### Question Paper Preview

**Question Paper Name:** Metallurgical Engineering 11th May 2019 Shift1  
**Subject Name:** Metallurgical Engineering  
**Duration:** 180  
**Total Marks:** 200  
**Display Marks:** No  
**Share Answer Key With Delivery Engine:** Yes  
**Actual Answer Key:** Yes

#### Mathematics

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**Question Number : 1**  
**Question Id : 8946584409**  
**Question Type : MCQ**  
**Option Shuffling :** Yes  
**Display Question Number :** Yes  
**Single Line Question Option :** No  
**Option Orientation :** Vertical

Let \( M = (a_{ij}) \) be a 10\( \times \)10 matrix such that \( a_{ij} = \begin{cases} 1, & \text{if } i + j = 11 \\ 0, & \text{otherwise} \end{cases} \). Then, the determinant of \( M \) is \( _____ \).

**Options :**
1. 0  
2. 1  
3. -1  
4. 11

**Question Number : 2**  
**Question Id : 8946584410**  
**Question Type : MCQ**  
**Option Shuffling :** Yes  
**Display Question Number :** Yes  
**Single Line Question Option :** No  
**Option Orientation :** Vertical

Let \( A \) and \( B \) be two square matrices of order \( n \). If \( AB = A \), \( BA = B \) then \( A^2 + B^2 = _____ \).

**Options :**
1. $AB$

2. $A - B$

3. $0$

4. $A + B$

Consider the system of linear equations $x + y + z = 3, x - y - z = 4, x - 5y + \alpha z = 6$. Then, the value of $\alpha$ for which this system has an infinite number of solutions is _______.

Options:
1. $-5$
2. $5$
3. $3$
4. $1$

If $A(\alpha, \beta) = \begin{pmatrix} \cos \alpha & \sin \alpha & 0 \\ -\sin \alpha & \cos \alpha & 0 \\ 0 & 0 & e^\beta \end{pmatrix}$, then the inverse of the matrix $A(\alpha, \beta)$ is _________.

Options:
1. $A(\alpha, \beta)$
2. $A(\alpha, -\beta)$
3. \( A(-\alpha, -\beta) \)

4. \( A(-\alpha, \beta) \)

Question Number : 5  Question Id : 8946884413  Question Type : MCQ  Option Shuffling : Yes  Display Question Number : Yes  Single Line Question Option : No  Option Orientation : Vertical

The rational fraction \( \frac{x^2 + 1}{(x^2 + 4)(x - 2)} \) is equal to \[ \text{__________} \]

Options :

1. \( \frac{3x + 6}{8(x^2 + 4)} + \frac{5}{4(x - 2)} \)

2. \( \frac{3x + 6}{4(x^2 + 4)} + \frac{5}{8(x - 2)} \)

3. \( \frac{3x + 6}{8(x^2 + 4)} + \frac{5}{8(x - 2)} \)

4. \( \frac{3x + 6}{(x^2 + 4)} + \frac{5}{(x - 2)} \)

Question Number : 6  Question Id : 8946884414  Question Type : MCQ  Option Shuffling : Yes  Display Question Number : Yes  Single Line Question Option : No  Option Orientation : Vertical

If \( \log_2 3 = a, \log_3 5 = b, \log_7 2 = c \), then \( \log_{140} 63 = \text{__________} \).

Options :

1. \( \frac{1 - 2ac}{2ac + abc + 1} \)

2. \( \frac{1 - 2ac}{2c - abc - 1} \)
3. \[ \frac{1 + 2ac}{2c - abc - 1} \]

4. \[ \frac{1 + 2ac}{2c + abc + 1} \]

**Question Number : 7  Question Id : 8946584415  Question Type : MCQ  Option Shuffling : Yes  Display Question Number : Yes  Single Line Question Option : No  Option Orientation : Vertical**

\[ \cos \frac{2\pi}{7} + \cos \frac{4\pi}{7} + \cos \frac{6\pi}{7} = \text{_____.} \]

**Options :**

1. 
2. 
3. 
4. 0

**Question Number : 8  Question Id : 8946584416  Question Type : MCQ  Option Shuffling : Yes  Display Question Number : Yes  Single Line Question Option : No  Option Orientation : Vertical**

If the angles \( A, B \) and \( C \) of a triangle are in an arithmetic progression and if \( a, b \) and \( c \) denote the lengths of the sides opposite to \( A, B \) and \( C \) respectively, then the value of the expression \( \frac{a}{c} \sin 2C + \frac{c}{a} \sin 2A \) is \( \text{_____.} \)

**Options :**

1. \( \sqrt{3} \)
2. \( \frac{\sqrt{3}}{2} \)
Question Number : 9 Question Id : 8946584417 Question Type : MCQ Option Shuffling : Yes Display Question Number : Yes Single Line Question Option : No Option Orientation : Vertical

If \( \sin x + \sin y = \frac{1}{4} \) and \( \cos x + \cos y = \frac{1}{3} \), then \( \cot(x + y) = \) __________.

Options :

1. \( \frac{7}{24} \)
2. \( \frac{24}{7} \)
3. \( \frac{3}{4} \)
4. \( \frac{1}{4} \)

Question Number : 10 Question Id : 8946584418 Question Type : MCQ Option Shuffling : Yes Display Question Number : Yes Single Line Question Option : No Option Orientation : Vertical

If \( \sin(x^\circ + 28^\circ) = \cos(3x^\circ - 78^\circ) \) and \( 0^\circ < x^\circ < 90^\circ \), then, which of the following is the value of \( x^\circ \)?

Options :

1. \( 50^\circ \)
2. \( 30^\circ \)
3. \( 16^\circ \)
4. \( 8^\circ \)
Question Number : 11  Question Id : 8946584419  Question Type : MCQ  Option Shuffling : Yes  Display Question Number : Yes  Single Line Question Option : No  Option Orientation : Vertical

If \( x = \tan \left( \csc^{-1} \frac{65}{63} \right) \) and \( y = \sec^2 \left( \cot^{-1} \frac{1}{2} \right) + \cos \left( \tan^{-1} \frac{1}{3} \right) \), then \((x, y) = \) _______.

Options:

\[
\begin{align*}
1. & \quad \left( \frac{63}{16}, 15 \right) \\
2. & \quad \left( \frac{16}{63}, 15 \right) \\
3. & \quad \left( \frac{63}{16}, 5 \right) \\
4. & \quad \left( \frac{16}{63}, 5 \right)
\end{align*}
\]

Question Number : 12  Question Id : 8946584420  Question Type : MCQ  Option Shuffling : Yes  Display Question Number : Yes  Single Line Question Option : No  Option Orientation : Vertical

The equation \( \tan^{-1} \left( \frac{x+1}{x-1} \right) + \tan^{-1} \left( \frac{x-1}{x} \right) = \tan^{-1} (-7) \) has _____________.

Options:

1. unique solution \( x = 2 \)
2. two solutions \( x = 1, 2 \)
3. no solution
4. infinite number of solutions

Question Number : 13  Question Id : 8946584421  Question Type : MCQ  Option Shuffling : Yes  Display Question Number : Yes  Single Line Question Option : No  Option Orientation : Vertical
In a triangle \(ABC\), let \(a, b\) and \(c\) denote the lengths of the sides opposite to 

\(A, B\) and \(C\) respectively. If \(\frac{1}{a+c} + \frac{1}{b+c} = \frac{3}{a+b+c}\), then the angle \(C\) is ____.

Options:
1. \(30^\circ\)
2. \(90^\circ\)
3. \(60^\circ\)
4. \(45^\circ\)

If \(\sin hx = 3\) then \(x = \) ____________.

Options:
1. \(\log(3 + \sqrt{10})\)
2. \(\log(3 - \sqrt{10})\)
3. \(\log(6 + \sqrt{10})\)
4. 1

Which of the following is NOT true for the complex numbers \(z_1\) and \(z_2\)?

Options:
1. \(\frac{z_1}{z_2} = \frac{z_1 \bar{z}_2}{|z_2|^2}\)
2. \[ |z_1 + z_2| \leq |z_1| + |z_2| \]

3. \[ |z_1 + z_2| \leq |z_1| - |z_2| \]

4. \[ |z_1 + z_2|^2 + |z_1 - z_2|^2 = 2|z_1|^2 + 2|z_2|^2 \]

Question Number : 16  Question Id : 8946584424  Question Type : MCQ  Option Shuffling : Yes  Display Question Number : Yes  Single Line Question Option : No  Option Orientation : Vertical

If a complex number \[ z = \frac{\sqrt{3}}{2} + i \frac{1}{2} \], then \[ z^4 \] is __________.

