A ball of mass $m$ is dropped from a building of height $h$. At the same time another ball of mass $2m$ is thrown upwards from its base such that it hits the falling ball at mid-point. The speed with which the heavier ball is thrown is

\begin{align*}
(1) & \quad \sqrt{2gh} \\
(2) & \quad \sqrt{gh} \\
(3) & \quad \sqrt{\frac{gh}{2}} \\
(4) & \quad \frac{1}{2} \sqrt{2gh}
\end{align*}

Here $g$ is acceleration due to gravity.

$m$ क्रमांक की गेंद को $h$ ऊँचाई के ब्लड से फिसला जाता है। तीन दूसरे समय उसके आगार से $2m$ प्रयोग की गेंद को इस प्रकार उजाद करके जाता है कि वह पहली गेंद को पथ-बिंदु पर फिसलने से विपरीत हो। भारी गेंद को नियत चाल रहे नजदीक रहे है वह है

\begin{align*}
(1) & \quad \sqrt{2gh} \\
(2) & \quad \sqrt{gh} \\
(3) & \quad \sqrt{\frac{gh}{2}} \\
(4) & \quad \frac{1}{2} \sqrt{2gh}
\end{align*}

वही $g$ पुलिलेख लगानी है।

Two particles of masses $m_1=100g$ and $m_2=40g$ have velocities

\[ \vec{v}_1 = 2.8 \hat{i} - 3 \hat{j} \text{ cm/s} \] and \[ \vec{v}_2 = 7.5 \hat{j} \text{ cm/s}. \] After collision their velocities are \[ \vec{v}'_1 = 1.2 \hat{i} - 2 \hat{j} \text{ cm/s} \] and \[ \vec{v}'_2 = 4 \hat{i} + 5 \hat{j} \text{ cm/s}. \] Choose the correct statement

(1) Total momentum (magnitude) and energy are respectively 280 dyne-sec and 500 erg
(2) Speed of centre of mass is initially of 2 cm/s
(3) Total momentum changes in the collision
(4) Speed of centre of mass changes after collision

dी भाग लिखने प्रयोग \( m_1=100g \) एवं \( m_2=40g \) है के चेम \( \vec{v}_1 = 2.8 \hat{i} - 3 \hat{j} \text{ cm/s} \) एवं \( \vec{v}_2 = 7.5 \hat{j} \text{ cm/s} \) है। टैक्स के चाल इसमें चेम \( \vec{v}'_1 = 1.2 \hat{i} - 2 \hat{j} \text{ cm/s} \) एवं \( \vec{v}'_2 = 4 \hat{i} + 5 \hat{j} \text{ cm/s} \) है।

(1) कुल लंबू (परिसर) एवं उर्जा ज्ञात: 280 dyne-sec एवं 500 एर्ज है।
(2) क्रमांक केंद्र की प्रारंभिक चाल 2 cm/s है।
(3) टैक्स में कुल संबंध में परिवर्तन होता है।
(4) टैक्स के पश्चात क्रमांक केंद्र की चाल में परिवर्तन होता है।
A bomb lying in an open ground, explodes in two fragments of masses $m_1$ and $m_2$. The ratio of their kinetic energies $T_1 : T_2$ will be.

(i) $\sqrt{\frac{m_2}{m_1}}$  
(ii) $\sqrt{\frac{m_1}{m_2}}$  
(iii) $\frac{m_2}{m_1}$  
(iv) $\frac{m_1}{m_2}$

A motor boat is moving towards North at 40 km/h and the water current in that region is 30 km/h from west to east direction. The resultant speed of the boat is

(1) 10 kps/h  
(2) 20 km/h  
(3) 35 km/h  
(4) 50 km/h

एक मोटर बोट उत्तर दिशा में 40 km/h के धीरे से पूर्व रवि है। तथा जल-पथरा इस क्षेत्र में पश्चिम से पूर्व की ओर 30 km/h है। बोट की पश्चिमी रफ्तार है

(1) 10 km/h  
(2) 20 km/h  
(3) 35 km/h  
(4) 50 km/h
Lagrangian of relativistic pendulum motion can be written as

\[ \frac{1}{2} \frac{m_c \dot{\phi}^2}{\sqrt{1 - \dot{\phi}^2/c^2}} - \frac{1}{2} k x^2 \]

\[ \frac{1}{2} m_c \dot{\phi}^2 - \frac{1}{2} k x^2 \]

\[ m_c c^2 \left( 1 - \frac{\dot{\phi}^2}{c^2} \right)^{-\frac{1}{2}} - 1 \cdot \frac{1}{2} k x^2 \]

\[ \frac{1}{2} m_c c^2 \left( 1 - \frac{\dot{\phi}^2}{c^2} \right)^{-\frac{1}{2}} \cdot + 1 \cdot \frac{1}{2} k x^2 \]

Here \( k \) is spring constant and other symbols have their usual meaning.
The correct canonical equations of motion are

1. \[ \dot{q}_i = -\frac{\partial H}{\partial \dot{q}_i}; \quad \dot{p}_i = \frac{\partial H}{\partial \dot{q}_i} \]
2. \[ \dot{q}_i = -\frac{\partial H}{\partial \dot{q}_i}; \quad \dot{p}_i = \frac{\partial H}{\partial \dot{q}_i} \]
3. \[ \dot{q}_i = \frac{\partial H}{\partial \dot{p}_i}; \quad \dot{p}_i = -\frac{\partial H}{\partial \dot{p}_i} \]
4. \[ \dot{q}_i = \frac{\partial H}{\partial \dot{p}_i}; \quad \dot{p}_i = -\frac{\partial H}{\partial \dot{p}_i} \]

All parameters have their usual meaning.

Give below are three symmetry principles and three conservation laws.

Identify the correct combinations:

A. Homogeneity of time
   a. Conservation of linear momentum
B. Homogeneity of space
   b. Conservation of energy
C. Isotropy of space
   c. Conservation of angular momentum

(1) (A,a), (B,b), (C,c)
(2) (A,b), (B,c), (C,a)
(3) (A,c), (B,a), ...
(4) (A,b), (B,a), (C,c)

Give below are three symmetry principles and three conservation laws.

Identify the correct combinations:

A. समय की सममता
   a. रैखिक संरक्षण
B. सामान्यता की सममता
   b. छलनी - संरक्षण
C. क्रमांक की हथियारता
   c. कोणिक संरक्षण

(1) (A,a), (B,b), (C,c)
(2) (A,b), (B,c), (C,a)
(3) (A,c), (B,a), (C,b)
(4) (A,b), (B,a), (C,c)
Total energy of a particle in rotating frame \(E\) is related to that measured in fixed frame \(E_0\) by the relations

\[
\begin{align*}
(1) \quad E &= E_0 - \omega \cdot \vec{L} \\
(2) \quad E &= E_0 - \frac{1}{2} \omega^2 \cdot \vec{L} \\
(3) \quad E &= E_0 + \omega \cdot \vec{L} \\
(4) \quad E &= E_0
\end{align*}
\]

Here \(\omega\) is the angular velocity of rotation and \(\vec{L}\) is the angular momentum of the system measured in rotating frame.

