National Testing Agency

Question Paper Name :	B Tech 8 Apr 2023 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

$$A = \left\{\theta \in (0,2\pi) : \frac{1 + 2i\sin\theta}{1 - i\sin\theta}\right.$$

is purely imaginary }. Then the sum of the elements in A is :

Options :

A. 3π

B. π

C. 2π

D. 4π

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

$25^{190} - 19^{190} - 8^{190} + 2^{190}$ is divisible by :

Options :

A. 14 but not by 34

B. neither 14 nor 34

C. both 14 and 34

D. 34 but not by 14

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

The integral

$$\int \left[\left(\frac{x}{2}\right)^x + \left(\frac{2}{x}\right)^x \right] \ln\left(\frac{ex}{2}\right) dx$$

is equal to :

Options :

A. $\left(\frac{x}{2}\right)^x + \left(\frac{2}{x}\right)^x + C$

B. $\left(\frac{x}{2}\right)^x - \left(\frac{2}{x}\right)^x + C$

C. $\left(\frac{x}{2}\right)^x \log_2\left(\frac{2}{x}\right) + C$

D. None

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

If the probability that the random variable X takes values x is given by

$$\mathrm{P(X} = x) = \mathrm{k}(x+1)3^{-x}, x = 0,1,2,3, \ \ldots$$

, where k is a constant, then $\mathrm{P(X} \geq 2)$ is equal to :

Options :

A. $\frac{7}{18}$

B. $\frac{20}{27}$

C. $\frac{7}{27}$

D. $\frac{11}{18}$

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

$$A = \{1,2,3,4,5,6,7\}$$

. Then the relation

$$R = \{(x, y) \in A \times A : x + y = 7\}$$

is :

Options :

A. reflexive but neither symmetric nor transitive

B. transitive but neither symmetric nor reflexive

C. symmetric but neither reflexive nor transitive

D. an equivalence relation

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

Let the mean and variance of 12 observations be $\frac{9}{2}$ and 4 respectively. Later on, it was observed that two observations were considered as 9 and 10 instead of 7 and 14 respectively. If the correct variance is $\frac{m}{n}$, where m and n are coprime, then m + n is equal to :

Options :

A. 317

B. 316

C. 314

D. 315

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

The absolute difference of the coefficients of x^{10} and x^7 in the expansion of

$$\left(2x^2 + \frac{1}{2x}\right)^{11}$$

is equal to :

Options :

A. $11^3 - 11$

B. $13^3 - 13$

C. $12^3 - 12$

D. $10^3 - 10$

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

The area of the quadrilateral ABCD with vertices A(2,1,1), B(1,2,5), C(−2, −3,5) and D(1, −6, −7) is equal to :

Options :

A. 48

B. $8\sqrt{38}$

C. 54

D. $9\sqrt{38}$

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

If the number of words, with or without meaning, which can be made using all the letters of the word MATHEMATICS in which C and S do not come together, is (6!)k, then k is equal to :

Options :

A. 5670

B. 1890

C. 2835

D. 945

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

If

$$A = \begin{bmatrix} 1 & 5 \\ \lambda & 10 \end{bmatrix}, \mathrm{A}^{-1} = \alpha \mathrm{A} + \beta \mathrm{I}$$

and $\alpha + \beta = -2$, then $4\alpha^2 + \beta^2 + \lambda^2$ is equal to :

Options :

A. 12

B. 10

C. 19

D. 14

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

If $\alpha > \beta > 0$ are the roots of the equation $ax^2 + bx + 1 = 0$, and

$$\lim_{x \to \frac{1}{\alpha}} \left(\frac{1 - \cos\left(x^2 + bx + a\right)}{2(1 - \alpha x)^2} \right)^{\frac{1}{2}} = \frac{1}{k}\left(\frac{1}{\beta} - \frac{1}{\alpha}\right), \text{ then k is equal to}$$

:

Options :

A. 2β

B. β

C. α

D. 2α

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

The value of

$$36\left(4\cos^2 9^\circ - 1\right)\left(4\cos^2 27^\circ - 1\right)\left(4\cos^2 81^\circ - 1\right)\left(4\cos^2 243^\circ - 1\right)$$

is :

Options :

A. 18

B. 36

C. 54

D. 27

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 S be the set of all values of $\theta \in [-\pi, \pi]$ for which the system of linear equations

$$x + y + \sqrt{3}\ z = 0$$
$$-x + (\tan\theta)y + \sqrt{7}\ z = 0$$
$$x + y + (\tan\theta)z = 0$$

has non-trivial solution. Then

$$\frac{120}{\pi}\sum_{\theta \in s}\theta$$

is equal to :

Options :

A. 40

B. 30

C. 10

D. 20

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

Let O be the origin and OP and OQ be the tangents to the circle

$$x^2 + y^2 - 6x + 4y + 8 = 0$$

at the points P and Q on it. If the circumcircle of the triangle OPQ passes through the point

$$\left(\alpha, \frac{1}{2}\right)$$

, then a value of α is :

Options :

A. 1

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

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

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

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 a_n be the n^{th} term of the series $5 + 8 + 14 + 23 + 35 + 50 + \ldots$ and

$$S_n = \sum_{k=1}^{n} a_k$$

. Then $S_{30} - a_{40}$ is equal to :

Options :

