National Testing Agency

Question Paper Name :	B Tech 10 Apr 2023 Shift 1
Subject Name :	B. Tech
Duration :	180
Total Marks :	300
Display Marks:	Yes

B. Tech

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

Mathematics Section A

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

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

If

$$I(x) = \int e^{\sin^2 x}(\cos x \sin 2x - \sin x)dx$$

and

$$I(0) = 1$$

, then

$$I\left(\frac{\pi}{3}\right)$$

is equal to :

Options :

A. $-e^{\frac{3}{4}}$

B. $-\frac{1}{2}e^{\frac{3}{4}}$

C. $e^{\frac{3}{4}}$

D. $\frac{1}{2}e^{\frac{3}{4}}$

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 shortest distance between the lines

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

and

$$\frac{x-4}{1}=\frac{y-1}{2}=\frac{z+3}{0}$$

is :

Options :

A. 8

B. 7

C. 6

D. 9

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 ellipse

$$E: x^2+9y^2=9$$

intersect the positive x and y-axes at the points A and B respectively. Let the major axis of E be a diameter of the circle C. Let the line passing through A and B meet the circle C at the point P. If the area of the triangle with vertices A, P and the origin O is

$$\frac{m}{n}$$

, where m and n are coprime, then $m-n$ is equal to :

Options :

A. 15

B. 16

C. 17

D. 18

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 O be the origin and the position vector of the point P be $-\hat{i}-2\hat{j}+3\hat{k}$. If the position vectors of the points A, B and C are $-2\hat{i}+\hat{j}-3\hat{k}, 2\hat{i}+4\hat{j}-2\hat{k}$ and $-4\hat{i}+2\hat{j}-\hat{k}$ respectively, then the projection of the vector $\overrightarrow{OP}$ on a vector perpendicular to the vectors $\overrightarrow{AB}$ and $\overrightarrow{AC}$ is :

Options :

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

B. 3

C. $\frac{10}{3}$

D. $\frac{8}{3}$

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

If

$$f(x)=\frac{(\tan 1^{\circ})x+\log_e(123)}{x\log_e(1234)-(\tan 1^{\circ})}, x>0$$

, then the least value of

$$f(f(x))+f\left(f\left(\frac{4}{x}\right)\right)$$

is :

Options :

A. 2

B. 4

C. 0

D. 8

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

If the coefficient of x^7 in

$$\left(ax - \frac{1}{bx^2}\right)^{13}$$

and the coefficient of x^{-5} in

$$\left(ax + \frac{1}{bx^2}\right)^{13}$$

are equal, then a^4b^4 is equal to :

Options :

A. 22

B. 33

C. 44

D. 11

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

An arc PQ of a circle subtends a right angle at its centre O. The mid point of the arc PQ is R. If

$$\overrightarrow{OP} = \vec{u}, \overrightarrow{OR} = \vec{v}$$

, and

$$\overrightarrow{OQ} = \alpha\vec{u} + \beta\vec{v}$$

, then α, β^2 are the roots of the equation :

Options :

A. $x^2 + x - 2 = 0$

B. $3x^2 + 2x - 1 = 0$

C. $3x^2 - 2x - 1 = 0$

D. $x^2 - x - 2 = 0$

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 N denote the sum of the numbers obtained when two dice are rolled. If the probability that

$$2^N < N!$$

is

$$\frac{m}{n}$$

, where m and n are coprime, then $4m - 3n$ is equal to :

Options :

A. 12

B. 6

C. 8

D. 10

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

A square piece of tin of side 30 cm is to be made into a box without top by cutting a square from each corner and folding up the flaps to form a box. If the volume of the box is maximum, then its surface area (in cm^2) is equal to :

Options :

A. 1025

B. 900

C. 800

D. 675

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

$$96\cos\frac{\pi}{33}\cos\frac{2\pi}{33}\cos\frac{4\pi}{33}\cos\frac{8\pi}{33}\cos\frac{16\pi}{33}$$

is equal to :

Options :

A. 4

B. 2

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

For the system of linear equations

$$2x - y + 3z = 5$$
$$3x + 2y - z = 7$$
$$4x + 5y + \alpha z = \beta$$

,

which of the following is **NOT** correct?