A particle of mass 5g lies in a potential field given by \(U(x) = 200x^2 + 250\) ergs/g. The frequency of oscillations for small displacements is

\[
\begin{align*}
(1) \quad 1.6 \text{ Hz} &\quad (2) \quad 3.2 \text{ Hz} \\
(3) \quad 6.4 \text{ Hz} &\quad (4) \quad 12.8 \text{ Hz}
\end{align*}
\]

A particle of mass 5g lies in a potential field given by \(U(x) = 200x^2 + 250\) ergs/g. The frequency of oscillations for small displacements is

\[
\begin{align*}
(1) \quad 1.6 \text{ Hz} &\quad (2) \quad 3.2 \text{ Hz} \\
(3) \quad 6.4 \text{ Hz} &\quad (4) \quad 12.8 \text{ Hz}
\end{align*}
\]
The volume of a cube of side $a$, as determined by an observer moving with velocity $\theta$ (along one of its sides) away from the cube will be

\[
\begin{align*}
(1) & \quad a^3 \\
(2) & \quad \frac{a^3}{\left(1 - \frac{\theta^2}{c^2}\right)^{3/2}}
\end{align*}
\]

$m_0$ पुल्ज के प्रति का आभार (इसकी एक पुल्ज की विक्षा में) $\theta$ चेंच से पूरा जा रहे दास्तक के अनुसार होगा:

\[
\begin{align*}
(1) & \quad a^3 \\
(2) & \quad \frac{a^3}{\left(1 - \frac{\theta^2}{c^2}\right)^{3/2}}
\end{align*}
\]

**II** Relativistic energy of a particle of rest mass $m_0$ moving with velocity $\frac{3}{5}c$ is

\[
\begin{align*}
(1) & \quad \frac{9}{50}m_0c^2 \\
(2) & \quad \frac{5}{4}m_0c^2 \\
(3) & \quad \frac{8}{5}m_0c^2 \\
(4) & \quad 2m_0c^2
\end{align*}
\]

$m_0$ निर्देश स्वयंम्भूत का चयन $\frac{3}{5}$ चेंच से पत्ता कर रहा है। इसकी अनुवादितें उठा हैं

\[
\begin{align*}
(1) & \quad \frac{9}{50}m_0c^2 \\
(2) & \quad \frac{5}{4}m_0c^2 \\
(3) & \quad \frac{8}{5}m_0c^2 \\
(4) & \quad 2m_0c^2
\end{align*}
\]

09/MSPH23_A1

**T**

[Concl...]

09 09 09 09 09 09 09
12. Two identical particles, each of rest mass $m_0$, collide and produce an extra particle - antiparticle pair of same mass. If one of the particles is at rest then the other must have minimum kinetic energy equal to

\[
\begin{align*}
(1) & \quad 2m_0c^2 \\
(2) & \quad 4m_0c^2 \\
(3) & \quad 7m_0c^2 \\
(4) & \quad 6m_0c^2
\end{align*}
\]

13. A frame $S'$ is moving along $x$-axis with respect to a frame $S$ with velocity $0.5 \, C$. A particle $O$ is moving in $S'$ along the same direction with velocity $0.5 \, C$. The velocity of $O$ as observed in $S$ is

\[
\begin{align*}
(1) & \quad 0 \\
(2) & \quad C \\
(3) & \quad 0.57C \\
(4) & \quad 0.8C
\end{align*}
\]

14. The potential in an electric field is given by $\phi = \left(3x^2 - y + z\right)$ vols. The charge density in the region is

\[
\begin{align*}
(1) & \quad -3 \varepsilon_0 \, c/m^3 \\
(2) & \quad -6 \varepsilon_0 \, c/m^3 \\
(3) & \quad 2 \varepsilon_0 \, c/m^3 \\
(4) & \quad 8 \varepsilon_0 \, c/m^3
\end{align*}
\]

\[\text{Continued...}\]
15. A point charge $q$ is moving with a velocity $\vec{v}$. The magnetic field due to this moving charge at a point, whose position vector with respect to the point charge is $\vec{r}$, is $\vec{B}$, then

$$\vec{B} = \frac{\vec{r}}{4\pi r^2} \times \vec{v}$$

16. Two thin long wires perpendicular to each other are placed along $X$- and $Y$-axes. The wires carry currents $I_1$ and $I_2$ respectively. The locus of points where magnetic induction is zero will be

1. A circle with centre at the origin
2. A straight line perpendicular to $X-Y$ plane and passing through origin
3. A straight line in $X-Y$ plane passing through origin and having a slope $\frac{I_2}{I_1}$
A search coil of area 0.01 m² and having 50 turns is placed between the pole-pieces of a magnet perpendicular to the magnetic field. The resistance of the coil is 20 ohms. The coil is connected to a ballistic galvanometer to measure induced charge. When the coil is suddenly removed from the magnetic field, the induced charge induced is found to be 500 μC. The strength of the magnetic field between the pole pieces of the magnet is

1. 0.01 T
2. 0.02 T
3. 0.04 T
4. 0.10 T

The resonant frequency of an L–C–R circuit is \( \omega_0 \), and its quality factor is \( Q \). Its bandwidth will be

1. \( \frac{Q}{\omega_0} \) Hz
2. \( \frac{Q}{\omega_0} \) Hz
3. \( \frac{1}{2\pi \sqrt{LC}} \) Hz
4. \( \frac{1}{2\pi \sqrt{LC}} \) Hz

The L–C–R circuit in the \( \omega_0 \) is connected to an L–C–R circuit in the \( \omega_0 \) and \( Q \) is connected to the circuit in the \( \omega_0 \). The quality factor of the circuit in the \( \omega_0 \) is determined to be 3. The bandwidth of the circuit in the \( \omega_0 \) is determined to be 2 Hz.
19. The power factor of an AC circuit at 60 Hz is 0.707. The power factor of this circuit at 120 Hz will be

<table>
<thead>
<tr>
<th>Option</th>
<th>Power Factor</th>
</tr>
</thead>
<tbody>
<tr>
<td>(1) 0.408</td>
<td>(2) 0.447</td>
</tr>
<tr>
<td>(3) 0.500</td>
<td>(4) 0.577</td>
</tr>
</tbody>
</table>

20. An electric field \( E = E_0 \sin \omega t \) is applied in a medium of conductivity \( \sigma \) and dielectric constant \( \varepsilon_r \). If the angular frequency at which the magnitudes of conduction current density and displacement current density become equal, it \( \omega \), then it will happen

- For all values of \( \omega \)
- For \( \omega = \frac{\sigma}{\varepsilon_r \omega} \)
- For \( \omega = \sqrt{\frac{\varepsilon_r}{\varepsilon_0 \sigma}} \)
- For no value of \( \omega \)

The electric field \( E \) is applied to a conductor of conductivity \( \sigma \) in a medium of dielectric constant \( \varepsilon_r \). When \( E = E_0 \sin \omega t \) is applied, it creates a current. The conduction current density and displacement current density become equal when the angular frequency \( \omega \) is such that

- For all values of \( \omega \), the current is higher.
- For \( \omega = \frac{\sigma}{\varepsilon_r \omega} \), the current is equal.
- For \( \omega = \sqrt{\frac{\varepsilon_r}{\varepsilon_0 \sigma}} \), the current is lower.
- For no value of \( \omega \), the current is not equal.

