National Testing Agency

Question Paper Name :	B Tech 8 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

The number of arrangements of the letters of the word "INDEPENDENCE" in which all the vowels always occur together is :

Options :

A. 16800

B. 14800

C. 18000

D. 33600

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

Let

$$f(x)=\frac{\sin x+\cos x-\sqrt{2}}{\sin x-\cos x}, x \in [0,\pi]-\left\{\frac{\pi}{4}\right\}$$

. Then

$$f\left(\frac{7\pi}{12}\right)f''\left(\frac{7\pi}{12}\right)$$

is equal to

Options :

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

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

C. $\frac{-1}{3\sqrt{3}}$

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

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

$$A=\begin{bmatrix}2 & 1 & 0\\ 1 & 2 & -1\\ 0 & -1 & 2\end{bmatrix}$$

. If

$$|\operatorname{adj}(\operatorname{adj}(\operatorname{adj} 2A))|=(16)^n$$

, then n is equal to :

Options :

A. 9

B. 8

C. 10

D. 12

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

$$\lim_{x \to 0}\left(\left(\frac{\left(1-\cos^2(3x)\right)}{\cos^3(4x)}\right)\left(\frac{\sin^3(4x)}{\left(\log_e(2x+1)\right)^5}\right)\right)$$

is equal to _____.

Options :

A. 15

B. 18

C. 9

D. 24

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

In a bolt factory, machines A, B and C manufacture respectively 20%, 30% and 50% of the total bolts. Of their output 3, 4 and 2 percent are respectively defective bolts. A bolt is drawn at random from the product. If the bolt drawn is found the defective, then the probability that it is manufactured by the machine C is :

Options :

A. $\frac{2}{7}$

B. $\frac{9}{28}$

C. $\frac{5}{14}$

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

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

The number of ways, in which 5 girls and 7 boys can be seated at a round table so that no two girls sit together, is :

Options :

A. 720

B. $7(360)^2$

C. $7(720)^2$

D. $126(5!)^2$

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

The shortest distance between the lines

$$\frac{x-4}{4}=\frac{y+2}{5}=\frac{z+3}{3}$$

and

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

is :

Options :

A. $3\sqrt{6}$

B. $6\sqrt{2}$

C. $6\sqrt{3}$

D. $2\sqrt{6}$

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 R be the focus of the parabola $y^2 = 20x$ and the line $y = mx + c$ intersect the parabola at two points P and Q.

Let the point $G(10,10)$ be the centroid of the triangle PQR. If $c - m = 6$, then $(PQ)^2$ is :

Options :

A. 317

B. 325

C. 346

D. 296

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

The area of the region $\{(x, y) : x^2 \leq y \leq 8 - x^2, y \leq 7\}$ is :

Options :

A. 18

B. 24

C. 20

D. 21

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

Let $C(\alpha, \beta)$ be the circumcenter of the triangle formed by the lines

$$4x + 3y = 69$$

$4y - 3x = 17$, and

$$x + 7y = 61$$

.

Then $(\alpha - \beta)^2 + \alpha + \beta$ is equal to :

Options :

A. 15

B. 17

C. 16

D. 18

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

Let

$$I(x) = \int \frac{(x+1)}{x(1+xe^x)^2} dx, x > 0$$

. If

$$\lim_{x \to \infty} I(x) = 0$$

, then $I(1)$ is equal to :

Options :

A. $\frac{e+1}{e+2} - \log_e(e+1)$

B. $\frac{e+1}{e+2} + \log_e(e+1)$

C. $\frac{e+2}{e+1} - \log_e(e+1)$

D. $\frac{e+2}{e+1} + \log_e(e+1)$

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

Let α, β, γ be the three roots of the equation $x^3 + bx + c = 0$. If

$$\beta\gamma = 1 = -\alpha$$

, then $b^3 + 2c^3 - 3\alpha^3 - 6\beta^3 - 8\gamma^3$ is equal to :

Options :

A. 21

B. 19

C. $\frac{169}{8}$

D. $\frac{155}{8}$

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 the number of elements in sets A and B be five and two respectively. Then the number of subsets of $A \times B$ each having at least 3 and at most 6 elements is :

Options :

A. 782

B. 772

C. 752

D. 792

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

$$S_K = \frac{1 + 2 + \ \ldots \ + K}{K}$$

and

$$\sum_{j=1}^{n} S_j^2 = \frac{n}{A}\left(Bn^2 + Cn + D\right)$$

, where $A, B, C, D \in \mathbb{N}$ and A has least value. Then

Options :

A. $A + B + C + D$ is divisible by 5

B. $A + C + D$ is not divisible by B

C. $$A + B = 5(D - C)$$

D. $A + B$ is divisible by D

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

$$P = \begin{bmatrix} \frac{\sqrt{3}}{2} & \frac{1}{2} \\ -\frac{1}{2} & \frac{\sqrt{3}}{2} \end{bmatrix}, A = \begin{bmatrix} 1 & 1 \\ 0 & 1 \end{bmatrix}$$

and $Q = PAP^T$. If

$$P^T Q^{2007} P = \begin{bmatrix} a & b \\ c & d \end{bmatrix}$$

, then $2a + b - 3c - 4d$ equal to :

Options :

A. 2004

B. 2006

C. 2007

D. 2005

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

If for

$$z = \alpha + i\beta, |z + 2| = z + 4(1 + i)$$

, then $\alpha + \beta$ and $\alpha\beta$ are the roots of the equation :

Options :