A. 11280

B. 11290

C. 11310

D. 11260

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

Let the vectors

$$\vec{u}_1 = \hat{i} + \hat{j} + a\hat{k}, \vec{u}_2 = \hat{i} + b\hat{j} + \hat{k}$$

and

$$\vec{u}_3 = c\hat{i} + \hat{j} + \hat{k}$$

be coplanar. If the vectors

$$\vec{v}_1 = (a+b)\hat{i} + c\hat{j} + c\hat{k}, \vec{v}_2 = a\hat{i} + (b+c)\hat{j} + a\hat{k}$$

and

$$\vec{v}_3 = b\hat{i} + b\hat{j} + (c+a)\hat{k}$$

are also coplanar, then 6(a + b + c) is equal to :

Options :

A. 12

B. 6

C. 0

D. 4

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

For $a, b \in \mathbb{Z}$ and $|a - b| \leq 10$, let the angle between the plane

$$P : ax + y - z = b$$

and the line

$$l : x - 1 = a - y = z + 1$$

be

$$\cos^{-1}\left(\frac{1}{3}\right)$$

. If the distance of the point $(6, -6, 4)$ from the plane P is $3\sqrt{6}$, then $a^4 + b^2$ is equal to :

Options :

A. 48

B. 85

C. 32

D. 25

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

The negation of $(p \wedge (\sim q)) \vee (\sim p)$ is equivalent to :

Options :

A. $p \wedge q$

B. $p \wedge (\sim q)$

C. $p \wedge (q \wedge (\sim p))$

D. $p \vee (q \vee (\sim p))$

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

Let P be the plane passing through the line

$$\frac{x-1}{1} = \frac{y-2}{-3} = \frac{z+5}{7}$$

and the point $(2, 4, -3)$.

If the image of the point $(-1, 3, 4)$ in the plane P

is (α, β, γ) then $\alpha + \beta + \gamma$ is equal to :

Options :

A. 10

B. 12

C. 9

D. 11

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

Let A(0,1), B(1,1) and C(1,0) be the mid-points of the sides of a triangle with incentre at the point D. If the focus of the parabola

$$y^2 = 4ax$$

passing through D is $(\alpha + \beta\sqrt{2}\ , 0)$, where α and β are rational numbers, then $\frac{\alpha}{\beta^2}$ is equal to :

Options :

A. $\frac{9}{2}$

B. 12

C. 6

D. 8

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 $[t]$ denote the greatest integer function. If

$$\int_0^{2.4} [x^2]\,dx = \alpha + \beta\sqrt{2}\ + \gamma\sqrt{3}\ + \delta\sqrt{5}$$

, then $\alpha + \beta + \gamma + \delta$ 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 the area enclosed by the lines

$$x + y = 2, y = 0, x = 0$$

and the curve

$$f(x) = \min\left\{x^2 + \frac{3}{4}, 1 + [x]\right\}$$

where $[x]$ denotes the greatest integer $\leq x$, be A. Then the value of 12 A 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

Let m and n be the numbers of real roots of the quadratic equations

$$x^2 - 12x + [x] + 31 = 0$$

and

$$x^2 - 5|x + 2| - 4 = 0$$

respectively, where $[x]$ denotes the greatest integer $\leq x$. Then $m^2 + mn + n^2$ 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 Type : SA Display Question Number : Yes Keyboard Layout : Inscript

Let

$$R = \{a, b, c, d, e\}$$

and

$$S = \{1,2,3,4\}$$

. Total number of onto functions $f : R \to S$ such that $f(a) \neq 1$, 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 Type : SA Display Question Number : Yes Keyboard Layout : Inscript

Let k and m be positive real numbers such that the function

$$f(x)=\begin{cases}3x^2+k\sqrt{x+1}\ , & 0<x<1\\ mx^2+k^2, & x\geq 1\end{cases}$$

is differentiable for all $x>0$. Then

$$\frac{8f'(8)}{f'\left(\frac{1}{8}\right)}$$

is equal to _____.

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

Let the solution curve

$$x=x(y), 0<y<\frac{\pi}{2}$$

, of the differential equation

$$\left(\log_e(\cos y)\right)^2\cos y\,dx-\left(1+3x\log_e(\cos y)\right)\sin y dy=0$$

satisfy

$$x\left(\frac{\pi}{3}\right)=\frac{1}{2\log_e 2}$$

. If

$$x\left(\frac{\pi}{6}\right)=\frac{1}{\log_e m-\log_e n}$$

, where m and n are coprime, then mn is equal to _____.

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

If domain of the function

$$\log_e\left(\frac{6x^2+5x+1}{2x-1}\right)+\cos^{-1}\left(\frac{2x^2-3x+4}{3x-5}\right)$$

is $(\alpha,\beta)\cup(\gamma,\delta]$, then $18\left(\alpha^2+\beta^2+\gamma^2+\delta^2\right)$ is equal to _____.

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

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

Let P_1 be the plane $3x - y - 7z = 11$ and P_2 be the plane passing through the points $(2, -1, 0), (2, 0, -1)$, and $(5, 1, 1)$. If the foot of the perpendicular drawn from the point $(7, 4, -1)$ on the line of intersection of the planes P_1 and P_2 is (α, β, γ), then $\alpha + \beta + \gamma$ 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

The ordinates of the points P and Q on the parabola with focus $(3, 0)$ and directrix $x = -3$ are in the ratio $3 : 1$. If $R(\alpha, \beta)$ is the point of intersection of the tangents to the parabola at P and Q, then $\frac{\beta^2}{\alpha}$ is equal to _____.

