

National Testing Agency

Question Paper Name :	B Tech 23rd Jan 2026 Shift 1
Subject Name :	B. Tech
Duration :	180
Total Marks :	300
Display Marks:	Yes

B. Tech

Group Number :	1
Group Maximum Duration :	0
Group Minimum Duration :	180
Show Attended Group? :	No
Edit Attended Group? :	No
Break time :	0
Group Marks :	300

Mathematics Section A

Section Number :	1
Section type :	Online
Mandatory or Optional :	Mandatory
Number of Questions :	20
Number of Questions to be attempted :	20
Section Marks :	80
Maximum Instruction Time :	0
Sub-Section Number :	1
Question Shuffling Allowed :	Yes
Is Section Default? :	No

Question Number : 1 Question Id : 8606541362 Question Type : MCQ Option Shuffling : Yes Display Question Number : Yes Is Question Mandatory : No Single Line Question Option : No Option Orientation : Vertical

Let the line $y - x = 1$ intersect the ellipse $\frac{x^2}{2} + \frac{y^2}{1} = 1$ at the points A and B. Then the angle made by the line segment AB at the center of the ellipse is :

Options :

8606544635. $\pi - \tan^{-1}\left(\frac{1}{4}\right)$

8606544636. $\frac{\pi}{2} + \tan^{-1}\left(\frac{1}{4}\right)$

8606544637. $\frac{\pi}{2} - \tan^{-1}\left(\frac{1}{4}\right)$

8606544638. $\frac{\pi}{2} + 2 \tan^{-1}\left(\frac{1}{4}\right)$

Question Number : 2 Question Id : 8606541361 Question Type : MCQ Option Shuffling : Yes Display Question Number : Yes Is Question Mandatory : No Single Line Question Option : No Option Orientation : Vertical

Number of solutions of $\sqrt{3} \cos 2\theta + 8 \cos \theta + 3\sqrt{3} = 0$, $\theta \in [-3\pi, 2\pi]$ is :

Options :

8606544631. 5

8606544632. 4

8606544633. 3

8606544634. 0

Question Number : 3 Question Id : 8606541366 Question Type : MCQ Option Shuffling : Yes Display Question Number : Yes Is Question Mandatory : No Single Line Question Option : No Option Orientation : Vertical

Let the direction cosines of two lines satisfy the equations : $4l + m - n = 0$ and $2mn + 10nl + 3lm = 0$. Then the cosine of the acute angle between these lines is :

Options :

8606544651. $\frac{20}{3\sqrt{38}}$

8606544652. $\frac{10}{7\sqrt{38}}$

8606544653. $\frac{10}{\sqrt{38}}$

8606544654. $\frac{10}{3\sqrt{38}}$

Question Number : 4 Question Id : 8606541363 Question Type : MCQ Option Shuffling : Yes Display Question Number : Yes Is Question Mandatory : No Single Line Question Option : No Option Orientation : Vertical

Let α and β respectively be the maximum and the minimum values of the function

$$f(\theta) = 4 \left(\sin^4 \left(\frac{7\pi}{2} - \theta \right) + \sin^4 (11\pi + \theta) \right) - 2 \left(\sin^6 \left(\frac{3\pi}{2} - \theta \right) + \sin^6 (9\pi - \theta) \right), \theta \in \mathbb{R}.$$

Then $\alpha + 2\beta$ is equal to :

Options :

8606544639. 3

8606544640. 6

8606544641. 4

8606544642. 5

Question Number : 5 Question Id : 8606541367 Question Type : MCQ Option Shuffling : Yes Display Question Number : Yes Is Question Mandatory : No Single Line Question Option : No Option Orientation : Vertical

$$\text{Let } f(x) = \begin{cases} \frac{ax^2 + 2ax + 3}{4x^2 + 4x - 3}, & x \neq -\frac{3}{2}, \frac{1}{2} \\ b, & x = -\frac{3}{2}, \frac{1}{2} \end{cases}$$

be continuous at $x = -\frac{3}{2}$. If $f \circ f(x) = \frac{7}{5}$, then x is equal to :

Options :

8606544655. 0

8606544656. 1

8606544657. 1.4

8606544658. 2

Question Number : 6 Question Id : 8606541352 Question Type : MCQ Option Shuffling : Yes Display Question Number : Yes Is Question Mandatory : No Single Line Question Option : No Option Orientation : Vertical

If α and β ($\alpha < \beta$) are the roots of the equation

$$(-2 + \sqrt{3})\left(\sqrt{x} - 3\right) + (x - 6\sqrt{x}) + (9 - 2\sqrt{3}) = 0, x \geq 0, \text{ then } \sqrt{\frac{\beta}{\alpha}} + \sqrt{\alpha\beta} \text{ is equal to :}$$

Options :

8606544595. 8

8606544596. 9

8606544597. 10

8606544598. 11

Question Number : 7 Question Id : 8606541364 Question Type : MCQ Option Shuffling : Yes Display Question Number : Yes Is Question Mandatory : No Single Line Question Option : No Option Orientation : Vertical

The vertices B and C of a triangle ABC lie on the line $\frac{x}{1} = \frac{1-y}{-2} = \frac{z-2}{3}$. The coordinates of A and

B are (1, 6, 3) and (4, 9, α) respectively and C is at a distance of 10 units from B. The area (in sq. units) of ΔABC is :

Options :

8606544643. $10\sqrt{13}$

8606544644. $5\sqrt{13}$

8606544645. $20\sqrt{13}$

8606544646. $15\sqrt{13}$

Question Number : 8 Question Id : 8606541355 Question Type : MCQ Option Shuffling : Yes Display Question Number : Yes Is Question Mandatory : No Single Line Question Option : No Option Orientation : Vertical

Among the statements :

I: If $\begin{vmatrix} 1 & \cos\alpha & \cos\beta \\ \cos\alpha & 1 & \cos\gamma \\ \cos\beta & \cos\gamma & 1 \end{vmatrix} = \begin{vmatrix} 0 & \cos\alpha & \cos\beta \\ \cos\alpha & 0 & \cos\gamma \\ \cos\beta & \cos\gamma & 0 \end{vmatrix}$, then $\cos^2\alpha + \cos^2\beta + \cos^2\gamma = \frac{3}{2}$, and

II: If $\begin{vmatrix} x^2 + x & x + 1 & x - 2 \\ 2x^2 + 3x - 1 & 3x & 3x - 3 \\ x^2 + 2x + 3 & 2x - 1 & 2x - 1 \end{vmatrix} = px + q$, then $p^2 = 196q^2$,

Options :

8606544607. both are true

8606544608. both are false

8606544609. only I is true

8606544610. only II is true

Question Number : 9 Question Id : 8606541369 Question Type : MCQ Option Shuffling : Yes Display Question Number : Yes Is Question Mandatory : No Single Line Question Option : No Option Orientation : Vertical

The value of the integral $\int_{\frac{\pi}{24}}^{\frac{5\pi}{24}} \frac{dx}{1 + \sqrt[3]{\tan 2x}}$ is :

Options :

8606544663. $\frac{\pi}{3}$

8606544664. $\frac{\pi}{6}$

8606544665. $\frac{\pi}{12}$

8606544666. $\frac{\pi}{18}$

Question Number : 10 Question Id : 8606541360 Question Type : MCQ Option Shuffling : Yes Display Question Number : Yes Is Question Mandatory : No Single Line Question Option : No Option Orientation : Vertical