Options :

A. The system has infinitely many solutions for $\alpha = -6$ and $\beta = 9$

B. The system has a unique solution for $\alpha \neq -5$ and $\beta = 8$

C. The system is inconsistent for $\alpha = -5$ and $\beta = 8$

D. The system has infinitely many solutions for $\alpha = -5$ and $\beta = 9$

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

A line segment AB of length λ moves such that the points A and B remain on the periphery of a circle of radius λ. Then the locus of the point, that divides the line segment AB in the ratio 2 : 3, is a circle of radius :

Options :

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

B. $\frac{3}{5}\lambda$

C. $\frac{\sqrt{19}}{7}\lambda$

D. $\frac{\sqrt{19}}{5}\lambda$

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 f be a differentiable function such that

$$x^2 f(x) - x = 4\int_0^x t f(t)dt$$

,

$$f(1) = \frac{2}{3}$$

. Then $18f(3)$ is equal to :

Options :

A. 160

B. 210

C. 150

D. 180

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 the first term α and the common ratio r of a geometric progression be positive integers. If the sum of squares of its first three terms is 33033, then the sum of these three terms is equal to

Options :

A. 241

B. 231

C. 220

D. 210

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 the complex number $z = x + iy$ be such that

$$\frac{2z - 3i}{2z + i}$$

is purely imaginary. If $x + y^2 = 0$, then $y^4 + y^2 - y$ is equal to :

Options :

A. $\frac{4}{3}$

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

C. $\frac{3}{4}$

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

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 two vertices of a triangle ABC be (2, 4, 6) and (0, −2, −5), and its centroid be (2, 1, −1). If the image of the third vertex in the plane $x + 2y + 4z = 11$ is (α, β, γ), then $\alpha\beta + \beta\gamma + \gamma\alpha$ is equal to :

Options :

A. 72

B. 74

C. 76

D. 70

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 negation of the statement $(p \vee q) \wedge (q \vee (\sim r))$ is :

Options :

A. $((\sim p) \vee r)) \wedge (\sim q)$

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

C. $((\sim p) \vee (\sim q)) \vee (\sim r)$

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

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 P be the point of intersection of the line

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

and the plane $x + y + z = 2$. If the distance of the point P from the plane $3x - 4y + 12z = 32$ is q, then q and 2q are the roots of the equation :

Options :

A. $x^2 + 18x - 72 = 0$

B. $x^2 - 18x - 72 = 0$

C. $x^2 + 18x + 72 = 0$

D. $x^2 - 18x + 72 = 0$

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

The slope of tangent at any point (x, y) on a curve

$$y = y(x)$$

is

$$\frac{x^2 + y^2}{2xy}, x > 0$$

. If

$$y(2) = 0$$

, then a value of $y(8)$ is :

Options :

A. $-4\sqrt{2}$

B. $2\sqrt{3}$

C. $4\sqrt{3}$

D. $-2\sqrt{3}$

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

If A is a 3×3 matrix and

$$|A| = 2$$

, then $|3\,adj\,(|3A|A^2)|$ is equal to :

Options :

A. $3^{12} . 6^{10}$

B. $3^{11} . 6^{10}$

C. $3^{12} . 6^{11}$

D. $3^{10} . 6^{11}$

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 $f:(-2,2) \to R$ be defined by

$$f(x) = \begin{cases} x[x], & -2 < x < 0 \\ (x-1)[x], & 0 \le x \le 2 \end{cases}$$

where $[x]$ denotes the greatest integer function. If m and n respectively are the number of points in $(-2,2)$ at which

$$y = |f(x)|$$

is not continuous and not differentiable, then $m + n$ is equal to _____.

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

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

Let

$$y = p(x)$$

be the parabola passing through the points $(-1,0), (0,1)$ and $(1,0)$. If the area of the region $\{(x,y) : (x+1)^2 + (y-1)^2 \le 1, y \le p(x)\}$ is A, then $12(\pi - 4A)$ is equal to _____.

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 elements in the set

$$\{n \in Z : |n^2 - 10n + 19| < 6\}$$

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

If the mean of the frequency distribution

Class :	**0-10**	**10-20**	**20-30**	**30-40**	**40-50**
Frequency :	2	3	x	5	4

is 28, then its variance 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 number of permutations, of the digits 1, 2, 3, ..., 7 without repetition, which neither contain the string 153 nor the string 2467, 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 coefficient of x^7 in $(1 - x + 2x^3)^{10}$ 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

Some couples participated in a mixed doubles badminton tournament. If the number of matches played, so that no couple played in a match, is 840, then the total number of persons, who participated in the tournament, is _____.

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 a, b, c be three distinct positive real numbers such that

$$(2a)^{\log_e a} = (bc)^{\log_e b}$$

and

$$b^{\log_e 2} = a^{\log_e c}$$

.

Then, 6a + 5bc 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 a common tangent to the curves $y^2 = 4x$ and

$$(x-4)^2 + y^2 = 16$$

touch the curves at the points P and Q. Then $(PQ)^2$ 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

The sum of all those terms, of the arithmetic progression 3, 8, 13, ..., 373, which are not divisible by 3, 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

Given below are two statements:

Statement I : If the number of turns in the coil of a moving coil galvanometer is doubled then the current sensitivity becomes double.

