# TELANGANA RESIDENTIAL EDUCATIONAL INSTITUTIONS RECRUITMENT BOARD TREI-RB

**Notations :**

1.Options shown in green color and with ✔ icon are correct.

2.Options shown in red color and with ✖ icon are incorrect.

| | |
|---|---|
| **Question Paper Name :** | Physics 19th Aug 2023 Shift 1 |
| **Subject Name :** | Physics |
| **Creation Date :** | 2023-08-19 12:26:05 |
| **Duration :** | 120 |
| **Total Marks :** | 100 |
| **Display Marks:** | Yes |
| **Calculator :** | None |
| **Magnifying Glass Required? :** | No |
| **Ruler Required? :** | No |
| **Eraser Required? :** | No |
| **Scratch Pad Required? :** | No |
| **Rough Sketch/Notepad Required? :** | No |
| **Protractor Required? :** | No |
| **Show Watermark on Console? :** | Yes |
| **Highlighter :** | No |
| **Auto Save on Console?** | Yes |
| **Change Font Color :** | No |
| **Change Background Color :** | No |
| **Change Theme :** | No |
| **Help Button :** | No |

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|---|---|
| **Show Reports :** | No |
| **Show Progress Bar :** | No |

# Physics

| | |
|---|---|
| **Group Number :** | 1 |
| **Group Id :** | 594253121 |
| **Group Maximum Duration :** | 0 |
| **Group Minimum Duration :** | 120 |
| **Show Attended Group? :** | No |
| **Edit Attended Group? :** | No |
| **Break time :** | 0 |
| **Group Marks :** | 100 |
| **Is this Group for Examiner? :** | No |
| **Examiner permission :** | Cant View |
| **Show Progress Bar? :** | No |

# Physics

| | |
|---|---|
| **Section Id :** | 594253137 |
| **Section Number :** | 1 |
| **Section type :** | Online |
| **Mandatory or Optional :** | Mandatory |
| **Number of Questions :** | 100 |
| **Number of Questions to be attempted :** | 100 |
| **Section Marks :** | 100 |
| **Enable Mark as Answered Mark for Review and Clear Response :** | Yes |
| **Maximum Instruction Time :** | 0 |
| **Sub-Section Number :** | 1 |

**Sub-Section Id :** 594253181

**Question Shuffling Allowed :** Yes

**Is Section Default? :** null

**Question Number : 1 Question Id : 59425312035 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0**

**Correct Marks : 1 Wrong Marks : 0.25**

Which of the following is **INCORRECT** for the matrix $M = \begin{bmatrix} 0 & 1 \\ 1 & 0 \end{bmatrix}$?

**Options :**

1. ✖ It is its own transpose

2. ✖ It is its own inverse5

3. ✖ It has Eigen values $\pm 1$

4. ✔ It is non-orthogonal

**Question Number : 2 Question Id : 59425312036 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0**

**Correct Marks : 1 Wrong Marks : 0.25**

Consider the linear differential equation $\frac{dy}{dx} = xy$. If $y = 2$ *at* $x = 0$, then the value of $y$ at $x = 2$ is given by

**Options :**

1. ✖ $e^{-2}$

2. ✖ $3e^2$

3. ✔ $2e^2$

4. ✖ $2e^{-2}$

**Question Number : 3 Question Id : 59425312037 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0**

**Correct Marks : 1 Wrong Marks : 0.25**

If $\vec{A} = yz\hat{i} + xz\hat{j} + xy\hat{k}$, then the integral $\oint_C \vec{A}.\overrightarrow{dl}$ is where C is along a perimeter of a rectangular area bounded by $x = 0, x = a$ and $y = 0, y = b$

**Options :**

1. ✔ $0$

2. ✖ $\frac{1}{2}(a^3 + b^3)$

3. ✖ $\pi(ab^2 + a^2b)$

4. ✖ $\pi(a^3 + b^3)$

**Question Number : 4 Question Id : 59425312038 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0**

**Correct Marks : 1 Wrong Marks : 0.25**

The value of Legendre's polynomial $P_3(-1)$ is

**Options :**

1. ✖ $3$

2. ✔ $-1$

3. ✖ $5$

4. ✖ $1$

**Question Number : 5 Question Id : 59425312039 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0**

**Correct Marks : 1 Wrong Marks : 0.25**

Laplace transform of $t^{\frac{1}{2}}$ is

**Options :**

1. ✖ $\sqrt{\frac{\pi}{s}}$

2. ✔ $\frac{1}{2s}\sqrt{\frac{\pi}{s}}$

3. ✖ $\frac{1}{2s}$

4. ✖ $\frac{\pi}{2s}$

**Question Number : 6 Question Id : 59425312040 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0**

**Correct Marks : 1 Wrong Marks : 0.25**

The value of $J_{\frac{1}{2}}\left(\frac{\pi}{2}\right) + J_{-\frac{1}{2}}\left(\frac{\pi}{2}\right)$ is

**Options :**

1. ✔ $\frac{2}{\pi}$

2. ✖ $0$

3. ✖ $\frac{1}{\pi}$

4. ✖ $\sqrt{\frac{2}{\pi}}$

**Question Number : 7 Question Id : 59425312041 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0**

**Correct Marks : 1 Wrong Marks : 0.25**

The order of singularity of $f(z) = \frac{1}{z - \sin z}$ $at\ z = 0$ is

**Options :**

1. ✖ $4$

2. ✔ $3$

3. ✖ $2$

4. ✖ $1$

**Question Number : 8 Question Id : 59425312042 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0**

**Correct Marks : 1 Wrong Marks : 0.25**

Residue of $f(z) = \frac{z^2}{z^2+4}$ $at$ $z = 2i$ is

**Options :**

1. ✔ $i$

2. ✖ $-i$

3. ✖ $1$

4. ✖ $0$

**Question Number : 9 Question Id : 59425312043 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0**

**Correct Marks : 1 Wrong Marks : 0.25**

Mutual interaction force between two particles can change

**Options :**

1. ✔

The kinetic energy but not the linear momentum

2. ✖ The linear momentum but not the kinetic energy

3. ✖ The linear momentum as well as kinetic energy

4. ✖ Neither the linear momentum nor the kinetic energy

**Question Number : 10 Question Id : 59425312044 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0**

**Correct Marks : 1 Wrong Marks : 0.25**

A particle of mass $m$ moves under action of central force whose potentials is $V(r) = (Kmr^3)$ $(K>0)$ then, the period of circular motion is

**Options :**

1. ✖ $\frac{2\pi}{3Kr}$

2. ✔ $\frac{2\pi}{\sqrt{3Kr}}$

3. ✖ $\frac{2\pi}{\sqrt{Kr}}$

4. ✖ $\frac{2\pi}{\sqrt{mKr}}$

**Question Number : 11 Question Id : 59425312045 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0**

**Correct Marks : 1 Wrong Marks : 0.25**

In Rutherford $\alpha$-scattering experiment, the scattering cross section is inversely proportional to

