National Testing Agency

Question Paper Name :	B Tech 24 Jun 2022 Shift 2
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 Type : MCQ Option Shuffling : Yes Display Question Number : Yes Is Question Mandatory : No Single Line Question Option : No Option Orientation : Vertical

Let

$$x * y = x^2 + y^3$$

and

$$(x * 1) * 1 = x * (1 * 1)$$

.

Then a value of

$$2\sin^{-1}\left(\frac{x^4 + x^2 - 2}{x^4 + x^2 + 2}\right)$$

is :

Options :

A. $\frac{\pi}{4}$

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

C. $\frac{\pi}{2}$

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

Question Number : 2 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 the real roots of the equation

$$(e^{2x} - 4)(6e^{2x} - 5e^{x} + 1) = 0$$

is

Options :

A. $\log_e 3$

B. $-\log_e 3$

C. $\log_e 6$

D. $-\log_e 6$

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

Let the system of linear equations

$x + y + \alpha z = 2$

$3x + y + z = 4$

$x + 2z = 1$

have a unique solution (x^*, y^*, z^*). If (α, x^*), (y^*, α) and $(x^*, -y^*)$ are collinear points, then the sum of absolute values of all possible values of α is

Options :

A. 4

B. 3

C. 2

D. 1

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

Let x, y > 0. If $x^3y^2 = 2^{15}$, then the least value of 3x + 2y is

Options :

A. 30

B. 32

C. 36

D. 40

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

Let

$$f(x) = \begin{cases} \frac{\sin(x-[x])}{x-[x]} & , x \in (-2,-1) \\ \max\{2x, 3[|x|]\} & , |x| < 1 \\ 1 & , otherwise \end{cases}$$

where [t] denotes greatest integer $\leq$ t. If m is the number of points where f is not continuous and n is the number of points where f is not differentiable, then the ordered pair (m, n) is :

Options :

A. (3, 3)

B. (2, 4)

C. (2, 3)

D. (3, 4)

Question Number : 6 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

$$\int_{-\pi/2}^{\pi/2} \frac{dx}{(1+e^x)(\sin^6 x + \cos^6 x)}$$

is equal to

Options :

A. 2π

B. 0

C. π

D. $\frac{\pi}{2}$

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

A particle is moving in the xy-plane along a curve C passing through the point (3, 3). The tangent to the curve C at the point P meets the x-axis at Q. If the y-axis bisects the segment PQ, then C is a parabola with :

Options :

A. length of latus rectum 3

B. length of latus rectum 6

C. focus $\left(\frac{4}{3}, 0\right)$

D. focus $\left(0, \frac{3}{4}\right)$

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

Let the maximum area of the triangle that can be inscribed in the ellipse

$$\frac{x^2}{a^2} + \frac{y^2}{4} = 1,\ a > 2$$

, having one of its vertices at one end of the major axis of the ellipse and one of its sides parallel to the y-axis, be $6\sqrt{3}$. Then the eccentricity of the ellipse is :

Options :

A. $\frac{\sqrt{3}}{2}$

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

C. $\frac{1}{\sqrt{2}}$

D. $\frac{\sqrt{3}}{4}$

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

Let the area of the triangle with vertices A(1, α), B(α, 0) and C(0, α) be 4 sq. units. If the points (α, $-\alpha$), ($-\alpha$, α) and (α^2, β) are collinear, then β is equal to :

Options :

A. 64

B. -8

C. -64

D. 512

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

The number of distinct real roots of the equation

$x^7 - 7x - 2 = 0$ is

Options :

A. 5

B. 7

C. 1

D. 3

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

A random variable X has the following probability distribution :

X	**0**	**1**	**2**	**3**	**4**
P(X)	k	2k	4k	6k	8k

The value of $P(1 < X < 4 \mid X \leq 2)$ is equal to :

Options :

A. $\frac{4}{7}$

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

C. $\frac{3}{7}$

D. $\frac{4}{5}$

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

If the shortest distance between the lines

$$\frac{x-1}{2}=\frac{y-2}{3}=\frac{z-3}{\lambda}$$

and

$$\frac{x-2}{1}=\frac{y-4}{4}=\frac{z-5}{5}$$

is

$$\frac{1}{\sqrt{3}}$$

, then the sum of all possible value of λ is :

Options :

A. 16

B. 6

C. 12

D. 15

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

Let $\hat{a}$ and $\hat{b}$ be two unit vectors such that

$$|(\hat{a}+\hat{b})+2(\hat{a}\times\hat{b})|=2$$

. If $\theta \in (0, \pi)$ is the angle between $\hat{a}$ and $\hat{b}$, then among the statements :