Statement II : Increasing current sensitivity of a moving coil galvanometer by only increasing the number of turns in the coil will also increase its voltage sensitivity in the same ratio

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

Options :

A. Statement I is true but Statement II is false

B. Statement I is false but Statement II is true

C. Both Statement I and Statement II are false

D. Both Statement I and Statement II are true

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

A physical quantity P is given as

$$P = \frac{a^2 b^3}{c\sqrt{d}}$$

The percentage error in the measurement of a, b, c and d are 1%, 2%, 3% and 4% respectively. The percentage error in the measurement of quantity P will be

Options :

A. 12%

B. 13%

C. 16%

D. 14%

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

Given below are two statements:

Statement I : Pressure in a reservoir of water is same at all points at the same level of water.

Statement II : The pressure applied to enclosed water is transmitted in all directions equally.

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 false

B. Statement I is false but Statement II is true

C. Statement I is true but Statement II is false

D. Both Statement I and Statement II are true

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

The energy of an electromagnetic wave contained in a small volume oscillates with

Options :

A. double the frequency of the wave

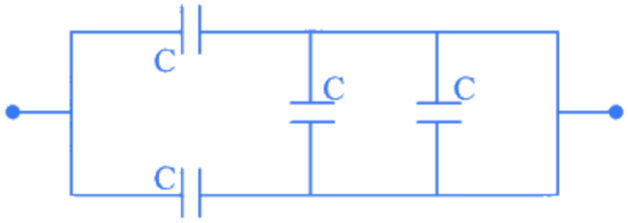
B. the frequency of the wave

C. half the frequency of the wave

D. zero frequency

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

The equivalent capacitance of the combination shown is :



Options :

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

B. 4C

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

D. 2C

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

Consider two containers A and B containing monoatomic gases at the same Pressure (P), Volume (V) and Temperature (T). The gas in A is compressed isothermally to $\frac{1}{8}$ of its original volume while the gas in B is compressed adiabatically to $\frac{1}{8}$ of its original volume. The ratio of final pressure of gas in B to that of gas in A is

Options :

A. $\frac{1}{8}$

B. $8^{\frac{3}{2}}$

C. 4

D. 8

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 range of the projectile projected at an angle of 15° with horizontal is 50 m. If the projectile is projected with same velocity at an angle of 45° with horizontal, then its range will be

Options :

A. $50\sqrt{2}$ m

B. 100 m

C. $100\sqrt{2}$ m

D. 50 m

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 particle executes S.H.M. of amplitude A along x-axis. At t = 0, the position of the particle is

$$x = \frac{A}{2}$$

and it moves along positive x-axis. The displacement of particle in time t is

$$x = A\sin(wt + \delta)$$

, then the value of δ will be

Options :

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

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

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

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

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 de Broglie wavelength of a molecule in a gas at room temperature (300 K) is λ_1. If the temperature of the gas is increased to 600 K, then the de Broglie wavelength of the same gas molecule becomes

Options :

A. $2\,\lambda_1$

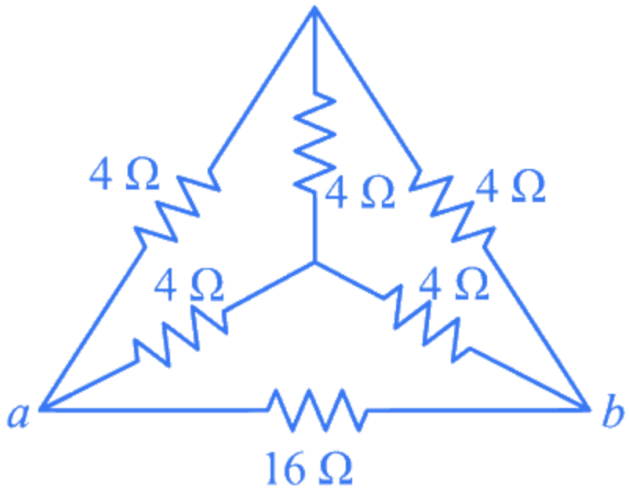
B. $\frac{1}{2}\lambda_1$

C. $\frac{1}{\sqrt{2}}\lambda_1$

D. $\sqrt{2}\ \lambda_1$

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

The equivalent resistance of the circuit shown below between points a and b is :



Options :

A. 16Ω

B. 20Ω

C. 3.2Ω

D. 24Ω

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 is placed at a distance of 12 cm in front of a plane mirror. The virtual and erect image is formed by the mirror. Now the mirror is moved by 4 cm towards the stationary object. The distance by which the position of image would be shifted, will be

Options :

A. 4 cm towards mirror

B. 2 cm towards mirror

C. 8 cm away from mirror

D. 8 cm towards mirror

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

Two satellites of masses m and 3m revolve around the earth in circular orbits of radii r & 3r respectively. The ratio of orbital speeds of the satellites respectively is

Options :