**Options :**

1. ✖ $E$

2. ✔ $E^2$

3. ✖ $E^3$

4. ✖ $E^{1/2}$

**Question Number : 12 Question Id : 59425312046 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0**

**Correct Marks : 1 Wrong Marks : 0.25**

Consider circular orbits in a central force potential $(r) = \frac{-K}{r^n}$, where $K > 0$ and $0 < n < 2$. If the time period of a circular orbit of radius R is $T_1$ and that of radius 2R is $T_2$, then $\frac{T_2}{T_1}$ is

**Options :**

1. ✖ $2^{n}/_{2}$

2. ✖ $2^{\frac{2}{2}n}$

3. ✔ $2^{\frac{n}{2}+1}$

4. ✖ $2^n$

**Question Number : 13 Question Id : 59425312047 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0**

**Correct Marks : 1 Wrong Marks : 0.25**

After a perfectly elastic collision of two identical balls (one which was initially at rest), the velocity of both the balls are non-zero. The angle $\theta$ between final velocities (in laboratory frame) is

**Options :**

1. ✔ $\theta = \frac{\pi}{2}$

2. ✖ $\theta = \pi$

3. ✖ $0 < \theta < \frac{\pi}{2}$

4. ✖ $\frac{\pi}{2} < \theta < \pi$

**Question Number : 14 Question Id : 59425312048 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0**

**Correct Marks : 1 Wrong Marks : 0.25**

The number of degrees of freedom for the general motion of a rigid body is

**Options :**

1. ✖ $3$

2. ✔ 6

3. ✖ 9

4. ✖ 12

**Question Number : 15 Question Id : 59425312049 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0**

**Correct Marks : 1 Wrong Marks : 0.25**

Four-point size bodies each of mass M are fixed at four corners of light square frame whose side length is L. The moment of inertia of four bodies about an axis perpendicular to plane of frame and passing through any corner of frame is

**Options :**

1. ✔ $4ML^2$

2. ✖ $2\sqrt{2}ML^2$

3. ✖ $3ML^2$

4. ✖ $2ML^2$

**Question Number : 16 Question Id : 59425312050 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0**

**Correct Marks : 1 Wrong Marks : 0.25**

The ratio of weights of a person inside a lift when it is stationery and when it is going down with a uniform acceleration 'a' is 3:2. The value of 'a' is

**Options :**

1. ✔ $\frac{g}{3}$

2. ✖ $\frac{2}{3}g$

3. ✖ $g$

4. ✖ $\frac{3}{2}g$

**Question Number : 17 Question Id : 59425312051 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0**

**Correct Marks : 1 Wrong Marks : 0.25**

If the Lagrangian of a dynamical system in two dimension is $L = \frac{1}{2}m\dot{x}^2 + m\dot{x}\dot{y}$, then its Hamiltonian is

**Options :**

1. ✖ $H = \frac{1}{m}p_x p_y + \frac{1}{2m}{p_y}^2$

2. ✔ $H = -\frac{p_x p_y}{m} + \frac{{p_x}^2}{2m}$

3. ✖ $H = \frac{1}{m}p_x p_y - \frac{1}{2m}{p_y}^2$

4. ✖ $H = \frac{1}{m}p_x p_y - \frac{1}{2}m{p_x}^2$

**Question Number : 18 Question Id : 59425312052 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0**

**Correct Marks : 1 Wrong Marks : 0.25**

If a generalized coordinate has the dimensions of velocity, generalized velocity has the dimension of

**Options :**

1. ✖ Displacement

2. ✖ Velocity

3. ✔ Acceleration

4. ✖ Force

**Question Number : 19 Question Id : 59425312053 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0**

**Correct Marks : 1 Wrong Marks : 0.25**

A particle of unit mass moves in a potential $V(x) = ax^2 + \frac{b}{x^2}$, where $a$ and $b$ are positive constants. The angular frequency of small oscillations about the minimum of the potential is

**Options :**

1. ✔ $\sqrt{8a}$

2. ✖ $\sqrt{8b}$

3. ✖ $\sqrt{\frac{8a}{b}}$

4. ✖ $\sqrt{\frac{8b}{a}}$

**Question Number : 20 Question Id : 59425312054 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0**

**Correct Marks : 1 Wrong Marks : 0.25**

Lorentz transformation equation holds for

**Options :**

1. ✖ Non relativistic velocities only

2. ✖ Relativistic velocities only

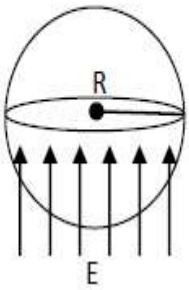
3. ✔ All velocities, relativistic and non-relativistic

4. ✖ Photons only

**Question Number : 21 Question Id : 59425312055 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0**

**Correct Marks : 1 Wrong Marks : 0.25**

A hemisphere of radius R is placed in a uniform electric field of intensity E. The Electric flux through the hemisphere is




**Options :**

1. ✖ $0$

2. ✖ $+\pi R^2 E$

3. ✔ $-\pi R^2 E$

4. ✖ $-\pi R E^2$

**Question Number : 22 Question Id : 59425312056 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0**

**Correct Marks : 1 Wrong Marks : 0.25**

A charge Q is placed at the center of a regular cube. The flux through all the six surfaces of the cube is

**Options :**

1. ✖ $0$

2. ✔ $\frac{Q}{\varepsilon_0}$

3. ✖ $\frac{3Q}{\varepsilon_0}$

4. ✖ $\frac{6Q}{\varepsilon_0}$

**Question Number : 23 Question Id : 59425312057 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0**

**Correct Marks : 1 Wrong Marks : 0.25**

A current 'I' is flowing in a thick and long conductor of cross-sectional radius R. Which of the following showing the magnetic field induction 'B' at any point at a distance 'x' from the axis of the conductor are correct?

A) $B_{inside} = \frac{\mu_0 I x}{2\pi R^2}$ for $x < R$

B) $B_{surface} = \frac{\mu_0 I}{2\pi R^2}$ for $x = R$

C) $B_{outside} = \frac{\mu_0 I}{2\pi R}$ for $x > R$

**Options :**

1. ✖ A and B only

2. ✖ B and C only

3. ✔ A and C only

4. ✖ A, B and C

**Question Number : 24 Question Id : 59425312058 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A**

**Minimum Instruction Time : 0**

**Correct Marks : 1 Wrong Marks : 0.25**

Choose the correct statements from the following regarding the equation of continuity in electricity:

A) This equation indicates that the current or charge per second, diverging from a small volume per unit volume is equal to the time rate of decrease of charge per unit volume at every point.

B) Equation of continuity: $\vec{\nabla}.\vec{J} + \frac{\partial \rho}{\partial t} = 0$, here, $\vec{J}$ and $\rho$ are current density and volume charge density respectively.