A. $x^2 + 2x - 3 = 0$

B. $x^2 + 3x - 4 = 0$

C. $x^2 + x - 12 = 0$

D. $x^2 + 7x + 12 = 0$

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

If the points with position vectors

$$\alpha\hat{i} + 10\hat{j} + 13\hat{k}, 6\hat{i} + 11\hat{j} + 11\hat{k}, \frac{9}{2}\hat{i} + \beta\hat{j} - 8\hat{k}$$

are collinear, then $(19\alpha - 6\beta)^2$ is equal to :

Options :

A. 16

B. 49

C. 36

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

If the coefficients of three consecutive terms in the expansion of $(1 + x)^n$ are in the ratio $1 : 5 : 20$, then the coefficient of the fourth term is

Options :

A. 3654

B. 1827

C. 5481

D. 2436

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

If the equation of the plane containing the line

$$x + 2y + 3z - 4 = 0 = 2x + y - z + 5$$

and perpendicular to the plane

$\vec{r} = (\hat{i} - \hat{j}) + \lambda(\hat{i} + \hat{j} + \hat{k}) + \mu(\hat{i} - 2\hat{j} + 3\hat{k})$

is $ax + by + cz = 4$, then $(a - b + c)$ is equal to :

Options :

A. 18

B. 22

C. 20

D. 24

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

Negation of $(p \Rightarrow q) \Rightarrow (q \Rightarrow p)$ is :

Options :

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

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

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

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

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 $\leq t$. Then

$$\frac{2}{\pi}\int_{\pi/6}^{5\pi/6}(8[\operatorname{cosec} x]-5[\cot x])dx$$

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

$$A=\{0,3,4,6,7,8,9,10\}$$

and R be the relation defined on A such that

$$R=\{(x,y)\in A\times A: x-y$$

is odd positive integer or

$$x-y=2\}$$

. The minimum number of elements that must be added to the relation R, so that it is a symmetric relation, 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

If the solution curve of the differential equation

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

passes through the points

$$\left(e,\frac{4}{3}\right)$$

and $\left(e^4,\alpha\right)$, then α 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 the mean and variance of 8 numbers x, y, 10,12,6,12,4,8 be 9 and 9.25 respectively. If $x>y$, then $3x-2y$ 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

$$\vec{a} = 6\hat{i} + 9\hat{j} + 12\hat{k}, \vec{b} = \alpha\hat{i} + 11\hat{j} - 2\hat{k}$$

and $\vec{c}$ be vectors such that

$$\vec{a} \times \vec{c} = \vec{a} \times \vec{b}$$

. If

$$\vec{a} \cdot \vec{c} = -12, \vec{c} \cdot (\hat{i} - 2\hat{j} + \hat{k}) = 5$$

, then $\vec{c} \cdot (\hat{i} + \hat{j} + \hat{k})$ 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

If a_α is the greatest term in the sequence

$$\alpha_n = \frac{n^3}{n^4 + 147}, n = 1,2,3, \ \ldots$$

, then α 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

Let $[t]$ denote the greatest integer $\leq t$. If the constant term in the expansion of

$$\left(3x^2 - \frac{1}{2x^5}\right)^7$$

is α, then $[\alpha]$ 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

Consider a circle

$$C_1 : x^2 + y^2 - 4x - 2y = \alpha - 5$$

. Let its mirror image in the line $y = 2x + 1$ be another circle

$$C_2 : 5x^2 + 5y^2 - 10fx - 10gy + 36 = 0$$

. Let r be the radius of C_2. Then $\alpha + r$ 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 largest natural number n such that 3^n divides 66! is _____.

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 λ_1, λ_2 be the values of λ for which the points

$$\left(\frac{5}{2}, 1, \lambda\right)$$

and $(-2,0,1)$ are at equal distance from the plane $2x + 3y - 6z + 7 = 0$. If $\lambda_1 > \lambda_2$, then the distance of the point $(\lambda_1 - \lambda_2, \lambda_2, \lambda_1)$ from the line

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

is _____.

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

An air bubble of volume 1 cm^3 rises from the bottom of a lake 40 m deep to the surface at a temperature of 12°C. The atmospheric pressure is 1×10^5 Pa the density of water is 1000 kg/m^3 and

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

. There is no difference of the temperature of water at the depth of 40 m and on the surface. The volume of air bubble when it reaches the surface will be:

Options :

A. $4\ cm^3$

B. $3\ cm^3$

C. $2\ cm^3$

D. $5\ cm^3$

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

In a reflecting telescope, a secondary mirror is used to:

Options :

A. make chromatic aberration zero

B. remove spherical aberration

C. reduce the problem of mechanical support

D. move the eyepiece outside the telescopic tube

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

Certain galvanometers have a fixed core made of non magnetic metallic material. The function of this metallic material is

Options :

A. to bring the coil to rest quickly

B. to produce large deflecting torque on the coil

C. to oscillate the coil in magnetic field for longer period of time

D. to make the magnetic field radial

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

Given below are two statements:

Statement I: If E be the total energy of a satellite moving around the earth, then its potential energy will be $\frac{E}{2}$.

Statement II: The kinetic energy of a satellite revolving in an orbit is equal to the half the magnitude of total energy E.

