only I follows
2. ✖ Only II follows
3. ✖ Only I and III follow
4. ✔ Only I and II follow

Question Number : 92 Question Id : 8616631392 Question Type : MCQ Option Shuffling : Yes
Display Question Number : Yes Is Question Mandatory : No Calculator : Normal Option
Orientation : Vertical
Correct Marks : 3 Wrong Marks : 1

From the given answer figures, select the one in which the question figure is hidden/embedded.

Question Figure:



Options :



1. ✔



2. ✖

3. ✖

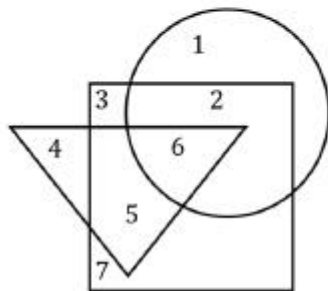


4. ✖



Question Number : 93 Question Id : 8616631393 Question Type : MCQ Option Shuffling : Yes Display Question Number : Yes Is Question Mandatory : No Calculator : Normal Option Orientation : Vertical Correct Marks : 3 Wrong Marks : 1

When a survey was made regarding the preferences in the watching of TV channel, a few said that they watch only ZEE TV channel, the others liked only Sun TV channel, while others Asianet TV channel. A small percentage said that they watch all the three TV channels. In the figure given below the circle indicates the Asianet TV channel, the square Z TV and the triangle the Sun TV channel. Which number in the figure indicates the fact that some people watch all the three TV channels?



Options :

1. ✖ 2

2. ✖ 5

3. ✔ 6

4. ✖ 3

Question Number : 94 Question Id : 8616631394 Question Type : MCQ Option Shuffling : Yes Display Question Number : Yes Is Question Mandatory : No Calculator : Normal Option Orientation : Vertical Correct Marks : 3 Wrong Marks : 1

If 27 March, 1995 was a Mon day, then what days of the week was 1 November, 1995?

Options :

1. ✖ Monday
2. ✖ Sunday
3. ✖ Tuesday
4. ✔ Wednesday

Question Number : 95 Question Id : 8616631395 Question Type : MCQ Option Shuffling : Yes Display Question Number : Yes Is Question Mandatory : No Calculator : Normal Option Orientation : Vertical

Correct Marks : 3 Wrong Marks : 1

Ashok started walking towards South. After walking 50 metres he took a right turn and walked 30 metres. He then took a right turn and walked 100 metres. He again took a right turn and walked 30 metres and stopped. How far and in which direction was he from the starting point?

Options :

1. ✖ 50 metres South
2. ✖ 150 metres North
3. ✖ 180 metres East
4. ✔ 50 metres North

Question Number : 96 Question Id : 8616631396 Question Type : MCQ Option Shuffling : Yes Display Question Number : Yes Is Question Mandatory : No Calculator : Normal Option Orientation : Vertical

Correct Marks : 3 Wrong Marks : 1

In a certain code language 'ROUTINE' is written as 'VMRGFLI'. How will be 'CRUELTY' written in that code language?

Options :

1. ✖ VPVCZRL
2. ✖ VPCVZRL
3. ✖ WPCVZRL

4. ✓ BGOVFIX

Question Number : 97 Question Id : 8616631397 Question Type : MCQ Option Shuffling : Yes
Display Question Number : Yes Is Question Mandatory : No Calculator : Normal Option
Orientation : Vertical

Correct Marks : 3 Wrong Marks : 1

Thirty-six vehicles are parked in a parking lot in a single row. After the first car, there is one scooter. After the second car, there are two scooters. After the third car, there are three scooters and so on. Work out the number of scooters in the second half of the row.

Options :

1. ✗ 10

2. ✗ 12

3. ✓ 15

4. ✗ 17

Question Number : 98 Question Id : 8616631398 Question Type : MCQ Option Shuffling : Yes
Display Question Number : Yes Is Question Mandatory : No Calculator : Normal Option
Orientation : Vertical

Correct Marks : 3 Wrong Marks : 1

In the following number series, a wrong number is given. Find out that wrong number.
10, 11, 24, 75, 303, 1525, 9156

Options :

1. ✗ 24

2. ✗ 1525

3. ✗ 75

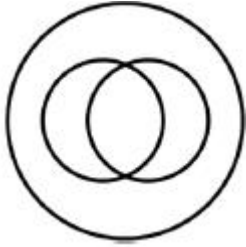
4. ✓ 303

Question Number : 99 Question Id : 8616631399 Question Type : MCQ Option Shuffling : Yes
Display Question Number : Yes Is Question Mandatory : No Calculator : Normal Option
Orientation : Vertical

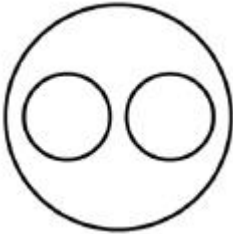
Correct Marks : 3 Wrong Marks : 1

Which of the following figures represents the relation between 'Sparrows', 'Birds' and 'Crows'?

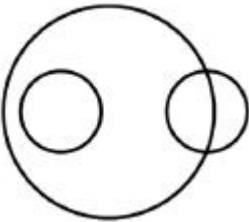
Options :



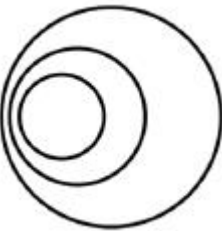
1. ✖



2. ✔



3. ✖

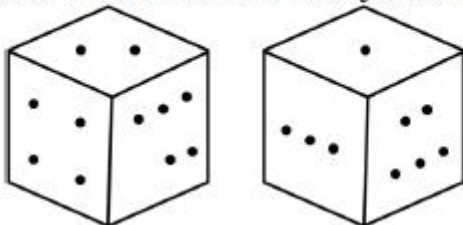


4. ✖

Question Number : 100 Question Id : 8616631400 Question Type : MCQ Option Shuffling : Yes
Display Question Number : Yes Is Question Mandatory : No Calculator : Normal Option
Orientation : Vertical

Correct Marks : 3 Wrong Marks : 1

Study the two different positions of a cube given below with dots from 1 to 6 marked on its faces. Find out how many dots are there on the face opposite to that containing 4 dots.



Options :

1. ✖ 1

2. ✖ 2

3. ✔ 3

4. ✖ 5