C) For steady currents, $\frac{\partial \rho}{\partial t} = 1$

**Options :**

1. ✔ A and B only

2. ✖ B and C only

3. ✖ A and C only

4. ✖ A, B and C

**Question Number : 25 Question Id : 59425312059 Question Type : MCQ Option Shuffling : Yes**

**Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A**

**Minimum Instruction Time : 0**

**Correct Marks : 1 Wrong Marks : 0.25**

A copper conductor has a diameter of 0.6 inch. and it is 1200 feet long. It carries a total dc current of 50 A. The current density in the conductor is

**Options :**

1. ✖ $1.74 \times 10^4\ \mathrm{A\ m^{-2}}$

2. ✔ $2.74 \times 10^5\ \text{A m}^{-2}$

3. ✖ $2.90 \times 10^6\ \text{A m}^{-2}$

4. ✖ $2.94 \times 10^7\ \text{A m}^{-2}$

**Question Number : 26 Question Id : 59425312060 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0**

**Correct Marks : 1 Wrong Marks : 0.25**

Choose the correct statements from the following regarding the conductors in electrostatic fields.

A) The static electric field intensity inside a conductor is zero.

B) The static electric field intensity at the surface of a conductor is everywhere directed parallel to that surface.

C) The conductor surface is an equipotential surface.

**Options :**

1. ✖ A and B only

2. ✖ B and C only

3. ✔ A and C only

4. ✖ A, B and C

**Question Number : 27 Question Id : 59425312061 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A**

**Minimum Instruction Time : 0**

**Correct Marks : 1 Wrong Marks : 0.25**

The boundary conditions for the conductor-to-free-space boundary in electrostatics are

**Options :**

1. ✔ normal component of B and tangential component of E is continuous

2. ✖ tangential component of B and normal component of E is continuous

3. ✖ normal component of H is continuous

4. ✖ normal component of B is discontinuous

**Question Number : 28 Question Id : 59425312062 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A**

**Minimum Instruction Time : 0**

**Correct Marks : 1 Wrong Marks : 0.25**

A ferrite material is operating in a linear mode with magnetic field induction (B) of 0.05 T.

If its relative permeability ($\mu_r$) is 50, then its magnetic susceptibility ($\chi_m$) and intensity of magnetic field (H) are

**Options :**

1. ✔ $\chi_m = 49$ and $H = 796\ Am^{-1}$

2. ✖ $\chi_m = 50$ and $H = 796\ Am^{-1}$

3. ✖ $\chi_m = 51$ and $H = 679\ Am^{-1}$

4.

✖ $\chi_m = 49$ and $H = 679\ Am^{-1}$

**Question Number : 29 Question Id : 59425312063 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0**

**Correct Marks : 1 Wrong Marks : 0.25**

The Poisson's equation and Laplace's equation relating an electric potential function 'V' to a charge distribution are respectively

**Options :**

1. ✖ $\nabla^2 V = \frac{\rho}{\varepsilon_0}$ and $\nabla^2 V = 0$

2. ✖ $\nabla^2 V = 0$ and $\nabla^2 V = -\frac{\rho}{\varepsilon_0}$

3. ✖ $\nabla^2 V = 0$ and $\nabla^2 V = \frac{\rho}{\varepsilon_0}$

4. ✔ $\nabla^2 V = -\frac{\rho}{\varepsilon_0}$ and $\nabla^2 V = 0$

**Question Number : 30 Question Id : 59425312064 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0**

**Correct Marks : 1 Wrong Marks : 0.25**

A circular conductor of radius $r_0 = 1\ cm$ has an internal field:

$H = \frac{10^4}{r}\left(\frac{1}{a^2}\sin ar - \frac{r}{a}\cos ar\right) a_\phi\ Am^{-1}$ where $= \frac{\pi}{2r_0}$.

The total current in the conductor is

**Options :**

1. ✖ $\frac{4}{\pi}$ A

2. ✔ $\frac{8}{\pi}$ A

3. ✖ $\frac{\pi}{4}$ A

4. ✖ $\frac{\pi}{8}$ A

**Question Number : 31 Question Id : 59425312065 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0**

**Correct Marks : 1 Wrong Marks : 0.25**

Which of the following Maxwell's electromagnetic equation in a free space is **INCORRECT**?

**Options :**

1. ✖ $\vec{\nabla}.\vec{E} = 0$

2. ✖ $\vec{\nabla}.\vec{B} = 0$

3. ✖ $\vec{\nabla} \times \vec{E} = -\frac{\partial \vec{B}}{\partial t}$

4. ✔ $\vec{\nabla} \times \vec{B} = -\mu_0 \varepsilon_0 \frac{\partial \vec{E}}{\partial t}$

**Question Number : 32 Question Id : 59425312066 Question Type : MCQ Option Shuffling : Yes**

**Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A**

**Minimum Instruction Time : 0**

**Correct Marks : 1 Wrong Marks : 0.25**

The correct equation for intensity of electric field in terms of scalar potential 'V' and vector potential '$\vec{A}$' is

**Options :**

1. ✖ $\vec{E} = -\nabla^2 V - \frac{\partial \vec{A}}{\partial t}$

2. ✖ $\vec{E} = \vec{\nabla} V + \frac{\partial \vec{A}}{\partial t}$

3. ✖ $\vec{E} = -\nabla^2 V + \frac{\partial \vec{A}}{\partial t}$

4. ✔ $\vec{E} = -\vec{\nabla} V - \frac{\partial \vec{A}}{\partial t}$

**Question Number : 33 Question Id : 59425312067 Question Type : MCQ Option Shuffling : Yes**

**Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A**

**Minimum Instruction Time : 0**

**Correct Marks : 1 Wrong Marks : 0.25**

If $\lambda$ is a gauge function, the transformation equations of scalar potential 'V' and vector potential '$\vec{A}$', into new set of scalar potential 'V′' and vector potential '$\vec{A}'$', are given by

**Options :**

1. ✖ $\vec{A}' = \vec{A} + \vec{\nabla}\lambda$ and $V' = V + \frac{\partial \lambda}{\partial t}$

2. ✖ $\vec{A}' = \vec{A} - \vec{\nabla}\lambda$ and $V' = V - \frac{\partial \lambda}{\partial t}$

3. ✔ $\vec{A}' = \vec{A} + \vec{\nabla}\lambda$ and $V' = V - \frac{\partial \lambda}{\partial t}$

4. ✖ $\vec{A}' = \vec{A} - \vec{\nabla}\lambda$ and $V' = V + \frac{\partial \lambda}{\partial t}$

**Question Number : 34 Question Id : 59425312068 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0**

**Correct Marks : 1 Wrong Marks : 0.25**

The energy per unit time, per unit area, transported by the electric and magnetic fields $(\vec{E}$ and $\vec{B})$ in a electromagnetic wave is given by

**Options :**

1. ✖ $\frac{1}{4\mu_o}(\vec{E} . \vec{B})$

2. ✖ $\frac{2}{\mu_o}(\vec{E} \times \vec{B})$

3. ✔ $\frac{1}{\mu_o}(\vec{E} \times \vec{B})$

4. ✖ $\frac{1}{4\,\mu_o}(\vec{E} \times \vec{B})$

**Question Number : 35 Question Id : 59425312069 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0**

**Correct Marks : 1 Wrong Marks : 0.25**

For a one-dimensional motion of a free particle, the bound state energy levels are

**Options :**

1. ✖ Degenerate and not discrete

2. ✖ Both discrete and degenerate

3. ✔ Discrete and not degenerate

4. ✖ Neither discrete nor degenerate

**Question Number : 36 Question Id : 59425312070 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0**

**Correct Marks : 1 Wrong Marks : 0.25**

Which of the following quantum mechanical operators are expressed correctly?