Let the domain of the function $f(x) = \log_3 \log_5 \log_7 (9x - x^2 - 13)$ be the interval (m, n) . Let the hyperbola $\frac{x^2}{a^2} - \frac{y^2}{b^2} = 1$ have eccentricity $\frac{n}{3}$ and the length of the latus rectum $\frac{8m}{3}$. Then $b^2 - a^2$ is equal to :

Options :

8606544627. 5

8606544628. 7

8606544629. 9

8606544630. 11

Question Number : 11 Question Id : 8606541368 Question Type : MCQ Option Shuffling : Yes Display Question Number : Yes Is Question Mandatory : No Single Line Question Option : No Option Orientation : Vertical

Let $f(x) = \int \frac{(2 - x^2) \cdot e^x}{(\sqrt{1+x})(1-x)^{3/2}} dx$. If $f(0) = 0$, then $f\left(\frac{1}{2}\right)$ is equal to :

Options :

8606544659. $\sqrt{3e} + 1$

8606544660. $\sqrt{3e} - 1$

8606544661. $\sqrt{2e} + 1$

8606544662. $\sqrt{2e} - 1$

Question Number : 12 Question Id : 8606541353 Question Type : MCQ Option Shuffling : Yes Display Question Number : Yes Is Question Mandatory : No Single Line Question Option : No Option Orientation : Vertical

A building construction work can be completed by two masons A and B together in 22.5 days. Mason A alone can complete the construction work in 24 days less than mason B alone. Then mason A alone will complete the construction work in :

Options :

8606544599. 24 days

8606544600. 30 days

8606544601. 36 days

8606544602. 42 days

Question Number : 13 Question Id : 8606541370 Question Type : MCQ Option Shuffling : Yes Display Question Number : Yes Is Question Mandatory : No Single Line Question Option : No Option Orientation : Vertical

Let $y=y(x)$ be the solution of the differential equation $x^4 dy + (4x^3 y + 2\sin x) dx = 0$, $x > 0$, $y\left(\frac{\pi}{2}\right) = 0$.

Then $\pi^4 y\left(\frac{\pi}{3}\right)$ is equal to :

Options :

8606544667. 81

8606544668. 72

8606544669. 64

8606544670. 92

Question Number : 14 Question Id : 8606541359 Question Type : MCQ Option Shuffling : Yes Display Question Number : Yes Is Question Mandatory : No Single Line Question Option : No Option Orientation : Vertical

A rectangle is formed by the lines $x=0$, $y=0$, $x=3$ and $y=4$. Let the line L be perpendicular to $3x + y + 6 = 0$ and divide the area of the rectangle into two equal parts. Then the distance of the point

$\left(\frac{1}{2}, -5\right)$ from the line L is equal to :

Options :

8606544623. $2\sqrt{5}$

8606544624. $3\sqrt{10}$

8606544625. $\sqrt{10}$

8606544626. $2\sqrt{10}$

Question Number : 15 Question Id : 8606541358 Question Type : MCQ Option Shuffling : Yes Display Question Number : Yes Is Question Mandatory : No Single Line Question Option : No Option Orientation : Vertical

Let the mean and variance of 8 numbers $-10, -7, -1, x, y, 9, 2, 16$ be $\frac{7}{2}$ and $\frac{293}{4}$, respectively.

Then the mean of 4 numbers $x, y, x+y+1, |x-y|$ is :

Options :

8606544619. 9

8606544620. 10

8606544621. 11

8606544622. 12

Question Number : 16 Question Id : 8606541351 Question Type : MCQ Option Shuffling : Yes Display Question Number : Yes Is Question Mandatory : No Single Line Question Option : No Option Orientation : Vertical

Let $A = \{-2, -1, 0, 1, 2, 3, 4\}$. Let R be a relation on A defined by xRy if and only if $2x + y \leq 2$. Let l be the number of elements in R . Let m and n be the minimum number of elements required to be added in R to make it reflexive and symmetric relations respectively. Then $l + m + n$ is equal to :

Options :

8606544591. 35

8606544592. 32

8606544593. 33

8606544594. 34

Question Number : 17 Question Id : 8606541365 Question Type : MCQ Option Shuffling : Yes Display Question Number : Yes Is Question Mandatory : No Single Line Question Option : No Option Orientation : Vertical

Let $\vec{a} = -\hat{i} + \hat{j} + 2\hat{k}$, $\vec{b} = \hat{i} - \hat{j} - 3\hat{k}$, $\vec{c} = \vec{a} \times \vec{b}$ and $\vec{d} = \vec{c} \times \vec{a}$.

Then $(\vec{a} - \vec{b}) \cdot \vec{d}$ is equal to :

Options :

8606544647. 4

8606544648. -4

8606544649. 2

8606544650. -2

Question Number : 18 Question Id : 8606541354 Question Type : MCQ Option Shuffling : Yes Display Question Number : Yes Is Question Mandatory : No Single Line Question Option : No Option Orientation : Vertical

Let $S = \{z : 3 \leq |2z - 3(1 + i)| \leq 7\}$ be a set of complex numbers.

Then $\min_{z \in S} \left| z + \frac{1}{2}(5 + 3i) \right|$ is equal to :

Options :

8606544603. $\frac{1}{2}$

8606544604. $\frac{3}{2}$

8606544605. 2

8606544606. $\frac{5}{2}$

Question Number : 19 Question Id : 8606541356 Question Type : MCQ Option Shuffling : Yes Display Question Number : Yes Is Question Mandatory : No Single Line Question Option : No Option Orientation : Vertical

The sum of all possible values of $n \in \mathbb{N}$, so that the coefficients of x , x^2 and x^3 in the expansion of $(1 + x^2)^2 (1 + x)^n$, are in arithmetic progression is :

Options :

8606544611. 3

8606544612. 7

8606544613. 9

8606544614. 12

Question Number : 20 Question Id : 8606541357 Question Type : MCQ Option Shuffling : Yes Display Question Number : Yes Is Question Mandatory : No Single Line Question Option : No Option Orientation : Vertical

The value of $\frac{{}^{100}C_{50}}{51} + \frac{{}^{100}C_{51}}{52} + \dots + \frac{{}^{100}C_{100}}{101}$ is :

Options :

8606544615. $\frac{2^{100}}{100}$

8606544616. $\frac{2^{100}}{101}$

$$8606544617. \frac{2^{101}}{100}$$

$$8606544618. \frac{2^{101}}{101}$$

Mathematics Section B

Section Number :	2
Section type :	Online
Mandatory or Optional :	Mandatory
Number of Questions :	5
Number of Questions to be attempted :	5
Section Marks :	20
Maximum Instruction Time :	0
Sub-Section Number :	1
Question Shuffling Allowed :	Yes
Is Section Default? :	No

Question Number : 21 Question Id : 8606541375 Question Type : SA Display Question Number : Yes Keyboard Layout : Inscript

Let the area of the region bounded by the curve $y = \max \{ \sin x, \cos x \}$, lines $x=0$, $x = \frac{3\pi}{2}$, and the x -axis be A. Then, $A + A^2$ is equal to _____.

Response Type : Numeric
 Evaluation Required For SA : Yes
 Show Word Count : Yes
 Answers Type : Equal
 Text Areas : PlainText

Question Number : 22 Question Id : 8606541372 Question Type : SA Display Question Number : Yes Keyboard Layout : Inscript

The number of 4-letter words, with or without meaning, which can be formed using the letters PQRPRSTUVP, is _____.