[Logical flow of the text]

09/MSPH23_A1
21. If $\vec{B}$ is the magnetic field intensity and $\vec{A}$ is the magnetic vector potential, then

1. $\vec{B} = \nabla \times \vec{A}$
2. $\vec{B} = \nabla \cdot \vec{A}$
3. $\vec{B} = \nabla \times \vec{A}$
4. $\vec{B} = \nabla \cdot \vec{A}$

22. The intensity of solar radiation received on Earth is 1.4 kW/m². Assuming the electromagnetic waves as plane, the amplitude of electric field in the radiation will be

1. 1.03 V/m
2. 10.3 V/m
3. 102.7 V/m
4. 1027 V/m
The components of electric field in an electromagnetic wave are

\[ E_x = E_0 \sin \left( \omega t + kz + \frac{\pi}{3} \right) \quad \text{and} \quad E_y = \frac{E_0}{\sqrt{2}} \sin \left( \omega t + kz - \frac{\pi}{6} \right) \]

then state of polarization is

1. Plane polarized
2. Unpolarized
3. Circularly Polarized
4. Elliptically Polarized

नेवी नियुक्त एक्सेंजीय वालों में नियुक्त किरण के पथ है

\[ E'_x = E_0 \sin \left( \omega t + \frac{\pi}{2} \right) \quad \text{and} \quad E'_y = \frac{E_0}{\sqrt{2}} \sin \left( \omega t + \frac{\pi}{6} \right) \]

सी तरंग की दृष्टि से पादहास है

1. समक दृष्टि
2. अधिकतम
3. दृष्टि दृष्टि
4. दृष्टि पीवी सूर्यिक दृष्टि

The radiation resistance of an oscillating dipole \((f \ll \lambda)\) in free space is

1. \( 73.1 \left( \frac{f}{c} \right)^2 \) ohms
2. \( 292 \left( \frac{f}{c} \right)^2 \) ohms
3. \( 789 \left( \frac{f}{c} \right)^2 \) ohms
4. \( 912 \left( \frac{f}{c} \right)^2 \) ohms

किसी वोल्टतम किस्म \((f \ll \lambda)\) का बुद्धिमत जासूस में बिच्चित्र प्रतिक्रिया है

1. \( 73.1 \left( \frac{f}{c} \right)^2 \) ohms
2. \( 292 \left( \frac{f}{c} \right)^2 \) ohms
3. \( 789 \left( \frac{f}{c} \right)^2 \) ohms
4. \( 912 \left( \frac{f}{c} \right)^2 \) ohms

09/NSPH23_A1

09 09 09 09 09 09 09
25. The minimum number of lines in a grating which will resolve the two sodium lines of wavelength 5890 Å and 5896 Å in the first order spectrum will be

\[
\begin{array}{ll}
(1) & 950 \\
(2) & 990 \\
(3) & 1150 \\
(4) & 1640 \\
\end{array}
\]

26. The amount of heat required to heat 1 mole of a diatomic gas through 1°C at constant pressure is \( R \) (gas constant).

\[
\begin{array}{ll}
(1) & 2.5 R \\
(2) & 3.5 R \\
(3) & 4.5 R \\
(4) & 1.5 R \\
\end{array}
\]

27. The efficiency of a carnot engine is 0.4. It absorb 250 kW at 227°C. The amount of heat rejected per second and the temperature of the sink are respectively

\[
\begin{array}{ll}
(1) & 100 \, \text{kW} \, ; \, 200 \, \text{K} \\
(2) & 150 \, \text{kW} \, ; \, 250 \, \text{K} \\
(3) & 150 \, \text{kW} \, ; \, 300 \, \text{K} \\
(4) & 200 \, \text{kW} \, ; \, 250 \, \text{K} \\
\end{array}
\]
28. Which of the following is the correct Maxwell's relation?

\[ \frac{\partial S}{\partial V} = -\frac{\partial P}{\partial T} \quad (1) \]
\[ \frac{\partial T}{\partial S} = \frac{-\partial P}{\partial V} \quad (2) \]
\[ \frac{\partial V}{\partial T} = \frac{-\partial P}{\partial S} \quad (3) \]
\[ \frac{\partial S}{\partial V} = -\frac{\partial P}{\partial T} \quad (4) \]

29. For a vapour in equilibrium with a liquid, the vapour pressure \( p \) depends on the temperature \( T \) as

\[ p = T \quad (1) \]
\[ p = T^2 \quad (2) \]
\[ p = e^{\sigma T} \quad (3) \]
\[ p = e^{\sigma T^2} \quad (4) \]

(\( \sigma \) is some positive number)

30. In terms of internal energy \( U \), entropy \( S \), temperature \( T \), pressure \( p \) and volume \( V \), the Helmholtz free energy \( F \) is

\[ F = U - TS \quad (1) \]
\[ F = U + pV \quad (2) \]
\[ F = U + TS + pV \quad (3) \]
\[ F = U + TS + pV \quad (4) \]

आधारित उत्तरों \( U, S, T, p, V \) के आधार पर \( F \) के निम्नलिखित मूल्यों

\[ F = U - TS \quad (1) \]
\[ F = U + pV \quad (2) \]
\[ F = U + TS + pV \quad (3) \]
\[ F = U + TS + pV \quad (4) \]
31 The phase space has
   (1) Two dimensions
   (2) Three dimensions
   (3) Four dimensions
   (4) Six dimensions

32 According to Maxwell-Boltzmann distribution law the ratio of most probable
   velocity and square root of mean square velocity
   (1) \( \frac{2}{3} \)
   (2) 1
   (3) \( \frac{3}{2} \)
   (4) 2

33 The relation between entropy \( S \) and thermodynamic probability \( P \) is given as
   (1) \( S = kP \)
   (2) \( S = \sqrt{P} \)
   (3) \( S = k \ln P \)
   (4) \( S = \frac{k}{P} \)

Where \( k \) is Boltzmann constant.
On the basis of Fermi-Dirac statistics, the specific heat of a F.D gas varies with its temperature $T$ as

1. $T^{1/2}$
2. $T^{-3/2}$
3. $T^{-1}$
4. $T$

- फर्मी-दिराक्सन की भावना पर एक फिर्मी-दिराक्सन गैस का निश्चितांक के साथ सीधे संबंधित है।

1. $T^{1/2}$
2. $T^{-3/2}$
3. $T^{-1}$
4. $T$ के अनुसार

Bose-Einstein condensation is possible for

1. Particles with spin $\frac{1}{2}$ at low temperature
2. Particles with spin 1 at very high temperature
3. Particles with spin $\frac{1}{2}$ at high temperature
4. Particles with spin 1 at very low temperature