(S1) :

$$2|\hat{a}\times\hat{b}|=|\hat{a}-\hat{b}|$$

(S2) : The projection of $\hat{a}$ on $(\hat{a}+\hat{b})$ is $\frac{1}{2}$

Options :

A. Only (S1) is true.

B. Only (S2) is true.

C. Both (S1) and (S2) are true.

D. Both (S1) and (S2) are false.

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

If

$$y = \tan^{-1}\left(\sec x^3 - \tan x^3\right), \frac{\pi}{2} < x^3 < \frac{3\pi}{2}$$

, then

Options :

A. $xy'' + 2y' = 0$

B. $x^2y'' - 6y + \frac{3\pi}{2} = 0$

C. $x^2y'' - 6y + 3\pi = 0$

D. $xy'' - 4y' = 0$

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

Let λ^* be the largest value of λ for which the function

$$f_\lambda(x) = 4\lambda x^3 - 36\lambda x^2 + 36x + 48$$

is increasing for all x $\in$ R. Then $f_{\lambda^*}(1) + f_{\lambda^*}(-1)$ is equal to :

Options :

A. 36

B. 48

C. 64

D. 72

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

$$\lim_{n \to \infty} \left(\frac{n^2}{(n^2+1)(n+1)} + \frac{n^2}{(n^2+4)(n+2)} + \frac{n^2}{(n^2+9)(n+3)} + \ .... \ + \frac{n^2}{(n^2+n^2)(n+n)} \right)$$

is equal to :

Options :

A. $\frac{\pi}{8} + \frac{1}{4}\log_e 2$

B. $\frac{\pi}{4}+\frac{1}{8}\log_e 2$

C. $\frac{\pi}{4}-\frac{1}{8}\log_e 2$

D. $\frac{\pi}{8}+\log_e\sqrt{2}$

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

The number of solutions of the equation

$$\cos\left(x+\frac{\pi}{3}\right)\cos\left(\frac{\pi}{3}-x\right)=\frac{1}{4}\cos^2 2x$$

, $x\in[-3\pi,3\pi]$ is :

Options :

A. 8

B. 5

C. 6

D. 7

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

Let the points on the plane P be equidistant from the points $(-4, 2, 1)$ and $(2, -2, 3)$. Then the acute angle between the plane P and the plane $2x + y + 3z = 1$ is :

Options :

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

B. $\frac{\pi}{4}$

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

D. $\frac{5\pi}{12}$

Question Number : 19 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 statements:

A : Rishi is a judge.

B : Rishi is honest.

C : Rishi is not arrogant.

The negation of the statement "if Rishi is a judge and he is not arrogant, then he is honest" is

Options :

A. $B \rightarrow (A \vee C)$

B. $(\sim B) \wedge (A \wedge C)$

C. $B \rightarrow ((\sim A) \vee (\sim C))$

D. $B \rightarrow (A \wedge C)$

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

The slope of normal at any point (x, y), $x > 0$, $y > 0$ on the curve $y = y(x)$ is given by

$$\frac{x^2}{xy - x^2y^2 - 1}$$

. If the curve passes through the point (1, 1), then $e \cdot y(e)$ is equal to

Options :

A. $\frac{1 - \tan(1)}{1 + \tan(1)}$

B. $\tan(1)$

C. 1

D. $\frac{1 + \tan(1)}{1 - \tan(1)}$

Mathematics Section B

Section Number :	2
Section type :	Online
Mandatory or Optional :	Mandatory
Number of Questions :	10
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 Type : SA Display Question Number : Yes Keyboard Layout : Inscript

Let $S = \{z \in C : |z - 3| \leq 1$ and $z(4 + 3i) + z(4 - 3i) \leq 24\}$. If $\alpha + i\beta$ is the point in S which is closest to 4i, then $25(\alpha + \beta)$ 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 Type : SA Display Question Number : Yes Keyboard Layout : Inscript

Let

$$S = \left\{ \begin{pmatrix} -1 & a \\ 0 & b \end{pmatrix}; a, b \in \{1,2,3, ...100\} \right\}$$

and let

$$T_n = \{A \in S : A^{n(n+1)} = I\}$$

. Then the number of elements in

$$\bigcap_{n=1}^{100} T_n$$

is _____.

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

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

The number of 7-digit numbers which are multiples of 11 and are formed using all the digits 1, 2, 3, 4, 5, 7 and 9 is _____.

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

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

The sum of all the elements of the set

$$\{\alpha \in \{1,2, ..., 100\} : HCF(\alpha, 24) = 1\}$$

is _____.