Response Type : Numeric
 Evaluation Required For SA : Yes
 Show Word Count : Yes
 Answers Type : Equal
 Text Areas : PlainText

Question Number : 23 Question Id : 8606541374 Question Type : SA Display Question Number : Yes Keyboard Layout : Inscript

Let f be a twice differentiable non-negative function such that $(f(x))^2 = 25 + \int_0^x ((f(t))^2 + (f'(t))^2) dt$.

Then the mean of $f(\log_e(1))$, $f(\log_e(2))$, ..., $f(\log_e(625))$ is equal to _____.

Response Type : Numeric
 Evaluation Required For SA : Yes
 Show Word Count : Yes
 Answers Type : Equal
 Text Areas : PlainText

Question Number : 24 Question Id : 8606541373 Question Type : SA Display Question Number : Yes Keyboard Layout : Inscript

From the first 100 natural numbers, two numbers first a and then b are selected randomly without replacement. If the probability that $a - b \geq 10$ is $\frac{m}{n}$, $\gcd(m, n) = 1$, then $m + n$ is equal to _____.

Response Type : Numeric

Evaluation Required For SA : Yes

Show Word Count : Yes

Answers Type : Equal

Text Areas : PlainText

Question Number : 25 Question Id : 8606541371 Question Type : SA Display Question Number : Yes Keyboard Layout : Inscript

Let $|A| = 6$, where A is a 3×3 matrix. If $|\text{adj}(3\text{adj}(A^2 \cdot \text{adj}(2A)))| = 2^m \cdot 3^n$, $m, n \in \mathbf{N}$, then $m + n$ is equal to _____.

Response Type : Numeric

Evaluation Required For SA : Yes

Show Word Count : Yes

Answers Type : Equal

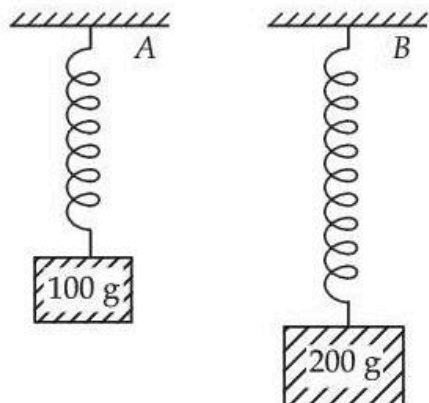
Text Areas : PlainText

Physics Section A

Section Number :	3
Section type :	Online
Mandatory or Optional :	Mandatory
Number of Questions :	20
Number of Questions to be attempted :	20
Section Marks :	80
Maximum Instruction Time :	0
Sub-Section Number :	1
Question Shuffling Allowed :	Yes
Is Section Default? :	No

Question Number : 26 Question Id : 8606541381 Question Type : MCQ Option Shuffling : Yes Display Question Number : Yes Is Question Mandatory : No Single Line Question Option : No Option Orientation : Vertical

Two blocks with masses 100 g and 200 g are attached to the ends of springs A and B as shown in figure. The energy stored in A is E . The energy stored in B , when spring constants k_A, k_B of A and B , respectively satisfy the relation $4k_A = 3k_B$, is :



Options :

8606544696. $4E$

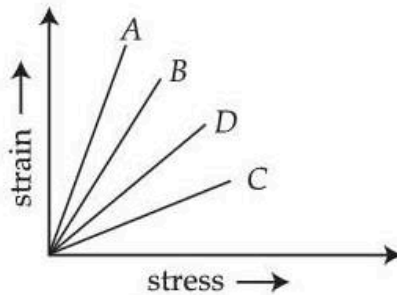
8606544697. $3E$

8606544698. $2E$

8606544699. $\frac{4}{3}E$

Question Number : 27 Question Id : 8606541382 Question Type : MCQ Option Shuffling : Yes Display Question Number : Yes Is Question Mandatory : No Single Line Question Option : No Option Orientation : Vertical

The strain-stress plot for materials A , B , C and D is shown in the figure. Which material has the largest Young's modulus ?



Options :

8606544700. A

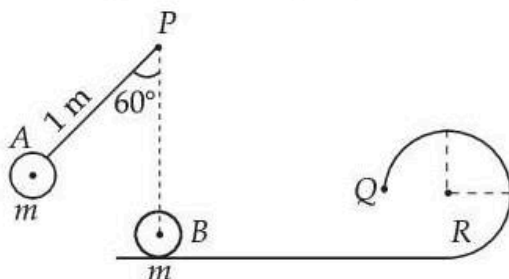
8606544701. B

8606544702. C

8606544703. D

Question Number : 28 Question Id : 8606541380 Question Type : MCQ Option Shuffling : Yes Display Question Number : Yes Is Question Mandatory : No Single Line Question Option : No Option Orientation : Vertical

A small bob A of mass m is attached to a massless rigid rod of length 1 m pivoted at point P and kept at an angle of 60° with vertical as shown in figure. At distance of 1 m below point P , an identical bob B is kept at rest on a smooth horizontal surface that extends to a circular track of radius R as shown in figure. If bob B just manages to complete the circular path of radius R upto a point Q after being hit elastically by bob A , then radius R is _____ m.



Options :

8606544692. $\frac{3}{5}$

8606544693. $\frac{1}{5}$

8606544694. $\frac{2 - \sqrt{3}}{5}$

8606544695. $\frac{2 + \sqrt{3}}{5}$

Question Number : 29 Question Id : 8606541391 Question Type : MCQ Option Shuffling : Yes Display Question Number : Yes Is Question Mandatory : No Single Line Question Option : No Option Orientation : Vertical

A thin prism with angle 5° of refractive index 1.72 is combined with another prism of refractive index 1.9 to produce dispersion without deviation. The angle of second prism is _____.

Options :

8606544736. 4°

8606544737. 5°

8606544738. 6°

8606544739. 4.5°

Question Number : 30 Question Id : 8606541376 Question Type : MCQ Option Shuffling : Yes Display Question Number : Yes Is Question Mandatory : No Single Line Question Option : No Option Orientation : Vertical

Four persons measure the length of a rod as 20.00 cm, 19.75 cm, 17.01 cm and 18.25 cm. The relative error in the measurement of average length of the rod is :

Options :

8606544676. 0.08

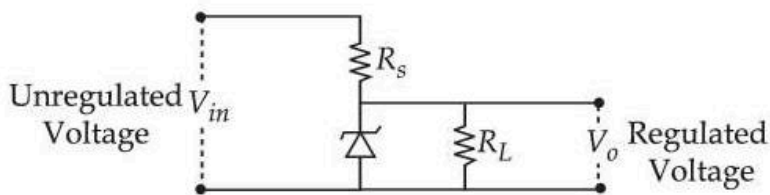
8606544677. 0.18

8606544678. 0.06

8606544679. 0.24

Question Number : 31 Question Id : 8606541395 Question Type : MCQ Option Shuffling : Yes Display Question Number : Yes Is Question Mandatory : No Single Line Question Option : No Option Orientation : Vertical

The following diagram shows a Zener diode as a voltage regulator. The Zener diode is rated at $V_z = 5\text{ V}$ and the desired current in load is 5 mA . The unregulated voltage source can supply upto 25 V . Considering the Zener diode can withstand four times of the load current, the value of resistor R_s (shown in circuit) should be _____ Ω .