- बोस-एइन्स्टीन कंडेनसेशन संभव है।
36. At high temperature \((kT >> \hbar \nu)\) the average energy of a harmonic oscillator will be

\[
\begin{align*}
(1) & \quad kT \\
(2) & \quad \hbar \nu \\
(3) & \quad \frac{\hbar \nu}{\exp\left(\frac{\hbar \nu}{kT}\right) - 1} \\
(4) & \quad \frac{3}{2} kT
\end{align*}
\]

37. In a Fermi gas all states below \(E_F\), the Fermi energy, are occupied at 0 K but if temperature is increased then

\[
\begin{align*}
(1) & \quad \text{Fermi energy increases} \\
(2) & \quad \text{Fermi energy decreases} \\
(3) & \quad \text{Some electrons of low energy} (<< E_F) \text{ cross Fermi level} \\
(4) & \quad \text{Some electrons of energy close to Fermi energy cross the Fermi level}
\end{align*}
\]

38. An electron of energy 150 eV is passed through a circular hole of radius 10^{-3} cm. The order of uncertainty in the angle of emergence will be

\[
\begin{align*}
(1) & \quad 10^3 \text{ radians} \\
(2) & \quad 10^2 \text{ radians} \\
(3) & \quad 10^{-3} \text{ radians} \\
(4) & \quad 10^{-4} \text{ radians}
\end{align*}
\]
An excited atom emits a photon in an average time of $10^{-8}$ s. The uncertainty in the frequency of the emitted photon is about

1. $10^5$ Hz
2. $8 \times 10^6$ Hz
3. $7 \times 10^5$ Hz
4. $5 \times 10^8$ Hz

The wave function of a particle confined in a cubical box of side $L$ is given as

$\psi = A \sin \frac{n\pi}{L} \sin \frac{m\pi}{L} \sin \frac{p\pi}{L}$. The value of $A$ is

1. $\left( \frac{L}{2} \right)^2$  
2. $\left( \frac{2}{L} \right)^2$  
3. $\left( \frac{L}{2} \right)^2$  
4. $\left( \frac{2}{L} \right)^2$

The wave function of a particle confined in a cubical box of side $L$ is given as $\psi = A \sin \frac{n\pi}{L} \sin \frac{m\pi}{L} \sin \frac{p\pi}{L}$. The value of $A$ is

1. $\left( \frac{L}{2} \right)^2$  
2. $\left( \frac{2}{L} \right)^2$  
3. $\left( \frac{L}{2} \right)^2$  
4. $\left( \frac{2}{L} \right)^2$
41 For a one dimensional box of length $L$, the separation of successive energy levels varies in the ratio

1. $1:2:3:4$
2. $1:3:5:7$
3. $2:4:9:16$
4. $3:5:7:9$

$L$ तथापि के एक विमीक बक्स के लिये अवरोधित तंत्रों करें कि अनुक्रमिक निगमन करते का अनपेक्षित निगमन प्राप्ति में वस्त्रता है

1. $1:2:3:4$
2. $1:3:5:7$
3. $2:4:9:16$
4. $3:5:7:9$

42 The wave function for a harmonic oscillator $\psi_n(\xi)$ is represented as

1. $H_n(\xi)e^{-\xi}$
2. $H_n(\xi)e^{+\xi}$
3. $H_n(\xi)e^{1/2\xi^2}$
4. $H_n(\xi)e^{1/2\xi^2}$

Where $H_n$ is the Hermite polynomial and $\xi = \alpha x$

उस अवरोधी वैकल्प के अनुपात का $\psi_n(\xi)$ का दर्धाता है

1. $H_n(\xi)e^{-\xi}$
2. $H_n(\xi)e^{+\xi}$
3. $H_n(\xi)e^{1/2\xi^2}$
4. $H_n(\xi)e^{1/2\xi^2}$

वर्तमान $H_n$ विनियम चुक्ताता $\xi = \alpha x$ है

43 Which of the following particles are emitted by tunneling phenomenon

1. $\bar{\psi}$ and $\bar{\psi}$
2. $\gamma$ and $\eta$
3. $\alpha$ and $\rho$ both
4. $\alpha$

निर्धारित पर दोनों के कर्क त्रह उन्मुक्तिकरण विरोध में लिया है?

1. $\bar{\psi}$ या $\bar{\psi}$
2. $\gamma$ या $\eta$
3. $\alpha$ या $\rho$ दोनों
4. $\alpha$
The eigenvalue equation for the operator \( L^2 \) is

\[ L^2 \Omega(\theta, \phi) = \lambda' \Omega(\theta, \phi) \]

The eigenvalues \( \lambda' \) are given by

1. \( \lambda' = \frac{\hbar^2}{2} \)
2. \( \lambda' = \hbar |l+1| \)
3. \( \lambda' = \frac{\hbar^2}{2} (l+1)^2 \)
4. \( \lambda' = \hbar^2 (l+1) \)

A particle has \( \vec{L} = 2 \) and \( \vec{S} = 2 \). The number of possible \( \vec{J} \) value are

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

Energy of the radiation emitted by hydrogen atom in the transitions between \( n = 2 \) and \( n = 1 \) states is \( E_0 \). The energy of the radiation for transitions between \( n = 3 \) and \( n = 1 \) will be

1. \( 3E_0 \)
2. \( 2E_0 \)
3. \( E_0 \)
4. \( \frac{32}{27} E_0 \)

Energy of the radiation emitted in the transitions between \( n = 2 \) and \( n = 1 \) states is \( E_0 \). The energy of the radiation for transitions between \( n = 3 \) and \( n = 1 \) will be

1. \( 3E_0 \)
2. \( 2E_0 \)
3. \( E_0 \)
4. \( \frac{32}{27} E_0 \)

\( \text{Contd...} \)
47. Pauli matrices \( \sigma_x = \begin{pmatrix} 0 & 1 \\ 1 & 0 \end{pmatrix} \) and \( \sigma_x = \begin{pmatrix} 1 & 0 \\ 0 & -1 \end{pmatrix} \) then \( \sigma_x \) will be

\[
\begin{align*}
(1) \quad & \begin{pmatrix} i & 0 \\ 0 & i \end{pmatrix} \\
(2) \quad & \begin{pmatrix} 0 & i \\ i & 0 \end{pmatrix}
\end{align*}
\]

48. The transition rate is written as

\[
\begin{align*}
(1) \quad & \Gamma = \frac{2\pi}{\hbar} \text{Tr} \rho \mathcal{L}_d \\
(2) \quad & \Gamma = \frac{2\pi}{\hbar} \text{Tr} \rho \mathcal{L}_d \\
(3) \quad & \gamma = \frac{2\pi}{\hbar} \text{Tr} \rho \mathcal{L}_d \\
(4) \quad & \gamma = \frac{2\pi}{\hbar} \text{Tr} \rho \mathcal{L}_d
\end{align*}
\]

Where symbols have their usual meaning.

