National Testing Agency

Question Paper Name :	B Tech 25 Jun 2022 Shift 2
Subject Name :	B. Tech
Duration :	180
Total Marks :	300
Display Marks:	Yes

B. Tech

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

Mathematics Section A

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

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

Let

$$A = \{x \in R : |x + 1| < 2\}$$

and

$$B = \{x \in R : |x - 1| \geq 2\}$$

. Then which one of the following statements is NOT true?

Options :

A. $A - B = (-1,1)$

B. $B - A = R - (-3,1)$

C. $A \cap B = (-3, -1]$

D. $A \cup B = R - [1,3)$

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 a, b ∈ R be such that the equation $ax^2 - 2bx + 15 = 0$ has a repeated root α. If α and β are the roots of the equation $x^2 - 2bx + 21 = 0$, then $\alpha^2 + \beta^2$ is equal to :

Options :

A. 37

B. 58

C. 68

D. 92

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 z_1 and z_2 be two complex numbers such that

$$z_1 = iz_2$$

and

$$\arg\left(\frac{z_1}{z_2}\right) = \pi$$

. Then :

Options :

A. $\arg z_2 = \frac{\pi}{4}$

B. $\arg z_2 = -\frac{3\pi}{4}$

C. $\arg z_1 = \frac{\pi}{4}$

D. $\arg z_1 = -\frac{3\pi}{4}$

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

The system of equations

$$-kx + 3y - 14z = 25$$
$$-15x + 4y - kz = 3$$
$$-4x + y + 3z = 4$$

is consistent for all k in the set

Options :

A. R

B. $R - \{-11, 13\}$

C. $R - \{13\}$

D. $R - \{-11, 11\}$

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

$$\lim_{x \to \frac{\pi}{2}} \left(\tan^2 x \left((2\sin^2 x + 3\sin x + 4)^{\frac{1}{2}} - (\sin^2 x + 6\sin x + 2)^{\frac{1}{2}} \right) \right)$$

is equal to

Options :

A. $\frac{1}{12}$

B. $-\frac{1}{18}$

C. $-\frac{1}{12}$

D. $\frac{1}{6}$

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 area of the region enclosed between the parabolas $y^2 = 2x - 1$ and $y^2 = 4x - 3$ is

Options :

A. $\frac{1}{3}$

B. $\frac{1}{6}$

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

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

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 coefficient of x^{101} in the expression $(5+x)^{500} + x(5+x)^{499} + x^2(5+x)^{498} + \ldots\ldots + x^{500}$, x > 0, is

Options :

A. $^{501}C_{101}\,(5)^{399}$

B. $^{501}C_{101}\,(5)^{400}$

C. $^{501}C_{100}\,(5)^{400}$

D. $^{500}C_{101}\,(5)^{399}$

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

Water is being filled at the rate of 1 cm^3 / sec in a right circular conical vessel (vertex downwards) of height 35 cm and diameter 14 cm. When the height of the water level is 10 cm, the rate (in cm^2 / sec) at which the wet conical surface area of the vessel increases is

Options :

A. 5

B. $\frac{\sqrt{21}}{5}$

C. $\frac{\sqrt{26}}{5}$

D. $\frac{\sqrt{26}}{10}$

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

If

$$b_n = \int_0^{\frac{\pi}{2}} \frac{\cos^2 nx}{\sin x} dx,\ n \in N$$

, then

Options :

A. $b_3 - b_2,\ b_4 - b_3,\ b_5 - b_4$ are in A.P. with common difference -2

$$\frac{1}{b_3 - b_2}, \frac{1}{b_4 - b_3}, \frac{1}{b_5 - b_4}$$

B. are in an A.P. with common difference 2

C. $b_3 - b_2$, $b_4 - b_3$, $b_5 - b_4$ are in a G.P.

$$\frac{1}{b_3 - b_2}, \frac{1}{b_4 - b_3}, \frac{1}{b_5 - b_4}$$

D. are in an A.P. with common difference -2

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

If

$$y = y(x)$$

is the solution of the differential equation

$$2x^2\frac{dy}{dx} - 2xy + 3y^2 = 0$$

such that

$$y(e) = \frac{e}{3}$$

, then y(1) is equal to :

Options :

A. $\frac{1}{3}$

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

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

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

The value of $2\sin(12°) - \sin(72°)$ is :

Options :