Options :

8606544752. 1000

8606544753. 100

8606544754. 10

8606544755. 4000

Question Number : 32 Question Id : 8606541379 Question Type : MCQ Option Shuffling : Yes Display Question Number : Yes Is Question Mandatory : No Single Line Question Option : No Option Orientation : Vertical

The moment of inertia of a square loop made of four uniform solid cylinders, each having radius R and length L ($R < L$) about an axis passing through the mid points of opposite sides, is (Take the mass of the entire loop as M) :

Options :

8606544688. $\frac{3}{8} MR^2 + \frac{1}{6} ML^2$

8606544689. $\frac{3}{4} MR^2 + \frac{7}{12} ML^2$

8606544690. $\frac{3}{8} MR^2 + \frac{7}{12} ML^2$

8606544691. $\frac{3}{4} MR^2 + \frac{1}{6} ML^2$

Question Number : 33 Question Id : 8606541383 Question Type : MCQ Option Shuffling : Yes Display Question Number : Yes Is Question Mandatory : No Single Line Question Option : No Option Orientation : Vertical

In a perfectly inelastic collision, two spheres made of the same material with masses 15 kg and 25 kg , moving in opposite directions with speeds of 10 m/s and 30 m/s , respectively, strike each other and stick together. The rise in temperature (in $^{\circ}\text{C}$), if all the heat produced during the collision is retained by these spheres, is :

(specific heat of sphere material $31\text{ cal/kg.}^{\circ}\text{C}$ and $1\text{ cal} = 4.2\text{ J}$)

Options :

8606544704. 1.15

8606544705. 1.44

8606544706. 1.75

8606544707. 1.95

Question Number : 34 Question Id : 8606541378 Question Type : MCQ Option Shuffling : Yes Display Question Number : Yes Is Question Mandatory : No Single Line Question Option : No Option Orientation : Vertical

Two small balls with masses m and $2m$ are attached to both ends of a rigid rod of length d and negligible mass. If angular momentum of this system is L about an axis (A) passing through its centre of mass and perpendicular to the rod then angular velocity of the system about A is :

Options :

8606544684. $\frac{2L}{5md^2}$

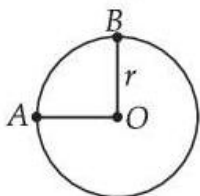
8606544685. $\frac{2L}{md^2}$

8606544686. $\frac{3}{2} \frac{L}{md^2}$

8606544687. $\frac{4}{3} \frac{L}{md^2}$

Question Number : 35 Question Id : 8606541390 Question Type : MCQ Option Shuffling : Yes Display Question Number : Yes Is Question Mandatory : No Single Line Question Option : No Option Orientation : Vertical

A wire of uniform resistance $\lambda \Omega/\text{m}$ is bent into a circle of radius r and another piece of wire with length $2r$ is connected between points A and B (AOB) as shown in figure. The equivalent resistance between points A and B is _____ Ω .



Options :

8606544732. $\frac{3\pi\lambda r}{8}$

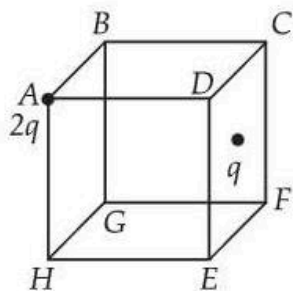
8606544733. $\frac{6\pi\lambda r}{3\pi + 16}$

8606544734. $2\pi\lambda r$

8606544735. $(\pi+1)2r\lambda$

Question Number : 36 Question Id : 8606541389 Question Type : MCQ Option Shuffling : Yes Display Question Number : Yes Is Question Mandatory : No Single Line Question Option : No Option Orientation : Vertical

Two point charges $2q$ and q are placed at vertex A and centre of face $CDEF$ of the cube as shown in figure. The electric flux passing through the cube is :



Options :

8606544728. $\frac{q}{\epsilon_0}$

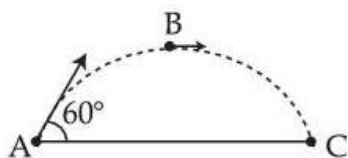
8606544729. $\frac{3q}{\epsilon_0}$

8606544730. $\frac{3q}{2\epsilon_0}$

8606544731. $\frac{3q}{4\epsilon_0}$

Question Number : 37 Question Id : 8606541377 Question Type : MCQ Option Shuffling : Yes Display Question Number : Yes Is Question Mandatory : No Single Line Question Option : No Option Orientation : Vertical

An object is projected with kinetic energy K from a point A at an angle 60° with the horizontal. The ratio of the difference in kinetic energies at points B and C to that at point A (see figure), in the absence of air friction is :



Options :

8606544680. $1 : 2$

8606544681. $2 : 3$

8606544682. $3 : 4$

Question Number : 38 Question Id : 8606541386 Question Type : MCQ Option Shuffling : Yes Display Question Number : Yes Is Question Mandatory : No Single Line Question Option : No Option Orientation : Vertical

A 20 m long uniform copper wire held horizontally is allowed to fall under the gravity ($g = 10 \text{ m/s}^2$) through a uniform horizontal magnetic field of 0.5 Gauss perpendicular to the length of the wire. The induced EMF across the wire when it travels a vertical distance of 200 m is _____ mV.

Options :

8606544716. $200\sqrt{10}$

8606544717. $20\sqrt{10}$

8606544718. $2\sqrt{10}$

8606544719. $0.2\sqrt{10}$

Question Number : 39 Question Id : 8606541394 Question Type : MCQ Option Shuffling : Yes Display Question Number : Yes Is Question Mandatory : No Single Line Question Option : No Option Orientation : Vertical

In hydrogen atom spectrum, ($R \rightarrow$ Rydberg's constant)

- A. the maximum wavelength of the radiation of Lyman series is $\frac{4}{3R}$
- B. the Balmer series lies in the visible region of the spectrum
- C. the minimum wavelength of the radiation of Paschen series is $\frac{9}{R}$
- D. the minimum wavelength of Lyman series is $\frac{5}{4R}$

Choose the **correct** answer from the options given below :

Options :

8606544748. A, B and D Only

8606544749. A, B Only

8606544750. A, B and C Only

8606544751. B, D Only

Question Number : 40 Question Id : 8606541393 Question Type : MCQ Option Shuffling : Yes Display Question Number : Yes Is Question Mandatory : No Single Line Question Option : No Option Orientation : Vertical

The de Broglie wavelength of an oxygen molecule at 27°C is $x \times 10^{-12}$ m. The value of x is (take Planck's constant $= 6.63 \times 10^{-34}$ J.s, Boltzmann constant $= 1.38 \times 10^{-23}$ J/K, mass of oxygen molecule $= 5.31 \times 10^{-26}$ kg)

Options :

8606544744. 20

8606544745. 24

8606544746. 26

8606544747. 30

Question Number : 41 Question Id : 8606541385 Question Type : MCQ Option Shuffling : Yes Display Question Number : Yes Is Question Mandatory : No Single Line Question Option : No Option Orientation : Vertical

A simple pendulum of string length 30 cm performs 20 oscillations in 10 s. The length of the string required for the pendulum to perform 40 oscillations in the same time duration is _____ cm. [Assume that the mass of the pendulum remains same.]