\[
\begin{align*}
(1) \quad & \Gamma = \frac{2\pi}{\hbar} \text{Tr} \rho \mathcal{L}_d \\
(2) \quad & \Gamma = \frac{2\pi}{\hbar} \text{Tr} \rho \mathcal{L}_d \\
(3) \quad & \gamma = \frac{2\pi}{\hbar} \text{Tr} \rho \mathcal{L}_d \\
(4) \quad & \gamma = \frac{2\pi}{\hbar} \text{Tr} \rho \mathcal{L}_d
\end{align*}
\]
49 The probability current density corresponding to the wave function

\[ \Psi(r) = \frac{\Phi_0}{r} \left( r^2 = x^2 + y^2 + z^2 \right) \]

is proportional to

(1) \( \frac{1}{r^2} \)  
(2) \( \frac{1}{r} \)  
(3) \( r \)  
(4) \( r^2 \)

वर्तमान \( \Psi(r) = \frac{\Phi_0}{r} \left( r^2 = x^2 + y^2 + z^2 \right) \) है जो वास्तविक-न्याय-व्यवस्था समस्या है।

(1) \( \frac{1}{r^2} \) के  
(2) \( \frac{1}{r} \) के  
(3) \( r \) के  
(4) \( r^2 \) के

50 For a given energy the elastic scattering cross-sections for \( f = 0 \) and \( f = 1 \) are in the ratio \( 1 : 9 \). The corresponding phase-shifts are respectively

(1) \( 45^\circ, 90^\circ \)  
(2) \( 30^\circ, 60^\circ \)  
(3) \( 20^\circ, 60^\circ \)  
(4) \( 30^\circ, 60^\circ \)

विशेष यह \( f \) के लिए \( f = 0 \) या \( f = 1 \) के लिए प्रकाश प्रविधितन अनुभवकर अनुभवावर \( 1 : 9 \) के अनुक्रम में है। इस प्रकाश विधिवत क्षेत्र के है।

(1) \( 45^\circ, 90^\circ \)  
(2) \( 30^\circ, 90^\circ \)  
(3) \( 20^\circ, 60^\circ \)  
(4) \( 30^\circ, 60^\circ \)
51. For a P-N junction diode, the reverse saturation current is 20 μA. If \((q/kT) = 40(V^{-1})\) and \(e^2 = 7.4\), then forward current with a forward bias of 0.1 V will be

\[
\begin{align*}
(1) & \quad 0.13 \text{ mA} \\
(2) & \quad 0.52 \text{ mA} \\
(3) & \quad 1.1 \text{ mA} \\
(4) & \quad 2.8 \text{ mA}
\end{align*}
\]

52. In a rectifier, the RMS and dc values corresponding to the output current are \(I_{\text{RMS}}\) and \(I_{\text{dc}}\) respectively. The ripple factor \(r\) of the rectifier is defined as

\[
\begin{align*}
(1) & \quad r = \frac{I_{\text{RMS}}}{I_{\text{dc}}} \\
(2) & \quad r = \left[\frac{I_{\text{RMS}}}{I_{\text{dc}}} - 1\right]^2 \\
(3) & \quad r = \frac{I_{\text{RMS}}}{I_{\text{dc}} + I_{\text{RMS}}} \\
(4) & \quad r = \left[\frac{I_{\text{RMS}}}{I_{\text{dc}}} - 1\right]^2
\end{align*}
\]

The ripple factor is a measure of the variation in the output current with respect to the dc component. A low ripple factor is desirable for many applications. The values provided above are calculated based on the given formulas.
A voltage regulation circuit is shown in the given figure. The value of \( R_L \) which will satisfy maximum power conditions for the zener diode will be

(1) 220 \( \Omega \)  
(2) 2k\( \Omega \)  
(3) 440 \( \Omega \)  
(4) 4k\( \Omega \)

54 An amplifier with common-base configuration is used

(1) As a non-inverting amplifier and as a constant current source  
(2) As a matching device between a high resistance source and a low resistance load  
(3) As a device to provide large current, voltage and power gain  
(4) In cascading, as matching is not needed between different stages

09/MSPH33_A] 25 [Contd...]
In the given circuit of a CE amplifier (the transistor parameters are: $h_{fe} = 100$ and $h_{ie} = 1.6 \times 10^3$. The voltage gain will be:

![Circuit Diagram]

1. $64$
2. $125$
3. $240$
4. $300$

For a JFET, pinch-off voltage is the voltage of drain-source voltage $V_{DS}$ at which:

1. Drain current $I_D$ becomes zero
2. The linear increase in $I_D$ with increase in $V_{DS}$ stops and $I_D$ becomes almost constant
3. $I_D$ suddenly increases
4. $V_{DS}$ becomes so large that JFET is damaged

JFET के लिए मुख्य विद्युत (pinch-off voltage) निर्धारित है, जो वैकल्पिक विद्युत $V_{DS}$ का बक्कर प्रभाव है।

1. विरोधी धारा $I_D$ धूप हो जाती है।
2. $V_{DS}$ में वृद्धि के कारण $I_D$ ने वैकल्पिक रूप से स्फटिक हो जाती है और $I_D$ नियन्त्रण निष्कर्ष हो जाती है।
3. $I_D$ एक अन्य धारा का रूप हो जाती है।
4. $I_D$ स्फटिक रूप से स्फटिक हो जाते हैं जब JFET बिता पाता है।

[MSPH22_A] 26 [Contd...
An amplifier has an internal voltage gain $100$. Its input and output impedances are $1\Omega$ and $50\Omega$ respectively. A negative feedback with feedback ratio $0.1$ is applied. The input and output impedances will now become

1. $10\Omega$ and $5\Omega$ respectively
2. $100\Omega$ and $500\Omega$ respectively
3. $11\Omega$ and $4.54\Omega$ respectively
4. $9.1\Omega$ and $45.4\Omega$ respectively

In an inverting amplifier, the impedance connected with input is $Z_i$, feedback impedances is $Z_f$ and its internal voltage gain is $A(A >> 1)$. Its resultant gain will be

1. $\frac{Z_f}{Z_i}$
2. $-\frac{A Z_f}{Z_i}$
3. $-\frac{A Z_i}{Z_f}$
4. $-\frac{A Z_f}{Z_f + Z_i}$

In the inverting amplifier, the impedance connected with input is $Z_i$, feedback impedances is $Z_f$ and its internal voltage gain is $A(A >> 1)$. Its resultant gain will be

1. $\frac{Z_f}{Z_i}$
2. $-\frac{A Z_f}{Z_i}$
3. $-\frac{A Z_i}{Z_f}$
4. $-\frac{A Z_f}{Z_f + Z_i}$
In the circuit shown, the output voltage $V_o$ is

\[ V_o = -\frac{V_t}{RC} \]

\[ V_o = -V_t RC \]

\[ V_o = -\frac{1}{RC} \int V_t \, dt \]

\[ V_o = -RC \frac{dV_t}{dt} \]

Pradistik Parerihen (2) nevithe kalta $V_o$ ka maha $R$.