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

Let $0 < z < y < x$ be three real numbers such that

$$\frac{1}{x}, \frac{1}{y}, \frac{1}{z}$$

are in an arithmetic progression and $x, \sqrt{2}\ y, z$ are in a geometric progression. If

$$xy + yz + zx = \frac{3}{\sqrt{2}} xyz$$

, then $3(x + y + z)^2$ 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

A hydraulic automobile lift is designed to lift vehicles of mass 5000 kg. The area of cross section of the cylinder carrying the load is 250 cm^2. The maximum pressure the smaller piston would have to bear is [Assume

$$g = 10\ m/s^2\ ]$$

Options :

A. $20 \times 10^{+6}$ Pa

B. $200 \times 10^{+6}$ Pa

C. $2 \times 10^{+5}$ Pa

D. $2 \times 10^{+6}$ Pa

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

An emf of 0.08 V is induced in a metal rod of length 10 cm held normal to a uniform magnetic field of 0.4 T, when moves with a velocity of:

Options :

A. $20\ ms^{-1}$

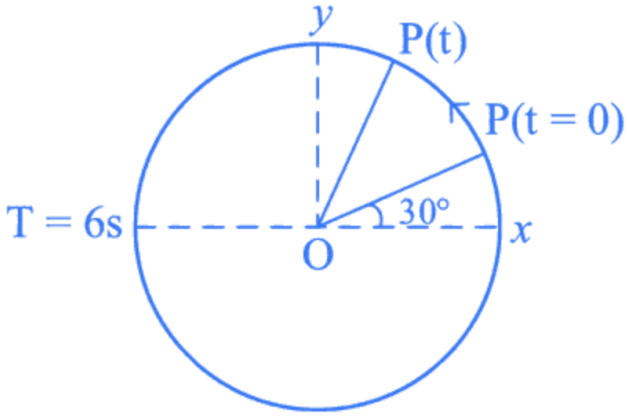
B. $2\ ms^{-1}$

C. $3.2\ ms^{-1}$

D. $0.5\ ms^{-1}$

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

For particle P revolving round the centre O with radius of circular path r and angular velocity ω, as shown in below figure, the projection of OP on the x-axis at time t is



Options :

A. $x(t) = \cos\left(\omega t - \frac{\pi}{6}\omega\right)$

B. $x(t) = \cos(\omega t)$

C. $x(t) = r\cos\left(\omega t + \frac{\pi}{6}\right)$

D. $x(t) = r\sin\left(\omega t + \frac{\pi}{6}\right)$

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

In photo electric effect

A. The photocurrent is proportional to the intensity of the incident radiation

B. Maximum Kinetic energy with which photoelectrons are emitted depends on the intensity of incident light.

C. Max. K.E with which photoelectrons are emitted depends on the frequency of incident light.

D. The emission of photoelectrons require a minimum threshold intensity of incident radiation.

E. Max. K.E of the photoelectrons is independent of the frequency of the incident light.

Choose the correct answer from the options given below:

Options :

A. A and E only

B. A and B only

C. B and C only

D. A and C only

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

A bullet of mass 0.1 kg moving horizontally with speed 400 ms^{-1} hits a wooden block of mass 3.9 kg kept on a horizontal rough surface. The bullet gets embedded into the block and moves 20 m before coming to rest. The coefficient of friction between the block and the surface is _____.

(Given

$$g = 10\ m/s^2$$

)

Options :

A. 0.65

B. 0.25

C. 0.50

D. 0.90

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

Given below are two statements

Statement I : Area under velocity- time graph gives the distance travelled by the body in a given time.

Statement II : Area under acceleration- time graph is equal to the change in velocity- in the given time.

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

Options :

A. Both Statement I and Statement II are False.

B. Both Statement I and Statement II are true.

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

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

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 acceleration due to gravity at height h above the earth if

$$h << \mathrm{R}$$

(Radius of earth) is given by

Options :

A. $g' = g\left(1 - \frac{2h}{R}\right)$

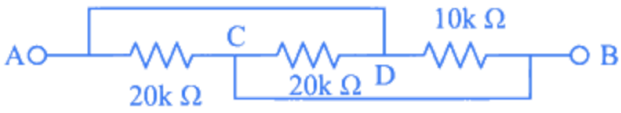
B. $g' = g\left(1 - \frac{2h^2}{R^2}\right)$

C. $g' = g\left(1 - \frac{h^2}{2R^2}\right)$

D. $g' = g\left(1 - \frac{h}{2R}\right)$

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

The equivalent resistance between A and B as shown in figure is:



Options :

A. 30 kΩ

B. 20 kΩ

C. 5 kΩ

D. 10 kΩ

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

The waves emitted when a metal target is bombarded with high energy electrons are

Options :

A. Infrared rays

B. Radio Waves

C. Microwaves

D. X-rays

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

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

Assertion A : Electromagnets are made of soft iron.

Reason R : Soft iron has high permeability and low retentivity.