A) Energy operator, $E = i\hbar\frac{\partial}{\partial t}$

B) Momentum operator, $p = +i\hbar\nabla$

C) Hamiltonian operator, $H = -\frac{\hbar^2}{2m}\nabla^2 + V$

**Options :**

1. ✖ A only

2. ✖ B only

3. ✖ A and B only

4. ✔ A and C only

**Question Number : 37 Question Id : 59425312071 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0**

**Correct Marks : 1 Wrong Marks : 0.25**

Which of the following commutator is **INCORRECT**?

**Options :**

1. ✖ $[x, p_x] = [y, p_y] = [z, p_z] = i\mathrm{h}$

2. ✔ $[x, p_y] = [y, p_z] = [z, p_x] = -i\mathrm{h}$

3. ✖ $[x, y] = [y, z] = [z, x] = 0$

4. ✖ $[p_x, p_y] = [p_y, p_z] = [p_z, p_x] = 0$

**Question Number : 38 Question Id : 59425312072 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0**

**Correct Marks : 1 Wrong Marks : 0.25**

Which of the following is **NOT** a Pauli spin matrix?

**Options :**

1. ✖ $\begin{pmatrix} 0 & 1 \\ 1 & 0 \end{pmatrix}$

2. ✔ $\begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix}$

3. ✖ $\begin{pmatrix} 0 & -i \\ i & 0 \end{pmatrix}$

4. ✖ $\begin{pmatrix} 1 & 0 \\ 0 & -1 \end{pmatrix}$

**Question Number : 39 Question Id : 59425312073 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0**

**Correct Marks : 1 Wrong Marks : 0.25**

Let $J_1$ and $J_2$ denote two total (orbital + spin) angular momentum operators. With the notation in the usual pattern, which of the following commutators are correct?

A) $[J_{1x}, J_{1y}] = i\hbar J_{1z}$

B) $[J_1^2, J_{1x}] = [J_2^2, J_{2x}] = 0$

C) $[J_{1x}, J_{2x}] = [J_{1x}, J_{2y}] = 0$

D) $[J_1^2, J_2^2] = i\hbar J$

**Options :**

1. ✖ A and B only

2. ✖ B and C only

3. ✔ A, B and C only

4. ✖ A, B, C and D

**Question Number : 40 Question Id : 59425312074 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0**

**Correct Marks : 1 Wrong Marks : 0.25**

An electron of energy 200 eV is passed through a circular hole of radius $10^{-4}$ cm. The uncertainty introduced in the angle of emergence is

**Options :**

1. ✖ $4 \times 10^{-4}$ radians

2. ✖ $5 \times 10^{-5}$ radians

3. ✔ $6 \times 10^{-6}$ radians

4. ✖ $7 \times 10^{-7}$ radians

**Question Number : 41 Question Id : 59425312075 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0**

**Correct Marks : 1 Wrong Marks : 0.25**

In Dirac's *bra* and *ket* algebra, the states of a dynamical system can be represented by bra and *ket* vectors. The *ket* vector corresponding to a given state A is denoted by $|A\rangle$. The corresponding vectors of the space dual to that of the *ket* vectors will be called bra vectors and denoted by $\langle B|$. The scalar product of (A, B) is denoted by $\langle A|B\rangle$ and is called bra-ket. Then, which of the following properties is **INCORRECT** corresponding to *ket*, bra and *bra-ket*

**Options :**

1. ✖ Every *ket* has a corresponding bra.

2. ✖ The norm is real and positive.

3. ✖ For any two states, triangle inequality holds good.

4. ✔ For any two states, Schwarz inequality does not hold good.

**Question Number : 42 Question Id : 59425312076 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0**

**Correct Marks : 1 Wrong Marks : 0.25**

For a particle in three-dimensional box, the relation between the density of states g(E) and its energy (E) is

**Options :**

1. ✖ $g(E) \propto E$

2. ✖ $g(E) \propto E^{-\frac{1}{2}}$

3. ✔ $g(E) \propto E^{+\frac{1}{2}}$

4. ✖ $g(E) \propto E^{-1}$

**Question Number : 43 Question Id : 59425312077 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0**

**Correct Marks : 1 Wrong Marks : 0.25**

The matrix $\begin{bmatrix} 0 & -i & 0 \\ i & 0 & 0 \\ 0 & 0 & 3 \end{bmatrix}$ is

**Options :**

1. ✖ The matrix is skew-Hermitian and its Eigen vectors are orthogonal

2. ✔ The matrix is Hermitian and its Eigen vectors are orthogonal

3. ✖ The matrix is Hermitian and its Eigen vectors are non-orthogonal

4. ✖ The matrix is skew-Hermitian and its Eigen vectors are non-orthogonal

**Question Number : 44 Question Id : 59425312078 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0**

**Correct Marks : 1 Wrong Marks : 0.25**

The average energy of a harmonic oscillator with oscillation frequency υ is expressed by

**Options :**

1. ✖ $E = \left(n - \frac{1}{2}\right) h\upsilon$

2. ✔ $E = \left(n + \frac{1}{2}\right) h\upsilon$

3. ✖ $E = (n - 1) h\upsilon$

4. ✖ $E = (n + 1) h\upsilon$

**Question Number : 45 Question Id : 59425312079 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0**

**Correct Marks : 1 Wrong Marks : 0.25**

The statement that the results from quantum theory must go over to results from classical mechanics when very large number of quanta is involved is

**Options :**

1. ✔ Bohr's correspondence principle

2. ✖ Bohr's complementary principle

3. ✖ de Broglie matter wave hypothesis

4. ✖ Bohr's quantization principle

**Question Number : 46 Question Id : 59425312080 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0**

**Correct Marks : 1 Wrong Marks : 0.25**

Consider a potential step defined by

$V(x) = 0 \; for \; x < 0$

$V(x) = V_0 \; for \; x > 0$

If $E > V_0$ and $\sqrt{\frac{2mE}{\hbar^2}} = k_1$ and $\sqrt{\frac{2m}{\hbar^2}(E - V_0)} = k_2$.