Options:
1. \[ 2\sqrt{2} + 2i \]
2. \[ \frac{-1}{2} + i \frac{\sqrt{3}}{2} \]
3. \[ \frac{\sqrt{3}}{2} - i \frac{1}{2} \]
4. \[ \frac{\sqrt{3}}{8} - i \frac{1}{8} \]

Question Number : 17  Question Id : 8946584425  Question Type : MCQ  Option Shuffling : Yes  Display Question Number : Yes  Single Line Question Option : No  Option Orientation : Vertical

The equation of the straight line which makes intercepts \( r \) and \( s \) on the coordinate axes such that \( r + s = 5 \) and \( rs = 6 \) is \( ax + by + c = 0 \), then \( a + b + c = \) ______.

Options:
1. \[ 11 \]
2. \[ 5 \]
3. -7
4. -1

If a straight line $ax + by + \sqrt{5} = 0$ touches the circle $x^2 + y^2 = 5$, then which of the following is TRUE?
Options:
1. $5(a^2 + b^2) = 1$
2. $a^2 + b^2 = \sqrt{5}$
3. $a^2 + b^2 = 1$
4. $\sqrt{a^2 + b^2} = 5$

If a chord of length 12 cm is at a distance of $4\sqrt{10}$ cm from the centre of the circle, then the radius of the circle is _____.
Options:
1. 14 cm
2. $\sqrt{304}$ cm
3. 4 cm
4. $\sqrt{124}$ cm
The 2019th derivative of the function \((x-1)e^{-x}\) is \(\quad\)

Options:

1. \(\frac{x - 2019}{e^x}\)

2. \(\frac{2019 - x}{e^x}\)

3. \(\frac{x - 2020}{e^x}\)

4. \(\frac{2020 - x}{e^x}\)

If \(z = f(x + ct) + \varphi(x - ct)\), then \(\frac{\partial^2 z}{\partial t^2} = \quad\)

Options:

1. \(c^2 \frac{\partial^2 z}{\partial x^2}\)

2. \(-c^2 \frac{\partial^2 z}{\partial x^2}\)

3. \(\frac{1}{c^2} \frac{\partial^2 z}{\partial x^2}\)

4. \(-\frac{1}{c^2} \frac{\partial^2 z}{\partial x^2}\)
Question Number : 22  Question Id : 8946584430  Question Type : MCQ  Option Shuffling : Yes  Display Question Number : Yes  Single Line Question Option : No  Option Orientation : Vertical

If \( x = r \cos \theta \), \( y = r \sin \theta \) and \( U = \frac{f(\theta)}{r} \) then \( x \frac{\partial U}{\partial x} + y \frac{\partial U}{\partial y} = \) ________.

Options :
1. 0
2. \( U \)
3. \( -U \)
4. \( 2U \)

Question Number : 23  Question Id : 8946584431  Question Type : MCQ  Option Shuffling : Yes  Display Question Number : Yes  Single Line Question Option : No  Option Orientation : Vertical

Let \( f(x + y) = f(x)f(y) \), \( \forall x, y \) and \( f'(0) = 5 \), \( f(2019) = 15 \). Then the value of \( f'(2019) \) is ________.

Options :
1. 3
2. 75
3. \( \frac{1}{3} \)
4. \( \frac{1}{75} \)

Question Number : 24  Question Id : 8946584432  Question Type : MCQ  Option Shuffling : Yes  Display Question Number : Yes  Single Line Question Option : No  Option Orientation : Vertical

The set of values of \( x \) for which the function \( f(x) = 2x^3 - 9x^2 + 12x + 4 \) is increasing is ________.

Options :
1. \( 1 < x < 2 \)
all \( x \in \mathbb{R} \)

\[ \mathbb{R} - [1, 2] \]

\[ x \geq 2 \]

Question Number : 25  Question Id : 8946584433  Question Type : MCQ  Option Shuffling : Yes  Display Question Number : Yes  Single Line Question Option : No  Option Orientation : Vertical

\[ \lim_{x \to \infty} \left( \log \left( 1 + \frac{x}{2} \right) - \log \left( \frac{x}{2} \right) \right) = \ldots \]

Options :
1. \( e^2 \)
2. \( \infty \)
3. 1
4. 2

Question Number : 26  Question Id : 8946584434  Question Type : MCQ  Option Shuffling : Yes  Display Question Number : Yes  Single Line Question Option : No  Option Orientation : Vertical

If \( f(x, y, z) = x^3 + xz^2 + y^3 + xyz, \quad x = e^t, \quad y = \cos t, \quad z = t^3 \) then \( \frac{df}{dt} \) at \( t = 0 \) is \ldots

Options :
1. 2
2. 4
3. \( e \)
4. 3

Question Number : 27  Question Id : 8946584435  Question Type : MCQ  Option Shuffling : Yes  Display Question Number : Yes  Single Line Question Option : No  Option Orientation : Vertical
Which of the following is the value of \( 5050 \times \int_0^1 \frac{(1-(1-x)^{50})^{100} x^{49} dx}{\int_0^1 (1-x^{50})^{101} x^{49} dx} \)?

Options:

1. 5100
2. \( \frac{1}{2} \)
3. 5050
4. \( \frac{1}{2} \)

\[ \int_0^1 \max \left\{ x, \frac{1}{2} - x \right\} dx = \ldots. \]

Options:

1. 0
2. \( \frac{1}{2} \)
3. \( \frac{9}{16} \)
4. \( \frac{9}{8} \)

\[ \lim_{n \to \infty} \frac{1}{n^6} \sum_{k=1}^n k^5 = \ldots. \]

Options:
1. $\frac{1}{6}$

2. $\frac{1}{5}$

3. 1

4. 6

Question Number : 30  Question Id : 8946584438  Question Type : MCQ  Option Shuffling : Yes  Display Question Number : Yes  Single Line Question Option : No  Option Orientation : Vertical

\[ \int_{-1}^{1} \frac{x^{15} (1 - x^2)^{12}}{(1 + x^2)^8} \, dx = \text{______}. \]

Options :

1. 0

2. $\frac{22}{7} - \pi$

3. $\frac{2}{105}$

4. $\frac{71}{15} \frac{3\pi}{4}$

Question Number : 31  Question Id : 8946584439  Question Type : MCQ  Option Shuffling : Yes  Display Question Number : Yes  Single Line Question Option : No  Option Orientation : Vertical

The area of the region bounded by the curves $y = 2 - x^2$ and $y = -x$ is ______.

Options :

1. 1

2. $\frac{8}{19}$
3. \(\frac{35}{4}\)

4. \(\frac{27}{6}\)

Question Number : 32  Question Id : 8946584440  Question Type : MCQ  Option Shuffling : Yes  Display Question Number : Yes  Single Line Question Option : No  Option Orientation : Vertical

The volume of the solid obtained by revolving the region bounded by the curves \(y = x^3, y = 8\) and \(x = 0\) about the y-axis is ________

Options:
1. \(\frac{96}{5}\)
2. \(\frac{96\pi}{5}\)
3. \(\frac{32\pi}{5}\)
4. \(\frac{32}{5}\)

Question Number : 33  Question Id : 8946584441  Question Type : MCQ  Option Shuffling : Yes  Display Question Number : Yes  Single Line Question Option : No  Option Orientation : Vertical

The value of \(\int_0^\pi \sin^2 \theta \cos^4 \theta d\theta\) is ________.

Options:
1. \(\frac{\pi^2}{32}\)
2. \(\frac{\pi}{32}\)
3. \(\frac{\pi^3}{16}\)
4. \[
\frac{\pi}{16}
\]

Question Number : 34  Question Id : 8946584442  Question Type : MCQ  Option Shuffling : Yes  Display Question Number : Yes  Single Line Question Option : No  Option Orientation : Vertical  
The average value of the function \( f(x) = 4 - x^2 \) over the interval \([-1, 3]\) is _____.  
Options :
1. \( 5 \)
2. \( \frac{20}{3} \)
3. \( \frac{5}{3} \)
4. \( 1 \)

Question Number : 35  Question Id : 8946584443  Question Type : MCQ  Option Shuffling : Yes  Display Question Number : Yes  Single Line Question Option : No  Option Orientation : Vertical  
The differential equation \( x \frac{dy}{dx} = y + x^2, \quad x > 0 \) satisfying \( y(0) = 0 \) has _________.  
Options :
1. infinitely many solutions
2. no solution
3. a unique solution
4. exactly two solutions

Question Number : 36  Question Id : 8946584444  Question Type : MCQ  Option Shuffling : Yes  Display Question Number : Yes  Single Line Question Option : No  Option Orientation : Vertical  
The differential equation \( (a xy^3 + y \cos x) \, dx + (x^2y^2 + b \sin x) \, dy = 0 \) is an exact differential equation for _________.  
Options :
1. \[ a = 1, \ b = \frac{3}{2} \]

2. \[ a = \frac{3}{2}, \ b = 1 \]

3. \[ a = \frac{2}{3}, \ b = 1 \]

4. \[ a = 1, \ b = \frac{2}{3} \]

If \( \sin x \) is a solution of the differential equation \( \frac{d^4 y}{dx^4} + 2 \frac{d^3 y}{dx^3} + 6 \frac{d^2 y}{dx^2} + 2 \frac{dy}{dx} + 5y = 0 \),
then the general solution is ________________.