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

Options :

A. Both A and R are correct and R is the correct explanation of A

B. A is not correct but R is correct

C. A is correct but R is not correct

D. Both A and R are correct but R is NOT the correct explanation of A

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

Electric potential at a point 'P' due to a point charge of 5×10^{-9}C is 50 V. The distance of 'P' from the point charge is:

(Assume,

$$\frac{1}{4\pi\varepsilon_0} = 9 \times 10^{+9}\ \text{Nm}^2\text{C}^{-2}$$

)

Options :

A. 0.9 cm

B. 90 cm

C. 3 cm

D. 9 cm

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

The orbital angular momentum of a satellite is L, when it is revolving in a circular orbit at height h from earth surface. If the distance of satellite from the earth centre is increased by eight times to its initial value, then the new angular momentum will be -

Options :

A. 9L

B. 8L

C. 4L

D. 3L

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

The temperature at which the kinetic energy of oxygen molecules becomes double than its value at 27°C is

Options :

A. 627°C

B. 927°C

C. 327°C

D. 1227°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

The trajectory of projectile, projected from the ground is given by

$$y = x - \frac{x^2}{20}$$

. Where x and y are measured in meter. The maximum height attained by the projectile will be.

Options :

A. 10 m

B. 5 m

C. 200 m

D. $10\sqrt{2}$ m

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

The width of fringe is 2 mm on the screen in a double slits experiment for the light of wavelength of 400 nm. The width of the fringe for the light of wavelength 600 nm will be:

Options :

A. 4 mm

B. 1.33 mm

C. 2 mm

D. 3 mm

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

Match List I with List II

	LIST I		**LIST II**
A.	Torque	I.	$ML^{-2}T^{-2}$
B.	Stress	II.	$ML^{2}T^{-2}$
C.	Pressure gradient	III.	$ML^{-1}T^{-1}$
D.	Coefficient of viscosity	IV.	$ML^{-1}T^{-2}$

Choose the correct answer from the options given below:

Options :

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

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

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

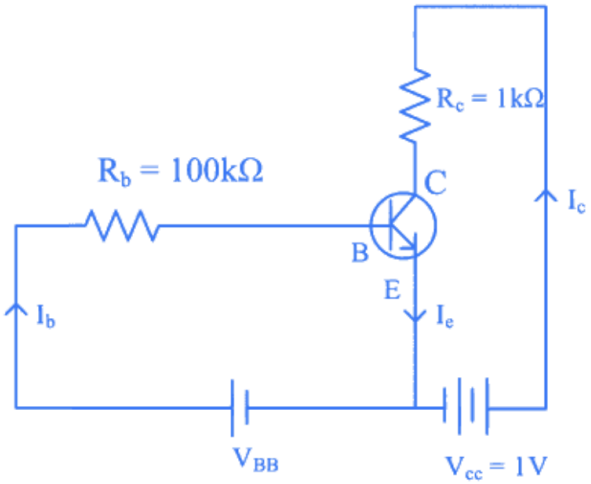
D. A-III, B-IV, C-I, D-II

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

For a given transistor amplifier circuit in CE configuration

$$V_{CC} = 1\ V, R_C = 1\ k\Omega, R_b = 100\ k\Omega$$

and $\beta = 100$. Value of base current I_b is



Options :

A. $I_b = 100\ \mu A$

B. $I_b = 0.1\ \mu A$

C. $I_b = 1.0\ \mu A$

D. $I_b = 10\ \mu A$

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

A radio active material is reduced to 1/8 of its original amount in 3 days. If 8×10^{-3} kg of the material is left after 5 days the initial amount of the material is

Options :

A. 64 g

B. 256 g

C. 32 g

D. 40 g

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

The power radiated from a linear antenna of length l is proportional to

(Given, $\lambda =$ Wavelength of wave):

Options :

A. $\left(\frac{l}{\lambda}\right)^2$

B. $\frac{l}{\lambda^2}$

C. $\frac{l^2}{\lambda}$

D. $\frac{l}{\lambda}$

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

Work done by a Carnot engine operating between temperatures 127°C and 27°C is 2 kJ. The amount of heat transferred to the engine by the reservoir is :

Options :

A. 8 kJ

B. 2 kJ

C. 4 kJ

D. 2.67 kJ

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

The number density of free electrons in copper is nearly 8×10^{28} m^{-3}. A copper wire has its area of cross section

$$= 2 \times 10^{-6} \text{ m}^2$$

and is carrying a current of 3.2 A. The drift speed of the electrons is _____ $\times 10^{-6} ms^{-1}$

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 transparent media having refractive indices 1.0 and 1.5 are separated by a spherical refracting surface of radius of curvature 30 cm. The centre of curvature of surface is towards denser medium and a point object is placed on the principle axis in rarer medium at a distance of 15 cm from the pole of the surface. The distance of image from the pole of the surface is _____ 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

A guitar string of length 90 cm vibrates with a fundamental frequency of 120 Hz. The length of the string producing a fundamental frequency of 180 Hz will be _____ cm.

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 body of mass 5 kg is moving with a momentum of 10 kg ms^{-1}. Now a force of 2 N acts on the body in the direction of its motion for 5 s. The increase in the Kinetic energy of the body is _____ J.