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 incorrect but Statement II is correct

C. Statement I is correct but Statement II is incorrect

D. Both Statement I and Statement II are correct

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

Dimension of

$$\frac{1}{\mu_0 \in_0}$$

should be equal to

Options :

A. T^2/L^2

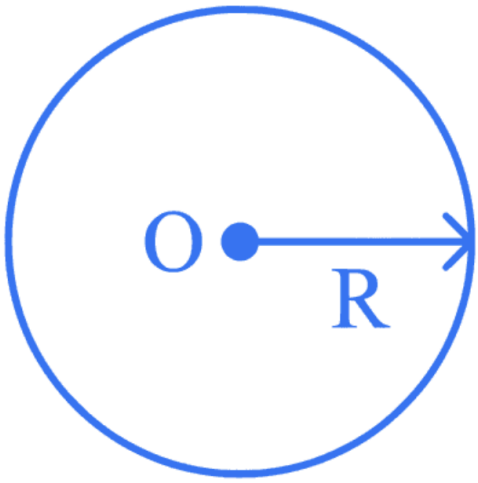
B. T/L

C. L^2/T^2

D. L/T

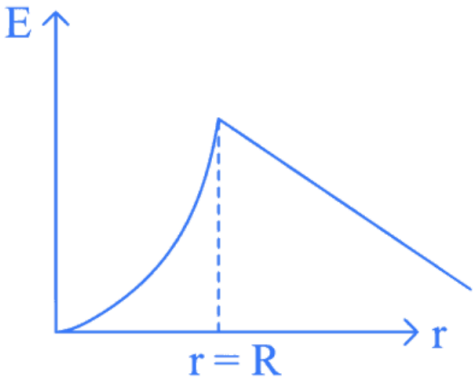
Question Number : 36 Question Type : MCQ Option Shuffling : Yes Display Question Number : Yes Is Question Mandatory : No Single Line Question Option : No Option Orientation : Vertical

Graphical variation of electric field due to a uniformly charged insulating solid sphere of radius R, with distance *r* from the centre O is represented by:

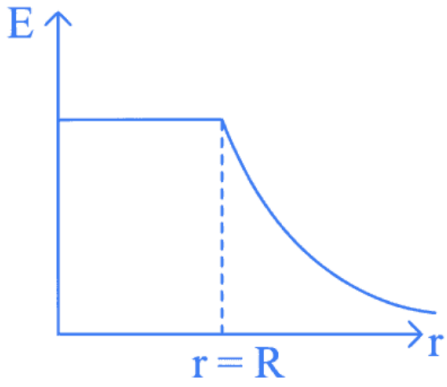


Options :

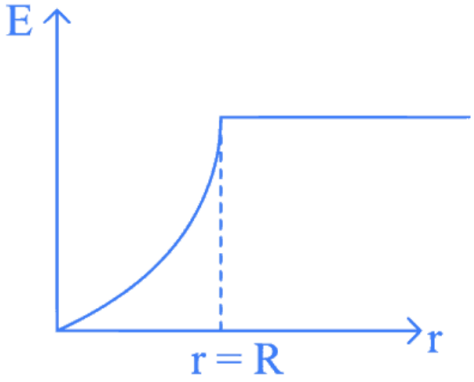
A.



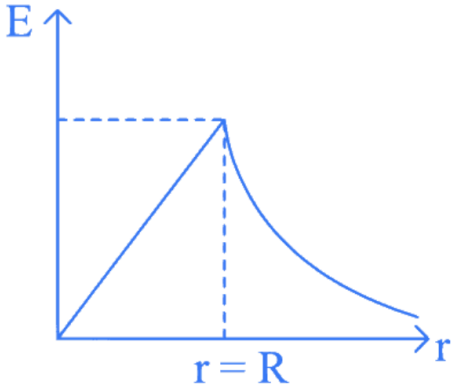
B.



C.



D.



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

Given below are two statements:

Statement I: If heat is added to a system, its temperature must increase.

Statement II: If positive work is done by a system in a thermodynamic process, its volume must increase.

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

Options :

A. Both Statement I and Statement II are true

B. 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 false

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 charge particle moving in magnetic field B, has the components of velocity along B as well as perpendicular to B. The path of the charge particle will be

Options :

A. helical path with the axis along magnetic field B

B. straight along the direction of magnetic field B

C. circular path

D. helical path with the axis perpendicular to the direction of magnetic field B

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

Two forces having magnitude A and $\frac{A}{2}$ are perpendicular to each other. The magnitude of their resultant is:

Options :

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

B. $\frac{\sqrt{5}\,A}{4}$

C. $\frac{\sqrt{5}\,A}{2}$

D. $\frac{\sqrt{5}\,A^2}{2}$

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

At any instant the velocity of a particle of mass 500 g is $\left(2t\hat{i} + 3t^2\hat{j}\right)\text{ms}^{-1}$. If the force acting on the particle at

$$t = 1\text{ s}$$

is $(\hat{i} + x\hat{j})$N. Then the value of x will be:

Options :

A. 2

B. 4

C. 6

D. 3

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

A cylindrical wire of mass (0.4 ± 0.01)g has length (8 ± 0.04)cm and radius (6 ± 0.03)mm. The maximum error in its density will be:

Options :

A. 1%

B. 5%

C. 4%

D. 3.5%

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 projectiles A and B are thrown with initial velocities of 40 m/s and 60 m/s at angles 30° and 60° with the horizontal respectively. The ratio of their ranges respectively is

$$\left(g = 10\ \text{m/s}^2\right)$$

Options :

A. $4:9$

B. $2:\sqrt{3}$

C. $\sqrt{3}:2$

D. $1:1$

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

For a nucleus ${}^{A}_{A}X$ having mass number A and atomic number Z

A. The surface energy per nucleon

$$(b_s) = -a_1 A^{2/3}$$

.