Options:

1. \( y = c_1 \sin x + c_2 \cos x + e^{-x}(c_3 \sin 2x + c_4 \cos 2x) \)

2. \( y = c_1 \sin x + c_2 \cos x + c_3 \sin 2x + c_4 \cos 2x \)

3. \( y = c_1 \sin x + c_2 \cos x + c_3 e^{-3x} + c_4 e^{-2x} \)

4. \( y = c_1 \sin x + c_2 \cos x + c_3 e^{3x} + c_4 e^{2x} \)

If \( D = \frac{d}{dx} \), then \( \frac{1}{D^2 - 4D + 13}(6e^{3x} \sin 3x) \) is ________________.

Options:

1. \( -xe^{3x} \cos 3x \)
2. $xe^{2x} \cos 3x$

3. $-xe^{2x} \sin 3x$

4. $xe^{2x} \sin 3x$

**Question Number : 39  Question Id : 8946584447  Question Type : MCQ  Option Shuffling : Yes  Display Question Number : Yes  Single Line Question Option : No  Option Orientation : Vertical**

The general solution of \( \left( \frac{e^{-2\sqrt{x}}}{\sqrt{x}} - \frac{y}{\sqrt{x}} \right) \frac{dx}{dy} = 1 \) is ________.

Options:
1. \( y = e^{2\sqrt{x}} (2\sqrt{x} + c) \)
2. \( y = 2\sqrt{x} e^{2\sqrt{x}} + c \)
3. \( y = 2\sqrt{x} e^{-2\sqrt{x}} + c \)
4. \( y = e^{-2\sqrt{x}} (2\sqrt{x} + c) \)

**Question Number : 40  Question Id : 8946584448  Question Type : MCQ  Option Shuffling : Yes  Display Question Number : Yes  Single Line Question Option : No  Option Orientation : Vertical**

Let \( y \) be the solution of the differential equation \( \frac{dy}{dx} + y = x, \ x \in \mathbb{R} \) and \( y(-1) = 0 \).

Then, \( y(1) \) is equal to ________.

Options:
1. \( \frac{2}{e} - \frac{2}{e^2} \)
2. \( 2e^{-2} \)
3. \[ 2 - \frac{2}{e} \]

4. \[ 2 - 2e \]

Question Number : 41  Question Id : 8946584449  Question Type : MCQ  Option Shuffling : Yes  Display Question Number : Yes  Single Line Question Option : No  Option Orientation : Vertical

If the substitution \( x = X + h, \ y = Y + k \) transforms the differential equation \((y - x + 1)dy - (y + x + 2)dx = 0\) into a homogeneous equation, then the value of \((h, k)\) is \[ \_ \_ \_ \_ \_ \_ \_ \_ \_ \_ \_ . \]

Options :

1. \[ \left( \frac{1}{2}, \frac{3}{2} \right) \]

2. \[ \left( -\frac{1}{2}, -\frac{3}{2} \right) \]

3. \[ \left( \frac{3}{2}, -\frac{1}{2} \right) \]

4. \[ \left( -\frac{3}{2}, \frac{1}{2} \right) \]

Question Number : 42  Question Id : 8946584450  Question Type : MCQ  Option Shuffling : Yes  Display Question Number : Yes  Single Line Question Option : No  Option Orientation : Vertical

The general solution of \[ \frac{dy}{dx} - y = y^2 (\sin x + \cos x) \] is \[ \_ \_ \_ \_ \_ \_ \_ \_ \_ \_ \_ . \]

Options :

1. \[ y = \frac{1}{ce^x - \sin x} \]

2. \[ y = ce^{-x} - e^x \sin x \]
3. \[ y = ce^{-x} - \sin x \]

4. \[ y = \frac{1}{ce^{-x} - \sin x} \]

**Question Number : 43  Question Id : 8946584451  Question Type : MCQ  Option Shuffling : Yes  Display Question Number : Yes Single Line Question Option : No  Option Orientation : Vertical**

The Laplace transform of the function \( f(t) = \begin{cases} \sin t, & \text{for } 0 \leq t \leq \pi \\ 0, & \text{for } t > \pi \end{cases} \)

is ________________.

Options:

1. \[ \frac{1}{1 + s^2} \text{ for all } s > 0 \]

2. \[ \frac{1}{1 + s^2} \text{ for all } s < \pi \]

3. \[ \frac{1 + e^{-\pi s}}{1 + s^2} \text{ for all } s > 0 \]

4. \[ \frac{e^{-\pi s}}{1 + s^2} \text{ for all } s > 0 \]

**Question Number : 44  Question Id : 8946584452  Question Type : MCQ  Option Shuffling : Yes  Display Question Number : Yes Single Line Question Option : No  Option Orientation : Vertical**

The inverse Laplace transform of \( \frac{5}{s} - \frac{3e^{-3s}}{s} - \frac{2e^{-7s}}{s} \) is ________________.

Options:

\[
 f(x) = \begin{cases} 
 5, & 0 < x < 3 \\
 0, & 3 < x < 7 \\
 2, & x > 7 
\end{cases}
\]
2. \( f(x) = \begin{cases} 5, & 0 < x < 7 \\ 2, & x > 7 \end{cases} \)

3. \( f(x) = \begin{cases} 5, & 3 < x < 7 \\ 0, & x > 7 \end{cases} \)

4. \( f(x) = \begin{cases} 5, & 0 < x < 7 \\ 0, & x > 7 \end{cases} \)

Question Number : 45  Question Id : 8946584453  Question Type : MCQ  Option Shuffling : Yes  Display Question Number : Yes  Single Line Question Option : No  Option Orientation : Vertical

The Laplace transform of a function \( f(x) \) is \( F(s) = \frac{1}{s^3 + 2s^2 + 2s} \). Then, \( \lim_{x \to 0} f(x) = \) ________

Options :
1. 0
2. 3
3. \( \infty \)
4. \( \frac{1}{2} \)

Question Number : 46  Question Id : 8946584454  Question Type : MCQ  Option Shuffling : Yes  Display Question Number : Yes  Single Line Question Option : No  Option Orientation : Vertical

The Laplace transform of the solution of the differential equation \( \frac{dy}{dx} - 2y = e^{5x} \) with the initial condition \( y(0) = 3 \) is ________.

Options :
1. \( \frac{1}{3(s-2)} + \frac{1}{3(s-5)} \)

2. \( \frac{8}{3(s-2)} + \frac{1}{s-5} \)

3. \( \frac{8}{3(s-2)} + \frac{1}{3(s-5)} \)

4. \( \frac{8}{s-2} + \frac{1}{3(s-5)} \)

Question Number : 47  Question Id : 8946584455  Question Type : MCQ  Option Shuffling : Yes  Display Question Number : Yes  Single Line Question Option : No  Option Orientation : Vertical

If \( L(y(x)) = Y(s) \) and \( y(x) = x^3 + \int_0^x \sin(x-t)y(t)dt \) then \( \frac{1}{6}Y(s) = \) _______.

Options :

1. \( \left( \frac{1}{s^4} + \frac{1}{s^6} \right) \)

2. \( \left( \frac{1}{s^3} + \frac{1}{s^5} \right) \)

3. \( \left( \frac{1}{s^3} + \frac{1}{s^7} \right) \)

4. \( \left( \frac{1}{s} + \frac{1}{s^3} \right) \)

Question Number : 48  Question Id : 8946584456  Question Type : MCQ  Option Shuffling : Yes  Display Question Number : Yes  Single Line Question Option : No  Option Orientation : Vertical

For \( x > 0 \), \( \int_0^\infty \frac{\sin xt}{t} dt \) is _______.

Options :
1. \frac{\pi}{2x}

2. \frac{1}{x}

3. \frac{\pi}{2}

4. \frac{\pi}{6}

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**Question 49**

**Question Type:** MCQ  
**Option Shuffling:** Yes  
**Display Question Number:** Yes  
**Single Line Question Option:** No  
**Option Orientation:** Vertical

If \( f(x) = \frac{1}{2}a_0 + \sum_{n=1}^{\infty} (a_n \cos nx + b_n \sin nx) \) is the Fourier series of the function

\[
f(x) = \begin{cases} 
0, & \text{if } -\pi < x < 0 \\
\pi, & \text{if } 0 \leq x \leq \pi
\end{cases}
\]

then, which of the following is TRUE?