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

The ratio of wavelength of spectral lines H_α and H_β in the Balmer series is $\frac{x}{20}$. 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 : 56 Question Type : SA Display Question Number : Yes Keyboard Layout : Inscript

A steel rod of length 1 m and cross sectional area 10^{-4} m^2 is heated from 0°C to 200°C without being allowed to extend or bend. The compressive tension produced in the rod is _____ $\times 10^4$ N. (Given Young's modulus of steel

$$= 2 \times 10^{11} \text{Nm}^{-2}$$

, coefficient of linear expansion

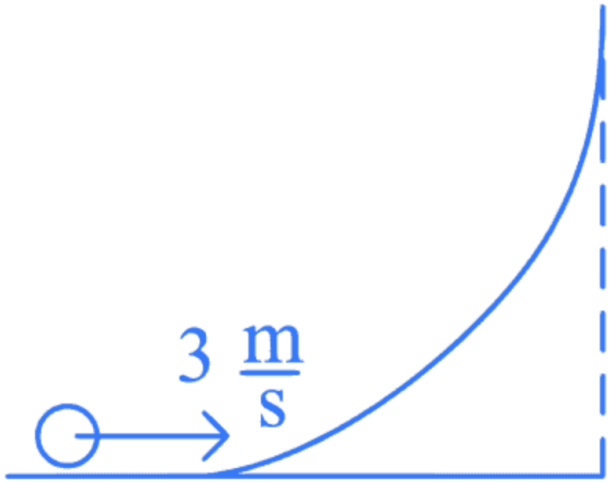
$$= 10^{-5}\ \text{K}^{-1}$$

)

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

A hollow spherical ball of uniform density rolls up a curved surface with an initial velocity 3 m/s (as shown in figure). Maximum height with respect to the initial position covered by it will be _____ cm.



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

The ratio of magnetic field at the centre of a current carrying coil of radius r to the magnetic field at distance r from the centre of coil on its axis is $\sqrt{x}$: 1. 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 600 pF capacitor is charged by 200 V supply. It is then disconnected from the supply and is connected to another uncharged 600 pF capacitor. Electrostatic energy lost in the process is _____ μJ

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

A series combination of resistor of resistance 100 Ω, inductor of inductance 1 H and capacitor of capacitance 6.25 μF is connected to an ac source. The quality factor of the circuit 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

Match List I with List II

	LIST I Coordination Complex		**LIST II Number of unpaired electrons**
A.	$\left[Cr(CN)_6\right]^{3-}$	I.	0
B.	$\left[Fe(H_2O)_6\right]^{2+}$	II.	3
C.	$\left[Co(NH_3)_6\right]^{3+}$	III.	2
D.	$\left[Ni(NH_3)_6\right]^{2+}$	IV.	4

Choose the correct answer from the options given below:

Options :

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

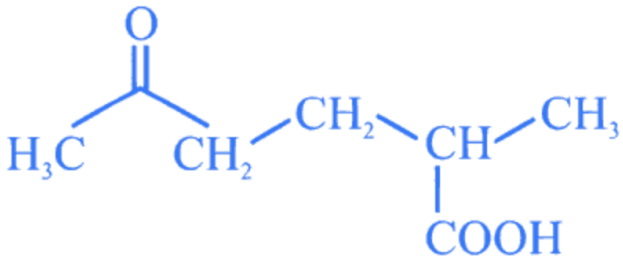
B. A-II, B-I, C-IV, D-III

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

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

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 correct IUPAC nomenclature for the following compound is:



Options :

A. 2 - Formyl -5-methylhexan-6-oic acid

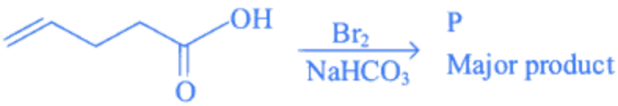
B. 5-Methyl-2-oxohexan-6-oic acid

C. 5-Formyl -2-methylhexanoic acid

D. 2-Methyl-5-oxohexanoic acid

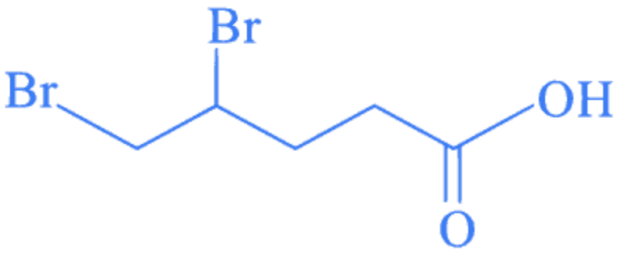
Question Number : 63 Question Type : MCQ Option Shuffling : Yes Display Question Number : Yes Is Question Mandatory : No Single Line Question Option : No Option Orientation : Vertical

Major product 'P' formed in the following reaction is:

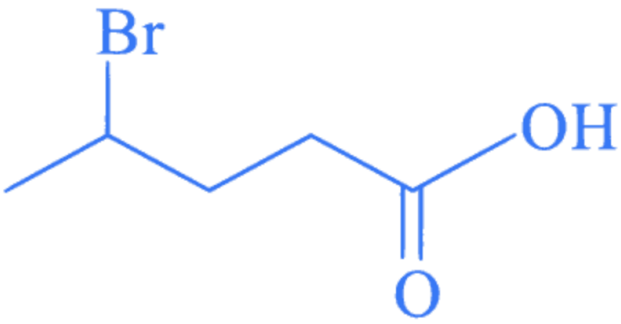


Options :

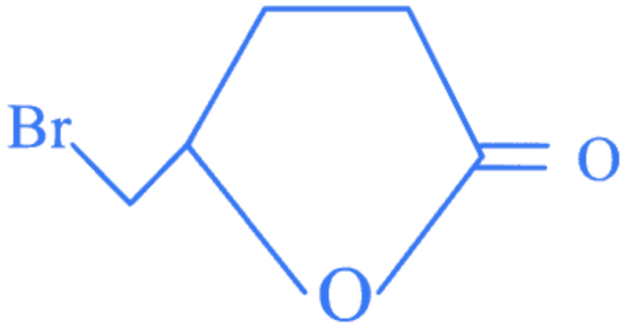
A.