A. $\frac{\sqrt{5}\ (1 - \sqrt{3}\ )}{4}$

B. $\frac{1 - \sqrt{5}}{8}$

C. $\frac{\sqrt{3}\ (1-\sqrt{5}\ )}{2}$

D. $\frac{\sqrt{3}\ (1-\sqrt{5}\ )}{4}$

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 biased die is marked with numbers 2, 4, 8, 16, 32, 32 on its faces and the probability of getting a face with mark n is

$$\frac{1}{n}$$

. If the die is thrown thrice, then the probability, that the sum of the numbers obtained is 48, is :

Options :

A. $\frac{7}{2^{11}}$

B. $\frac{7}{2^{12}}$

C. $\frac{3}{2^{10}}$

D. $\frac{13}{2^{12}}$

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

The value of

$$\tan^{-1}\left(\frac{\cos\left(\frac{15\pi}{4}\right)-1}{\sin\left(\frac{\pi}{4}\right)}\right)$$

is equal to :

Options :

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

B. $-\frac{\pi}{8}$

C. $-\frac{5\pi}{12}$

D. $-\frac{4\pi}{9}$

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

The line y = x + 1 meets the ellipse

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

at two points P and Q. If r is the radius of the circle with PQ as diameter then $(3r)^2$ is equal to :

Options :

A. 20

B. 12

C. 11

D. 8

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

The sum $1 + 2 \cdot 3 + 3 \cdot 3^2 + \ldots\ldots\ldots + 10 \cdot 3^9$ is equal to :

Options :

A. $\frac{2 \cdot 3^{12}+10}{4}$

B. $\frac{19 \cdot 3^{10}+1}{4}$

C. $5 \cdot 3^{10}-2$

D. $\frac{9 \cdot 3^{10}+1}{2}$

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 p be the plane passing through the intersection of the planes

$$\vec{r} \cdot \left(\hat{i} + 3\hat{j} - \hat{k}\right) = 5$$

and

$$\vec{r} \cdot \left(2\hat{i} - \hat{j} + \hat{k}\right) = 3$$

, and the point (2, 1, −2). Let the position vectors of the points X and Y be $\hat{i} - 2\hat{j} + 4\hat{k}$ and $5\hat{i} - \hat{j} + 2\hat{k}$ respectively. Then the points :

Options :

A. X and X + Y are on the same side of P

B. Y and Y − X are on the opposite sides of P

C. X and Y are on the opposite sides of P

D. X + Y and X − Y are on the same side of P

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

A circle touches both the y-axis and the line x + y = 0. Then the locus of its center is :

Options :

A. $y = \sqrt{2}\ x$

B. $x = \sqrt{2}\ y$

C. $y^2 - x^2 = 2xy$

D. $x^2 - y^2 = 2xy$

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 angle made by the tangent at the point (x_0, y_0) on the curve

$$x = 12(t + \sin t \cos t)$$

,

$$y = 12(1 + \sin t)^2$$

,

$$0 < t < \frac{\pi}{2}$$

, with the positive x-axis is $\frac{\pi}{3}$, then y_0 is equal to:

Options :

A. $6\left(3+2\sqrt{2}\ \right)$

B. $3\left(7+4\sqrt{3}\ \right)$

C. 27

D. 48

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 negation of the Boolean expression $((\sim q) \wedge p) \Rightarrow ((\sim p) \vee q)$ is logically equivalent to :

Options :

A. $p \Rightarrow q$

B. $q \Rightarrow p$

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

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

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 the line

$$y = 4 + kx,\ k > 0$$

, is the tangent to the parabola $y = x - x^2$ at the point P and V is the vertex of the parabola, then the slope of the line through P and V is :

Options :

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

B. $\frac{26}{9}$

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

D. $\frac{23}{6}$

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

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

and

$$B = \begin{pmatrix} -1 & 2 \\ -1 & 2 \end{pmatrix}$$

. Then the number of elements in the set {(n, m) : n, m ∈ {1, 2, ..., 10} and $nA^n + mB^m = I$} is _____.