Options :

8606544712. 0.75

8606544713. 7.5

8606544714. 15

8606544715. 120

Question Number : 42 Question Id : 8606541392 Question Type : MCQ Option Shuffling : Yes Display Question Number : Yes Is Question Mandatory : No Single Line Question Option : No Option Orientation : Vertical

Consider light travelling from a medium A to medium B separated by a plane interface. If the light undergoes total internal reflection during its travel from medium A to B and the speed of light in media A and B are 2.4×10^8 m/s and 2.7×10^8 m/s, respectively, then the value of critical angle is :

Options :

8606544740. $\sin^{-1}\left(\frac{9}{8}\right)$

8606544741. $\tan^{-1}\left(\frac{8}{\sqrt{17}}\right)$

8606544742. $\cos^{-1}\left(\frac{8}{9}\right)$

8606544743. $\cot^{-1}\left(\frac{3}{\sqrt{13}}\right)$

Question Number : 43 Question Id : 8606541387 Question Type : MCQ Option Shuffling : Yes Display Question Number : Yes Is Question Mandatory : No Single Line Question Option : No Option Orientation : Vertical

Given below are two statements : one is labelled as **Assertion (A)** and the other is labelled as **Reason (R)**.

Consider a ferromagnetic material :

Assertion (A) : The individual atoms in a ferromagnetic material possess a magnetic dipole moment and interact with one another in such a way that they spontaneously align themselves forming domains.

Reason (R) : At high enough temperature, the domain structure of ferromagnetic material disintegrates. Thus, magnetization will disappear at high enough temperature known as Curie temperature.

In the light of the above statements, choose the **correct answer** from the options given below :

Options :

8606544720. Both **(A)** and **(R)** are true and **(R)** is the correct explanation of **(A)**

8606544721. Both **(A)** and **(R)** are true but **(R)** is **not** the correct explanation of **(A)**

8606544722. **(A)** is true but **(R)** is false

8606544723. **(A)** is false but **(R)** is true

Question Number : 44 Question Id : 8606541388 Question Type : MCQ Option Shuffling : Yes Display Question Number : Yes Is Question Mandatory : No Single Line Question Option : No Option Orientation : Vertical

Match List - I with List - II.

List - I

Relation

List - II

Law

A. $\oint \vec{E} \cdot d\vec{l} = -\frac{d}{dt} \oint \vec{B} \cdot d\vec{a}$

I. Ampere's circuital law

B. $\oint \vec{B} \cdot d\vec{l} = \mu_0 \left(I + \epsilon_0 \frac{d\phi_E}{dt} \right)$

II. Faraday's laws of electromagnetic induction

C. $\oint \vec{E} \cdot d\vec{a} = \frac{1}{\epsilon_0} \int_V \rho dv$

III. Ampere - Maxwell law

D. $\oint \vec{B} \cdot d\vec{l} = \mu_0 I$

IV. Gauss's law of electrostatics

Choose the **correct answer** from the options given below :

Options :

8606544724. A-II, B-III, C-I, D-IV

8606544725. A-II, B-III, C-IV, D-I

8606544726. A-I, B-IV, C-III, D-II

8606544727. A-IV, B-I, C-II, D-III

Question Number : 45 Question Id : 8606541384 Question Type : MCQ Option Shuffling : Yes Display Question Number : Yes Is Question Mandatory : No Single Line Question Option : No Option Orientation : Vertical

In a screw gauge, the zero of the circular scale lies 3 divisions above the horizontal pitch line when their metallic studs are brought in contact. Using this instrument thickness of a sheet is measured. If pitch scale reading is 1 mm and the circular scale reading is 51 then the correct thickness of the sheet is _____ mm.

[Assume least count is 0.01 mm]

Options :

8606544708. 1.48

8606544709. 1.54

8606544710. 1.51

8606544711. 1.50

Physics Section B

Section Number :	4
Section type :	Online
Mandatory or Optional :	Mandatory
Number of Questions :	5
Number of Questions to be attempted :	5
Section Marks :	20
Maximum Instruction Time :	0
Sub-Section Number :	1
Question Shuffling Allowed :	Yes
Is Section Default? :	No

Question Number : 46 Question Id : 8606541399 Question Type : SA Display Question Number : Yes Keyboard Layout : Inscript

A simple pendulum made of mass 10 g and a metallic wire of length 10 cm is suspended vertically in a uniform magnetic field of 2 T. The magnetic field direction is perpendicular to the plane of oscillations of the pendulum. If the pendulum is released from an angle of 60° with vertical, then maximum induced EMF between the point of suspension and point of oscillation is _____ mV. (Take $g = 10 \text{ m/s}^2$)

Response Type : Numeric

Evaluation Required For SA : Yes

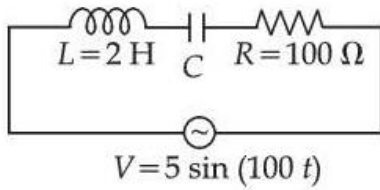
Show Word Count : Yes

Answers Type : Equal

Text Areas : PlainText

Question Number : 47 Question Id : 8606541396 Question Type : SA Display Question Number : Yes Keyboard Layout : Inscript

Using a variable frequency a.c. voltage source the maximum current measured in the given LCR circuit is 50 mA for $V = 5 \sin(100t)$. The values of L and R are shown in the figure. The capacitance of the capacitor (C) used is _____ μF .



Response Type : Numeric

Evaluation Required For SA : Yes

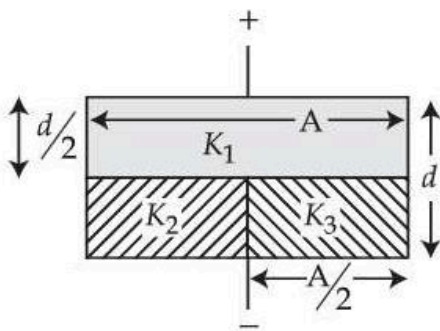
Show Word Count : Yes

Answers Type : Equal

Text Areas : PlainText

Question Number : 48 Question Id : 8606541400 Question Type : SA Display Question Number : Yes Keyboard Layout : Inscript

The space between the plates of a parallel plate capacitor of capacitance C (without any dielectric) is now filled with three dielectric slabs of dielectric constants $K_1 = 2$, $K_2 = 3$ and $K_3 = 5$ (as shown in figure). If new capacitance is $\frac{n}{3}C$ then the value of n is _____.



Response Type : Numeric

Evaluation Required For SA : Yes

Show Word Count : Yes

Answers Type : Equal

Text Areas : PlainText

Question Number : 49 Question Id : 8606541398 Question Type : SA Display Question Number : Yes Keyboard Layout : Inscript

The equation of the electric field of an electromagnetic wave propagating through free space is given by : $E = \sqrt{377} \sin(6.27 \times 10^3 t - 2.09 \times 10^{-5} x)$ N/C

The average power of the electromagnetic wave is $\left(\frac{1}{\alpha}\right)$ W/m². The value of α is _____

$$\left(\text{Take } \sqrt{\frac{\mu_0}{\epsilon_0}} = 377 \text{ in SI units} \right)$$

Response Type : Numeric

Evaluation Required For SA : Yes

Show Word Count : Yes

Answers Type : Equal

Text Areas : PlainText

Question Number : 50 Question Id : 8606541397 Question Type : SA Display Question Number : Yes Keyboard Layout : Inscript

In two separate Young's double-slit experimental set-ups and two monochromatic light sources of different wavelengths are used to get fringes of equal width. The ratios of the slits separations and that of the wavelengths of light used are 2 : 1 and 1 : 2 respectively. The corresponding ratio of the distances between the slits and the respective screens (D_1/D_2) is _____.