B. The Coulomb contribution to the binding energy

$$b_c = -a_2 \frac{Z(Z-1)}{A^{4/3}}$$

C. The volume energy

$$b_v = a_3 A$$

D. Decrease in the binding energy is proportional to surface area.

E. While estimating the surface energy, it is assumed that each nucleon interacts with 12 nucleons. (a_1, a_2 and a_3 are constants)

Choose the most appropriate answer from the options given below:

Options :

A. C, D only

B. B, C, E only

C. B, C only

D. A, B, C, D 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

An aluminium rod with Young's modulus

$$Y = 7.0 \times 10^{10}\ \text{N/m}^2$$

undergoes elastic strain of 0.04%. The energy per unit volume stored in the rod in SI unit is:

Options :

A. 5600

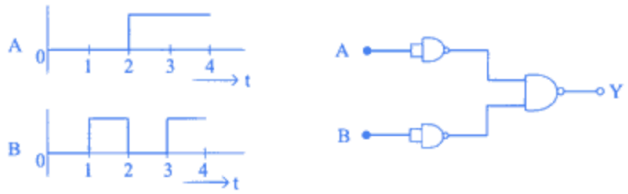
B. 2800

C. 11200

D. 8400

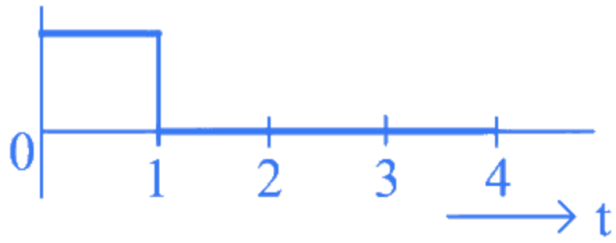
Question Number : 45 Question Type : MCQ Option Shuffling : Yes Display Question Number : Yes Is Question Mandatory : No Single Line Question Option : No Option Orientation : Vertical

For the logic circuit shown, the output waveform at Y is:



Options :

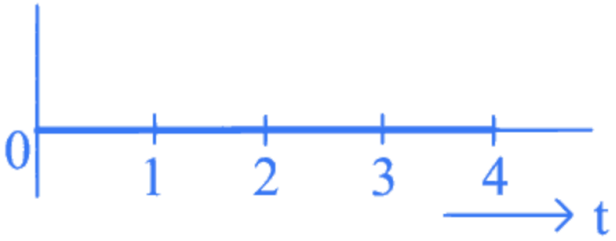
A.



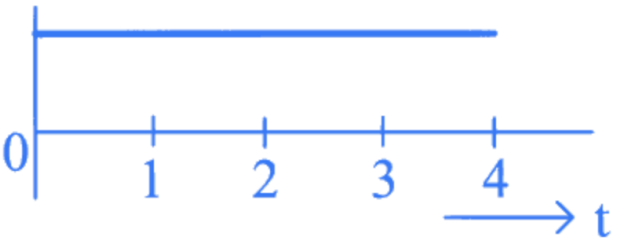
B.



C.



D.



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

The weight of a body on the earth is 400 N. Then weight of the body when taken to a depth half of the radius of the earth will be:

Options :

A. 300 N

B. 200 N

C. 100 N

D. Zero

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

Proton (P) and electron (e) will have same de-Broglie wavelength when the ratio of their momentum is (assume,

$$m_p = 1849\ m_e$$

):

Options :

A. 1 : 1

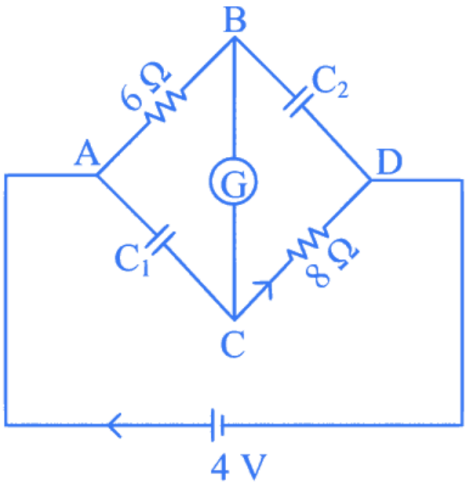
B. 1 : 43

C. 1 : 1849

D. 43 : 1

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

In this figure the resistance of the coil of galvanometer G is 2 Ω. The emf of the cell is 4 V. The ratio of potential difference across C_1 and C_2 is:



Options :

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

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

C. 1

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

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 engine of a train moving with speed 10 ms^{-1} towards a platform sounds a whistle at frequency 400 Hz. The frequency heard by a passenger inside the train is: (neglect air speed. Speed of sound in air $= 330\ ms^{-1}$)

Options :

A. 200 Hz

B. 412 Hz

C. 400 Hz

D. 388 Hz

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 TV transmitting antenna is 98 m high and the receiving antenna is at the ground level. If the radius of the earth is 6400 km, the surface area covered by the transmitting antenna is approximately:

Options :

A. $4868\ km^2$

B. $1240\ km^2$

C. $3942\ km^2$

D. $1549\ km^2$

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

The magnetic intensity at the center of a long current carrying solenoid is found to be $1.6 \times 10^3 Am^{-1}$. If the number of turns is 8 per cm, then the current flowing through the solenoid is _____ A.

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

An organ pipe 40 cm long is open at both ends. The speed of sound in air is 360 ms^{-1}. The frequency of the second harmonic is _____ Hz.

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 current of 2 A flows through a wire of cross-sectional area 25.0 mm^2. The number of free electrons in a cubic meter are 2.0×10^{28}. The drift velocity of the electrons is _____ $\times 10^{-6}$ ms^{-1} (given, charge on electron

$$= 1.6 \times 10^{-19} C$$

).

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 nucleus with mass number 242 and binding energy per nucleon as 7.6 MeV breaks into two fragment each with mass number 121. If each fragment nucleus has binding energy per nucleon as 8.1 MeV, the total gain in binding energy is _____ MeV.

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 momentum of a body is increased by 50%. The percentage increase in the kinetic energy of the body is _____ %.