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

$$f(x) = \left[2x^2 + 1\right]$$

and

$$g(x) = \begin{cases} 2x - 3, & x < 0 \\ 2x + 3, & x \geq 0 \end{cases}$$

, where [t] is the greatest integer ≤ t. Then, in the open interval $(-1, 1)$, the number of points where fog is discontinuous 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 value of b > 3 for which

$$12\int_3^b \frac{1}{(x^2-1)(x^2-4)}dx = \log_e\left(\frac{49}{40}\right)$$

, 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

If the sum of the co-efficient of all the positive even powers of x in the binomial expansion of

$$\left(2x^3 + \frac{3}{x}\right)^{10}$$

is $5^{10} - \beta \cdot 3^9$, then β 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

If the mean deviation about the mean of the numbers 1, 2, 3, ..., n, where n is odd, is

$$\frac{5(n+1)}{n}$$

, then n is equal to _____.

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

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

Let

$$\vec{b} = \hat{i} + \hat{j} + \lambda\hat{k}$$

, $\lambda \in$ R. If $\vec{a}$ is a vector such that

$$\vec{a} \times \vec{b} = 13\hat{i} - \hat{j} - 4\hat{k}$$

and

$$\vec{a} \cdot \vec{b} + 21 = 0$$

, then

$$\left(\vec{b} - \vec{a}\right).\left(\hat{k} - \hat{j}\right) + \left(\vec{b} + \vec{a}\right).\left(\hat{i} - \hat{k}\right)$$

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

The total number of three-digit numbers, with one digit repeated exactly two times, 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

$$f(x) = |(x-1)(x^2-2x-3)| + x - 3,\ x \in R$$

. If m and M are respectively the number of points of local minimum and local maximum of f in the interval (0, 4), then m + M 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 l_1 be the line in xy-plane with x and y intercepts $\frac{1}{8}$ and

$$\frac{1}{4\sqrt{2}}$$

respectively, and l_2 be the line in zx-plane with x and z intercepts

$$-\frac{1}{8}$$

and

$$-\frac{1}{6\sqrt{3}}$$

respectively. If d is the shortest distance between the line l_1 and l_2, then d^{-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

Let the eccentricity of the hyperbola

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

be $\frac{5}{4}$. If the equation of the normal at the point

$$\left(\frac{8}{\sqrt{5}}, \frac{12}{5}\right)$$

on the hyperbola is

$$8\sqrt{5}\ x + \beta y = \lambda$$

, then $\lambda - \beta$ 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 :

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. One is labelled as Assertion A and the other is labelled as Reason R.

Assertion A : Two identical balls A and B thrown with same velocity 'u' at two different angles with horizontal attained the same range R. IF A and B reached the maximum height h_1 and h_2 respectively, then

$$R = 4\sqrt{h_1 h_2}$$

Reason R : Product of said heights.

$$h_1 h_2 = \left(\frac{u^2 \sin^2\theta}{2g}\right) . \left(\frac{u^2 \cos^2\theta}{2g}\right)$$

Choose the correct answer :

Options :

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

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

C. A is true but R is false.

D. A is false but R is 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

Two buses P and Q start from a point at the same time and move in a straight line and their positions are represented by

$$X_P(t) = \alpha t + \beta t^2$$

and

$$X_Q(t) = ft - t^2$$

. At what time, both the buses have same velocity?

Options :

A. $\frac{\alpha - f}{1 + \beta}$

B. $\frac{\alpha + f}{2(\beta - 1)}$

C. $\frac{\alpha + f}{2(1+\beta)}$

D. $\frac{f - \alpha}{2(1+\beta)}$

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

A disc with a flat small bottom beaker placed on it at a distance R from its center is revolving about an axis passing through the center and perpendicular to its plane with an angular velocity ω. The coefficient of static friction between the bottom of the beaker and the surface of the disc is μ. The beaker will revolve with the disc if :

Options :

A. $R \leq \frac{\mu g}{2\omega^2}$

B. $R \leq \frac{\mu g}{\omega^2}$

C. $R \geq \frac{\mu g}{2\omega^2}$

D. $R \geq \frac{\mu g}{\omega^2}$

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

A solid metallic cube having total surface area 24 m^2 is uniformly heated. If its temperature is increased by 10°C, calculate the increase in volume of the cube. (Given $\alpha = 5.0 \times 10^{-4}\ °C^{-1}$).