Assuming the symbols to have their usual meaning, $A \oplus \overline{A} \cdot B$ is equal to

\[ A \cdot B \]

\[ \overline{A} \cdot B \]

\[ A + B \]

\[ \overline{A} + B \]

Rabindra pita samajh aasthi mukho dude $A \oplus \overline{A} \cdot B$ shukhy hae.

\[ A \cdot B \]

\[ \overline{A} \cdot B \]

\[ A + B \]

\[ \overline{A} + B \]$ ke
The combination of gates shown in the figure represents

\[ A \rightarrow \quad \rightarrow Y \]
\[ B \quad \quad \quad \quad Y \]

1. AND operation
2. NAND operation
3. OR operation
4. NOR operation

In a half adder:

1. Sum column is AND operation and carry column is XOR operation
2. Sum column is XOR operation and carry column is OR operation
3. Sum column is AND operation and carry column is also AND operation
4. Sum column is XOR operation and carry column is AND operation

09/MSPH23_AJ
Parity of the wave function of an electron in an atom is

(1) always even
(2) always odd

\[ (-1)^l \]
\[ (-1)^l \]

The orbital wave function of a particle is

\[ Y(\theta, \phi) = \frac{\sqrt{15}}{\sqrt{16\pi}} \sin \theta \cos \phi \exp(i\phi) \]

If the particle has angular momentum \( l \) and its projection on Z-axis is \( m \) then

(1) \( l = 1 \); \( m = 1 \)
(2) \( l = 1 \); \( m = -1 \)
(3) \( l = 2 \); \( m = -1 \)
(4) \( l = 2 \); \( m = 1 \)

The spectral lines in LyC \( \alpha \) of an atom for \( \Delta n = 1 \) in increasing order of wave numbers are of

(1) Paschen, Lyman, Balmer, Brackett series
(2) Lyman, Balmer, Paschen, Brackett series
(3) Balmer, Paschen, Brackett, Lyman, series
(4) Brackett, Paschen, Balmer, Lyman, series

\( \Delta n = 1 \) के लिए साप्ताहिक परम्परा की स्पेक्ट्रल रेखाओं, हरें वंडर व के बढ़ते ब्रांच के अनुसार हैं:

(1) पाशेन, लायमन, बल्मर, ब्रेकेट श्रेणी की
(2) बल्मर, पाशेन, ब्रेकेट श्रेणी की
(3) ब्रेकेट, पाशेन, लायमन श्रेणी की
(4) पाशेन, ब्रेकेट, लायमन श्रेणी की
66 The emission spectrum of an atomic source has singlet and triplet lines. These should be coming from:

1. one electron atom
2. two-electron atom
3. three-electron atom
4. inert gas atom

The value of Landé g-factor for D₂ line of sodium is:

1. \( \frac{1}{2} \)
2. 1
3. \( \frac{3}{2} \)
4. 2

67 Choose the wrong statement:

1. Zeeman effect is observed when atom is placed in weak magnetic field.
2. Paschen-Back effect is observed when atom is placed in very strong magnetic field in place of Zeeman effect.
3. Stark effect is splitting of lines in presence of electric field and magnetic field together.
4. For hydrogen atom, \( n = 2 \) level splits into three levels in presence of weak electric field.

09 MSPH23A1:

(1) त्रिकोणीय परक्रम के दृश्य तुलनात्मक रूप में ऊर्जा शीतल होता है की जीवन प्रतिकृति उदाहरण देता है।
(2) त्रिकोणीय परक्रम के त्रिकोणीय रूप में ऊर्जा शीतल होता है की जीवन प्रतिकृति की नुक्सान प्रतिकृति देता है।
(3) द्रुष्य तुलनात्मक रूप में एक त्रिकोणीय उदाहरण में द्रुष्य की प्रतिकृति की दर्शन प्रतिकृति करते है।
(4) तुलना तुलनात्मक रूप में ऊर्जा प्रतिकृति की \( n = 2 \) त्रिकोणीय रूप में द्रुष्य की प्रतिकृति हो।

09 09 09 09 09 09
Two levels in an atom, whose nuclear spin is \( I = 3 \), have the designations \( 2D_{\frac{5}{2}} \) and \( 2P_{\frac{3}{2}} \). The expected number of components in the hyperfine structure of the corresponding spectral line is

(1) 6 
(2) 4 
(3) 3 
(4) 2

If the \( k_\alpha \) X-rays of Cu\((Z = 29)\) have a wavelength of \( 1.52 \, \text{Å} \), then the wavelength of the corresponding radiation for element with \( Z = 43 \) will be

(1) 1.1 \, \text{Å} 
(2) 0.82 \, \text{Å} 
(3) 0.66 \, \text{Å} 
(4) 2.1 \, \text{Å} 

यदि \( Cu(Z = 29) \) की \( k_\alpha \) X-रेखाओं की लम्बाई 1.52 \, \text{Å} \ है तो \( Z = 43 \) के क्षेत्र के लिए संबंधित रेखाओं का लंबाई कैसे होगा?

(1) 1.1 \, \text{Å} 
(2) 0.82 \, \text{Å} 
(3) 0.66 \, \text{Å} 
(4) 2.1 \, \text{Å} 

MSPH23_32 [Cont'd...
When a gamma ray of energy \(1.02\text{MeV} \left(2\text{mc}^2\right)\) is scattered in elastically at 60° angle, then energies of the scattered photon and recoil electron are in the ratio respectively

(1) 2 : 1
(2) 1 : 2
(3) 1 : 3
(4) 1 : 1

If the fundamental band of \(H_2\text{CP}^{13}\) lies at 3.46 μ, the wavelength of the corresponding band of \(H_2\text{CP}^{17}\) will be

(1) 6.13 μ
(2) 5.64 μ
(3) 4.83 μ
(4) 3.15 μ

With excitation line 4358 Å, a sample gives stokes line at 4458 Å. The wavelength of the anti-stokes line will be

(1) 4358 Å
(2) 4224 Å
(3) 4258 Å
(4) 4262 Å

4358 Å के विकिरण से प्रतीत करने पर एक सूचक 4458 Å पर स्टोक्स लाइन निकलती है। प्रतीत-स्टोक्स रेखा की अन्तरग्रुण होगी

(1) 4358 Å
(2) 4224 Å
(3) 4258 Å
(4) 4262 Å
74. Find the correct statement for He-Ne Laser
   (1) Spatial coherence and temporal coherence are same
   (2) Laser radiation comes from $5s \rightarrow 3p$ transitions in He atoms
   (3) The Laser light becomes highly monochromatic due to the properties of resonating cavity
   (4) Length of the Laser cavity should be large than 1 meter

75. Number of Bravais lattices for orthorhombic, tetragonal, cubic and monoclinic lattices are respectively
   (1) 4, 2, 3, 2
   (2) 4, 3, 2
   (3) 2, 3, 4, 2
   (4) 4, 2, 1