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

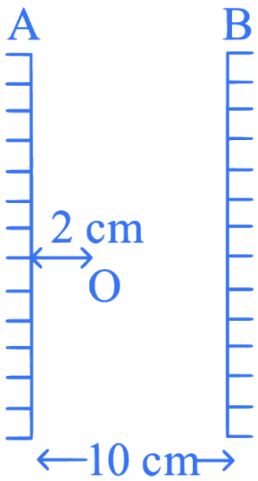
Question Number : 56 Question Type : SA Display Question Number : Yes Keyboard Layout : Inscript

An electric dipole of dipole moment is 6.0×10^{-6} Cm placed in a uniform electric field of 1.5×10^{3} NC^{-1} in such a way that dipole moment is along electric field. The work done in rotating dipole by 180° in this field will be _____ mJ.

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

Two vertical parallel mirrors A and B are separated by 10 cm. A point object O is placed at a distance of 2 cm from mirror A. The distance of the second nearest image behind mirror A from the mirror A is _____ 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

An air bubble of diameter 6 mm rises steadily through a solution of density 1750 kg/m^3 at the rate of 0.35 cm/s. The co-efficient of viscosity of the solution (neglect density of air) is _____ Pas (given, $g = 10\ ms^{-2}$).

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

An oscillating LC circuit consists of a 75 mH inductor and a 1.2 μF capacitor. If the maximum charge to the capacitor is 2.7 μC. The maximum current in the circuit will be _____ mA

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 moment of inertia of a semicircular ring about an axis, passing through the center and perpendicular to the plane of ring, is

$$\frac{1}{x}MR^2$$

, where R is the radius and M is the mass of the semicircular ring. The value of x 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

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

Assertion A: Butan -1- ol has higher boiling point than ethoxyethane.

Reason R: Extensive hydrogen bonding leads to stronger association of molecules.

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

Options :

A. A is false but R is true

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

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 : 62 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 complex is octahedral, diamagnetic and the most stable?

Options :

A. $Na_3[CoCl_6]$

B. $\left[Co\left(H_2O\right)_6\right]Cl_2$

C. $K_3\left[Co(CN)_6\right]$

D. $\left[Ni\left(NH_3\right)_6\right]Cl_2$

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

The correct order of electronegativity for given elements is:

Options :

A. $C > P > At > Br$

B. $Br > C > At > P$

C. $Br > P > At > C$

D. $P > Br > C > At$

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 correct order of spin only magnetic moments for the following complex ions is

Options :

A. $\left[Fe(CN)_6\right]^{3-} < \left[CoF_6\right]^{3-} < \left[MnBr_4\right]^{2-} < \left[Mn(CN)_6\right]^{3-}$

B. $\left[MnBr_4\right]^{2-} < \left[CoF_6\right]^{3-} < \left[Fe(CN)_6\right]^{3-} < \left[Mn(CN)_6\right]^{3-}$

C. $\left[Fe(CN)_6\right]^{3-} < \left[Mn(CN)_6\right]^{3-} < \left[CoF_6\right]^{3-} < \left[MnBr_4\right]^{2-}$

D. $\left[CoF_6\right]^{3-} < \left[MnBr_4\right]^{2-} < \left[Fe(CN)_6\right]^{3-} < \left[Mn(CN)_6\right]^{3-}$

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

$$2IO_3^- + xI^- + 12H^+ \rightarrow 6I_2 + 6H_2O$$

What is the value of x ?

Options :

A. 10

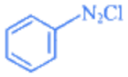
B. 2

C. 12

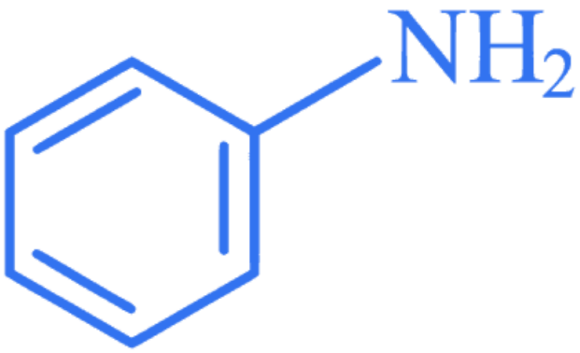
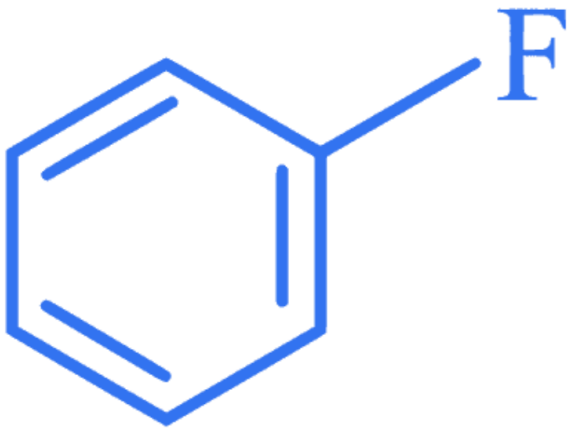
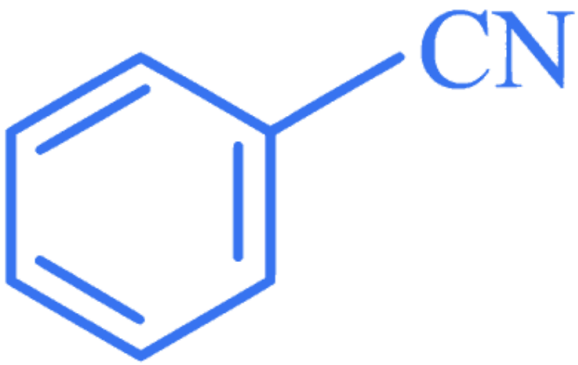
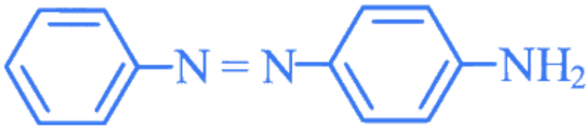
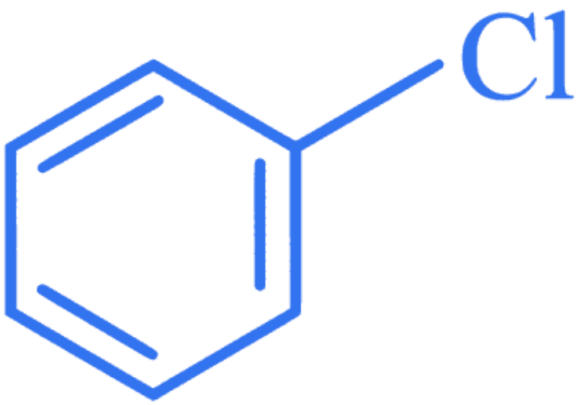
D. 6