**Options:**

1. \( a_n = 0, \text{ for all } n \geq 0 \)

2. \( a_0 = \frac{\pi}{2} \) and \( a_n = 0, \text{ for all } n \geq 1 \)

3. \( b_n \neq 0, \text{ for all } n \geq 1 \)

4. \( a_0 = \pi \) and \( a_n = 0, \text{ for all } n \geq 1 \)

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**Question 50**

**Question Type:** MCQ  
**Option Shuffling:** Yes  
**Display Question Number:** Yes  
**Single Line Question Option:** No  
**Option Orientation:** Vertical

A function \( f(x) \) is such that \( f(x + 2\pi) = f(x) \) and \( f(x) = x, -\pi \leq x \leq \pi \). The Fourier series of \( f(x) \) is ____________.

**Options:**
\[2(\sin x - \frac{1}{2}\sin 2x + \frac{1}{3}\sin 3x - \ldots)\]

2.
\[2(\sin x + \frac{1}{2}\sin 2x + \frac{1}{3}\sin 3x + \ldots)\]

3.
\[2(\cos x - \frac{1}{2}\cos 2x + \frac{1}{3}\cos 3x - \ldots)\]

4.
\[2(\cos x + \frac{1}{2}\cos 2x + \frac{1}{3}\cos 3x + \ldots)\]

The dimensional formula for gravitational constant is ______.

Options:
1. \(L^3T^{-2}M^{-1}\)
2. \(L^3T^2M^{-1}\)
3. \(L^2T^3M^{-2}\)
4. \(L^3T^1M^{-3}\)

The dimensions of the quantities in one of the following pairs are same. Identify the pairs.

Options:
1. torque and work
2. angular momentum and work
3. energy and Young’s modules
4. light year and wavelength

Question Number : 53  Question Id : 8946584461  Question Type : MCQ  Option Shuffling : Yes  Display Question Number : Yes
Single Line Question Option : No  Option Orientation : Vertical

Which of the following is not correct?
Options :

1. \( j \times i = -k \)
2. \( k \times j = -i \)
3. \( i \times k = -j \)
4. \( k \times i = -j \)

Question Number : 54  Question Id : 8946584462  Question Type : MCQ  Option Shuffling : Yes  Display Question Number : Yes
Single Line Question Option : No  Option Orientation : Vertical

If \( 0.5 \mathbf{i} + 0.8 \mathbf{j} + c \mathbf{k} \) is a unit vector then \( c \) is______.
Options :

1. \( \sqrt{0.89} \)
2. 0.2
3. 0.3
4. \( \sqrt{0.11} \)

Question Number : 55  Question Id : 8946584463  Question Type : MCQ  Option Shuffling : Yes  Display Question Number : Yes
Single Line Question Option : No  Option Orientation : Vertical
Which of the following is correct?

Options:

1. \(A.B \neq B.A\)

2. \(A.(B+C) = A.B + C.A\)

3. \(A.B = A.B - A.C\)

4. \(A.B = -B.A\)

The acceleration due to gravity on the surface of the earth is given by______

Options:

1. \(G\)

2. \(GM/R^2\)

3. \(GM/R\)

4. \(GM\)

The value of \(g\) is maximum at______.

Options:

1. equator

2. Pole

3. higher altitudes
at the centre of the earth

4.

Question Number : 58  Question Id : 8946584466  Question Type : MCQ  Option Shuffling : Yes  Display Question Number : Yes  Single Line Question Option : No  Option Orientation : Vertical

When the speed of rotation of earth increases your weight

Options :

1. increases

2. decreases

   remains constant

3.

4. becomes zero

Question Number : 59  Question Id : 8946584467  Question Type : MCQ  Option Shuffling : Yes  Display Question Number : Yes  Single Line Question Option : No  Option Orientation : Vertical

The value of G is zero at

Options :

1. nowhere

2. the centre of the earth

3. surface of the earth

4. pole

Question Number : 60  Question Id : 8946584468  Question Type : MCQ  Option Shuffling : Yes  Display Question Number : Yes  Single Line Question Option : No  Option Orientation : Vertical

If the linear momentum is increased by 50%, the kinetic energy will be increased

by

Options :

1. 50%
2. 100%
3. 125%
4. 25%

Question Number : 61  Question Id : 8946584469  Question Type : MCQ  Option Shuffling : Yes  Display Question Number : Yes  Single Line Question Option : No  Option Orientation : Vertical
A metallic block slides down a smooth inclined plane when released from the top, while the other falls freely from the same point, then ______

Options :
1. both will reach the ground with the same velocity
2. both will reach the ground together
3. both will reach the ground travelling with same acceleration
4. the block sliding down the plane will strike earlier

Question Number : 62  Question Id : 8946584470  Question Type : MCQ  Option Shuffling : Yes  Display Question Number : Yes  Single Line Question Option : No  Option Orientation : Vertical
A long spring is stretched by 2 cm and its potential energy is u. If the spring is stretched by 10 cm, then the potential energy stored in it will be ______.

Options :
1. u/24
2. u/5
3. 5u
4. 25u
Two masses of 1 gm and 4 gm are moving with equal kinetic energies. The ratio of the magnitudes of their linear momentum is ________

Options:
1. 4:1
2. $\sqrt{2}:1$
3. 1:2
4. 1:16

A body is dropped from rest at height 0.5 m. What will be its velocity when it just strikes the ground?

Options:
1. 7 m/s
2. 9.8 m/s
3. 4.9 m/s
4. $\sqrt{9.8}$ m/s

A particle moves such that its acceleration $a$ is given by $a = -bx$ where $x$ is the displacement from equilibrium and $b$ is a constant. The period of oscillation is ________.

Options:
1. $2\Pi b$
2. $2\pi\sqrt{b}$

3. $2\pi/b$

4. $2\sqrt{\pi}/b$

Question Number : 66  Question Id : 8946584474  Question Type : MCQ  Option Shuffling : Yes  Display Question Number : Yes  Single Line Question Option : No  Option Orientation : Vertical

A particle is vibrating in simple harmonic motion with amplitude of 4 cm. At what displacement from the equilibrium position is its energy half potential and half kinetic?

Options :
1. 1 cm

2. $\sqrt{2}$ cm

3. 2 cm

4. $2\sqrt{2}$ cm

Question Number : 67  Question Id : 8946584475  Question Type : MCQ  Option Shuffling : Yes  Display Question Number : Yes  Single Line Question Option : No  Option Orientation : Vertical

When a star approaches the earth, the waves are shifted towards ________

Options :
1. green colour

2. yellow colour

3. blue end

4. red end

Question Number : 68  Question Id : 8946584476  Question Type : MCQ  Option Shuffling : Yes  Display Question Number : Yes  Single Line Question Option : No  Option Orientation : Vertical
If a tuning fork of frequency 90 is sounded and moved towards an observer with a velocity equal to one tenth the velocity of sound, then the note heard by the observer will have frequency______.

Options:
1. 100
2. 90
3. 80
4. 900

What is the most important factor which helps to recognise a person by his/her voice alone______

Options:
1. quality
2. pitch
3. intensity
4. quality, pitch and intensity

The quality of tone______

Options:
1. decreases with loudness
2. varies inversely as amplitude
3. varies directly as pitch

4. depends on the overtones present

The conduction of heat from hot body to cold body is an example of___________.

Options:
1. reversible process

2. irreversible process

3. isothermal process

4. isobaric process

From the isothermal drawn from Andrews experiment, it can be inferred that_______

Options:
1. CO$_2$ is a perfect gas

2. there is continuity of state

3. there is discontinuity of state

4. gases like CO$_2$ and H$_2$ cannot be liquefied

A diesel cycle works at_______

Options:
1. constant volume
2. constant pressure
3. constant temperature
4. both constant volume and constant temperature

The transition temperature of most low temperature superconducting elements is in the range of ________

Options:
1. zero to 10 k
2. 10 k to 20 k
3. 20 k to 50 k
4. 50 k alone

Propagation of light through fiber core is due to ________

Options:
1. diffraction
2. interference
3. total internal reflection
4. reflection
Question Number : 76  Question Id : 8946584484  Question Type : MCQ  Option Shuffling : Yes  Display Question Number : Yes  Single Line Question Option : No  Option Orientation : Vertical

Which of the following energy orders is correct?

Options :
1. \(6s < 4f < 5d < 6p\)
2. \(4f < 5d < 6s < 6p\)
3. \(4f < 6s < 6p < 5d\)
4. \(6s < 6p < 5d < 4f\)

Question Number : 77  Question Id : 8946584485  Question Type : MCQ  Option Shuffling : Yes  Display Question Number : Yes  Single Line Question Option : No  Option Orientation : Vertical

An element A of atomic number 11 combines with an element B of atomic number 17. The compound formed is ____________.

Options :
1. Covalent AB
2. Ionic AB
3. Covalent AB\(_2\)
4. Ionic AB\(_2\)

Question Number : 78  Question Id : 8946584486  Question Type : MCQ  Option Shuffling : Yes  Display Question Number : Yes  Single Line Question Option : No  Option Orientation : Vertical

The oxidation number of ‘S’ in \(S_8\), \(S_2F_2\), \(H_2S\) respectively are ____________.