A. 3 : 1

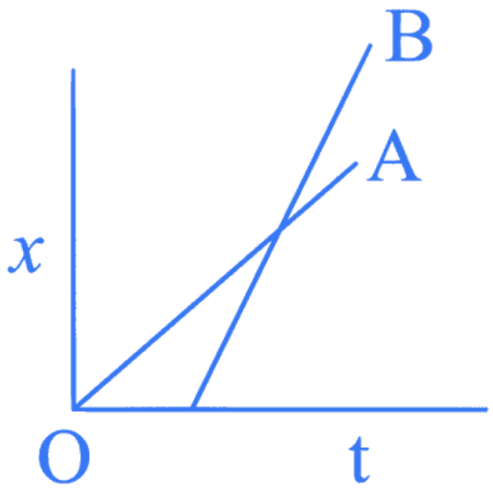
B. $\sqrt{3}$: 1

C. 1 : 1

D. 9 : 1

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 position-time graphs for two students A and B returning from the school to their homes are shown in figure.



(A) A lives closer to the school

(B) B lives closer to the school

(C) A takes lesser time to reach home

(D) A travels faster than B

(E) B travels faster than A

Choose the correct answer from the options given below :

Options :

A. (A), (C) and (D) only

B. (A) and (E) only

C. (A), (C) and (E) only

D. (B) and (E) only

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 angular momentum for the electron in Bohr's orbit is L. If the electron is assumed to revolve in second orbit of hydrogen atom, then the change in angular momentum will be

Options :

A. L

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

C. zero

D. 2 L

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

Given below are two statements:

Statement I : Maximum power is dissipated in a circuit containing an inductor, a capacitor and a resistor connected in series with an AC source, when resonance occurs

Statement II : Maximum power is dissipated in a circuit containing pure resistor due to zero phase difference between current and voltage.

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

Options :

A. Statement I is false but Statement II is true

B. Both Statement I and Statement II are false

C. Statement I is true but Statement II is false

D. Both Statement I and Statement II are true

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)	3 Translational degrees of freedom	(I)	Monoatomic gases
(B)	3 Translational, 2 rotational degrees of freedoms	(II)	Polyatomic gases
(C)	3 Translational, 2 rotational and 1 vibrational degrees of freedom	(III)	Rigid diatomic gases
(D)	3 Translational, 3 rotational and more than one vibrational degrees of freedom	(IV)	Nonrigid diatomic gases

Choose the correct answer from the options given below:

Options :

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

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

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

D. (A)-(I), (B)-(IV), (C)-(III), (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

Assuming the earth to be a sphere of uniform mass density, the weight of a body at a depth

$$d = \frac{R}{2}$$

from the surface of earth, if its weight on the surface of earth is 200 N, will be:

(Given R = radius of earth)

Options :

A. 100 N

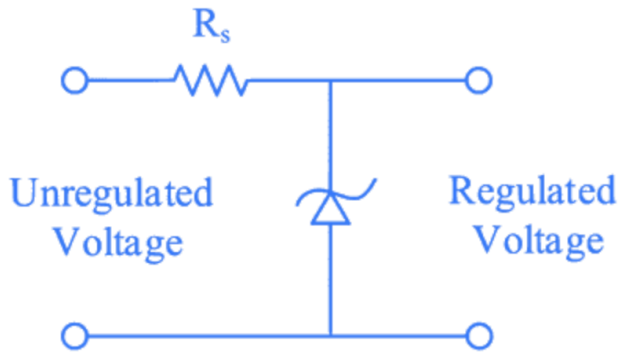
B. 400 N

C. 300 N

D. 500 N

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 zener diode of power rating 1.6 W is to be used as voltage regulator. If the zener diode has a breakdown of 8V and it has to regulate voltage fluctuating between 3 V and 10 V. The value of resistance R_s for safe operation of diode will be



Options :

A. 13 Ω

B. 13.3 Ω

C. 10 Ω

D. 12 Ω

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

A particle of mass m moving with velocity v collides with a stationary particle of mass 2m. After collision, they stick together and continue to move together with velocity

Options :

A. v

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

C. $\frac{v}{4}$

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

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 carrier wave of amplitude 15 V is modulated by a sinusoidal base band signal of magnitude 3 V. The ratio of maximum amplitude to minimum amplitude in an amplitude modulated wave is

Options :

A. 1

B. 5

C. 2

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

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 transverse harmonic wave on a string is given by

$$y(x,t) = 5\sin(6t + 0.003x)$$

where x and y are in cm and t in sec. The wave velocity is _____ ms^{-1}.