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

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

The remainder on dividing $1 + 3 + 3^2 + 3^3 + ... + 3^{2021}$ by 50 is _____.

Response Type : Numeric

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

Question Number : 26 Question Type : SA Display Question Number : Yes Keyboard Layout : Inscript

The area (in sq. units) of the region enclosed between the parabola $y^2 = 2x$ and the line $x + y = 4$ is _____.

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

Question Number : 27 Question Type : SA Display Question Number : Yes Keyboard Layout : Inscript

Let a circle C : $(x - h)^2 + (y - k)^2 = r^2$, $k > 0$, touch the x-axis at (1, 0). If the line $x + y = 0$ intersects the circle C at P and Q such that the length of the chord PQ is 2, then the value of $h + k + r$ is equal to _____.

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

Question Number : 28 Question Type : SA Display Question Number : Yes Keyboard Layout : Inscript

Let the hyperbola

$$H: \frac{x^2}{a^2} - y^2 = 1$$

and the ellipse

$$E: 3x^2 + 4y^2 = 12$$

be such that the length of latus rectum of H is equal to the length of latus rectum of E. If e_H and e_E are the eccentricities of H and E respectively, then the value of $12\left(e_H^2 + e_E^2\right)$ is equal to _____.

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

Question Number : 29 Question Type : SA Display Question Number : Yes Keyboard Layout : Inscript

Let P_1 be a parabola with vertex (3, 2) and focus (4, 4) and P_2 be its mirror image with respect to the line $x + 2y = 6$. Then the directrix of P_2 is $x + 2y =$ _____.

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

Question Number : 30 Question Type : SA Display Question Number : Yes Keyboard Layout : Inscript

In an examination, there are 10 true-false type questions. Out of 10, a student can guess the answer of 4 questions correctly with probability $\frac{3}{4}$ and the remaining 6 questions correctly with probability $\frac{1}{4}$. If the probability that the student guesses the answers of exactly 8 questions correctly out of 10 is $\frac{27k}{4^{10}}$, then k 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 : 31 Question Type : MCQ Option Shuffling : Yes Display Question Number : Yes Is Question Mandatory : No Single Line Question Option : No Option Orientation : Vertical

Identify the pair of physical quantities that have same dimensions:

Options :

A. velocity gradient and decay constant

B. Wien's constant and Stefan constant

C. angular frequency and angular momentum

D. wave number and Avogadro number

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

The distance between Sun and Earth is R. The duration of year if the distance between Sun and Earth becomes 3R will be :

Options :

A. $\sqrt{3}$ years

B. 3 years

C. 9 years

D. $3\sqrt{3}$ years

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

A stone of mass m, tied to a string is being whirled in a vertical circle with a uniform speed. The tension in the string is

Options :

A. the same throughout the motion.

B. minimum at the highest position of the circular path.

C. minimum at the lowest position of the circular path.

D. minimum when the rope is in the horizontal position.

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

Two identical charged particles each having a mass 10 g and charge 2.0×10^{-7}C are placed on a horizontal table with a separation of L between them such that they stay in limited equilibrium. If the coefficient of friction between each particle and the table is 0.25, find the value of L. [Use g = 10 ms^{-2}]

Options :

A. 12 cm

B. 10 cm

C. 8 cm

D. 5 cm

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

Two massless springs with spring constants 2 k and 9 k, carry 50 g and 100 g masses at their free ends. These two masses oscillate vertically such that their maximum velocities are equal. Then, the ratio of their respective amplitudes will be :

Options :

A. 1 : 2

B. 3 : 2

C. 3 : 1

D. 2 : 3

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

What will be the most suitable combination of three resistors A = 2Ω, B = 4Ω, C = 6Ω so that

$$\left(\frac{22}{3}\right)$$

Ω is equivalent resistance of combination?

Options :

A. Parallel combination of A and C connected in series with B.

B. Parallel combination of A and B connected in series with C.

C. Series combination of A and C connected in parallel with B.

D. Series combination of B and C connected in parallel with A.

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

The soft-iron is a suitable material for making an electromagnet. This is because soft-iron has

Options :

A. low coercivity and high retentivity.

B. low coercivity and low permeability.

C. high permeability and low retentivity.

D. high permeability and high retentivity.

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

A proton, a deutron and an α-particle with same kinetic energy enter into a uniform magnetic field at right angle to magnetic field. The ratio of the radii of their respective circular paths is :

Options :

A. $1 : \sqrt{2} : \sqrt{2}$

B. $1 : 1 : \sqrt{2}$

C. $\sqrt{2} : 1 : 1$

1 :

$\sqrt{2}$

D. : 1

Question Number : 39 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 : The reactance of an ac circuit is zero. It is possible that the circuit contains a capacitor and an inductor.