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

Match List I with List II:



is reacted with reagents in List I to form products in List II.

	LIST I (Reagent)		**LIST II (Product)**
A.		I.	
B.	HBF_4, Δ	II.	
C.	Cu, HCl	III.	
D.	CuCN/KCN	IV.	

Choose the correct answer from the options given below:

Options :

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

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

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

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

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

Which halogen is known to cause the reaction given below :

$$2Cu^{2+} + 4X^{-} \rightarrow Cu_2X_2(s) + X_2$$

Options :

A. All halogens

B. Only Iodine

C. Only Bromine

D. Only Chlorine

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

In chromyl chloride, the number of d-electrons present on chromium is same as in

(Given at no. of Ti : 22, V : 23, Cr : 24, Mn : 25, Fe : 26)

Options :

A. Mn (VII)

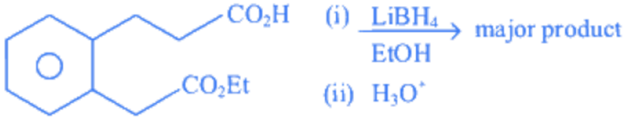
B. Ti (III)

C. Fe (III)

D. V (IV)

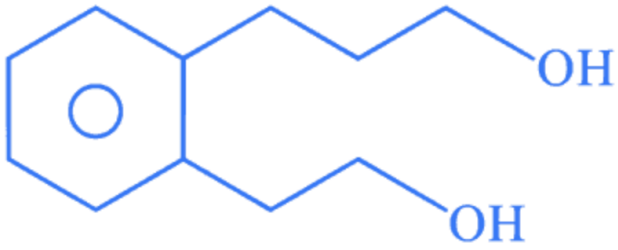
Question Number : 69 Question Type : MCQ Option Shuffling : Yes Display Question Number : Yes Is Question Mandatory : No Single Line Question Option : No Option Orientation : Vertical

The major product formed in the following reaction is:

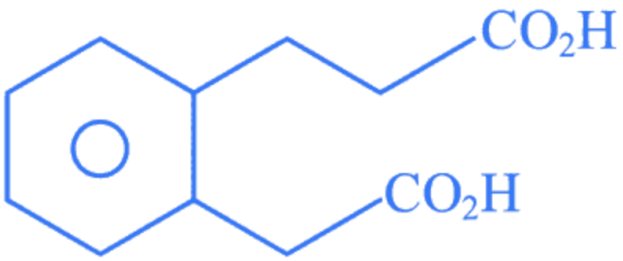


Options :

A.



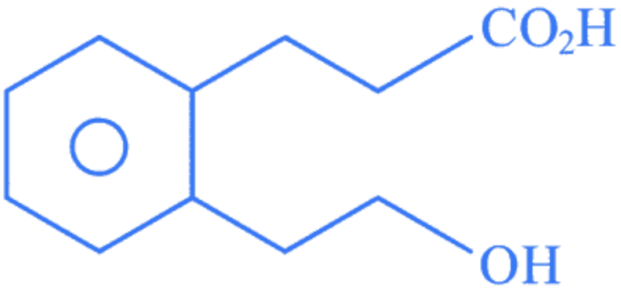
B.



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

The reaction

$$\frac{1}{2}H_2(g) + AgCl(s) \rightleftharpoons H^+(aq) + Cl^-(aq) + Ag(s)$$

occurs in which of the given galvanic cell.

Options :

A. $Ag|AgCl(s)|KCl(sol^n)\,|AgNO_3|Ag$

B. $Pt|H_2(g)|HCl(sol^n)\,|AgCl(s)|Ag$

C. $Pt|H_2(g)|HCl(sol^n)\,|AgNO_3(sol^n)\,|Ag$

D. $Pt|H_2(g)|KCl(sol^n)|AgCl(s)|Ag$

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

Sulphur (S) containing amino acids from the following are:

(a) isoleucine (b) cysteine (c) lysine (d) methionine (e) glutamic acid

Options :

A. b, d

B. a, d

C. b, c, e

D. a, b, c

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 water gas on reacting with cobalt as a catalyst forms

Options :

A. Methanoic acid

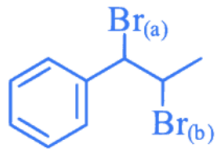
B. Methanol

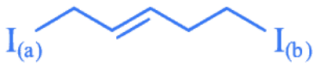
C. Methanal

D. Ethanol

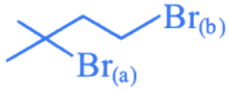
Question Number : 73 Question Type : MCQ Option Shuffling : Yes Display Question Number : Yes Is Question Mandatory : No Single Line Question Option : No Option Orientation : Vertical

Choose the halogen which is most reactive towards S_N1 reaction in the given compounds (A, B, C & D)

A. 