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

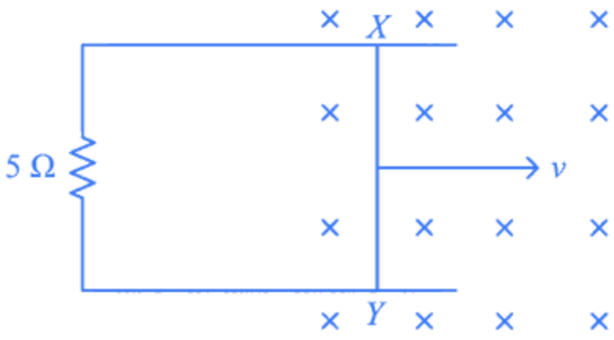
Question Number : 52 Question Type : SA Display Question Number : Yes Keyboard Layout : Inscript

10 resistors each of resistance 10 Ω can be connected in such as to get maximum and minimum equivalent resistance. The ratio of maximum and minimum equivalent resistance will be _____.

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

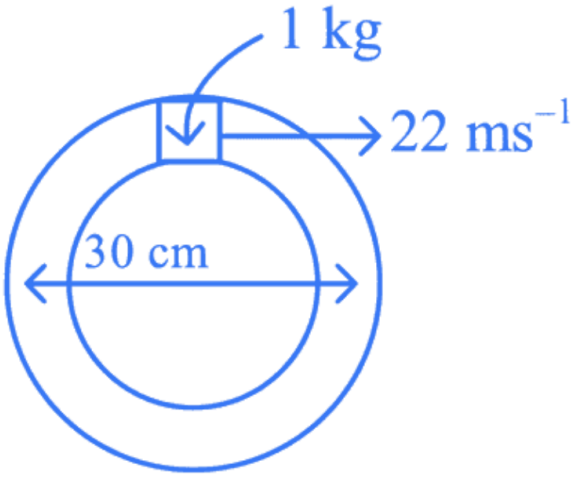
A 1 m long metal rod XY completes the circuit as shown in figure. The plane of the circuit is perpendicular to the magnetic field of flux density 0.15 T. If the resistance of the circuit is 5Ω, the force needed to move the rod in direction, as indicated, with a constant speed of 4 m/s will be _____ 10^{-3} N.



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 closed circular tube of average radius 15 cm, whose inner walls are rough, is kept in vertical plane. A block of mass 1 kg just fit inside the tube. The speed of block is 22 m/s, when it is introduced at the top of tube. After completing five oscillations, the block stops at the bottom region of tube. The work done by the tube on the block is _____ J. (Given g = 10 m/s^2).



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

Unpolarised light of intensity 32 Wm^{-2} passes through the combination of three polaroids such that the pass axis of the last polaroid is perpendicular to that of the pass axis of first polaroid. If intensity of emerging light is 3 Wm^{-2}, then the angle between pass axis of first two polaroids 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

Three concentric spherical metallic shells X, Y and Z of radius a, b and c respectively [a < b < c] have surface charge densities $\sigma, -\sigma$ and σ respectively. The shells X and Z are at same potential. If the radii of X & Y are 2 cm and 3 cm, respectively. The radius of shell Z is _____ cm.

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

If the earth suddenly shrinks to $\frac{1}{64}$th of its original volume with its mass remaining the same, the period of rotation of earth becomes $\frac{24}{x}$h. The value of x is _____.

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

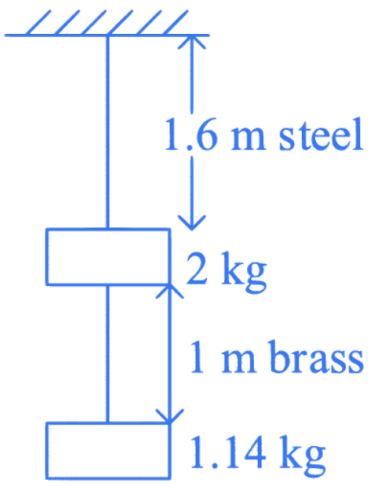
Question Number : 58 Question Type : SA Display Question Number : Yes Keyboard Layout : Inscript

The current required to be passed through a solenoid of 15 cm length and 60 turns in order of demagnetise a bar magnet of magnetic intensity $2.4 \times 10^3\ Am^{-1}$ is _____ A.

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

Two wires each of radius 0.2 cm and negligible mass, one made of steel and the other made of brass are loaded as shown in the figure. The elongation of the steel wire is _____ $\times 10^{-6}$ m. [Young's modulus for steel = 2×10^{11} Nm^{-2} and g = 10 ms^{-2}]



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

The decay constant for a radioactive nuclide is 1.5×10^{-5} s^{-1}. Atomic weight of the substance is 60 g mole $^{-1}$, (

$$N_A = 6 \times 10^{23}$$

). The activity of 1.0 μg of the substance is _____ $\times 10^{10}$ Bq.