76. For a cubic lattice of lattice spacing $a$, the distance between successive parallel planes $(h, k, l)$
   (1) $h^2 + k^2 + l^2$
   (2) $a/(h+k+l)$
   (3) $a((h^2 + k^2 + l^2)^{1/2})$
   (4) $a((h^2 + k^2 + l^2)^{1/2})$
When an X-ray of 1.5 Å wavelength strikes a bcc crystal, the first diffraction maxima is observed at the Bragg angle of 30°. The spacing between the corresponding planes and the Miller indices are:

1. \(0.75 \, \text{Å} : (100)\)
2. \(1.5 \, \text{Å} : (110)\)
3. \(1.5 \, \text{Å} : (111)\)
4. \(0.75 \, \text{Å} : (111)\)

KCl and KBr are both alkali halides with NaCl structure but in the X-ray diffraction, there are differences namely certain planes do not diffract in KCl. These planes are:

1. (1 1 1), (2 1 1), (3 1 1)
2. (1 0 0), (3 0 0), (5 0 0)
3. (1 1 0), (2 2 0), (3 3 0)
4. (1 1 1), (3 1 1), (3 3 1)

KCl is NaCl… KBr (At-At distance is 3.9 Å in KCl and 3.8 Å in KBr)… [Contd...]
For umklapp process the interacting phonons must have a wave vector at least:

(1) \( \vec{G} \)  
(2) \( 2\vec{G} \)  
(3) \( \frac{\vec{G}}{2} \)  
(4) \( \frac{\vec{G}}{4} \)

Where \( \vec{G} \) is base vector of the reciprocal lattice.

For a free electron gas, the average energy of an electron at \( \vec{0} \) is:

(1) \( E_F \)  
(2) \( \frac{3}{2} E_F \)  
(3) \( \frac{1}{2} E_F \)  
(4) \( \frac{2}{3} E_F \)

\( E_F \) is Fermi energy.

For a free electron gas, the average energy of an electron at \( \vec{0} \) is:

(1) \( E_F \)  
(2) \( \frac{3}{2} E_F \)  
(3) \( \frac{1}{2} E_F \)  
(4) \( \frac{2}{3} E_F \)

And \( E_F \) is Fermi energy.
For metals like Al, the electrical conductivity $\sigma$ at frequency $\omega$ is related to DC conductivity $\sigma_0$ as

1. $\sigma = \sigma_0$

2. $\sigma = \frac{\sigma_0}{1 + j\omega\tau}$

3. $\sigma = \sigma_0 (1 + j\omega\tau)$

4. $\sigma = \sigma_0 \omega\tau$

Where $\omega$ is the frequency of source and $\tau$ is the mean free path of electrons in the metal.

According to Debye model, the heat capacity of solids, at very low temperatures, varies with temperature $T$ as

1. $T^2$

2. $e^{\frac{\alpha T}{T}}$

3. $e^{\alpha T}$

4. $e^{\alpha T}$

According to Debye model the heat capacity of solids, at very low temperatures, varies with temperature $T$ as

1. $T^2$

2. $e^{\alpha T}$

3. $e^{\alpha T}$

4. $e^{\alpha T}$

Where $\alpha$ is the Debye temperature.
The relation between mobility \( \mu \), Hall coefficient \( R \) and electrical conductivity \( \sigma \) for an extrinsic semi-conductor is given as:

\[
\begin{align*}
(1) \quad & \mu = \frac{\sigma}{R} \\
(2) \quad & \mu = \frac{R}{\sigma} \\
(3) \quad & \mu = \sqrt{R\sigma} \\
(4) \quad & \mu = R\sigma
\end{align*}
\]

The number of vacancies produced on heating in a sheet of aluminium relative to total atoms near melting (~500 K) is of the order of:

\[
\begin{align*}
(1) \quad & 10^{-5} \\
(2) \quad & 10^{-7} \\
(3) \quad & 10^{-4} \\
(4) \quad & 10^{-3}
\end{align*}
\]

Give vacancy formation energy \( E_0 \) is 0.78 eV in Al.

Vapourisation temperature of aluminium is about (~500 K) as this is the temperature at which it is possible to observe the formation of metallic particles.

\[
\begin{align*}
(1) \quad & 10^{-5} \\
(2) \quad & 10^{-7} \\
(3) \quad & 10^{-4} \\
(4) \quad & 10^{-3}
\end{align*}
\]

It is noted that in Al, the formation of vacancies requires 0.78 eV.

The effective number of Bohr magnetons (\( \mu_B \)) for Ce\(^{3+} \) ions is:

\[
\begin{align*}
\text{(Give for Ce}\(^{3+}\), \( J = \frac{5}{2} ; s = \frac{1}{2} ; f = \frac{3}{2}) \quad & 6.6 \\
\text{(2) } & 4.8 \\
\text{(3) } & 3.6 \\
\text{(4) } & 2.5
\end{align*}
\]

Ce\(^{3+} \) are the IUC elements and have the following magnetic properties:

\[
\begin{align*}
\text{(Give for Ce}\(^{3+}\), \( J = \frac{5}{2} ; s = \frac{1}{2} ; f = \frac{3}{2} \)) \quad & 6.6 \\
\text{(2) } & 4.8 \\
\text{(3) } & 3.6 \\
\text{(4) } & 2.5
\end{align*}
\]
For an antiferromagnetic material, the value of Curie-Weiss temperature $\theta$ is 50 K. The ratio of its susceptibilities at 100 K and 150 K is respectively

(1) $1.50 : 1$
(2) $2 : 1$
(3) $1 : 1.58$
(4) $1.33 : 1$

Sketch the temperature dependence of magnetization of a paramagnetic substance.

(1) $1.50 : 1$
(2) $2 : 1$
(3) $1 : 1.58$
(4) $1.33 : 1$

87. For Al, the values of $I_G$ and $H_C$ (at 0 K) are 1.2 K and 100 Gauss. The value of $H_C$ at 0.6 K will be about:

(1) 125 Gauss
(2) 90 Gauss
(3) 50 Gauss
(4) 75 Gauss

For Al, the values of $I_G$ and $H_C$ (at 0 K) are 1.2 K and 100 Gauss. The value of $H_C$ at 0.6 K will be about:

(1) 125 Gauss
(2) 90 Gauss
(3) 50 Gauss
(4) 75 Gauss

88. Which of the statements is correct for nuclear matter?

(1) Its density increases with $A^{1/3}$ but lies around $10^{12} \text{ kg/m}^3$
(2) Its density is nearly constant of value $10^{15} \text{ kg/m}^3$
(3) Its density is nearly constant of value $10^{17} \text{ kg/m}^3$
(4) Its density decreases with $A^{1/3}$ and has a value about $10^{19} \text{ kg/m}^3$

Which of the statements is correct for nuclear matter?

(1) Its density increases with $A^{1/3}$ but lies around $10^{12} \text{ kg/m}^3$
(2) Its density is nearly constant of value $10^{15} \text{ kg/m}^3$
(3) Its density is nearly constant of value $10^{17} \text{ kg/m}^3$
(4) Its density decreases with $A^{1/3}$ and has a value about $10^{19} \text{ kg/m}^3$
The gyromagnetic ratios for protons and neutrons are respectively

(1) $+2.79$, $+2.79$  
(2) $5.58$, $+5.58$
(3) $5.58$, $-3.82$  
(4) $2.79$, $-1.91$

नेरोगन व मूककरण के पुर्ण पृथक्कर अनुवाद है

(1) $+2.79$, $+2.79$  
(2) $5.58$, $+5.58$
(3) $5.58$, $-3.82$  
(4) $2.79$, $-1.91$

Give below are four statements. Which of these is the correct combination?