Options :

A. $2.4 \times 10^6\ cm^3$

B. $1.2 \times 10^5\ cm^3$

C. $6.0 \times 10^4\ cm^3$

D. $4.8 \times 10^5\ cm^3$

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

A copper block of mass 5.0 kg is heated to a temperature of 500°C and is placed on a large ice block. What is the maximum amount of ice that can melt? [Specific heat of copper : 0.39 J g^{-1} $°C^{-1}$ and latent heat of fusion of water : 335 J g^{-1}]

Options :

A. 1.5 kg

B. 5.8 kg

C. 2.9 kg

D. 3.8 kg

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

The ratio of specific heats

$$\left(\frac{C_P}{C_V}\right)$$

in terms of degree of freedom (f) is given by :

Options :

A. $\left(1+\frac{f}{3}\right)$

B. $\left(1+\frac{2}{f}\right)$

C. $\left(1+\frac{f}{2}\right)$

D. $\left(1+\frac{1}{f}\right)$

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

For a particle in uniform circular motion, the acceleration $\vec{a}$ at any point P(R, θ) on the circular path of radius R is (when θ is measured from the positive x-axis and v is uniform speed) :

Options :

A. $-\frac{v^2}{R}\sin\theta\hat{i}+\frac{v^2}{R}\cos\theta\hat{j}$

B. $-\frac{v^2}{R}\cos\theta\hat{i}+\frac{v^2}{R}\sin\theta\hat{j}$

C. $-\frac{v^2}{R}\cos\theta\hat{i}-\frac{v^2}{R}\sin\theta\hat{j}$

D. $-\frac{v^2}{R}\hat{i}+\frac{v^2}{R}\hat{j}$

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

Two metallic plates form a parallel plate capacitor. The distance between the plates is 'd'. A metal sheet of thickness $\frac{d}{2}$ and of area equal to area of each plate is introduced between the plates. What will be the ratio of the new capacitance to the original capacitance of the capacitor?

Options :

A. 2 : 1

B. 1 : 2

C. 1 : 4

D. 4 : 1

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

Two cells of same emf but different internal resistances r_1 and r_2 are connected in series with a resistance R. The value of resistance R, for which the potential difference across second cell is zero, is :

Options :

A. $r_2 - r_1$

B. $r_1 - r_2$

C. r_1

D. r_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

Given below are two statements :

Statement I : Susceptibilities of paramagnetic and ferromagnetic substances increase with decrease in temperature.

Statement II : Diamagnetism is a result of orbital motions of electrons developing magnetic moments opposite to the applied magnetic field.

Choose the correct answer from the options given below :

Options :

A. Both Statement I and Statement II are true.

B. Both Statement I and Statement II are false.

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

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

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

A long solenoid carrying a current produces a magnetic field B along its axis. If the current is doubled and the number of turns per cm is halved, the new value of magnetic field will be equal to

Options :

A. B

B. 2B

C. 4B

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

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

A sinusoidal voltage V(t) = 210 sin 3000 t volt is applied to a series LCR circuit in which L = 10 mH, C = 25 μF and R = 100 Ω. The phase difference (Φ) between the applied voltage and resultant current will be :

Options :

A. $\tan^{-1}(0.17)$

B. $\tan^{-1}(9.46)$

C. $\tan^{-1}(0.30)$

D. $\tan^{-1}(13.33)$

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 electromagnetic waves travel in a medium at a speed of 2.0×10^8 m/s. The relative permeability of the medium is 1.0. The relative permittivity of the medium will be :

Options :

A. 2.25

B. 4.25

C. 6.25

D. 8.25

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 interference pattern is obtained with two coherent light sources of intensity ratio 4 : 1. And the ratio

$$\frac{I_{\max} + I_{\min}}{I_{\max} - I_{\min}}$$

is

$$\frac{5}{x}$$

. Then, the value of x will be equal to :

Options :

A. 3

B. 4

C. 2

D. 1

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

A light whose electric field vectors are completely removed by using a good polaroid, allowed to incident on the surface of the prism at Brewster's angle. Choose the most suitable option for the phenomenon related to the prism.