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

The compound which does not exist is

Options :

A. $(NH_4)_2BeF_4$

B. $PbEt_4$

C. BeH_2

D. NaO_2

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 number of molecules and moles in 2.8375 litres of O_2 at STP are respectively

Options :

A. 1.505×10^{23} and 0.250 mol

B. 7.527×10^{22} and 0.250 mol

C. 7.527×10^{23} and 0.125 mol

D. 7.527×10^{22} and 0.125 mol

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 one that does not stabilize 2° and 3° structures of proteins is

Options :

A. –O –O –linkage

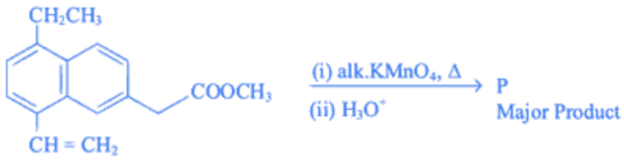
B. –S –S –linkage

C. van der Waals forces

D. H-bonding

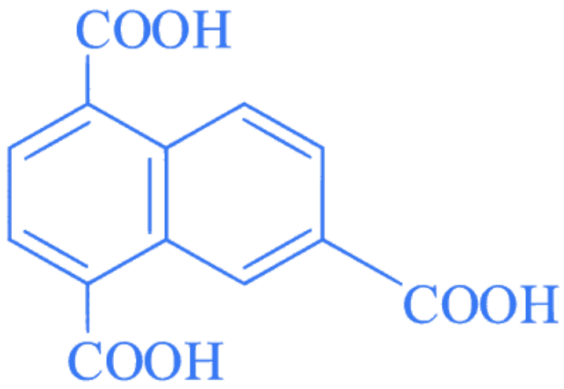
Question Number : 64 Question Type : MCQ Option Shuffling : Yes Display Question Number : Yes Is Question Mandatory : No Single Line Question Option : No Option Orientation : Vertical

The major product 'P' formed in the given reaction is

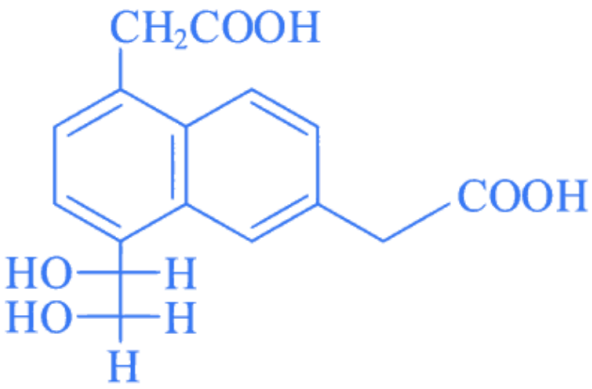


Options :

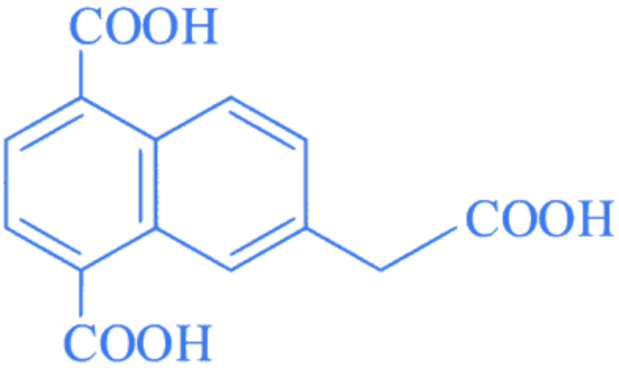
A.



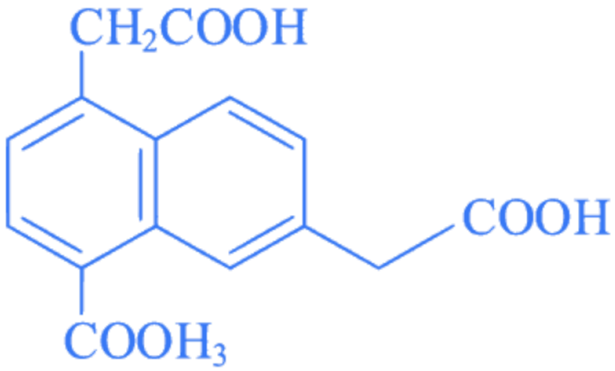
B.



C.



D.



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

Prolonged heating is avoided during the preparation of ferrous ammonium sulphate to :

Options :

A. prevent hydrolysis

B. prevent breaking

C. prevent oxidation

D. prevent reduction

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

Which of the following statements are correct?

(A) The M^{3+}/M^{2+} reduction potential for iron is greater than manganese.

(B) The higher oxidation states of first row d-block elements get stabilized by oxide ion.

(C) Aqueous solution of Cr^{2+} can liberate hydrogen from dilute acid.

(D) Magnetic moment of V^{2+} is observed between 4.4 - 5.2 BM.