Options :
1. 0, +1 and -2
2. +2, +1 and -2

3. 0, +1 and +2

4. -2, +1 and -2

The elements A, B, C and D have the following electronic configurations:

A: 1S², 2S², 2P¹

B: 1S², 2S², 2P⁶, 3S², 3P¹

C: 1S², 2S², 2P⁶, 3S², 3P³

D: 1S², 2S², 2P⁶, 3S², 3P⁵

The elements that belong to same group are ________.

Options:
1. A and C

2. C and D

3. A and D

4. A and B

4.9 gm of H₂SO₄ is present in 2 lit of its solution. The molarity of the solution is ________.

Options:
1. 0.1 M
2. 0.025 M
3. 0.25 M
4. 0.01 M

The molecular weight of H₃PO₄ is 98. The equivalent weight is ________ gram / equivalents.

Options:
1. 98
2. 49
3. 32.66
4. 24.5

Which of the following is the Bronsted acid?

Options:
1. Cl⁻
2. NH₂⁻
3. CH₃COO⁻
4. NH₄⁺
Question Number : 83  Question Id : 8946584491  Question Type : MCQ  Option Shuffling : Yes  Display Question Number : Yes  Single Line Question Option : No  Option Orientation : Vertical

The pH of 1 M KOH is _____.

Options :
1. 12
2. 11
3. 14
4. 13

Question Number : 84  Question Id : 8946584492  Question Type : MCQ  Option Shuffling : Yes  Display Question Number : Yes  Single Line Question Option : No  Option Orientation : Vertical

Froth floatation process is used for the ____________.

Options :
1. Oxide ores
2. Sulphide ores
3. Chloride ores
4. Oxide ores and Chloride ores

Question Number : 85  Question Id : 8946584493  Question Type : MCQ  Option Shuffling : Yes  Display Question Number : Yes  Single Line Question Option : No  Option Orientation : Vertical

The composition of brass is ____________.

Options :
1. Cu and Zn
2. Cu and Ni
3. Cu and Mn
4. Cu and Fe

Which of the following statements is correct?

Options:
1. Cathode is positive terminal in an electrolytic cell
2. Cathode is negative terminal in a galvanic cell
3. Reduction occurs at cathode in either of cells
4. Oxidation occurs at cathode in either of cells

In the electrolysis of CuCl₂ solution using copper electrode, if 2.5 gm of Cu is deposited at cathode, then at anode ________________.

Options:
1. 890 mL of Cl₂ at STP is liberated
2. 445 mL of O₂ at STP is liberated
3. 2.5 gm of copper is deposited
4. a decrease of 2.5 gm of mass takes place

The unit of resistivity is ________.

Options:
1. Ω
2. \( \Omega \text{ m} \)

3. \( \Omega /\text{m} \)

4. \( \Omega \text{ m}^2 \)

Question Number: 89  Question Id: 8946584497  Question Type: MCQ  Option Shuffling: Yes  Display Question Number: Yes  Single Line Question Option: No  Option Orientation: Vertical

Which of the following metals provide cathodic protection to iron?

Options:

1. Cu and Ni
2. Al and Zn
3. Al and Cu
4. Co and Ni

Question Number: 90  Question Id: 8946584498  Question Type: MCQ  Option Shuffling: Yes  Display Question Number: Yes  Single Line Question Option: No  Option Orientation: Vertical

The chemical composition of rust is ________.

Options:

1. \( \text{Fe}_3\text{O}_4 \)
2. \( \text{Fe}_3\text{O}_3 \)
3. \( \text{Fe}_2\text{O}_3, n\text{H}_2\text{O} \)
4. \( \text{Fe}_3\text{O}_3, x\text{H}_2\text{O} \)

Question Number: 91  Question Id: 8946584499  Question Type: MCQ  Option Shuffling: Yes  Display Question Number: Yes  Single Line Question Option: No  Option Orientation: Vertical

1 ppm of hardness of water is equal to ____________________.

Options:
1. 1 part of CaCO₃ hardness in 10⁶ parts of water

2. 1 part of CaCO₃ hardness in 10⁸ parts of water

3. 1 part of CaCO₃ hardness in 10⁷ parts of water

4. 1 part of CaCO₃ hardness in 10⁵ parts of water

The temporary hardness of water is due to the presence of ____________.

Options:
1. MgCl₂ and CaCl₂

2. Ca(NO₃)₂ and Mg(NO₃)₂

3. CaSO₄ and MgSO₄

4. Ca(HCO₃)₂ and Mg(HCO₃)₂

The basic buffer solution is a mixture of ____________.

Options:
1. NH₃ + NH₄Cl

2. HCl + NH₄Cl

3. NaCl + NH₄Cl

4. KOH + NH₄Cl
Which of the following polymers has amide linkage?

Options:

1. Terylene
2. Bakelite
3. Nylon
4. PVC

The monomer of natural rubber is ____________.

Options:

1. Butadiene
2. Chloroprene
3. 2-methyl 1,2 butadiene
4. 2-methyl 1,3 butadiene

Which of the following is a thermo setting?

Options:

1. Bakelite
2. Polyethylene
3. Nylon-6
4. Natural rubber
The composition of water gas is ____________________.

Options:
1. CO and H₂ are combustible gases and CO₂ and N₂ are non-combustible gases
2. CO + CO₂ are combustible gases and H₂O and N₂ non-combustible gases
3. CO + N₂ are combustible gases and H₂O and H₂ are non-combustible gases
4. N₂ + H₂ are combustible gases and CO + H₂O are non-combustible gases

Earth is protected from UV radiation by ________________.

Options:
1. Nitrogen layer
2. Ozone layer
3. Carbon dioxide layer
4. Oxygen layer

Which of the following statements is not correct?

Options:
1. CO is the main air pollutant
2. All pollutants are not wastes
3. Water is polluted by dissolved Oxygen
Lichens are pollution indicators

Minamata disease is caused due to the presence of ____________.

Options:
1. Cd
2. Pb
3. As
4. Hg

Which of the following minerals of metal is adequately available in India?

Options:
1. Aluminium
2. Copper
3. Graphite
4. Uranium
The method is one of the principal mineral exploration methods.

Options:
1. Radioactive
2. Seismic
3. Magnetic
4. Gravitational

Match the list in Group A with Group B and find the correct answer.

**Group A**
- a. Collector
- b. Regulator
- c. Activator
- d. Frother

**Group B**
- I. Pine oil
- II. Copper sulphate
- III. Sodium ethyl xanthate
- IV. Lime

Options:
1. a-II, b-III, c-IV, d-I
2. a-IV, b-II, c-III, d-I
3. a-III, b-IV, c-II, d-I
4. a-I, b-III, c-II, d-IV
Match the metals listed in Group A with the corresponding ores given in Group B and find the correct answer.

**Group A**

a. Lead  
b. Zinc  
c. Uranium  
d. Niobium

**Group B**

I. Columbite  
II. Cassiterite  
III. Galena  
IV. Pitchblende  
V. Sphalerite

**Options:**

1. a-III, b-V, c-II, d-IV  
2. a-III, b-II, c-V, d-IV  
3. a-III, b-V, c-IV, d-I  
4. a-III, b-IV, c-V, d-II

---

**Question Number : 105**  
**Question Id : 8946584513**  
**Question Type : MCQ**  
**Option Shuffling : Yes**  
**Display Question Number : Yes**  
**Single Line Question Option : No**  
**Option Orientation : Vertical**

...metallurgical extraction methods are advantageous for lean and complex ores.

**Options :**

1. Pyro  
2. Electro  
3. Powder  
4. Hydro

---

**Question Number : 106**  
**Question Id : 8946584514**  
**Question Type : MCQ**  
**Option Shuffling : Yes**  
**Display Question Number : Yes**  
**Single Line Question Option : No**  
**Option Orientation : Vertical**
Match the extraction methods listed in Group A with the metals given in Group B and find the correct answer.