Statement II : In ac circuit, the average power delivered by the source never becomes zero.

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

Options :

A. Both Statement I and Statement II are true.

B. Both Statement I and Statement II are false.

C. Statement I is true but Statement II is false.

D. Statement I is false but Statement II is true.

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

Potential energy as a function of r is given by

$$U = \frac{A}{r^{10}} - \frac{B}{r^5}$$

, where r is the interatomic distance, A and B are positive constants. The equilibrium distance between the two atoms will be :

Options :

A. $\left(\frac{A}{B}\right)^{\frac{1}{5}}$

B. $\left(\frac{B}{A}\right)^{\frac{1}{5}}$

C. $\left(\frac{2A}{B}\right)^{\frac{1}{5}}$

D. $\left(\frac{B}{2A}\right)^{\frac{1}{5}}$

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

An object of mass 5 kg is thrown vertically upwards from the ground. The air resistance produces a constant retarding force of 10 N throughout the motion. The ratio of time of ascent to the time of descent will be equal to : [Use $g = 10\ ms^{-2}$].

Options :

A. 1 : 1

B. $\sqrt{2}$: $\sqrt{3}$

C. $\sqrt{3}$: $\sqrt{2}$

D. 2 : 3

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

A fly wheel is accelerated uniformly from rest and rotates through 5 rad in the first second. The angle rotated by the fly wheel in the next second, will be :

Options :

A. 7.5 rad

B. 15 rad

C. 20 rad

D. 30 rad

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

A 100 g of iron nail is hit by a 1.5 kg hammer striking at a velocity of 60 ms^{-1}. What will be the rise in the temperature of the nail if one fourth of energy of the hammer goes into heating the nail?

[Specific heat capacity of iron = 0.42 $Jg^{-1}\ °C^{-1}$]

Options :

A. 675°C

B. 1600°C

C. 16.07°C

D. 6.75°C

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

If the charge on a capacitor is increased by 2 C, the energy stored in it increases by 44%. The original charge on the capacitor is (in C)

Options :

A. 10

B. 20

C. 30

D. 40

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

A long cylindrical volume contains a uniformly distributed charge of density ρ. The radius of cylindrical volume is R. A charge particle (q) revolves around the cylinder in a circular path. The kinetic energy of the particle is :

Options :

A. $\frac{\rho q R^2}{4\varepsilon_0}$

B. $\frac{\rho q R^2}{2\varepsilon_0}$

C. $\frac{q\rho}{4\varepsilon_0 R^2}$

D. $\frac{4\varepsilon_0 R^2}{q\rho}$

Question Number : 46 Question Type : MCQ Option Shuffling : Yes Display Question Number : Yes Is Question Mandatory : No Single Line Question Option : No Option Orientation : Vertical

An electric bulb is rated as 200 W. What will be the peak magnetic field at 4 m distance produced by the radiations coming from this bulb? Consider this bulb as a point source with 3.5% efficiency.

Options :

A. 1.19×10^{-8}T

B. 1.71×10^{-8}T

C. 0.84×10^{-8}T

D. 3.36×10^{-8}T

Question Number : 47 Question Type : MCQ Option Shuffling : Yes Display Question Number : Yes Is Question Mandatory : No Single Line Question Option : No Option Orientation : Vertical

The light of two different frequencies whose photons have energies 3.8 eV and 1.4 eV respectively, illuminate a metallic surface whose work function is 0.6 eV successively. The ratio of maximum speeds of emitted electrons for the two frequencies respectively will be :

Options :

A. 1 : 1

B. 2 : 1

C. 4 : 1

D. 1 : 4

Question Number : 48 Question Type : MCQ Option Shuffling : Yes Display Question Number : Yes Is Question Mandatory : No Single Line Question Option : No Option Orientation : Vertical

Two light beams of intensities in the ratio of 9 : 4 are allowed to interfere. The ratio of the intensity of maxima and minima will be :

Options :

A. 2 : 3

B. 16 : 81

C. 25 : 169

D. 25 : 1

Question Number : 49 Question Type : MCQ Option Shuffling : Yes Display Question Number : Yes Is Question Mandatory : No Single Line Question Option : No Option Orientation : Vertical

In Bohr's atomic model of hydrogen, let K, P and E are the kinetic energy, potential energy and total energy of the electron respectively. Choose the correct option when the electron undergoes transitions to a higher level :

Options :