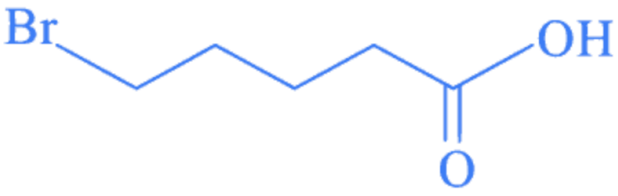
B.



C.



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

A compound 'X' when treated with phthalic anhydride in presence of concentrated H_2SO_4 yields 'Y'. 'Y' is used as an acid/base indicator. 'X' and 'Y' are respectively

Options :

A. Toludine, Phenolphthalein

B. Carbolic acid, Phenolphthalein

C. Salicylaldehyde, Phenolphthalein

D. Anisole, methyl orange

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

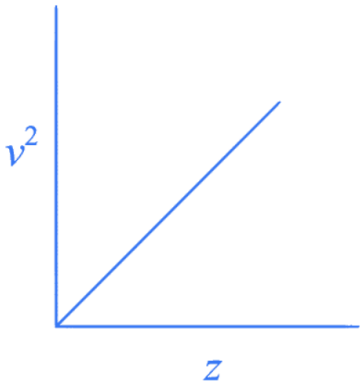
Henry Moseley studied characteristic X-ray spectra of elements. The graph which represents his observation correctly is

Given $\upsilon =$ frequency of X-ray emitted

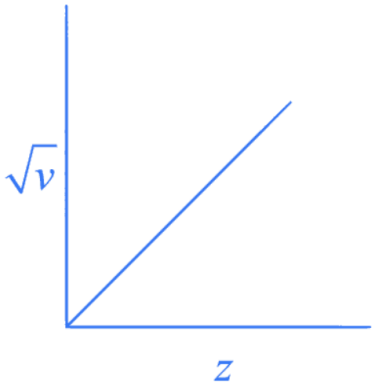
Z = atomic number

Options :

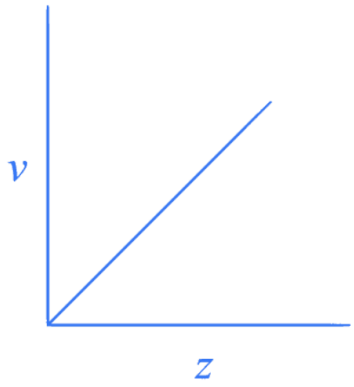
A.



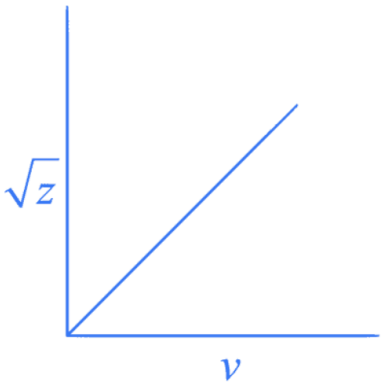
B.



C.



D.



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

Given below are two statements:

Statement I : In redox titration, the indicators used are sensitive to change in pH of the solution.

Statement II : In acid-base titration, the indicators used are sensitive to change in oxidation potential.

In the light of the above statements, choose the most appropriate answer from the options given below

Options :

A. Both Statement I and Statement II are incorrect

B. Statement I is correct but Statement II is incorrect

C. Statement I is incorrect but Statement II is correct

D. Both Statement I and Statement II are correct

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

For a good quality cement, the ratio of lime to the total of the oxides of Si, Al and Fe should be as close as to :

Options :

A. 3

B. 2

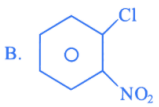
C. 1

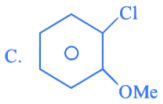
D. 4

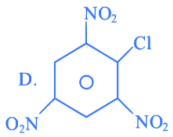
Question Number : 68 Question Type : MCQ Option Shuffling : Yes Display Question Number : Yes Is Question Mandatory : No Single Line Question Option : No Option Orientation : Vertical

The correct order of reactivity of following haloarenes towards nucleophilic substitution with aqueous NaOH is :

A. 

B. 

C. 

D. 

Choose the correct answer from the options given below:

Options :

A. C > A > D > B

B. D > B > A > C

C. A > B > D > C

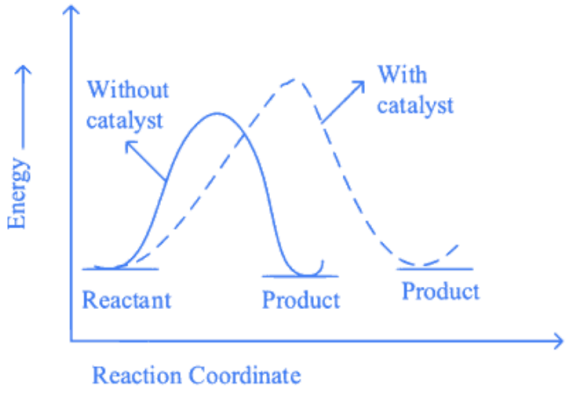
D. D > C > B > A

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

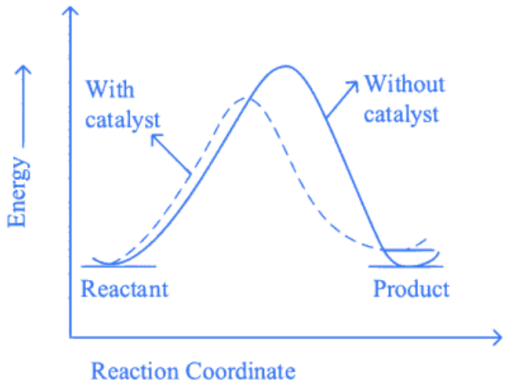
The correct reaction profile diagram for a positive catalyst reaction.