Choose the correct answer from the options given below :

Options :

A. (B), (C) only

B. (A), (B) only

C. (A), (B), (D) only

D. (C), (D) only

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

The octahedral diamagnetic low spin complex among the following is :

Options :

A. $[Co(NH_3)_6]^{3+}$

B. $[NiCl_4]^{2-}$

C. $[CoCl_6]^{3-}$

D. $[CoF_6]^{3-}$

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

Using column chromatography, mixture of two compounds 'A' and 'B' was separated. 'A' eluted first, this indicates 'B' has

Options :

A. high R_f, weaker adsorption

B. high R_f, stronger adsorption

C. low R_f, weaker adsorption

D. low R_f, stronger adsorption

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

Given

(A)	$2CO(g) + O_2(g) \rightarrow 2CO_2(g)$		$\Delta H_1^0 = -x \text{ kJ mol}^{-1}$
(B)	$C(\text{graphite}) + O_2(g) \rightarrow CO_2(g)$		$\Delta H_2^0 = -y \text{ kJ mol}^{-1}$

ΔH^0 for the reaction

$$C(\text{graphite}) + \frac{1}{2}O_2(g) \rightarrow CO(g)$$

is :

Options :

A. $\frac{x - 2y}{2}$

B. $\frac{x + 2y}{2}$

C. $2y - x$

D. $\frac{2x - y}{2}$

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

Isomeric amines with molecular formula $C_8H_{11}N$ give the following tests

Isomer (P) ⇒ Can be prepared by Gabriel phthalimide synthesis

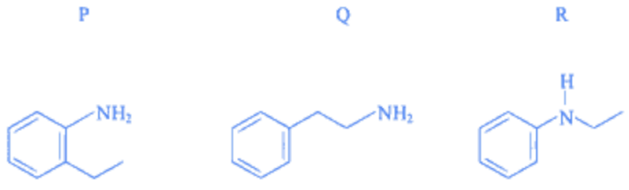
Isomer (Q) ⇒ Reacts with Hinsberg's reagent to give solid insoluble in NaOH

Isomer (R) ⇒ Reacts with HONO followed by β-naphthol in NaOH to give red dye.

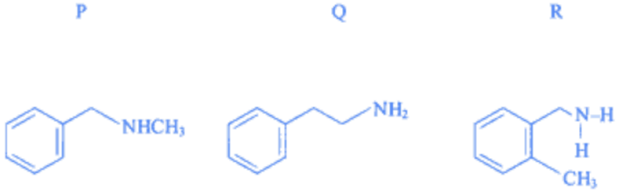
Isomers (P), (Q) and (R) respectively are

Options :

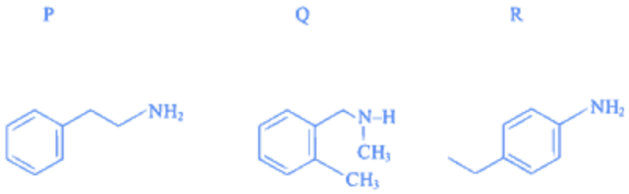
A.



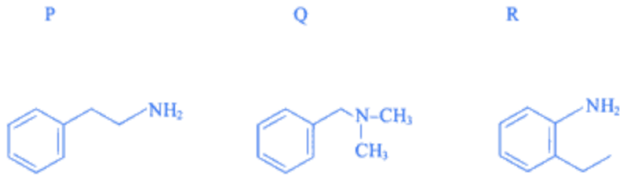
B.



C.



D.



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

Given below are two statements:

Statement I : Aqueous solution of $K_2Cr_2O_7$ is preferred as a primary standard in volumetric analysis over $Na_2Cr_2O_7$ aqueous solution.

Statement II : $K_2Cr_2O_7$ has a higher solubility in water than $Na_2Cr_2O_7$.

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

Options :

A. Statement I is true but Statement II is false

B. Both Statement I and Statement II are false

C. Statement I is false but Statement II is true

D. Both Statement I and Statement II are true

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

Suitable reaction condition for preparation of Methyl phenyl ether is

Options :

A. Benzene, MeBr

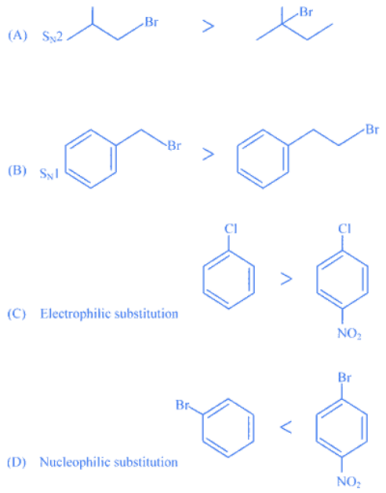
B. $PhO^{\ominus}Na^{\oplus}$, MeBr

C. Ph - Br, $MeO^{\ominus}Na^{\oplus}$

D. $PhO^{\ominus}Na^{\oplus}$, MeOH

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

Identify the correct order of reactivity for the following pairs towards the respective mechanism



Choose the correct answer from the options given below:

Options :