(a) Nuclear forces are strongest and attractive at all distances
(b) Nuclear forces are non-central
(c) Nuclear forces are charge independent
(d) Nuclear forces depend on relative orientation of the spins of the interacting nucleons

(1) (a), (b), (c)
(2) (b), (c)
(3) (b), (d), (a)
(4) (b), (c), (d)

नीचे चार समय दिये हैं। इनमें से किस संयोजन ठीक-ठा है?

(a) नाँथकोष वल समय अंतिक्षारी है पर अभी भी दूरियों पर आकर्षण होते हैं
(b) नाथकोष वल अंतिक्षू होते हैं
(c) नाथकोष वल अंतिक्षू (वार्ष) अनुकूलित होते हैं
(d) नाथकोष वल अंतिक्षू दिवंगत नाथको वल चक्करों के साथ अनुकूलित होते हैं

(1) (a), (b), (c)
(2) (b), (c)
(3) (b), (d), (a)
(4) (b), (c), (d)
The binding energy $E_b$ for a mass $A$ of a nucleus is given by

$$E_b(Z, A) = \text{constant} - \frac{0.6z^2}{A^{1/3}} - 20 \frac{(A - 22)^2}{A} \pm \frac{125}{A}$$

The value of $Z$ for most stable nucleus of mass number $A$ will be

(1) $\frac{A}{2}$  (2) $\frac{40A}{80A^{2/3}}$

(3) $\frac{40A}{80 + 0.6A^{2/3}}$  (4) $\frac{40A}{80 - 0.6A^{2/3}}$

A प्रमाण राशि $Z$ के नापिक भी देखना चाहिए $E_b$ हो रही है

$$E_b(Z, A) = \text{constant} - \frac{0.6z^2}{A^{1/3}} - 20 \frac{(A - 22)^2}{A} \pm \frac{125}{A}$$

प्रमाण राशि $A$ के अन्य लघु नापिक के $Z$ का मान हो रहा है

(1) $\frac{A}{2}$  (2) $\frac{40A}{80A^{2/3}}$

(3) $\frac{40A}{80 + 0.6A^{2/3}}$  (4) $\frac{40A}{80 - 0.6A^{2/3}}$

The coulomb interaction energy for the $^{27}_{13}Al$ is $E$. The corresponding value for the nucleus $^{64}_{26}Ni$ will be about

(1) 3.5 E  (2) 2.3 E

(3) 2.1 E  (4) 1.8 E

$^{27}_{13}Al$ की कुलभ काल्पनिक विद्या कहलाती $E$ है। $^{64}_{26}Ni$ नापिक के लिए इसका संगत मान

(1) 3.5 E  (2) 2.3 E

(3) 2.1 E  (4) 1.8 E
According to shell model the parities of the nuclei \( ^7L_4 \) and \( ^{19}F \) would be respectively

1. \( \text{Odd} (-); \text{Even} (+) \)
2. \( \text{Even} (+); \text{Even} (+) \)
3. \( \text{Even} (+); \text{Odd} (-) \)
4. \( \text{Odd} (-); \text{Odd} (-) \)

The ratio of energies of \( 4(+) \) and \( 2(+) \) levels for even-even nuclei away from magic numbers is about

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

A thin ionization chamber is traversed successively by a 10 MeV \(^{14}N\) proton, a 20 MeV deuteron, 30 MeV \(^{16}O\) particle and a 40 MeV \(^{18}F\) particle (Neglecting logarithmic term). The relative size of the ionization pulse produced is

1. \([1, 2, 3, 4]\)
2. \([1, 1, 3, 4]\)
3. \([1, 1, 3, 3]\)
4. \([1, 1, 4, 4]\)

A thin ionization chamber is traversed successively by a 10 MeV \(^{14}N\) proton, a 20 MeV deuteron, 30 MeV \(^{16}O\) particle and a 40 MeV \(^{18}F\) particle (Neglecting logarithmic term). The relative size of the ionization pulse produced is

1. \([1, 2, 3, 4]\)
2. \([1, 1, 3, 4]\)
3. \([1, 1, 3, 3]\)
4. \([1, 1, 4, 4]\)
The range of an $\alpha$-particle is a nuclear emission is 300 $\mu$m. The range of $^3$He nucleus of same initial velocity is it will be

(1) 400 $\mu$m  
(2) 600 $\mu$m  
(3) 900 $\mu$m  
(4) 1200 $\mu$m

The range $\alpha$-particle $\gamma$-ray emission in nuclear 300 $\mu$m is due to the nuclear emission $^3$He nucleus.

(1) 400 $\mu$m  
(2) 600 $\mu$m  
(3) 900 $\mu$m  
(4) 1200 $\mu$m

The cross-section for $\gamma$-ray reaction away from resonance varies with speed $v$ of neutrons as

(1) $v^{-1}$  
(2) $v^{-1/2}$  
(3) $v^{1/2}$  
(4) $v$

The energy of the back-scattered peak in the pulse height spectrum from scintillation detector $\gamma$-rays of $m_e c^2$. $\gamma$ is electron's mass energy will be

(1) $\frac{1}{3} m_e c^2$  
(2) $\frac{1}{2} m_e c^2$  
(3) $\frac{2}{3} m_e c^2$  
(4) $m_e c^2$

The energy of the back-scattered peak in the pulse height spectrum from scintillation detector $\gamma$-rays of $m_e c^2$. $\gamma$ is electron's mass energy will be

(1) $\frac{1}{3} m_e c^2$  
(2) $\frac{1}{2} m_e c^2$  
(3) $\frac{2}{3} m_e c^2$  
(4) $m_e c^2$
The relation between hypercharge $Y$, baryon number $B$, strangeness number $S$ and charm number $C$

1. $Y = S - B + C$
2. $Y = S + B - C$
3. $Y = S + B + C$
4. $Y = S - B - C$

The energy produced in the fission of 1 mole of $^{235}U$ will be about:

(Avogadro number is $6 \times 10^{23}$)

1. $1.5 \times 10^{22}$ MeV
2. $2.5 \times 10^{23}$ MeV
3. $4 \times 10^{23}$ MeV
4. $5 \times 10^{23}$ MeV

(Given that each $^{235}U$ gives 200 MeV energy in fission)

The energy produced in the fission of 1 mole of $^{235}U$ will be about:

(Avogadro number is $6 \times 10^{23}$)

1. $1.5 \times 10^{23}$ MeV
2. $2.5 \times 10^{23}$ MeV
3. $4 \times 10^{23}$ MeV
4. $5 \times 10^{23}$ MeV

(Provided that each $^{235}U$ gives 200 MeV energy in fission)