A. All K, P and E increase.

B. K decreases, P and E increase.

C. P decreases, K and E increase.

D. K increases, P and E decrease.

Question Number : 50 Question Type : MCQ Option Shuffling : Yes Display Question Number : Yes Is Question Mandatory : No Single Line Question Option : No Option Orientation : Vertical

A Carnot engine takes 5000 kcal of heat from a reservoir at 727°C and gives heat to a sink at 127°C. The work done by the engine is

Options :

A. 3×10^6 J

B. Zero

C. 12.6×10^6 J

D. 8.4×10^6 J

Physics Section B

Section Number :	4
Section type :	Online
Mandatory or Optional :	Mandatory
Number of Questions :	10
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 : 51 Question Type : SA Display Question Number : Yes Keyboard Layout : Inscript

A body is projected from the ground at an angle of 45° with the horizontal. Its velocity after 2s is 20 ms^{-1}. The maximum height reached by the body during its motion is _____ m. (use g = 10 ms^{-2})

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

Question Number : 52 Question Type : SA Display Question Number : Yes Keyboard Layout : Inscript

Two travelling waves of equal amplitudes and equal frequencies move in opposite directions along a string. They interfere to produce a stationary wave whose equation is given by

$$y = (10 \cos \pi x \sin \frac{2\pi t}{T})$$

cm

The amplitude of the particle at

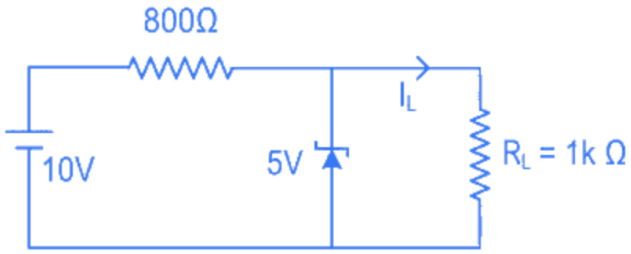
$$x = \frac{4}{3}$$

cm will be _____ cm.

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

Question Number : 53 Question Type : SA Display Question Number : Yes Keyboard Layout : Inscript

In the given circuit, the value of current I_L will be _____ mA. (When R_L = 1kΩ)



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

Question Number : 54 Question Type : SA Display Question Number : Yes Keyboard Layout : Inscript

A ray of light is incident at an angle of incidence 60° on the glass slab of refractive index $\sqrt{3}$. After refraction, the light ray emerges out from other parallel faces and lateral shift between incident ray and emergent ray is $4\sqrt{3}$ cm. The thickness of the glass slab is _____ cm.

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

Question Number : 55 Question Type : SA Display Question Number : Yes Keyboard Layout : Inscript

A circular coil of 1000 turns each with area $1m^2$ is rotated about its vertical diameter at the rate of one revolution per second in a uniform horizontal magnetic field of 0.07T. The maximum voltage generation will be _____ V.

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

Question Number : 56 Question Type : SA Display Question Number : Yes Keyboard Layout : Inscript

A monoatomic gas performs a work of $\frac{Q}{4}$ where Q is the heat supplied to it. The molar heat capacity of the gas will be _____ R during this transformation. Where R is the gas constant.

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

Question Number : 57 Question Type : SA Display Question Number : Yes Keyboard Layout : Inscript

An antenna is placed in a dielectric medium of dielectric constant 6.25. If the maximum size of that antenna is 5.0 mm, it can radiate a signal of minimum frequency of _____ GHz.

(Given $\mu_r = 1$ for dielectric medium)

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

Question Number : 58 Question Type : SA Display Question Number : Yes Keyboard Layout : Inscript

A potentiometer wire of length 10 m and resistance 20 Ω is connected in series with a 25 V battery and an external resistance 30 Ω. A cell of emf E in secondary circuit is balanced by 250 cm long potentiometer wire. The value of E (in volt) is $\frac{x}{10}$. The value of x is _____.

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

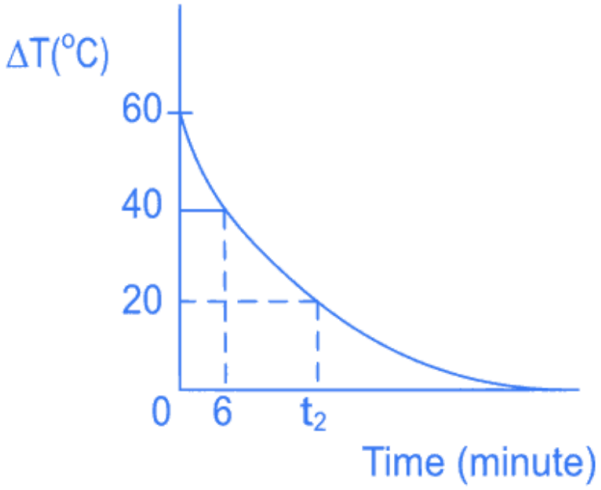
Question Number : 59 Question Type : SA Display Question Number : Yes Keyboard Layout : Inscript

A sample contains 10^{-2} kg each of two substances A and B with half lives 4 s and 8 s respectively. The ratio of their atomic weights is 1 : 2. The ratio of the amounts of A and B after 16 s is $\frac{x}{100}$. The value of x is _____.