A. (A), (B) and (D) only

B. (A), (B), (C) and (D)

C. (B), (C) and (D) only

D. (A), (C) and (D) only

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

The pair from the following pairs having both compounds with net non-zero dipole moment is

Options :

A. cis-butene, trans-butene

B. CH_2Cl_2, $CHCl_3$

C. Benzene, anisidine

D. 1,4-Dichlorobenzene, 1,3-Dichlorobenzene

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

The enthalpy change for the adsorption process and micelle formation respectively are

Options :

A. $\Delta H_{ads} > 0$ and $\Delta H_{mic} < 0$

B. $\Delta H_{ads} > 0$ and $\Delta H_{mic} > 0$

C. $\Delta H_{ads} < 0$ and $\Delta H_{mic} < 0$

D. $\Delta H_{ads} < 0$ and $\Delta H_{mic} > 0$

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

Lime reacts exothermally with water to give 'A' which has low solubility in water. Aqueous solution of 'A' is often used for the test of CO_2, a test in which insoluble B is formed. If B is further reacted with CO_2 then soluble compound is formed, 'A' is :

Options :

A. Quick lime

B. White lime

C. Lime water

D. Slaked lime

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 the following is used as a stabilizer during the concentration of sulphide ores?

Options :

A. Cresols

B. Xanthates

C. Fatty acids

D. Pine oils

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

Given below are two reactions, involved in the commercial production of dihydrogen (H_2). The two reactions are carried out at temperature "T_1" and "T_2", respectively

$$C(s) + H_2O(g) \xrightarrow{T_1} CO(g) + H_2(g)$$

$$CO(g) + H_2O(g) \xrightarrow[Catalyst]{T_2} CO_2(g) + H_2(g)$$

The temperatures T_1 and T_2 are correctly related as :

Options :

A. $T_1 < T_2$

B. $T_1 = T_2$

C. $T_1 = 100$ K, $T_2 = 1270$ K

D. $T_1 > T_2$

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

Match List I with List II

	List I Industry		**List II Waste Generated**
(A)	Steel plants	(I)	Gypsum
(B)	Thermal power plants	(II)	Fly ash
(C)	Fertilizer industries	(III)	Slag
(D)	Paper mills	(IV)	Bio-degradable wastes

Choose the correct answer from the options given below :

Options :

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

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

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

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

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

Match List I with List II

	List I Polymer		**List II Type/Class**
(A)	Nylon-2-Nylon-6	(I)	Thermosetting polymer
(B)	Buna-N	(II)	Biodegradable polymer
(C)	Urea-formaldehyde resin	(III)	Synthetic rubber
(D)	Dacron	(IV)	Polyester

Choose the correct answer from the options given below:

Options :

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

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

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

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

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

In potassium ferrocyanide, there are _____ pairs of electrons in the t_{2g} set of orbitals.

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 number of bent-shaped molecule/s from the following is _____

N_3^-, NO_2^-, I_3^-, O_3, SO_2

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 number of correct statement/s involving equilibria in physical processes from the following is _____

(A) Equilibrium is possible only in a closed system at a given temperature.

(B) Both the opposing processes occur at the same rate.

(C) When equilibrium is attained at a given temperature, the value of all its parameters became equal.

(D) For dissolution of solids in liquids, the solubility is constant at a given temperature.

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

The sum of lone pairs present on the central atom of the interhalogen IF_5 and IF_7 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

The number of incorrect statement/s about the black body from the following is _____

(A) Emit or absorb energy in the form of electromagnetic radiation.

(B) Frequency distribution of the emitted radiation depends on temperature.

(C) At a given temperature, intensity vs frequency curve passes through a maximum value.

(D) The maximum of the intensity vs frequency curve is at a higher frequency at higher temperature compared to that at lower temperature.

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

A molecule undergoes two independent first order reactions whose respective half lives are 12 min and 3 min. If both the reactions are occurring then the time taken for the 50% consumption of the reactant is _____ min. (Nearest integer)

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 the following reactions, the total number of oxygen atoms in X and Y is _____.

$Na_2O + H_2O \rightarrow 2X$

$Cl_2O_7 + H_2O \rightarrow 2Y$

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

$$FeO_4^{2-} \xrightarrow{+2.2V} Fe^{3+} \xrightarrow{+0.70V} Fe^{2+} \xrightarrow{-0.45V} Fe^0$$

$E^{\theta}_{FeO_4^{2-}/Fe^{2+}}$ is $x \times 10^{-3}$ V. 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 : 89 Question Type : SA Display Question Number : Yes Keyboard Layout : Inscript

If the degree of dissociation of aqueous solution of weak monobasic acid is determined to be 0.3, then the observed freezing point will be _____% higher than the expected/theoretical freezing point. (Nearest integer)

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

At constant temperature, a gas is at a pressure of 940.3 mm Hg. The pressure at which its volume decreases by 40% is _____ mm Hg. (Nearest integer)

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