Options :

A. Reflected and refracted rays will be perpendicular to each other.

B. Wave will propagate along the surface of prism.

C. No refraction, and there will be total reflection of light.

D. No reflection, and there will be total transmission of light.

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

A proton, a neutron, an electron and an α particle have same energy. If λ_p, λ_n, λ_e and λ_a are the de Broglie's wavelengths of proton, neutron, electron and α particle respectively, then choose the correct relation from the following :

Options :

A. $\lambda_p = \lambda_n > \lambda_e > \lambda_a$

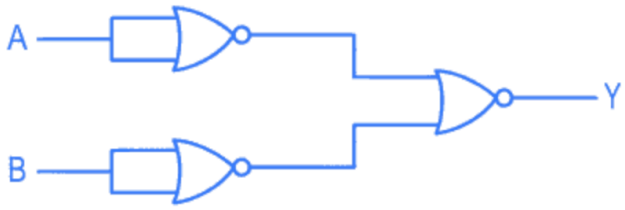
B. $\lambda_a < \lambda_n < \lambda_p < \lambda_e$

C. $\lambda_e < \lambda_p = \lambda_n > \lambda_a$

D. $\lambda_e = \lambda_p = \lambda_n = \lambda_a$

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

Identify the logic operation performed by the given circuit:



Options :

A. AND gate

B. OR gate

C. NOR gate

D. NAND gate

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

If n represents the actual number of deflections in a converted galvanometer of resistance G and shunt resistance S. Then the total current I when its figure of merit is K will be:

Options :

A. $\frac{KS}{(S+G)}$

B. $\frac{(G+S)}{nKS}$

C. $\frac{nKS}{(G+S)}$

D. $\frac{nK(G+S)}{S}$

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

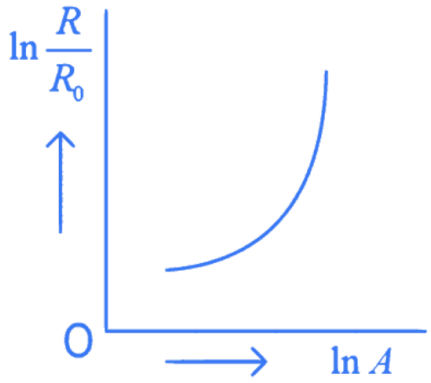
Which of the following figure represents the variation of

$$l_n\left(\frac{R}{R_0}\right)$$

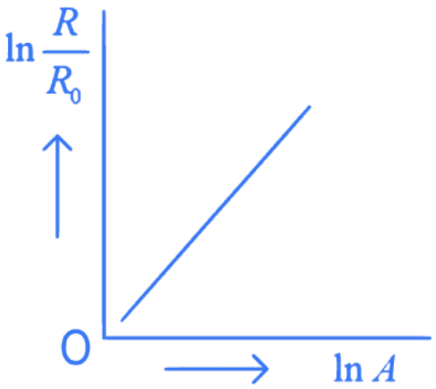
with l_nA (if R = radius of a nucleus and A = its mass number)

Options :

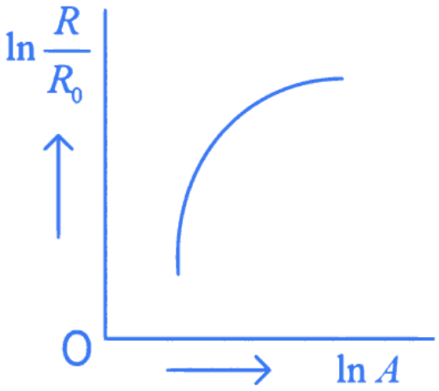
A.



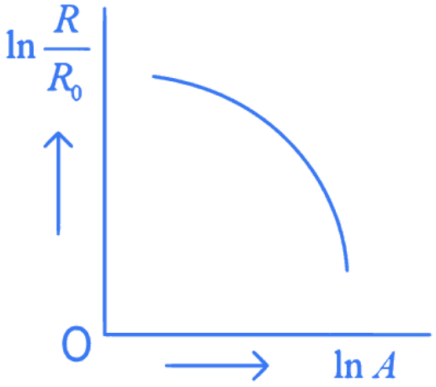
B.



C.



D.



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

Match List I with List II

	List - I		**List -II**
A.	Facsimile	I.	Static Document Image
B.	Guided media Channel	II.	Local Broadcast Radio
C.	Frequency Modulation	III.	Rectangular wave
D.	Digital Signal	IV.	Optical Fiber

Choose the correct answer from the following options:

Options :

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

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

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

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

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

For

$$z = a^2x^3y^{\frac{1}{2}}$$

, where 'a' is a constant. If percentage error in measurement of 'x' and 'y' are 4% and 12% respectively, then the percentage error for 'z' will be _____%.