Response Type : Numeric

Evaluation Required For SA : Yes

Show Word Count : Yes

Answers Type : Equal

Text Areas : PlainText

Chemistry Section A

Section Number :	5
Section type :	Online
Mandatory or Optional :	Mandatory
Number of Questions :	20
Number of Questions to be attempted :	20
Section Marks :	80
Maximum Instruction Time :	0
Sub-Section Number :	1
Question Shuffling Allowed :	Yes
Is Section Default? :	No

Question Number : 51 Question Id : 8606541409 Question Type : MCQ Option Shuffling : Yes Display Question Number : Yes Is Question Mandatory : No Single Line Question Option : No Option Orientation : Vertical

The correct statements from the following are :

- A. Ionic radii of trivalent cations of group 13 elements decreases down the group.
- B. Electronegativity of group 13 elements decreases down the group.
- C. Among the group 13 elements, Boron has highest first ionisation enthalpy.
- D. The trichloride and triiodide of group 13 elements are covalent in nature.

Choose the **correct** answer from the options given below :

Options :

8606544793. A and C Only

8606544794. B and D Only

8606544795. C and D Only

8606544796. A and D Only

Question Number : 52 Question Id : 8606541413 Question Type : MCQ Option Shuffling : Yes Display Question Number : Yes Is Question Mandatory : No Single Line Question Option : No Option Orientation : Vertical

Given below are two statements :

Statement I : Sublimation is used for the separation and purification of compounds with low melting point.

Statement II : The boiling point of a liquid increases as the external pressure is reduced.

In the light of the above statements, choose the **correct** answer from the options given below :

Options :

8606544809. Both **Statement I** and **Statement II** are true

8606544810. Both **Statement I** and **Statement II** are false

8606544811. **Statement I** is true but **Statement II** is false

8606544812. **Statement I** is false but **Statement II** is true

Question Number : 53 Question Id : 8606541408 Question Type : MCQ Option Shuffling : Yes Display Question Number : Yes Is Question Mandatory : No Single Line Question Option : No Option Orientation : Vertical

The correct trend in the first ionization enthalpies of the elements in the 3rd period of periodic table is :

Options :

8606544789. $\text{Si} < \text{S} < \text{Al} < \text{P} < \text{Cl}$

8606544790. $\text{Al} < \text{Si} < \text{S} < \text{P} < \text{Cl}$

8606544791. $\text{S} < \text{Si} < \text{Al} < \text{P} < \text{Cl}$

8606544792. $\text{Al} < \text{S} < \text{P} < \text{Si} < \text{Cl}$

Question Number : 54 Question Id : 8606541407 Question Type : MCQ Option Shuffling : Yes Display Question Number : Yes Is Question Mandatory : No Single Line Question Option : No Option Orientation : Vertical

In the given electrochemical cell, $\text{Ag(s)} \mid \text{AgCl(s)} \mid \text{FeCl}_2(\text{aq}), \text{FeCl}_3(\text{aq}) \mid \text{Pt(s)}$ at 298 K, the cell potential (E_{cell}) will increase when :

A. Concentration of Fe^{2+} is increased.

B. Concentration of Fe^{3+} is decreased.

C. Concentration of Fe^{2+} is decreased.

D. Concentration of Fe^{3+} is increased.

E. Concentration of Cl^- is increased.

Choose the **correct** answer from the options given below :

Options :

8606544785. A and B Only

8606544786. A and E Only

8606544787. B Only

8606544788. C, D and E Only

Question Number : 55 Question Id : 8606541404 Question Type : MCQ Option Shuffling : Yes Display Question Number : Yes Is Question Mandatory : No Single Line Question Option : No Option Orientation : Vertical

A cup of water at 5°C (system) is placed in a microwave oven and the oven is turned on for one minute during which the water begins to boil. Which of the following option is **true** ?

Options :

8606544773. $q = +ve, w = -ve, \Delta U = +ve$

8606544774. $q = +ve, w = 0, \Delta U = -ve$

8606544775. $q = +ve, w = -ve, \Delta U = -ve$

8606544776. $q = -ve, w = -ve, \Delta U = -ve$

Question Number : 56 Question Id : 8606541403 Question Type : MCQ Option Shuffling : Yes Display Question Number : Yes Is Question Mandatory : No Single Line Question Option : No Option Orientation : Vertical

Identify the molecule (X) with maximum number of lone pairs of electrons (obtained using Lewis dot structure) among HNO_3 , H_2SO_4 , NF_3 and O_3 . Choose the **correct** bond angle made by the central atom of the molecule (X).

Options :

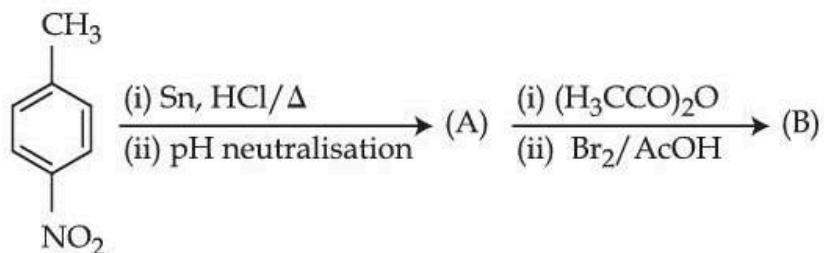
8606544769. 116°

8606544770. 102°

8606544771. 107°

8606544772. 120°

Consider the following sequence of reactions.



4-Nitrotoluene

Assuming that the reaction proceeds to completion, then 137 mg of 4-nitrotoluene will produce _____ mg of B.

(Given molar mass in g mol^{-1} H : 1, C : 12, N : 14, O : 16, Br : 80)

Options :

8606544833. 208

8606544834. 228

8606544835. 146

8606544836. 301

Given below are two statements :

Statement I : $[\text{CoBr}_4]^{2-}$ ion will absorb light of lower energy than $[\text{CoCl}_4]^{2-}$ ion.

Statement II : In $[\text{CoI}_4]^{2-}$ ion, the energy separation between the two set of d-orbitals is more than $[\text{CoCl}_4]^{2-}$ ion.

In the light of the above statements, choose the **correct** answer from the options given below :

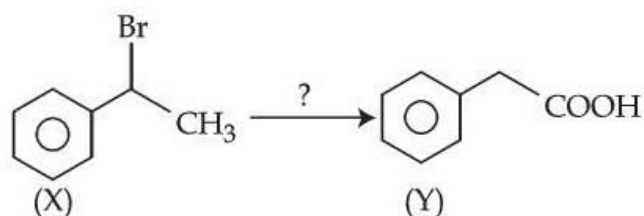
Options :

8606544797. Both **Statement I** and **Statement II** are true

8606544798. Both **Statement I** and **Statement II** are false

8606544799. **Statement I** is true but **Statement II** is false

8606544800. **Statement I** is false but **Statement II** is true



The correct sequence of reagents for the above conversion of X to Y is :

Options :

8606544821. (i) B_2H_6/H_2O_2 (ii) NaOEt (iii) Jones reagent

8606544822. (i) Jones reagent (ii) NaOEt (iii) Hot $KMnO_4/KOH$

8606544823. (i) NaOEt (ii) B_2H_6/H_2O_2 (iii) Jones reagent

8606544824. (i) NaOH (aq) (ii) Jones reagent (iii) H_3O^+

Consider the general reaction given below at 400 K



The values of K_p and K_c are studied under the same condition of temperature but variation in x and y .