Options :

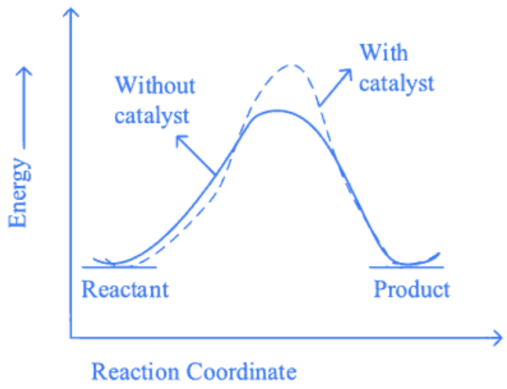
A.



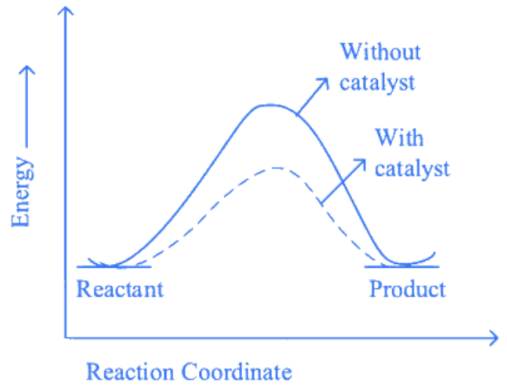
B.



C.



D.



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

Match List I with List II

	LIST I Natural amino acid		**LIST II One letter code**
A.	Glutamic acid	I.	Q
B.	Glutamine	II.	W
C.	Tyrosine	III.	E
D.	Tryptophan	IV.	Y

Choose the correct answer from the options given below:

Options :

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

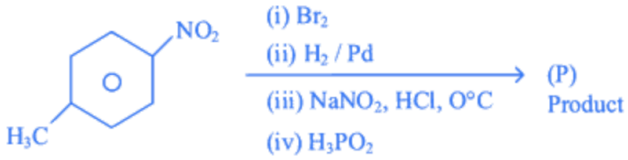
B. A-IV, B-III, C-I, D-II

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

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

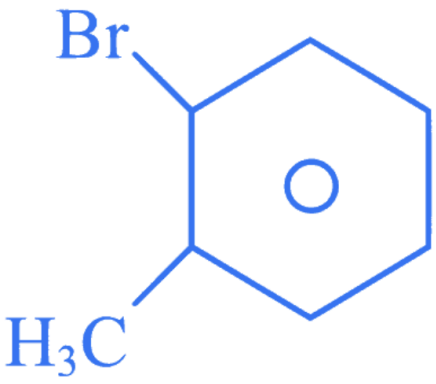
Question Number : 71 Question Type : MCQ Option Shuffling : Yes Display Question Number : Yes Is Question Mandatory : No Single Line Question Option : No Option Orientation : Vertical

The product (P) formed from the following multistep reaction is:

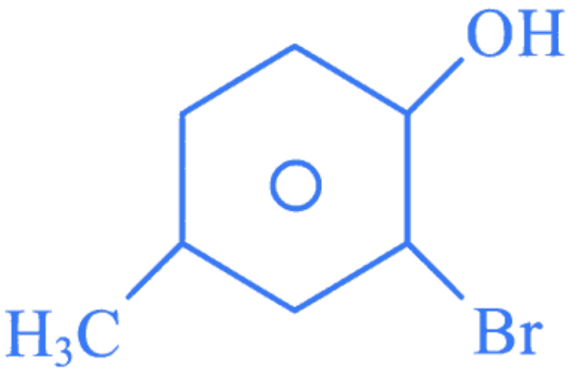


Options :

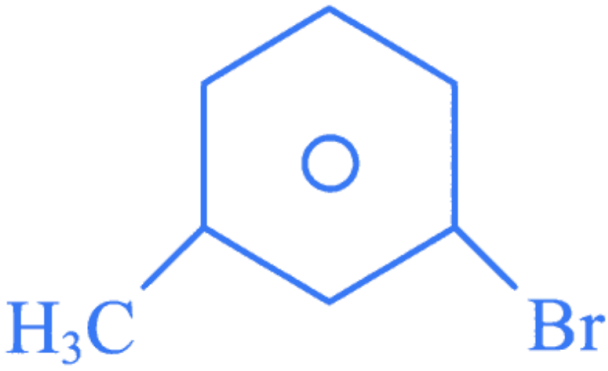
A.



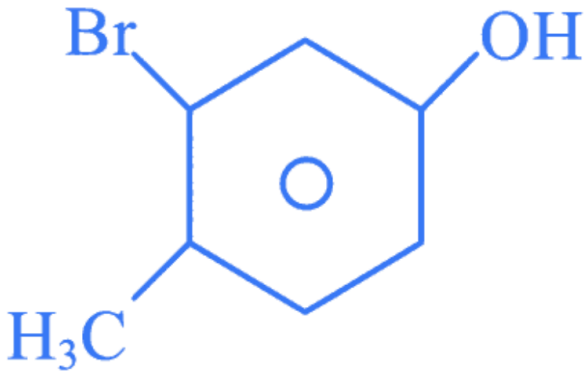
B.