### Group A

- a. Roasting followed by carbothermic reduction
- b. Electrolysis of fused salt
- c. Roasting followed by controlled oxidation
- d. Halide process

### Group B

- I. Ti
- II. Pb
- III. Al
- IV. Cu
- V. Au

Options:

1. a-II, b-III, c-IV, d-I
2. a-V, b-IV, c-III, d-I
3. a-II, b-V, c-I, d-IV
4. a-III, b-II, c-V, d-I

---

**Cyclones are primarily used for _____________**

Options:

1. Comminution
2. Dewatering
3. Concentration
4. Classification

---

**Chalcopyrite is an ore of _____________.**

Options:
1. Iron
2. Zinc
3. Copper
4. Titanium

Question Number : 109  Question Id : 8946584517  Question Type : MCQ  Option Shuffling : Yes  Display Question Number : Yes  Single Line Question Option : No  Option Orientation : Vertical
Heating of coal in absence of air at high temperature is called as ____________
Options:
1. Gasification
2. Coalification
3. Run-of-mine
4. Carbonization

Question Number : 110  Question Id : 8946584518  Question Type : MCQ  Option Shuffling : Yes  Display Question Number : Yes  Single Line Question Option : No  Option Orientation : Vertical
Which of the following fuels has high calorific value?
Options:
1. Carbureted water gas
2. Water gas
3. Producer gas
4. Blast furnace gas

Question Number : 111  Question Id : 8946584519  Question Type : MCQ  Option Shuffling : Yes  Display Question Number : Yes  Single Line Question Option : No  Option Orientation : Vertical
Match Group A with Group B and find the correct answer

**Group A**

a. Dulong formula  
b. Carbon  
c. Dwight-Lloyd machine  
d. Radiation

**Group B**

I. Ultimate analysis  
II. Gray body  
III. Sintering  
IV. Refractory

Options:
1. a-I, b-II, c-III, d-IV  
2. a-II, b-IV, c-III, d-I  
3. a-I, b-IV, c-III, d-II  
4. a-III, b-I, c-IV, d-II

An example for basic refractory is ____________

Options:
1. Quartz  
2. Dolomite  
3. Silica  
4. Fire clay

Fire clay refractory contains ____________

Options:
1. $\text{Al}_2\text{O}_3$
2. SiO₂
3. Al₂O₃ and SiO₂
4. MgO

Question Number : 114  Question Id : 8946584522  Question Type : MCQ  Option Shuffling : Yes  Display Question Number : Yes  Single Line Question Option : No  Option Orientation : Vertical
For blast furnace hearth walls_________ refractories are used.
Options :
1. Silica
2. Carbon
3. Magnesite
4. SiC

Question Number : 115  Question Id : 8946584523  Question Type : MCQ  Option Shuffling : Yes  Display Question Number : Yes  Single Line Question Option : No  Option Orientation : Vertical
Which thermocouple of the following is used for temperature measurement of 1100 °C in a furnace?
Options :
1. Chromel-Alumel
2. Copper-Constantan
3. Iron-Constantan
4. Chromel-Constantan

Question Number : 116  Question Id : 8946584524  Question Type : MCQ  Option Shuffling : Yes  Display Question Number : Yes  Single Line Question Option : No  Option Orientation : Vertical
IR pyrometers are very advantageous to measure the temperatures of ________ and above.
Options :
1. 150 °C
2. -200 °C
3. 450 °C
4. 1300 °C

Match the properties given in Group A with the units given in Group B and find the correct answer.

**Group A**

- a. Thermal conductivity
- b. Heat transfer coefficient
- c. Specific heat
- d. Diffusivity

**Group B**

- I. J/m² -s-K
- II. J/m -s-K
- III. m²/s
- IV. J/mol-K

Options:

1. a-I, b-II, c-IV, d-III
2. a-II, b-III, c-I, d-IV
3. a-II, b-I, c-IV, d-III
4. a-II, b-IV, c-III, d-I

Critical value of the Gibb’s energy of nucleation at equilibrium temperature is ________.

Options:

1. Infinite
2. Zero
3. Positive

4. Negative

Question Number : 119  Question Id : 8946584527  Question Type : MCQ  Option Shuffling : Yes  Display Question Number : Yes  Single Line Question Option : No  Option Orientation : Vertical

Which of the following can give information about the corrosion rate?

Options :
1. Ellingham diagram
2. Pourbaix diagram
3. Tafel extrapolation
4. EMF series

Question Number : 120  Question Id : 8946584528  Question Type : MCQ  Option Shuffling : Yes  Display Question Number : Yes  Single Line Question Option : No  Option Orientation : Vertical

Which of the following metals cannot be electroplated from aqueous electrolyte?

Options :
1. Al
2. Cu
3. Ni
4. Zn

Question Number : 121  Question Id : 8946584529  Question Type : MCQ  Option Shuffling : Yes  Display Question Number : Yes  Single Line Question Option : No  Option Orientation : Vertical

Which of the following partial derivatives is equal to \( \left( \frac{\partial S}{\partial V} \right)_T \)?

Options :
\[-\left( \frac{\partial S}{\partial V} \right)_T\]
1.
2. \(- \left( \frac{\partial V}{\partial T} \right)_P \)

3. \(\left( \frac{\partial S}{\partial V} \right)_P \)

4. \(- \left( \frac{\partial V}{\partial T} \right)_S \)

Question Number: 122  Question Id: 8946584530  Question Type: MCQ  Option Shuffling: Yes  Display Question Number: Yes  Single Line Question Option: No  Option Orientation: Vertical

One mole of element P is mixed with one mole of element Q. The entropy of mixing at 0 Kelvin temperature is ____________

Options:
1. \(- R \ln 0.5 \)
2. Infinity
3. Zero
4. \(- R \ln 2 \)

Question Number: 123  Question Id: 8946584531  Question Type: MCQ  Option Shuffling: Yes  Display Question Number: Yes  Single Line Question Option: No  Option Orientation: Vertical

In Ellingham diagram, the slope of the line represent is ____________

Options:
1. \(- \Delta S^\circ \)
2. \(- \Delta H^\circ \)
3. \(\Delta S^\circ \)
4. \(\Delta H^\circ \)
During the paramagnetic to ferromagnetic transition of iron, which property does abruptly change?

Options:
1. Entropy
2. Enthalpy
3. Heat capacity
4. Free energy

Driving force for grain growth after completion of recrystallization is ____________.

Options:
1. Grain boundary energy
2. Dislocation density
3. Vacancy concentration
4. Stored energy

Match the list in Group A with Group B and find the correct answer

<table>
<thead>
<tr>
<th>Group A</th>
<th>Group B</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. Iron-silicon alloy</td>
<td>I. Heating element</td>
</tr>
<tr>
<td>b. Ga, As</td>
<td>II. Ultrasonic generator</td>
</tr>
<tr>
<td>c. Nichrome</td>
<td>III. Transformer core</td>
</tr>
<tr>
<td>d. Quartz crystals</td>
<td>IV. Light emitting diode</td>
</tr>
</tbody>
</table>

Options:
The Miller indices of the common direction to (111) and (110) planes for a cubic system is ________

Options:
1. \([\overline{1}10]\)
2. \([110]\)
3. \([101]\)
4. \([111]\)

In continuous cooling of eutectoid steel, which phase of the following does not form?

Options:
1. Fully bainitic
2. Fully Pearlitic
3. Pearlitic and bainitic
4. Martensitic
Match the alloy names listed in Group A with the main elements present in them listed in Group B and find the correct answer

**Group A**
- a. Babbit
- b. Muntz metal
- c. Invar
- d. Inconel

**Group B**
- I. Fe-Ni
- II. Ni-Cr-Fe
- III. Cu-Zn
- IV. Sn-Sb-Cu

Options:
1. a-III, b-I, c-IV, d-II
2. a-III, b-IV, c-I, d-II
3. a-IV, b-I, c-II, d-III
4. a-IV, b-III, c-I, d-II

Question Number: 130  Question Id: 8946584538  Question Type: MCQ  Option Shuffling: Yes  Display Question Number: Yes  Single Line Question Option: No  Option Orientation: Vertical

In heterogeneous nucleation, the critical radius of the nucleus does not depend on

__________.

Options:
1. Under cooling
2. Enthalpy change of product
3. Surface energy
4. Contact angle

Question Number: 131  Question Id: 8946584539  Question Type: MCQ  Option Shuffling: Yes  Display Question Number: Yes  Single Line Question Option: No  Option Orientation: Vertical

For which of the following, the complete solid solubility is possible for the alloy system?
The self-diffusion in FCC metals occurs by one of the following mechanisms.

Options:
1.Interstitial
2. Substitutional
3. Interstitialcy
4. Vacancy

The eutectic reaction in a binary system is represented by

Options:
1. Liquid = Solid1 + Solid2
2. Liquid + Solid1 = Solid2
3. Solid = Solid1 + Solid2
4. Liquid1 + Liquid2 = Solid

For which unit cell of a crystal, \( a = b \neq c \) and \( \alpha = \beta = \gamma = 90^\circ \)?

Options:
1. Cubic
2. Rhombohedral
3. Tetragonal
4. Orthorhombic

Nitriding is carried out in the region of ____________
Options:
1. Ferrite
2. Ferrite and austenite
3. Austenite
4. Liquid

Normalizing is carried out to obtain ____________ steels.
Options:
1. Soft
2. Brittle
3. Strong
4. Coarse grained
Match the list in Group A with Group B and find the correct answer

Group A
- a. Quenching
- b. Maraging
- c. Tempering
- d. Austempering

Group B
- I. Bainite
- II. Martensite
- III. Intermetallic precipitates
- IV. Epsilon carbide

Options:
1. a-II, b-III, c-I, d-IV
2. a-I, b-III, c-II, d-IV
3. a-II, b-III, c-IV, d-I
4. a-III, b-II, c-I, d-IV

Which coolant of the following is used in laser surface hardening?