(i) $K_p = 85.87$ and $K_c = 2.586$ appropriate units

(ii) $K_p = 0.862$ and $K_c = 28.62$ appropriate units

The values of x and y in (i) and (ii) respectively are :

(i) (ii)

Options :

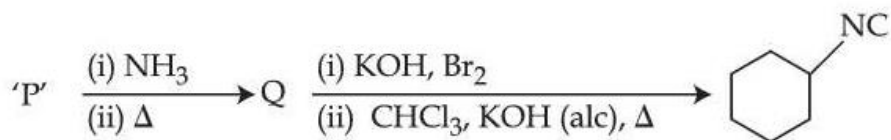
8606544781. 1, 2 2, 1

8606544782. 1, 3 2, 1

8606544783. 3, 1 3, 1

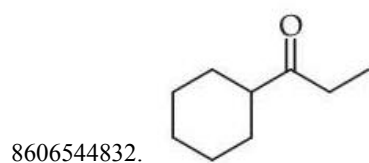
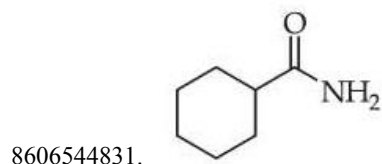
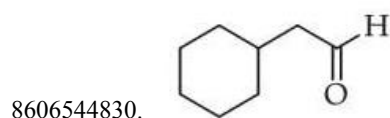
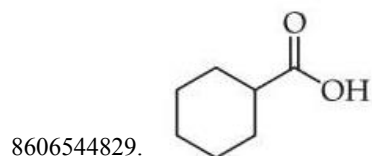
8606544784. 4, 1 4, 1

Compound 'P' undergoes the following sequence of reactions :



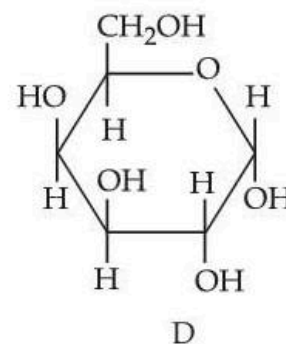
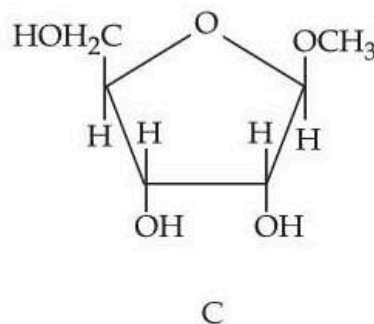
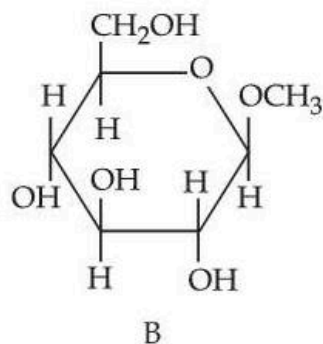
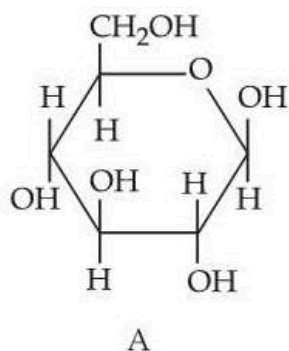
'P' is :

Options :



Question Number : 62 Question Id : 8606541420 Question Type : MCQ Option Shuffling : Yes Display Question Number : Yes Is Question Mandatory : No Single Line Question Option : No Option Orientation : Vertical

From the given following (A to D) cyclic structures, those which will not react with Tollen's reagent are :



Options :

8606544837. A and B

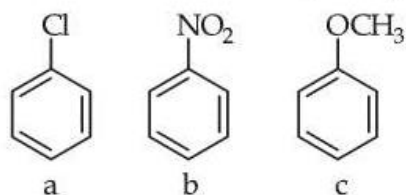
8606544838. A and D

8606544839. B and D

8606544840. B and C

Question Number : 63 Question Id : 8606541414 Question Type : MCQ Option Shuffling : Yes Display Question Number : Yes Is Question Mandatory : No Single Line Question Option : No Option Orientation : Vertical

Consider the following compounds



Arrange these compounds in the increasing order of reactivity with nitrating mixture.

Options :

8606544813. $c < b < a$

8606544814. $b < c < a$

8606544815. $c < a < b$

8606544816. $b < a < c$

Question Number : 64 Question Id : 8606541402 Question Type : MCQ Option Shuffling : Yes Display Question Number : Yes Is Question Mandatory : No Single Line Question Option : No Option Orientation : Vertical

Given,

(A) $n=5, m_l = -1$

(B) $n=3, l=2, m_l = -1, m_s = +\frac{1}{2}$

The maximum number of electron(s) in an atom that can have the quantum numbers as given in (A) and (B) respectively are :

Options :

8606544765. 26 and 1

8606544766. 2 and 4

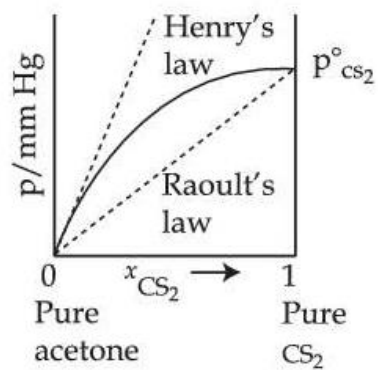
8606544767. 8 and 1

8606544768. 4 and 1

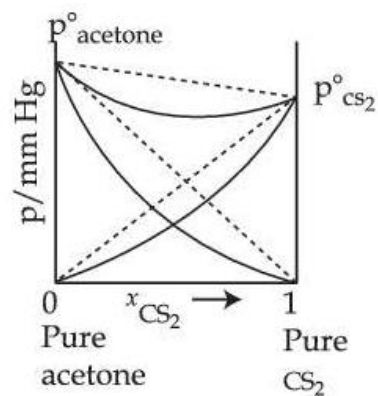
Question Number : 65 Question Id : 8606541405 Question Type : MCQ Option Shuffling : Yes Display Question Number : Yes Is Question Mandatory : No Single Line Question Option : No Option Orientation : Vertical

Which one of the following graphs accurately represents the plot of partial pressure of CS_2 vs its mole fraction in a mixture of acetone and CS_2 at constant temperature ?

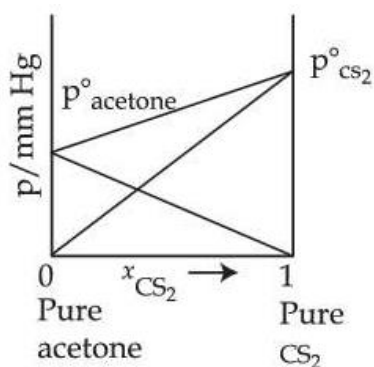
Options :



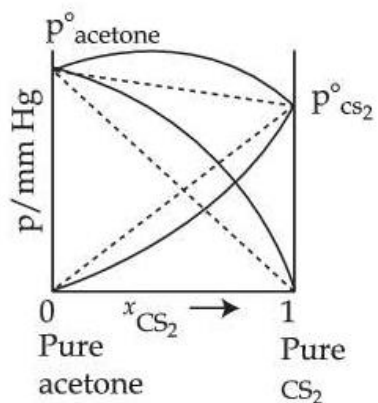
8606544777.



8606544778.