C.



D.



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

The descending order of acidity for the following carboxylic acid is-

A. CH_3COOH

B. $F_3C - COOH$

C. $ClCH_2 - COOH$

D. $FCH_2 - COOH$

E. $BrCH_2 - COOH$

Choose the correct answer from the options given below:

Options :

A. B > C > D > E > A

B. D > B > A > E > C

C. B > D > C > E > A

D. E > D > B > A > C

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

Given below are two statements:

Statement I : Methyl orange is a weak acid.

Statement II : The benzenoid form of methyl orange is more intense/deeply coloured than the quinonoid form.

In the light of the above statement, choose the most appropriate answer from the options given below:

Options :

A. Both Statement I and Statement II are incorrect

B. Statement I is incorrect but Statement II is correct

C. Both statement I and Statement II are correct

D. Statement I is correct but Statement II is incorrect

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

Given below are two statements: One is labelled as Assertion A and the other is labelled as Reason R.

Assertion A : Sodium is about 30 times as abundant as potassium in the oceans.

Reason R : Potassium is bigger in size than sodium.

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

Options :

A. Both A and R are true but R is NOT the correct explanation of A

B. A is false but R is true

C. Both A and R are true and R is the correct explanation of A

D. A is true but R is false

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 have same number of significant figures?

A. 0.00253

B. 1.0003

C. 15.0

D. 163

Choose the correct answer from the options given below

Options :

A. A, C and D only

B. B and C only

C. A, B and C only

D. C and D only

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

Arrange the following gases in increasing order of van der Waals constant 'a'

A. Ar

B. CH_4

C. H_2O

D. C_6H_6

Choose the correct option from the following.

Options :

A. D, C, B and A

B. A, B, C and D

C. B, C, D and A

D. C, D, B and A

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 of these reactions is not a part of breakdown of ozone in stratosphere?

Options :

A. $CF_2Cl_2(g) \xrightarrow{uv} \dot{C}l(g) + \dot{C}F_2Cl(g)$

B. $C\dot{l}(g) + O_3(g) \longrightarrow Cl\dot{O}(g) + O_2(g)$

C. $2Cl\dot{O} \longrightarrow ClO_2(g) + C\dot{l}(g)$

D. $Cl\dot{O}(g) + O(g) \longrightarrow C\dot{l}(g) + O_2(g)$

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

The statement/s which are true about antagonists from the following is/are:

A. They bind to the receptor site.

B. Get transferred inside the cell for their action.

C. Inhibit the natural communication of the body.

D. Mimic the natural messenger.

Choose the correct answer from the options given below:

Options :

A. B only

B. A and B

C. A and C

D. A, C and D

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

In Hall - Heroult process, the following is used for reducing Al_2O_3 :-

Options :

A. Magnesium

B. CaF_2

C. Graphite

D. Na_3AlF_6

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

Which of the following can reduce decomposition of H_2O_2 on exposure to light :

Options :

A. Urea

B. Glass containers

C. Alkali

D. Dust

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

The number of species from the following carrying a single lone pair on central atom Xenon is _____.

$$XeF_5^+, XeO_3, XeO_2F_2, XeF_5^-, XeO_3F_2, XeOF_4, XeF_4$$

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

The observed magnetic moment of the complex $\left[Mn(NCS)_6\right]^{x-}$ is 6.06 BM. The numerical value of x is _____.

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 solubility product of $BaSO_4$ is 1×10^{-10} at 298 K. The solubility of $BaSO_4$ in 0.1 M K_2SO_4(aq) solution is _____ $\times 10^{-9}$ g L^{-1} (nearest integer).

Given: Molar mass of $BaSO_4$ is 233 g mol^{-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

If the boiling points of two solvents X and Y (having same molecular weights) are in the ratio 2 : 1 and their enthalpy of vaporizations are in the ratio 1 : 2, then the boiling point elevation constant of X is m times the boiling point elevation constant of Y. The value of m is _____ (nearest integer)

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

For complete combustion of ethene.

$$C_2H_4(g) + 3O_2(g) \rightarrow 2CO_2(g) + 2H_2O(l)$$

the amount of heat produced as measured in bomb calorimeter is 1406 kJ mol^{-1} at 300 K. The minimum value of $T\Delta S$ needed to reach equilibrium is $(-)$ _____ kJ. (Nearest integer)

Given :

$$R = 8.3\ J\ K^{-1}\ mol^{-1}$$

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

The number of atomic orbitals from the following having 5 radial nodes is _____.

7s, 7p, 6s, 8p, 8d

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

The sum of oxidation state of the metals in $Fe(CO)_5$, VO^{2+} and WO_3 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

The number of incorrect statements from the following is _____.

A. The electrical work that a reaction can perform at constant pressure and temperature is equal to the reaction Gibbs energy.

B. E°_{cell} cell is dependent on the pressure.

C.

$$\frac{dE^{\theta}\,\text{cell}}{\text{dT}} = \frac{\Delta_r S^{\theta}}{\text{nF}}$$

D. A cell is operating reversibly if the cell potential is exactly balanced by an opposing source of potential difference.

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

The ratio of sigma and π bonds present in pyrophosphoric acid is _____.

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

Coagulating value of the electrolytes $AlCl_3$ and NaCl for As_2S_3 are 0.09 and 50.04 respectively. The coagulating power of $AlCl_3$ is x times the coagulating power of NaCl. The value of x is _____.

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