Options:
1. Water medium
2. Oil medium
3. Air medium
4. No medium

For wire drawing of medium carbon steels, _________ heat treatment is adopted.

Options:
1. Quenching
2. Austempering

3. Quenching and tempering

4. Patenting

---

**Question Number : 140  Question Id : 8946584548  Question Type : MCQ  Option Shuffling : Yes  Display Question Number : Yes  Single Line Question Option : No  Option Orientation : Vertical**

Age-hardenable or precipitation hardenable alloys can be used ________________

**Options:**
1. Below ageing temperature
2. Above ageing temperature
3. At solutionizing temperature
4. Upto melting point

---

**Question Number : 141  Question Id : 8946584549  Question Type : MCQ  Option Shuffling : Yes  Display Question Number : Yes  Single Line Question Option : No  Option Orientation : Vertical**

Which of the following heat treatments is given to overcome stress corrosion cracking of brass?

**Options:**
1. Tempering
2. Thermo-mechanical treatment
3. Annealing
4. Normalizing

---

**Question Number : 142  Question Id : 8946584550  Question Type : MCQ  Option Shuffling : Yes  Display Question Number : Yes  Single Line Question Option : No  Option Orientation : Vertical**

Decarburization can be avoided in high speed steels by ________________.

**Options:**
1. Single stage heating
Two stage heating

Single stage quenching

Two stage quenching

Which of the following stainless steels cannot be heat treated?

Options:
1. Ferritic
2. Austenitic
3. Martensitic
4. Precipitation-hardened

Temper brittleness occurs during tempering in the range of __________

Options:
1. 350-550 °C
2. 150-250 °C
3. 0-150 °C
4. Sub-zero temperature
Match the facilities in a steel plant listed in Group A with the associated terms in Group B and find the correct answer.

**Group A**

a. Electric arc furnace  
b. LD convertor  
c. Continuous caster  
d. Blast furnace

**Group B**

I. High top pressure  
II. Dummy bar  
III. Slag splashing  
IV. Eccentric bottom tapping

Options:

1. a-IV, b-I, c-II, d-III  
2. a-II, b-IV, c-I, d-III  
3. a-IV, b-III, c-II, d-I  
4. a-I, b-III, c-II, d-IV

---

**Question Number : 146  Question Id : 8946584554  Question Type : MCQ  Option Shuffling : Yes  Display Question Number : Yes  Single Line Question Option : No  Option Orientation : Vertical**

Blast furnace is a ________________

Options:

1. Counter-current reactor  
2. Co-current reactor  
3. Cross-current reactor  
4. No-current reactor

---

**Question Number : 147  Question Id : 8946584555  Question Type : MCQ  Option Shuffling : Yes  Display Question Number : Yes  Single Line Question Option : No  Option Orientation : Vertical**

The driving force for sintering of a powder compact is ________________

Options:

1. Volume energy
2. Strain energy

3. Stacking fault energy

4. Surface energy

In continuous casting of liquid steel, the mould is made of ____________

Options:
1. Refractory oxide
2. Silicon carbide
3. Water cooled copper
4. Water cooled steel

For efficient performance of blast furnace, the extent of reduction of Wustite should be ______

Options:
1. 50-60% indirect reduction
2. 100% indirect reduction
3. 100% direct reduction
4. 50-60% direct reduction

In the acid Bessemer steel process, the hot metal should have the following composition (Where S is Sulphur and P is Phosphorus)

Options:
1. $S < 0.05\%$ and $P < 1.5\%$

2. $S < 0.05\%$ and $P < 0.05\%$

3. $S < 0.05\%$ and $P > 1.5\%$

4. $S > 1.5\%$ and $P < 0.05\%$

Pellets are not as popular in burden as sinter in the iron blast furnace because of their __________

Options:
1. Poor reducibility
2. Low mechanical strength
3. Swelling tendency
4. Shape

Which of the following factors is not desirable for effective phosphorus removal in BOF steel making process?

Options:
1. Higher temperature
2. Lower temperature
3. Higher basicity
4. Higher FeO level in slag
process is performed for inclusion modification in ladle metallurgy of steel making.

Options:

1. Oxygen top blowing

2. Oxygen bottom blowing

3. Aluminium wire injection

4. Calcium wire injection

In steel making, the addition of bauxite is done to ________________

Options:

1. improve Phosphorus distribution ratio

2. decrease viscosity of slag

3. increase the activity of FeO in slag

4. improve Sulphur distribution ratio

Which of the following statements regarding Kroll’s process is not correct?

Options:

1. Pure metal chlorides serve as raw material

2. Reduction chamber should be free of oxygen

3. Useful for the extraction of Ti and Zr
4. Reduction is done by Al

Match the metals listed in Group A with the process in Group B and find the correct answer

**Group A**
- a. Nickel refining
- b. Copper
- c. Zinc
- d. Iron sponge

**Group B**
- I. Poling
- II. Carbonyl process
- III. Rotary kiln process
- IV. Distillation

Options:
1. a-Ⅰ, b-Ⅱ, c-Ⅲ, d-Ⅳ
2. a-Ⅱ, b-Ⅰ, c-Ⅳ, d-Ⅲ
3. a-Ⅳ, b-Ⅱ, c-Ⅰ, d-Ⅲ
4. a-Ⅲ, b-Ⅳ, c-Ⅱ, d-Ⅰ

A conventional copper converter is blown from ________________

Options:
1. top
2. bottom
3. side
4. top and bottom
Which reducing agent is used in the extraction of magnesium from calcinated dolomite via Pidgeon process?

Options:
1. Carbon
2. Ferrosilicon
3. Silicon
4. Sodium

The Al₂O₃ content of cryolite in Hall-Héroult’s cell is maintained between ____________.

Options:
1. 6 – 12 %
2. 18 – 20 %
3. 2 – 5 %
4. 12 – 15 %

In imperial smelting process for extraction of zinc, zinc vapor is quenched in the external condenser by ____________

Options:
1. Jet of water
2. Blast of air
3. Mix of water and air

4. Molten lead

Monazite deposits constitute an important source for ____________.

Options:
1. Titanium
2. Thorium
3. Molybdenum
4. Niobium

Copper can be reduced from copper sulphate solution by ________.

Options:
1. Iron
2. Silver
3. Lead
4. Carbon
Match the list in Group A with Group B and find the correct answer

**Group A**

a. Penetrameter  
b. Differential coil probe  
c. Piezo-electric probe  
d. Developer

**Group B**

I. Ultrasonic test  
II. Dye-penetrant test  
III. X-ray radiography  
IV. Acoustic emission test

Options:

1. a-III, b-IV, c-I, d-II
2. a-II, b-I, c-III, d-IV
3. a-I, b-II, c-IV, d-III
4. a-IV, b-III, c-II, d-I

Subsurface defects and its location can be found by the following test ________________

Options:

1. Ultrasonic pulse echo
2. Penetrant
3. Eddy current
4. Magnetic particle

Generally brittle materials have % of elongation below ______.

Options:

1. 5
2. 10
3. 20
4. 40

Question Number : 166  Question Id : 8946584574  Question Type : MCQ  Option Shuffling : Yes  Display Question Number : Yes  Single Line Question Option : No  Option Orientation : Vertical

Match the list in Group A with Group B and find the correct answer

Group A
a. Tensile
b. Compressive
c. Fatigue
d. Creep

Group B
I. Barreling
II. Intergranular cracking
III. Striations
IV. Cup and cone
V. Earing

Options :
1. a-IV, b-V, c-III, d-I
2. a-IV, b-I, c-III, d-II
3. a-V, b-I, c-IV, d-II
4. a-III, b-II, c-I, d-IV

Question Number : 167  Question Id : 8946584575  Question Type : MCQ  Option Shuffling : Yes  Display Question Number : Yes  Single Line Question Option : No  Option Orientation : Vertical

Which test is commonly used to understand high temperature deformation behavior of materials?

Options :
1. Impact
2. Fatigue
3. Creep

4. Compression

Fatigue resistance of a steel is reduced by ________________.

Options:
1. Decarburization
2. Polishing of surface
3. Fine grain size
4. Shot peening

Match the list in Group A with Group B and find the correct answer

**Group A**

a. Low cycle fatigue
b. Creep
c. Impact toughness
d. Stretcher strain

**Group B**

I. Charpy test
II. Portevin-Le Chatlier effect
III. Coffin-Manson equation
IV. Larson-Miller parameter
V. Jominy end Quench test

Options:
1. a-II, b-IV, c-I, d-V
2. a-II, b-I, c-V, d-III
3. a-III, b-IV, c-I, d-II
4. a-III, b-I, c-IV, d-V

The fracture toughness of lower strength ductile material is best measured by ____________.