The solution of Schrodinger wave equation gives the values of transmission coefficient (T) and reflection coefficient (R) are

**Options :**

1. ✖ $T = \frac{4k_1k_2}{(k_1-k_2)^2}$ and $R = \frac{(k_1-k_2)^2}{(k_1+k_2)^2}$

2. ✖ $T = \frac{(k_1-k_2)^2}{(k_1+k_2)^2}$ and $R = \frac{4k_1k_2}{(k_1+k_2)^2}$

3. ✖ $T = \frac{(k_1+k_2)^2}{(k_1-k_2)^2}$ and $R = \frac{4k_1k_2}{(k_1+k_2)^2}$

4. ✔ $T = \frac{4k_1k_2}{(k_1+k_2)^2}$ and $R = \frac{(k_1-k_2)^2}{(k_1+k_2)^2}$

**Question Number : 47 Question Id : 59425312081 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0**

**Correct Marks : 1 Wrong Marks : 0.25**

If the angular momentum operators are denoted by $L_x$ , $L_y$ , $L_z$, which of the following commutators are true?

**Options :**

1. ✖ $[L_z, x] = i\hbar y$

2. ✖ $[L_z, p_x] = i\hbar p_y$

3. ✔ $[L_z, p_z] = i\hbar z$

4. ✖ $[L_x, L_y] = i\hbar L_z$

**Question Number : 48 Question Id : 59425312082 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0**

**Correct Marks : 1 Wrong Marks : 0.25**

Consider that a system undergoes a transition from an initial state $|\psi_i\rangle$ into a continuum of final states $|\psi_f\rangle$. If $\rho(E_i)$ and $\rho(E_f)$ are the densities of initial and final states respectively, $\hat{V}$ is the time dependent interaction, the total transition rate $W_{if}$ is given by

**Options :**

1. ✖ $W_{if} = \frac{2\pi}{\hbar} |\langle\psi_i|\hat{V}|\psi_f\rangle|^2 \rho(E_f)$

2. ✖ $W_{if} = \frac{\hbar}{2\pi} |\langle\psi_f|\hat{V}|\psi_i\rangle|^2 \rho(E_i)$

3. ✔ $W_{if} = \frac{2\pi}{\hbar} |\langle\psi_f|\hat{V}|\psi_i\rangle|^2 \rho(E_i)$

4. ✖ $W_{if} = \frac{\hbar}{2\pi} |\langle\psi_f|\hat{V}|\psi_i\rangle|^2 \rho(E_f)$

**Question Number : 49 Question Id : 59425312083 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0**

**Correct Marks : 1 Wrong Marks : 0.25**

Choose the **INCORRECT** statements from the following regarding the first law of thermodynamics

A) The work of a system for any adiabatic process connecting two end states depends only on the path of change of states.

B) The energy is a property whose change is measured by the adiabatic work between two given end states.

C) The energy change of a system in any process is equal to the work and heat inputs into the system.

D) The first law of thermodynamics is a consequence of law of conservation of mass in the systems undergoing interactions.

**Options :**

1. ✔ A and D only

2. ✖ B and C only

3. ✖ A, B and C only

4. ✖ A, B, C and D

**Question Number : 50 Question Id : 59425312084 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0**

**Correct Marks : 1 Wrong Marks : 0.25**

Choose the correct statements from the following regarding the second law of thermodynamics

A) Kelvin and Planck statement: It is impossible to construct a device that operates in a cycle and produces positive work while interacting with one heat reservoir only

B) Clausius statement: It is impossible to devise a process whose sole result is the transfer of heat from a cold reservoir to a hotter one.

**Options :**

1. ✖ A only

2. ✖ B only

3. ✔ Both A and B

4. ✖ Neither A nor B

**Question Number : 51 Question Id : 59425312085 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0**

**Correct Marks : 1 Wrong Marks : 0.25**

A reservoir at 20 °C receives 800 kJ of heat from its surroundings at 30 °C. The entropy change of the reservoir is

**Options :**

1. ✖ $1.529\ \text{kJ K}^{-1}$

2. ✔ $2.729\ \text{kJ K}^{-1}$

3. ✖ $3.429\ \text{kJ K}^{-1}$

4. ✖ $4.329\ \text{kJ K}^{-1}$

**Question Number : 52 Question Id : 59425312086 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0**

**Correct Marks : 1 Wrong Marks : 0.25**

Which of the following Maxwell's thermodynamical relations is **WRONGLY** expressed?
(Where, P- Pressure, V- Volume, T- Temperature and S- entropy)

**Options :**

1. ✖ $\left(\frac{\partial T}{\partial V}\right)_S = -\left(\frac{\partial P}{\partial S}\right)_V$

2. ✖ $\left(\frac{\partial S}{\partial V}\right)_T = \left(\frac{\partial P}{\partial T}\right)_V$

3. ✔ $\left(\frac{\partial T}{\partial P}\right)_S = -\left(\frac{\partial V}{\partial S}\right)_P$

4. ✖ $\left(\frac{\partial S}{\partial P}\right)_T = -\left(\frac{\partial V}{\partial T}\right)_P$

**Question Number : 53 Question Id : 59425312087 Question Type : MCQ Option Shuffling : Yes**

**Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A**

**Minimum Instruction Time : 0**

**Correct Marks : 1 Wrong Marks : 0.25**

P, V, T and S being the usual notations for pressure, volume, temperature and entropy, the correct expression for difference in specific heat at constant pressure $(C_p)$ and specific heat at constant volume $(C_v)$ is

**Options :**

1. ✖ $C_P - C_V = P\left(\frac{\partial P}{\partial T}\right)_V \left(\frac{\partial V}{\partial T}\right)_P$

2. ✖ $C_P - C_V = -T\left(\frac{\partial T}{\partial P}\right)_V \left(\frac{\partial V}{\partial T}\right)_P$

3. ✖ $C_P - C_V = -T\left(\frac{\partial P}{\partial T}\right)_V \left(\frac{\partial T}{\partial V}\right)_P$

4. ✔ $C_P - C_V = T\left(\frac{\partial P}{\partial T}\right)_V \left(\frac{\partial V}{\partial T}\right)_P$

**Question Number : 54 Question Id : 59425312088 Question Type : MCQ Option Shuffling : Yes**

**Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A**

**Minimum Instruction Time : 0**

**Correct Marks : 1 Wrong Marks : 0.25**

A state is an equilibrium state if and only if, for any change to a neighboring state of equal energy, the entropy

**Options :**

1. ✖ does not decrease

2. ✔ does not increase

3. ✖ remains constant

4. ✖ either increases or decreases

**Question Number : 55 Question Id : 59425312089 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0**

**Correct Marks : 1 Wrong Marks : 0.25**

If F, C and N denote the number of degrees of freedom, the number of components and the number of phases in equilibrium of a system, then Gibb's phase rule is

**Options :**

1. ✖ $F = 1 - C - N$

2. ✖ $F = 2 - C + N$

3. ✔ $F = 2 + C - N$

4. ✖ $F = 1 + C + N$

**Question Number : 56 Question Id : 59425312090 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0**

**Correct Marks : 1 Wrong Marks : 0.25**

Stirling's approximation for $\log(x!)$ is

**Options :**

1. ✖ $2x\log(x) - x$

2. ✖ $x\log(x) - 2x$

3. ✖ $x\log(x) + x$

4. ✔ $x\log(x) - x$

**Question Number : 57 Question Id : 59425312091 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0**

**Correct Marks : 1 Wrong Marks : 0.25**

Which of the following diode exhibits a voltage controlled negative resistance?