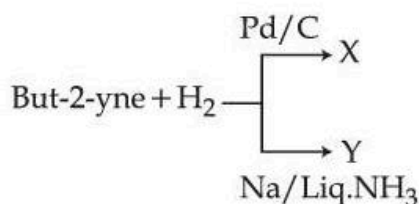


8606544779.



8606544780.

But-2-yne and hydrogen (one mole each) are separately treated with (i) Pd/C and (ii) Na/ liq. NH_3 to give the products X and Y respectively.



Identify the **incorrect** statements.

- A. X and Y are stereoisomers.
- B. Dipole moment of X is zero.
- C. Boiling point of X is higher than Y.
- D. X and Y react with $\text{O}_3/\text{Zn} + \text{H}_2\text{O}$ to give different products.

Choose the **correct** answer from the options given below :

Options :

8606544817. A and C Only

8606544818. B and D Only

8606544819. B and C Only

8606544820. A and B Only

The statements that are **incorrect** about the nickel(II) complex of dimethylglyoxime are :

- A. It is red in colour.
- B. It has a high solubility in water at $\text{pH} = 9$.
- C. The Ni ion has two unpaired d-electrons.
- D. The N – Ni – N bond angle is almost close to 90° .
- E. The complex contains four five-membered metallacycles (metal containing rings).

Choose the **correct** answer from the options given below :

Options :

8606544801. B, C and E Only

8606544802. A, D and B Only

8606544803. C and D Only

8606544804. C and E Only

Question Number : 68 Question Id : 8606541401 Question Type : MCQ Option Shuffling : Yes Display Question Number : Yes Is Question Mandatory : No Single Line Question Option : No Option Orientation : Vertical

Which of the following statements regarding the energy of the stationary state is **true** in the following one - electron systems ?

Options :

8606544761. -1.09×10^{-18} J for second orbit of H atom.

8606544762. $+2.18 \times 10^{-18}$ J for second orbit of He^+ ion

8606544763. $+8.72 \times 10^{-18}$ J for first orbit of He^+ ion

8606544764. -2.18×10^{-18} J for third orbit of Li^{2+} ion

Question Number : 69 Question Id : 8606541412 Question Type : MCQ Option Shuffling : Yes Display Question Number : Yes Is Question Mandatory : No Single Line Question Option : No Option Orientation : Vertical

Match List - I with List - II.

List - I

Functional group (detection)

- A. Unsaturation (Baeyer's test)
- B. Alcoholic group (Ceric ammonium nitrate test)
- C. Aldehyde group (Tollen's reagent)
- D. Phenolic group (FeCl_3 test)

List - II

Change observed during detection

- I. Red colour appears
- II. Silver mirror appears
- III. Violet colour appears
- IV. Discharge of pink colour

Choose the **correct** answer from the options given below :

Options :

8606544805. A-IV, B-III, C-II, D-I

8606544806. A-III, B-IV, C-II, D-I

8606544807. A-IV, B-I, C-II, D-III

8606544808. A-III, B-IV, C-I, D-II

Question Number : 70 Question Id : 8606541417 Question Type : MCQ Option Shuffling : Yes Display Question Number : Yes Is Question Mandatory : No Single Line Question Option : No Option Orientation : Vertical

'x' is the product which is obtained from propanenitrile and stannous chloride in the presence of hydrochloric acid followed by hydrolysis. 'y' is the product which is obtained from the but-2-ene by the ozonolysis followed by hydrolysis. From the following, which product is not obtained when one mole of 'x' and one mole of 'y' react with each other in the presence of alkali followed by heating ?

Options :

8606544825. 3-Methylbut-2-enal

8606544826. Pent-2-enal

8606544827. 2-Methylpent-2-enal

8606544828. 2-Methylbut-2-enal

Chemistry Section B

Section Number :	6
Section type :	Online
Mandatory or Optional :	Mandatory
Number of Questions :	5
Number of Questions to be attempted :	5
Section Marks :	20
Maximum Instruction Time :	0
Sub-Section Number :	1
Question Shuffling Allowed :	Yes
Is Section Default? :	No

Question Number : 71 Question Id : 8606541424 Question Type : SA Display Question Number : Yes Keyboard Layout : Inscript

The crystal field splitting energy of $[\text{Co}(\text{oxalate})_3]^{3-}$ complex is 'n' times that of the $[\text{Cr}(\text{oxalate})_3]^{3-}$ complex. Here 'n' is _____. (Assume $\Delta_o > P$)

Response Type : Numeric

Evaluation Required For SA : Yes

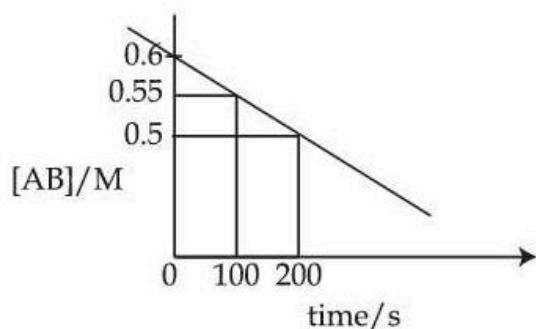
Show Word Count : Yes

Answers Type : Equal

Text Areas : PlainText

Question Number : 72 Question Id : 8606541423 Question Type : SA Display Question Number : Yes Keyboard Layout : Inscript

For the thermal decomposition of reactant $\text{AB}(\text{g})$, the following plot is constructed.



The half life of the reaction is 'x' min.

x = _____ min. (Nearest integer)

Response Type : Numeric

Evaluation Required For SA : Yes

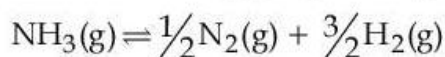
Show Word Count : Yes

Answers Type : Equal

Text Areas : PlainText

Question Number : 73 Question Id : 8606541422 Question Type : SA Display Question Number : Yes Keyboard Layout : Inscript

For the following gas phase equilibrium reaction at constant temperature,



if the total pressure is $\sqrt{3}$ atm and the pressure equilibrium constant (K_p) is 9 atm, then the degree of dissociation is given as $(x \times 10^{-2})^{-1/2}$. The value of x is _____. (nearest integer)

Response Type : Numeric

Evaluation Required For SA : Yes

Show Word Count : Yes

Answers Type : Equal

Text Areas : PlainText

Question Number : 74 Question Id : 8606541421 Question Type : SA Display Question Number : Yes Keyboard Layout : Inscript

x mg of pure HCl was used to make an aqueous solution. 25.0 mL of 0.1 M $\text{Ba}(\text{OH})_2$ solution is used when the HCl solution was titrated against it. The numerical value of x is _____ $\times 10^{-1}$. (Nearest integer)

Given : Molar mass of HCl and $\text{Ba}(\text{OH})_2$ are 36.5 and 171.0 g mol^{-1} respectively.

Response Type : Numeric

Evaluation Required For SA : Yes

Show Word Count : Yes

Answers Type : Equal

Text Areas : PlainText

Question Number : 75 Question Id : 8606541425 Question Type : SA Display Question Number : Yes Keyboard Layout : Inscript

Consider all the structural isomers with molecular formula $\text{C}_5\text{H}_{11}\text{Br}$ are separately treated with $\text{KOH}(\text{aq})$ to give respective substitution products, without any rearrangement. The number of products which can exhibit optical isomerism from these is _____.

Response Type : Numeric

Evaluation Required For SA : Yes

Show Word Count : Yes

Answers Type : Equal

Text Areas : PlainText