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

Question Number : 60 Question Type : SA Display Question Number : Yes Keyboard Layout : Inscript

In an experiment to verify Newton's law of cooling, a graph is plotted between the temperature difference (ΔT) of the water and surroundings and time as shown in figure. The initial temperature of water is taken as 80° C. The value of t_2 as mentioned in the graph will be _____.



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

120 g of an organic compound that contains only carbon and hydrogen gives 330 g of CO_2 and 270 g of water on complete combustion. The percentage of carbon and hydrogen, respectively are

Options :

A. 25 and 75

B. 40 and 60

C. 60 and 40

D. 75 and 25

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

The energy of one mole of photons of radiation of wavelength 300 nm is

(Given : $h = 6.63 \times 10^{-34}$ J s, $N_A = 6.02 \times 10^{23}$ mol^{-1}, $c = 3 \times 10^{8}$ m s^{-1})

Options :

A. 235 kJ mol^{-1}

B. 325 kJ mol^{-1}

C. 399 kJ mol^{-1}

D. 435 kJ mol^{-1}

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

The correct order of bond orders of C_2^{2-}, N_2^{2-} and O_2^{2-} is, respectively

Options :

A. $C_2^{2-} < N_2^{2-} < O_2^{2-}$

B. $O_2^{2-} < N_2^{2-} < C_2^{2-}$

C. $C_2^{2-} < O_2^{2-} < N_2^{2-}$

N_2^{2-} < C_2^{2-} < O_2^{2-}

D.

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

At 25°C and 1 atm pressure, the enthalpies of combustion are as given below :

Substance	H_2	**C (graphite)**	$C_2H_6(g)$
$\frac{\Delta_c H^\ominus}{kJ\,mol^{-1}}$	−286.0	−394.0	−1560.0

The enthalpy of formation of ethane is

Options :

A. $+54.0\ kJ\ mol^{-1}$

B. $-68.0\ kJ\ mol^{-1}$

C. $-86.0\ kJ\ mol^{-1}$

D. $+97.0\ kJ\ mol^{-1}$

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

For a first order reaction, the time required for completion of 90% reaction is 'x' times the half life of the reaction. The value of 'x' is

(Given : ln 10 = 2.303 and log 2 = 0.3010)

Options :

A. 1.12

B. 2.43

C. 3.32

D. 33.31

Question Number : 66 Question Type : MCQ Option Shuffling : Yes Display Question Number : Yes Is Question Mandatory : No Single Line Question Option : No Option Orientation : Vertical

Metals generally melt at very high temperature. Amongst the following, the metal with the highest melting point will be :

Options :

A. Hg

B. Ag

C. Ga

D. Cs

Question Number : 67 Question Type : MCQ Option Shuffling : Yes Display Question Number : Yes Is Question Mandatory : No Single Line Question Option : No Option Orientation : Vertical

PCl_5 is well known, but NCl_5 is not. because,

Options :

A. nitrogen is less reactive than phosphorus.

B. nitrogen doesn't have d-orbitals in its valence shell.

C. catenation tendency is weaker in nitrogen than phosphorus.

D. size of phosphorus is larger than nitrogen.

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

Transition metal complex with highest value of crystal field splitting (Δ_0) will be :

Options :

A. $[Cr(H_2O)_6]^{3+}$

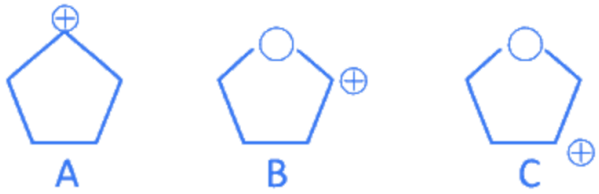
B. $[Mo(H_2O)_6]^{3+}$

C. $[Fe(H_2O)_6]^{3+}$

D. $[Os(H_2O)_6]^{3+}$

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

Arrange the following carbocations in decreasing order of stability.



Options :

A. B > A > C

B. A > B > C

C. C > B > A

D. C > A > B

Question Number : 70 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 : The presence of weaker π-bonds make alkenes less stable than alkanes.