B. 

C. 

D. 

Options :

A. $A - Br_{(b)}; B - I_{(a)}; C - Br_{(a)}; D - Br_{(a)}$

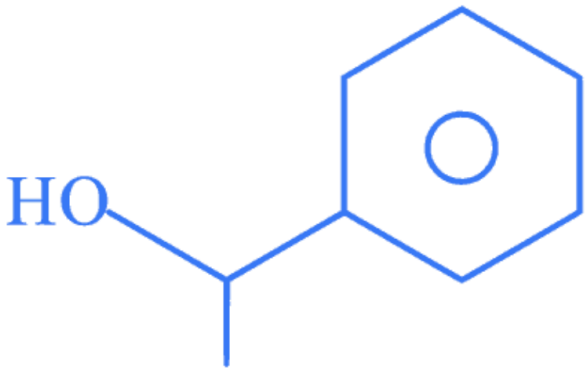
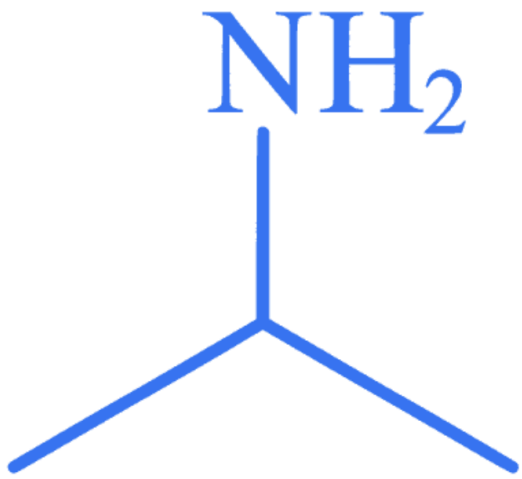
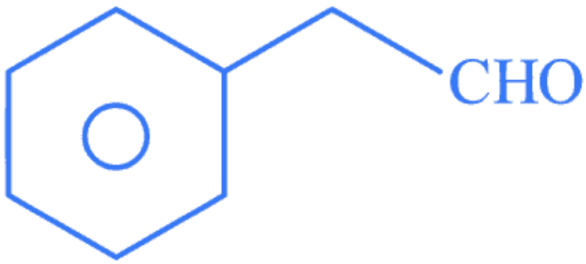
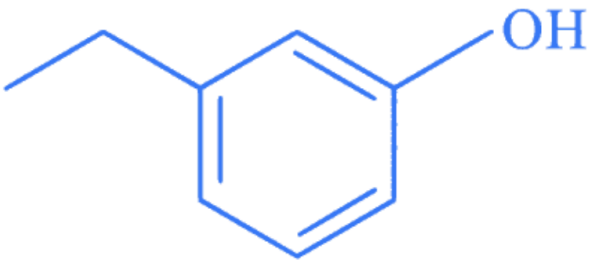
B. $A - Br_{(a)}; B - I_{(a)}; C - Br_{(a)}; D - Br_{(a)}$

C. $A - Br_{(b)}; B - I_{(b)}; C - Br_{(b)}; D - Br_{(b)}$

D. $A - Br_{(a)}; B - I_{(a)}; C - Br_{(b)}; D - Br_{(a)}$

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

Match List I with List II:

	LIST I (Reagents used)		**LIST II (Compound with Functional group detected)**
A.	Alkaline solution of copper sulphate and sodium citrate	I.	
B.	Neutral $FeCl_3$	II.	
C.	Alkaline chloroform solution	III.	
D.	Potassium iodide and sodium hypochlorite	IV.	

Choose the correct answer from the options given below:

Options :

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

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

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

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

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

Match List I with List II:

	LIST I (Species)		**LIST II (Maximum allowed concentration in ppm in drinking water)**
A.	F^-	I.	< 50 ppm
B.	SO_4^{2-}	II.	< 5 ppm
C.	NO_3^-	III.	< 2 ppm
D.	Zn	IV.	< 500 ppm

Choose the correct answer from the options given below :

Options :

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

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

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

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

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

Match List I with List II:

	LIST I		**LIST II**
A.	Saccharin	I.	High potency sweetener
B.	Aspartame	II.	First artificial sweetening agent
C.	Alitame	III.	Stable at cooking temperature
D.	Sucralose	IV.	Unstable at cooking temperature

Choose the correct answer from the options given below:

Options :

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

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

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

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

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

Given below are two statements:

Statement I : Lithium and Magnesium do not form superoxide

Statement II : The ionic radius of Li^{+} is larger than ionic radius of Mg^{2+}

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

Options :

A. Statement I is incorrect but Statement II is correct

B. Both Statement I and Statement II are incorrect

C. Both Statement I and Statement II are correct

D. Statement I is correct but Statement II is incorrect

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

What is the purpose of adding gypsum to cement?

Options :

A. To facilitate the hydration of cement

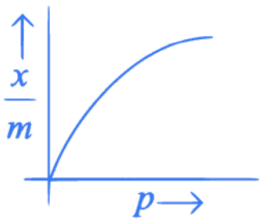
B. To speed up the process of setting

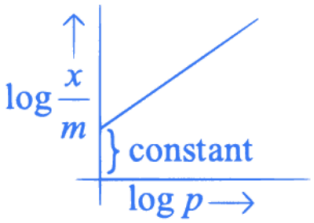
C. To give a hard mass

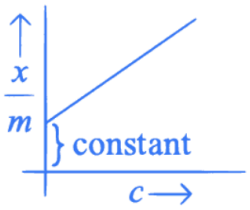
D. To slow down the process of setting

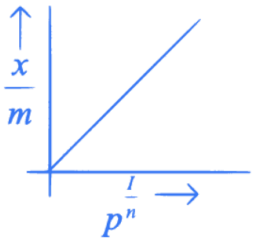
Question Number : 79 Question Type : MCQ Option Shuffling : Yes Display Question Number : Yes Is Question Mandatory : No Single Line Question Option : No Option Orientation : Vertical

Which of the following represent the Freundlich adsorption isotherms?