Options:
1. J–integral method
2. $K_{IC}$ evaluation
3. Impact test
4. Flexural test

Tungsten filament for lamp is commonly produced by ________________.

Options:
1. Powder metallurgy and metal forming
2. Powder metallurgy and welding
3. Casting and metal forming
4. Casting and welding
Match the list in Group A with Group B and find the correct answer

**Group A**

a. Drawing  
b. Forging  
c. Rolling  
d. Stretch forming

**Group B**

I. Large curved disc  
II. Tube  
III. Crank shaft  
IV. Plate

Options:

1. a-II, b-III, c-IV, d-I
2. a-I, b-IV, c-III, d-II
3. a-III, b-II, c-I, d-IV
4. a-IV, b-I, c-II, d-III

---

In metal forming, hot working and cold working is defined based on ________________.

Options:

1. Solidus temperature
2. Recrystallization temperature
3. Transformation temperature
4. Eutectic temperature

---

Thin foils of aluminium is produced by ________________

Options:

1. 2-High roll mill
2. High roll mill
3. Planetary mill
4. Cluster/Sendzimir mill

In sheet metal forming, stretcher strains occur in ________________.
Options:
1. Low carbon steel
2. Duralumin
3. Austenitic stainless steels
4. Ni-base alloy

The respective units for dislocation density and stress intensity factor are ________________.
Options:
1. m² and MPa.m
2. m² and MPa.m\(^{1/2}\)
3. m² and MPa.m\(^{1/2}\)
4. m² and MPa.m

Number of slip systems in close packed hexagonal metal is______.
Options:
A defect that is bounded by two mirror planes is_________.

Options:
1. Stacking fault
2. Grain boundary
3. Edge dislocation
4. Twin

Match the list in Group A with Group B and find the correct answer

<table>
<thead>
<tr>
<th>Group A</th>
<th>Group B</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. Forging</td>
<td>I. Alligator</td>
</tr>
<tr>
<td>b. Rolling</td>
<td>II. Cold shut</td>
</tr>
<tr>
<td>c. Deep drawing</td>
<td>III. Chevron cracks</td>
</tr>
<tr>
<td>d. Extrusion</td>
<td>IV. Wrinkles</td>
</tr>
</tbody>
</table>

Options:
1. a-I, b-II, c-III, d-IV
2. a-II, b-I, c-III, d-IV
3. a-I, b-III, c-IV, d-III
4. a-IV, b-III, c-II, d-I

Movement of jogs can produce ____________.
Options:
1. Vacancies
2. Grain boundary sliding
3. Screw dislocation
4. Twin

Low melting point metals/alloys are generally casted by ____________
Options:
1. Sand casting
2. Investment casting
3. Die casting
4. Centrifugal casting
Match the list in Group A with Group B and find the correct answer.

**Group A**

a. Hot tear  
b. Misrun  
c. Blister  
d. Rat tail

**Group B**

I. Insufficient melt super heat  
II. High residual stresses  
III. Improper venting  
IV. Expansion of sand

Options:

1. a-I, b-II, c-III, d-IV
2. a-III, b-IV, c-I, d-II
3. a-IV, b-III, c-II, d-I
4. a-II, b-I, c-III, d-IV

Question Number : 183  Question Id : 8946584591  Question Type : MCQ  Option Shuffling : Yes  Display Question Number : Yes  Single Line Question Option : No  Option Orientation : Vertical

Riser is not required for the casting of ____________

Options:

1. White cast iron
2. Grey cast iron
3. Al alloys
4. Steel

Question Number : 184  Question Id : 8946584592  Question Type : MCQ  Option Shuffling : Yes  Display Question Number : Yes  Single Line Question Option : No  Option Orientation : Vertical

In a sound casting, the last liquid to solidify is in the ____________.

Options:

1. Riser
2. Gate
3. Runner
4. Vent

Draft allowance is given to patterns for ________________

Options:
1. Compensating liquid state shrinkage
2. Easy removal of pattern from the mould
3. Providing support for core
4. Compensating solid state shrinkage

Match the list in Group A with Group B and find the correct answer

<table>
<thead>
<tr>
<th>Group A</th>
<th>Group B</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. Macro-segregation</td>
<td>I. Inoculation</td>
</tr>
<tr>
<td>b. Fine grained structure</td>
<td>II. Gas evolution and shrinkage</td>
</tr>
<tr>
<td>c. Porosity</td>
<td>III. Temperature gradient and super cooling</td>
</tr>
<tr>
<td>d. Dendrites</td>
<td>IV. Density difference and convection currents</td>
</tr>
</tbody>
</table>

Options:
1. a-I, b-III, c-II, d-IV
2. a-IV, b-I, c-II, d-III
3. a-II, b-IV, c-I, d-III
4. a-IV, b-I, c-III, d-II

Which casting technique is used for obtaining close dimensional accuracy?
Options:
1. Centrifugal casting
2. Sand casting
3. Die casting
4. Investment casting

Mould coating material that helps in grain refinement of metal casting is ________.
Options:
1. Cobalt aluminide
2. Zinc
3. Tellurium
4. Boron

For casting of cast iron, generally melting is done by using ____________.
Options:
1. Cupola
2. Muffle furnace
3. Blast furnace

4. Convertor

Question Number : 190  Question Id : 8946584598  Question Type : MCQ  Option Shuffling : Yes  Display Question Number : Yes  Single Line Question Option : No  Option Orientation : Vertical

Directional solidification is preferred for applications such as ____________.

Options :
1. Engine blocks

2. Connecting rods

3. Permanent magnets

4. Gears

Question Number : 191  Question Id : 8946584599  Question Type : MCQ  Option Shuffling : Yes  Display Question Number : Yes  Single Line Question Option : No  Option Orientation : Vertical

In a brazing process, the liquid metal fills the gap by ________ infiltration

Options :
1. Capillary

2. Gravity

3. Pressure

4. Vacuum

Question Number : 192  Question Id : 8946584600  Question Type : MCQ  Option Shuffling : Yes  Display Question Number : Yes  Single Line Question Option : No  Option Orientation : Vertical

The nature of submerged arc welding flux with basicity index of 0.5 is ________

Options :
1. Neutral

2. Acidic
3. Basic

4. Semi basic

Question Number : 193  Question Id : 8946584601  Question Type : MCQ  Option Shuffling : Yes  Display Question Number : Yes  Single Line Question Option : No  Option Orientation : Vertical
Which of the following is not a solid state welding process?

Options :
1. Friction stir welding
2. Ultrasonic welding
3. Flux cored arc welding
4. Explosive welding

Question Number : 194  Question Id : 8946584602  Question Type : MCQ  Option Shuffling : Yes  Display Question Number : Yes  Single Line Question Option : No  Option Orientation : Vertical
How much carbon equivalent in steel is considered to be good for weldability?

Options :
1. 1.0
2. 0.8
3. 0.6
4. 0.4

Question Number : 195  Question Id : 8946584603  Question Type : MCQ  Option Shuffling : Yes  Display Question Number : Yes  Single Line Question Option : No  Option Orientation : Vertical
The weld structure of a metal has similarity to that of the metal produced via _______.

Options :
1. Casting
2. Powder metallurgy
3. Rolling
4. Forging

Match the list in Group A with Group B and find the correct answer

<table>
<thead>
<tr>
<th>Group A</th>
<th>Group B</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. Ultrasonic welding</td>
<td>I. Thermochemical</td>
</tr>
<tr>
<td>b. Spot welding</td>
<td>II. Electrical resistance</td>
</tr>
<tr>
<td>c. SMAW</td>
<td>III. Friction</td>
</tr>
<tr>
<td>d. Thermit welding</td>
<td>IV. Electrical arc</td>
</tr>
</tbody>
</table>

Options:
1. a-III, b-II, c-I, d-IV
2. a-IV, b-III, c-II, d-I
3. a-I, b-III, c-IV, d-II
4. a-III, b-II, c-IV, d-I

Weld decay in austenitic stainless steels can be avoided by ________________.

Options:
1. Reducing carbon content
2. Increasing carbon content
3. Eliminating strong carbide formers
4. Decreasing chromium content
Non consumable electrode is used in _______________ process.

Options:
1. Gas metal arc welding
2. Gas tungsten arc welding
3. Submerged arc welding
4. Laser welding

Match the list in Group A with Group B and find the correct answer

**Group A**
- a. Soldering
- b. Welding
- c. Brazing

**Group B**
- I. Silver-Titanium alloy
- II. Silver-Tin alloy
- III. Mild steel
- IV. Lead flouride

Options:
1. a-II, b-III, c-I
2. a-I, b-II, c-III
3. a-III, b-I, c-IV
4. a-II, b-IV, c-I

Which region of weld does undergo heat treatment effect?

Options:
1. Base metal
2. Weld metal
3. HAZ
4. Centre of the weld