Statement II : The strength of the double bond is greater than that of carbon-carbon single bond.

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

Options :

A. Both Statement I and Statement II are correct.

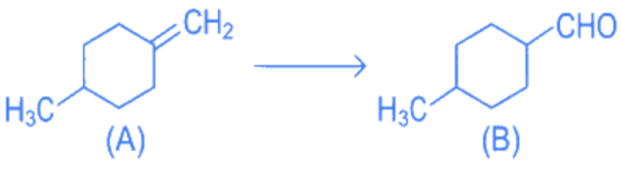
B. Both Statement I and Statement II are incorrect.

C. Statement I is correct but Statement II is incorrect.

D. Statement I is incorrect but Statement II is correct.

Question Number : 71 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 reagents / reactions will convert 'A' to 'B' ?



Options :

A. PCC oxidation

B. Ozonolysis

C. BH_3, $H_2O_2/^-OH$ followed by PCC oxidation

D. HBr, hydrolysis followed by oxidation by $K_2Cr_2O_7$.

Question Number : 72 Question Type : MCQ Option Shuffling : Yes Display Question Number : Yes Is Question Mandatory : No Single Line Question Option : No Option Orientation : Vertical

Hex-4-ene-2-ol on treatment with PCC gives 'A'. 'A' on reaction with sodium hypoiodite gives 'B', which on further heating with soda lime gives 'C'. The compound 'C' is :

Options :

A. 2-pentene

B. proponaldehyde

C. 2-butene

D. 4-methylpent-2-ene

Question Number : 73 Question Type : MCQ Option Shuffling : Yes Display Question Number : Yes Is Question Mandatory : No Single Line Question Option : No Option Orientation : Vertical

The conversion of propan-1-ol to n-butylamine involves the sequential addition of reagents. The correct sequential order of reagents is

Options :

A. (i) $SOCl_2$ (ii) KCN (iii) H_2/Ni, Na(Hg)/C_2H_5OH

B. (i) HCl (ii) H_2/Ni, Na(Hg)/C_2H_5OH

C. (i) $SOCl_2$ (ii) KCN (iii) CH_3NH_2

D. (i) HCl (ii) CH_3NH_2

Question Number : 74 Question Type : MCQ Option Shuffling : Yes Display Question Number : Yes Is Question Mandatory : No Single Line Question Option : No Option Orientation : Vertical

In the flame test of a mixture of salts, a green flame with blue centre was observed. Which one of the following cations may be present?

Options :

A. Cu^{2+}

B. Sr^{2+}

C. Ba^{2+}

D. Ca^{2+}

Question Number : 75 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 chemical reactions represents Hall-Heroult Process?

Options :

A. $Cr_2O_3 + 2Al \rightarrow Al_2O_3 + 2Cr$

B. $2Al_2O_3 + 3C \rightarrow 4Al + 3CO_2$

C. $FeO + CO \rightarrow Fe + CO_2$

D. $2[Au(CN)_2]^-_{(aq)} + Zn(s) \rightarrow 2Au(s) + [Zn(CN_4)]^{2-}$

Question Number : 76 Question Type : MCQ Option Shuffling : Yes Display Question Number : Yes Is Question Mandatory : No Single Line Question Option : No Option Orientation : Vertical

In the industrial production of which of the following, molecular hydrogen is obtained as a byproduct?

Options :

A. NaOH

B. NaCl

C. Na metal

D. Na_2CO_3

Question Number : 77 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 compounds is used as a chemical in certain type of fire extinguishers?

Options :

A. Baking soda

B. Soda ash

C. Washing soda

D. Caustic soda

Question Number : 78 Question Type : MCQ Option Shuffling : Yes Display Question Number : Yes Is Question Mandatory : No Single Line Question Option : No Option Orientation : Vertical

Some gases are responsible for heating of atmosphere (green house effect). Identify from the following the gaseous species which does not cause it.

Options :

A. CH_4

B. O_3

C. H_2O

D. N_2

Question Number : 79 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 is not an example of a condensation polymer?

Options :

A. Nylon 6,6

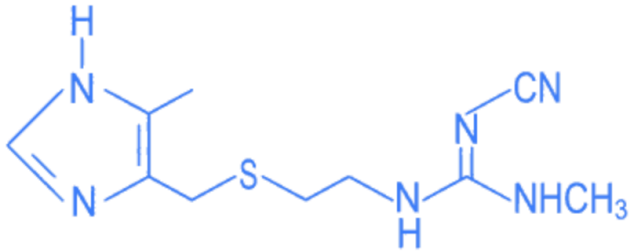
B. Dacron

C. Buna-N

D. Silicone

Question Number : 80 Question Type : MCQ Option Shuffling : Yes Display Question Number : Yes Is Question Mandatory : No Single Line Question Option : No Option Orientation : Vertical

The structure shown below is of which well-known drug molecule?