**Options :**

1. ✔ Tunnel diode

2. ✖ Zener diode

3. ✖ Junction diode

4. ✖ Varactor diode

**Question Number : 58 Question Id : 59425312092 Question Type : MCQ Option Shuffling : Yes**

**Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A**

**Minimum Instruction Time : 0**

**Correct Marks : 1 Wrong Marks : 0.25**

The ripple factor of a bridge rectifier and half wave rectifier are

**Options :**

1. ✖ 1.21 and 0.48

2. ✔ 0.48 and 1.21

3. ✖ 1.21 and 1.21

4. ✖ 0.48 and 0.48

**Question Number : 59 Question Id : 59425312093 Question Type : MCQ Option Shuffling : Yes**

**Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A**

**Minimum Instruction Time : 0**

**Correct Marks : 1 Wrong Marks : 0.25**

Which one of the following gives the current gain of a Darlington pair?
(here $\beta_1, \beta_2$ are current gains of transistors)

**Options :**

1. ✖ $\beta_1/\beta_2$

2. ✖ $\beta_1 + \beta_2$

3. ✔ $\beta_1.\beta_2$

4. ✖ $\beta_1 - \beta_2$

**Question Number : 60 Question Id : 59425312094 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0**

**Correct Marks : 1 Wrong Marks : 0.25**

Which one of the following represents the reverse voltage transfer ratio?

**Options :**

1. ✔ $h_{re}$

2. ✖ $h_{ie}$

3. ✖ $h_{oe}$

4. ✖ $h_{fe}$

**Question Number : 61 Question Id : 59425312095 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0**

**Correct Marks : 1 Wrong Marks : 0.25**

A non-inverting amplifier has $R_i$ =1 kΩ and $R_f$ = 100 kΩ, values, then its closed-loop voltage gain is

**Options :**

1. ✖ 10000

2. ✖ 100

3. ✔ 101

4. ✖ 100

**Question Number : 62 Question Id : 59425312096 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0**

**Correct Marks : 1 Wrong Marks : 0.25**

The 2′*s* complement of a binary number 0101 0110 is

**Options :**

1. ✔ 1010 1010

2. ✖ 1010 1001

3. ✖ 1010 1011

4. ✖ 1010 1000

**Question Number : 63 Question Id : 59425312097 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0**

**Correct Marks : 1 Wrong Marks : 0.25**

The STACK of 8085 microprocessor operates using the following method

**Options :**

1. ✖ FIFO

2. ✖ FILO

3. ✖ Random

4. ✔ LIFO

**Question Number : 64 Question Id : 59425312098 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0**

**Correct Marks : 1 Wrong Marks : 0.25**

The modulation index of wide band FM system is

**Options :**

1. ✖ =1

2. ✖ <1

3. ✔ >1

4. ✖ Zero

**Question Number : 65 Question Id : 59425312099 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0**

**Correct Marks : 1 Wrong Marks : 0.25**

If relativistic correction is important for $v/c > 0.005$ for an electron in Hydrogen atom, for which orbit this correction should be applied?

**Options :**

1. ✔ $n=1$

2. ✖ $n=2$

3. ✖ $n=3$

4. ✖ $n=4$

**Question Number : 66 Question Id : 59425312100 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0**

**Correct Marks : 1 Wrong Marks : 0.25**

The degree of degeneracy of the $n^{th}$ energy level in the hydrogen atom is

**Options :**

1. ✖ $n$

2. ✔ $n^2$

3. ✖ $1/n$

4. ✖ $1/n^2$

**Question Number : 67 Question Id : 59425312101 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0**

**Correct Marks : 1 Wrong Marks : 0.25**

The doublet splitting of the first excited state $^2P_{3/2} \rightarrow {}^2P_{1/2}$ of H- atom is 0.365 $cm^{-1}$. The corresponding separation for $Li^{++}$ is approximately

**Options :**

1. ✖ $81\ m^{-1}$

2. ✖ $30\ m^{-1}$

3. ✔ $30\ cm^{-1}$

4. ✖ $1/81\ m^{-1}$

**Question Number : 68 Question Id : 59425312102 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0**

**Correct Marks : 1 Wrong Marks : 0.25**

The number of fine structure lines of $H_\alpha$ line is

**Options :**

1. ✖ 2

2. ✔ 3

3. ✖ 4

4. ✖ 5

**Question Number : 69 Question Id : 59425312103 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0**

**Correct Marks : 1 Wrong Marks : 0.25**

In the quantum mechanical calculation, the unperturbed energy of He atom in the ground – state is

**Options :**

1. ✖ $2\,Z^2E_H$

2. ✖ $Z^2\,E_H$

3. ✖ $-2\,Z^2$

4. ✔ $-\,2\,Z^2E_H$

**Question Number : 70 Question Id : 59425312104 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0**

**Correct Marks : 1 Wrong Marks : 0.25**

According to Lande interval rule the energy interval between consecutive levels J and J+1 of a fine- structure multiplet is proportional to

**Options :**

1. ✖ $J$

2. ✖ $J-1$

3. ✖ $J^2$

4. ✔ $J+1$

**Question Number : 71 Question Id : 59425312105 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0**

**Correct Marks : 1 Wrong Marks : 0.25**

The quantum numbers of the two optical electrons in a two-valence electron atom are

$n_1 = 6, l_1 = 3, S_1 = ½$

$n_2 = 5, l_2 = 3, S_2 = ½$

For L-S coupling the possible values of J for S=0 are

**Options :**

1. ✖ 1, 2, 3

2. ✖ 3, 4, 5

3. ✔ 2, 3, 4

4. ✖ 2, 3, 4, 5

**Question Number : 72 Question Id : 59425312106 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0**

**Correct Marks : 1 Wrong Marks : 0.25**

The magnetic moment in Bohr magneton of an atom in the $^3P_2$ state is

**Options :**

1. ✖ $\sqrt{\frac{3}{2}}$

2. ✖ $2\sqrt{\frac{3}{2}}$

3. ✖ $\frac{3}{2}$

4. ✔ $3\sqrt{\frac{3}{2}}$

**Question Number : 73 Question Id : 59425312107 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0**

**Correct Marks : 1 Wrong Marks : 0.25**

The $J = 1 \leftarrow 0$ transition in HCl occurs at 20.68 $cm^{-1}$. The molecule to be a rigid rotator, then the wavelength of the transition for $15 \leftarrow 14$ is