A. 

B. 

C. 

D. 

Choose the correct answer from the options given below:

Options :

A. B, C, D only

B. A, B only

C. A, B, D only

D. A, C, D only

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 metals can be extracted through alkali leaching technique?

Options :

A. Sn

B. Cu

C. Au

D. Pb

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 given statement/s which is/are correct is _____.

(A) The stronger the temperature dependence of the rate constant, the higher is the activation energy.

(B) If a reaction has zero activation energy, its rate is independent of temperature.

(C) The stronger the temperature dependence of the rate constant, the smaller is the activation energy.

(D) If there is no correlation between the temperature and the rate constant then it means that the reaction has negative activation energy.

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 following factors which affect the percent covalent character of the ionic bond is _____

(A) Polarising power of cation

(B) Extent of distortion of anion

(C) Polarisability of the anion

(D) Polarising power of anion

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

0.5 g of an organic compound (X) with 60% carbon will produce _____ $\times 10^{-1}$ g of CO_2 on complete combustion.

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

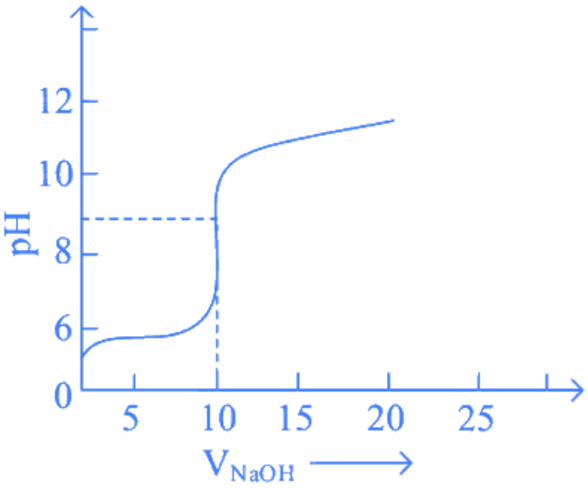
The titration curve of weak acid vs. strong base with phenolphthalein as indictor) is shown below. The

$$K_{phenolphthalein} = 4 \times 10^{-10}$$

.

Given:

$$\log 2 = 0.3$$



The number of following statement/s which is/are correct about phenolphthalein is _____

A. It can be used as an indicator for the titration of weak acid with weak base.

B. It begins to change colour at

$$pH = 8.4$$

C. It is a weak organic base

D. It is colourless in acidic medium

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

When a 60 W electric heater is immersed in a gas for 100 s in a constant volume container with adiabatic walls, the temperature of the gas rises by 5°C. The heat capacity of the given gas is _____ JK^{-1} (Nearest integer)

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

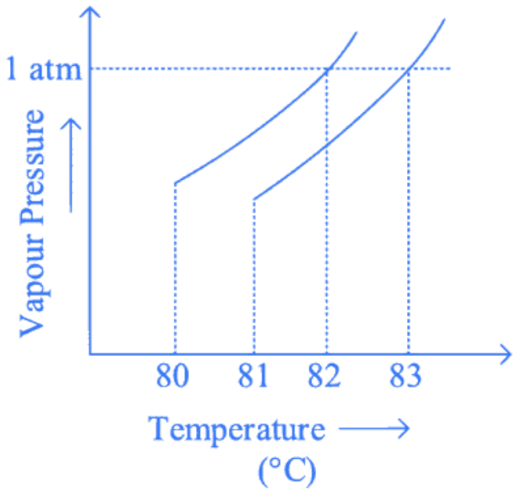
Molar mass of the hydrocarbon (X) which on ozonolysis consumes one mole of O_3 per mole of (X) and gives one mole each of ethanal and propanone is _____ $g\ mol^{-1}$

(Molar mass of C : 12 $g\ mol^{-1}$, H : 1 $g\ mol^{-1}$)

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 vapour pressure vs. temperature curve for a solution solvent system is shown below.



The boiling point of the solvent is _____ °C.

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 following statement/s which is/are incorrect is _____

(A) Line emission spectra are used to study the electronic structure

(B) The emission spectra of atoms in the gas phase show a continuous spread of wavelength from red to violet

(C) An absorption spectrum is like the photographic negative of an emission spectrum

(D) The element helium was discovered in the sun by spectroscopic method

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

XeF_4 reacts with SbF_5 to form

$$[XeF_m]^{n+}\left[SbF_y\right]^{z-}$$

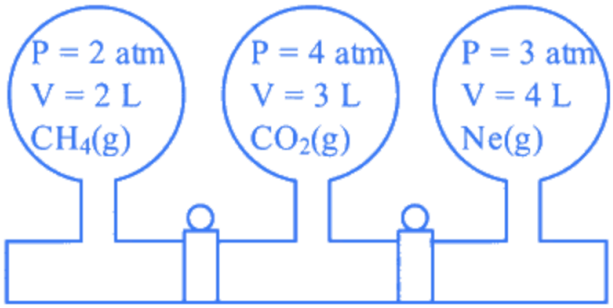
.

$$m+n+y+z=$$

_____

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



Three bulbs are filled with CH_4, CO_2 and Ne as shown in the picture. The bulbs are connected through pipes of zero volume. When the stopcocks are opened and the temperature is kept constant throughout, the pressure of the system is found to be _____ atm. (Nearest integer)

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