Options :

A. Ranitidine

B. Seldane

C. Cimetidine

D. Codeine

Chemistry Section B

Section Number :	6
Section type :	Online
Mandatory or Optional :	Mandatory
Number of Questions :	10
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 : 81 Question Type : SA Display Question Number : Yes Keyboard Layout : Inscript

A company dissolves 'x' amount of CO_2 at 298 K in 1 litre of water to prepare soda water. X = _____ $\times 10^{-3}$ g. (nearest integer)

(Given : partial pressure of CO_2 at 298 K = 0.835 bar.

Henry's law constant for CO_2 at 298 K = 1.67 kbar.

Atomic mass of H, C and O is 1, 12, and 6 g mol^{-1}, respectively)

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

Question Number : 82 Question Type : SA Display Question Number : Yes Keyboard Layout : Inscript

PCl_5 dissociates as

$PCl_5(g) \rightleftharpoons PCl_3(g) + Cl_2(g)$

5 moles of PCl_5 are placed in a 200 litre vessel which contains 2 moles of N_2 and is maintained at 600 K. The equilibrium pressure is 2.46 atm. The equilibrium constant K_p for the dissociation of PCl_5 is _____ $\times 10^{-3}$. (nearest integer)

(Given : R = 0.082 L atm K^{-1} mol^{-1}; Assume ideal gas behaviour)

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

Question Number : 83 Question Type : SA Display Question Number : Yes Keyboard Layout : Inscript

The resistance of a conductivity cell containing 0.01 M KCl solution at 298 K is 1750 Ω. If the conductivity of 0.01 M KCl solution at 298 K is 0.152×10^{-3} S cm^{-1}, then the cell constant of the conductivity cell is _____ $\times 10^{-3}$ cm^{-1}.

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

Question Number : 84 Question Type : SA Display Question Number : Yes Keyboard Layout : Inscript

Manganese (VI) has ability to disproportionate in acidic solution. The difference in oxidation states of two ions it forms in acidic solution is _____.

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

Question Number : 85 Question Type : SA Display Question Number : Yes Keyboard Layout : Inscript

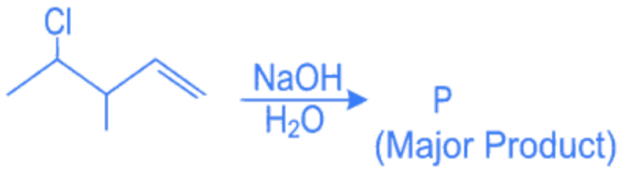
0.2 g of an organic compound was subjected to estimation of nitrogen by Dumas method in which volume of N_2 evolved (at STP) was found to be 22.400 mL. The percentage of nitrogen in the compound is _____.

[nearest integer]

(Given : Molar mass of N_2 is 28 g mol^{-1}. Molar volume of N_2 at STP : 22.4 L)

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

Question Number : 86 Question Type : SA Display Question Number : Yes Keyboard Layout : Inscript



Consider the above reaction. The number of π electrons present in the product 'P' is _____.

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

Question Number : 87 Question Type : SA Display Question Number : Yes Keyboard Layout : Inscript

In alanylglycyl leucyl alanyl valine, the number of peptide linkages is _____.

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

Question Number : 88 Question Type : SA Display Question Number : Yes Keyboard Layout : Inscript

At 300 K, a sample of 3.0 g of gas A occupies the same volume as 0.2 g of hydrogen at 200 K at the same pressure. The molar mass of gas A is _____ g mol^{-1}. (nearest integer) Assume that the behaviour of gases as ideal.

(Given : The molar mass of hydrogen (H_2) gas is 2.0 g mol^{-1}.)

Response Type : Numeric
Evaluation Required For SA : Yes
Show Word Count : Yes

Answers Type : Equal
Text Areas : PlainText

Question Number : 89 Question Type : SA Display Question Number : Yes Keyboard Layout : Inscript

When 200 mL of 0.2 M acetic acid is shaken with 0.6 g of wood charcoal, the final concentration of acetic acid after adsorption is 0.1 M. The mass of acetic acid adsorbed per gram of carbon is _____ g.

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

Question Number : 90 Question Type : SA Display Question Number : Yes Keyboard Layout : Inscript

(a) Baryte, (b) Galena, (c) Zinc blende and (d) Copper pyrites. How many of these minerals are sulphide based?

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