**Options :**

1. ✖ 10.34 $cm^{-1}$

2. ✖ 20.68 $cm^{-1}$

3. ✔ $32 \times 10^{-4}\ cm^{-1}$

4. ✖ $16 \times 10^{-4}\ cm^{-1}$

**Question Number : 74 Question Id : 59425312108 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0**

**Correct Marks : 1 Wrong Marks : 0.25**

Frequency of Raman lines depends on

**Options :**

1. ✖ frequency of incident line

2. ✔ the scattering substance

3. ✖ intensity of incident light

4. ✖ strength of the field

**Question Number : 75 Question Id : 59425312109 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0**

**Correct Marks : 1 Wrong Marks : 0.25**

The coherence length of He- Ne LASER is 1500 Km and wavelength of light used is 632.8 nm.
The band width and frequency spread are

**Options :**

1. ✖ $2.67 \times 10^{-17}$ m and 20 Hz

2. ✔ $2.67 \times 10^{-20}$ m and 20 Hz

3. ✖ $2.67 \times 10^{-17}$ m and 5 Hz

4. ✖ $2.67 \times 10^{-20}$ m and 5 Hz

**Question Number : 76 Question Id : 59425312110 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0**

**Correct Marks : 1 Wrong Marks : 0.25**

The number of photons emitted per second from a 1 watt Ar- ion laser operating at 488.0 nm is approximately

**Options :**

1. ✖ $10.23 \times 10^{19}$

2. ✔ $2.46 \times 10^{18}$

3. ✖ $10.23 \times 10^{17}$

4. ✖ $2.46 \times 10^{15}$

**Question Number : 77 Question Id : 59425312111 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0**

**Correct Marks : 1 Wrong Marks : 0.25**

In which of the following Bravais Lattices, **NOT** all axial angles are right angles?

**Options :**

1. ✖ Tetragonal

2. ✔ Rhombohedral

3. ✖ Orthorhombic

4. ✖ Cubic

**Question Number : 78 Question Id : 59425312112 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0**

**Correct Marks : 1 Wrong Marks : 0.25**

A narrow beam of X-rays with wavelength 1.5 Å is reflected from an ionic crystal with an FCC lattice structure with a density 3.32 gm-cm$^{-3}$. The molecular weight is 108 amu. Then its lattice constant is (1 amu = $1.66 \times 10^{-24}$ gm)

**Options :**

1. ✔ 6.00 Å

2. ✖ 4.56 Å

3. ✖ 4.00 Å

4. ✖ 2.56 Å

**Question Number : 79 Question Id : 59425312113 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0**

**Correct Marks : 1 Wrong Marks : 0.25**

The quanta of energy in elastic wave called as

**Options :**

1. ✖ Photon

2. ✖ Hyperon

3. ✖ Nucleon

4. ✔ Phonon

**Question Number : 80 Question Id : 59425312114 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0**

**Correct Marks : 1 Wrong Marks : 0.25**

Einstein's theory of specific heat concludes that at lower temperature, the specific heat

**Options :**

1. ✖ Drops linearly with increase of temperature

2. ✖ Drops linearly with decrease of temperature

3. ✔ Drops exponentially with decrease of temperature

4. ✖ Same as classical value 3R

**Question Number : 81 Question Id : 59425312115 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0**

**Correct Marks : 1 Wrong Marks : 0.25**

The heat capacity $C_v$ at constant volume of a metal varies as a function of temperature as $AT + BT^3$ where A and B are constants. The temperature dependence of the entropy at constant volume is

**Options :**

1. ✔ $AT + \frac{1}{3}BT^3$

2. ✖ $AT + BT^3$

3. ✖ $\frac{1}{2}AT + \frac{1}{3}BT^3$

4. ✖ $\frac{1}{2}AT + \frac{1}{4}BT^3$

**Question Number : 82 Question Id : 59425312116 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A**

**Minimum Instruction Time : 0**

**Correct Marks : 1 Wrong Marks : 0.25**

Which of the following relation gives Wiedemann-Franz law? ($\sigma_T$ and $\sigma$ are thermal and electrical conductivities of metal respectively, $L$ is Lorentz number and T is Temperature in Kelvin)

**Options :**

1. ✖ $\frac{\sigma_T}{\sigma} = \frac{L}{T}$

2. ✔ $\frac{\sigma_T}{\sigma} = LT$

3. ✖ $\frac{\sigma}{\sigma_T} = \frac{L}{T}$

4. ✖ $\frac{\sigma}{\sigma_T} = LT$

**Question Number : 83 Question Id : 59425312117 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A**

**Minimum Instruction Time : 0**

**Correct Marks : 1 Wrong Marks : 0.25**

The Hall coefficient of a metal is low, it means that

**Options :**

1. ✔ The charge carrier density in metal is high

2. ✖ The charge carrier density in metal is low

3. ✖ The Hall field produced in the metal is high

4. ✖ The conductivity of the metal is zero

**Question Number : 84 Question Id : 59425312118 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0**

**Correct Marks : 1 Wrong Marks : 0.25**

Bloch's theorem asserts that the wave function of electronics in periodic potential

**Options :**

1. ✖ Is an exponentially falling function

2. ✖ Is an exponentially increasing function

3. ✖ Is in the form of pure plane waves

4. ✔ Has the form of a plane wave multiplied by a function with the periodicity of the crystal lattice

**Question Number : 85 Question Id : 59425312119 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0**

**Correct Marks : 1 Wrong Marks : 0.25**

In semiconductors at room temperature

**Options :**

1. ✖ The valance band is completely filled and conduction band is partially filled

2. ✖ The valance band is completely filled

3. ✖ The conduction band is completely empty

4. ✔ The valance band is partially empty and the conduction band is partially filled

**Question Number : 86 Question Id : 59425312120 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0**

**Correct Marks : 1 Wrong Marks : 0.25**

In the AC Josephson effect, a super current flow across two super conductors separated by a thin insulating layer and kept at an electric potential difference $\Delta V$. The angular frequency of the resultant super current is given by

**Options :**

1. ✔ $\frac{2e\Delta V}{\hbar}$

2. ✖ $\frac{e\Delta V}{\hbar}$

3. ✖ $\frac{e\Delta V}{\pi\hbar}$

4. ✖ $\frac{e\Delta V}{2\pi\hbar}$

**Question Number : 87 Question Id : 59425312121 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0**

**Correct Marks : 1 Wrong Marks : 0.25**

For super conducting material, the relation between transition temperature ($T_C$) and isotopic mass (M) is

**Options :**

1. ✖ $T_C \propto M$

2. ✖ $T_C \propto M^{-1}$

3. ✖ $T_C \propto M^{\frac{1}{2}}$

4. ✔ $T_C \propto M^{-\frac{1}{2}}$

**Question Number : 88 Question Id : 59425312122 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0**

**Correct Marks : 1 Wrong Marks : 0.25**

Lattice vacancies are created when certain atoms in a semiconductor are missing, this defect of the crystal is known as

**Options :**

1. ✖ Avalanche defect

2. ✖ Tunnel defect

3. ✔ Schottky defect

4. ✖ Frenkel defect

**Question Number : 89 Question Id : 59425312123 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0**

**Correct Marks : 1 Wrong Marks : 0.25**

The penetration power of γ- rays is approximately

**Options :**

1. ✖ 10 times of α – Particle

2. ✖ 100 times of α – Particle

3. ✖ 1000 times of α – Particle

4. ✔ 10000 times of α – Particle

**Question Number : 90 Question Id : 59425312124 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0**

**Correct Marks : 1 Wrong Marks : 0.25**

The range 'R' of an α – particle in a substance is related to ($E_0$ – initial Kinetic energy)

**Options :**

1. ✔ $\int_{E_0}^{0} \frac{dE}{\frac{dE}{dx}}$

2. ✖ $\int_{E_0}^{0} \frac{dE}{dx}$

3. ✖ $\int_{E_0}^{0} \frac{dx}{dE}$

4. ✖ $\int_{E_0}^{0} dE$

**Question Number : 91 Question Id : 59425312125 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0**

**Correct Marks : 1 Wrong Marks : 0.25**

If $_{82}Pb^{214}$ isotope forms some compound by chemical combination, its half-life period

**Options :**

1. ✖ decreases

2. ✖ increases

3. ✔ remains same

4. ✖ continuously changes

**Question Number : 92 Question Id : 59425312126 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0**

**Correct Marks : 1 Wrong Marks : 0.25**

Which of the following radio-active series is **NOT** in order?

**Options :**

1. ✖ $_{92}U^{238} \rightarrow _{90}Th^{234} \rightarrow _{88}Ra^{226} \rightarrow _{82}Pb^{214}$

2. ✖ $_{90}Th^{232} \rightarrow _{86}Rn^{222} \rightarrow _{84}Po^{218} \rightarrow _{82}Pb^{214}$

3. ✔ $_{89}Ac^{227} \rightarrow _{91}Pa^{231} \rightarrow _{88}Ra^{223} \rightarrow _{82}Pb^{214}$

4. ✖ $_{95}Pu^{241} \rightarrow _{91}Nb^{237} \rightarrow _{87}Fr^{221} \rightarrow _{82}Pb^{209}$

**Question Number : 93 Question Id : 59425312127 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0**

**Correct Marks : 1 Wrong Marks : 0.25**

After four half-lives, the decayed part of a radioactive material would be

**Options :**

1. ✖ 6. 25 %

2. ✖ 50 %

3. ✖ 12.75 %

4. ✔ 93.75%

**Question Number : 94 Question Id : 59425312128 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0**

**Correct Marks : 1 Wrong Marks : 0.25**

The Q value of Rutherford's reaction $_7N^{14} + _2He^4 \rightarrow _8O^{17} + _1H^1$ is

(Given $_7N^{14} = 14.003074$ u, $_2He^4 = 4.002603$ u; $_8O^{17} = 16.99131$ u; $_1H^1 = 1.007825$ u)

**Options :**

1. ✖ 1.19 MeV

2. ✔ −1.19 MeV

3. ✖ 11.9 MeV

4. ✖ −11.9 MeV

**Question Number : 95 Question Id : 59425312129 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A**

**Minimum Instruction Time : 0**

**Correct Marks : 1 Wrong Marks : 0.25**

What is the mass number 'A' of a nucleus whose radius is $r = 2.71$ fermi?
($r_0 = 1.3 \times 10^{-15}$ m)

**Options :**

1. ✖ 4

2. ✖ 6

3. ✔ 8

4. ✖ 2

**Question Number : 96 Question Id : 59425312130 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A**

**Minimum Instruction Time : 0**

**Correct Marks : 1 Wrong Marks : 0.25**

If electric quadrupole moment Q is –ve, then the shape of the nucleus is

**Options :**

1. ✔ Ellipsoid (a > b)

2. ✖ Ellipsoid (b > a)

3. ✖ Spherical

4. ✖ Tetrahedron

**Question Number : 97 Question Id : 59425312131 Question Type : MCQ Option Shuffling : Yes**

**Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A**

**Minimum Instruction Time : 0**

**Correct Marks : 1 Wrong Marks : 0.25**

If $m_n$, $m_p$ and $m_d$ be masses of neutron, proton and deuteron respectively, then the binding energy of the deuteron would be

**Options :**

1. ✖ $(m_n + m_p - m_d)$

2. ✔ $(m_n + m_p - m_d)\ C^2$

3. ✖ $(m_n + m_p - m_d)\ /A$

4. ✖ $(m_n + m_p - m_d)\ C^2/A$

**Question Number : 98 Question Id : 59425312132 Question Type : MCQ Option Shuffling : Yes**

**Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A**

**Minimum Instruction Time : 0**

**Correct Marks : 1 Wrong Marks : 0.25**

An electron and its antiparticle are annihilated after collision. What will be the wavelength of the emitted radiation?

**Options :**

1. ✔ 0.024 Å

2. ✖ $0.24\ \text{Å}$

3. ✖ $2.4\ \text{Å}$

4. ✖ $24\ \text{Å}$

**Question Number : 99 Question Id : 59425312133 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0**

**Correct Marks : 1 Wrong Marks : 0.25**

In a certain fission process, if the mass loss is 0.12 %, then the electric energy generated is

**Options :**

1. ✖ $9 \times 10^{7}\ \text{KWH}$

2. ✖ $1 \times 10^{7}\ \text{KWH}$

3. ✔ $3 \times 10^{7}\ \text{KWH}$

4. ✖ $6 \times 10^{7}\ \text{KWH}$

**Question Number : 100 Question Id : 59425312134 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0**

**Correct Marks : 1 Wrong Marks : 0.25**

In the semi-empirical mass formula, the contribution of Coulomb energy of a nucleus of Mass number 'A' and atomic number 'Z' is in the form of equation (a – constant)

**Options :**

1. ✖ $a\,Z\,A^{2/3}$

2. ✔ $\frac{aZ\,(Z-1)}{A^{\frac{1}{3}}}$

3. ✖ $\frac{aZ\,(Z-1)}{A}$

4. ✖ $\frac{aZ^2}{A^{\frac{2}{3}}}$