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

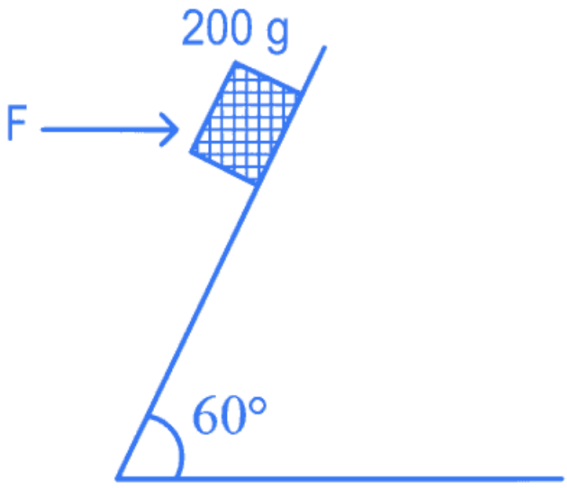
Question Number : 52 Question Type : SA Display Question Number : Yes Keyboard Layout : Inscript

A curved in a level road has a radius 75 m. The maximum speed of a car turning this curved road can be 30 m/s without skidding. If radius of curved road is changed to 48 m and the coefficient of friction between the tyres and the road remains same, then maximum allowed speed would be _____ m/s.

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 block of mass 200 g is kept stationary on a smooth inclined plane by applying a minimum horizontal force F = $\sqrt{x}$ N as shown in figure.



The value of x = _____.

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

Moment of Inertia (M.I.) of four bodies having same mass 'M' and radius '2R' are as follows:

I_1 = M.I. of solid sphere about its diameter

I_2 = M.I. of solid cylinder about its axis

I_3 = M.I. of solid circular disc about its diameter

I_4 = M.I. of thin circular ring about its diameter

If $2(I_2 + I_3) + I_4 = x \cdot I_1$, then the value of x will be _____.

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

Two satellites S_1 and S_2 are revolving in circular orbits around a planet with radius R_1 = 3200 km and R_2 = 800 km respectively. The ratio of speed of satellite S_1 to be speed of satellite S_2 in their respective orbits would be

$$\frac{1}{x}$$

where x = _____.

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

When a gas filled in a closed vessel is heated by raising the temperature by 1°C, its pressure increases by 0.4%. The initial temperature of the gas is _____ K.

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

27 identical drops are charged at 22V each. They combine to form a bigger drop. The potential of the bigger drop will be _____ V.

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

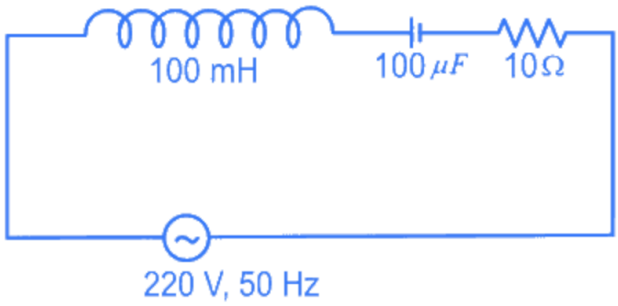
Question Number : 58 Question Type : SA Display Question Number : Yes Keyboard Layout : Inscript

The length of a given cylindrical wire is increased to double of its original length. The percentage increase in the resistance of the wire will be _____ %.

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

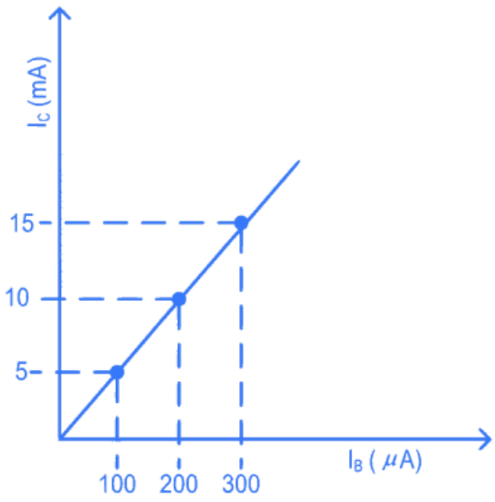
In a series LCR circuit, the inductance, capacitance and resistance are L = 100 mH, C = 100 μF and R = 10 Ω respectively. They are connected to an AC source of voltage 220 V and frequency of 50 Hz. The approximate value of current in the circuit will be _____ A.



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

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

In an experiment of CE configuration of n-p-n transistor, the transfer characteristics are observed as given in figure.



If the input resistance is 200 Ω and output resistance is 60 Ω, the voltage gain in this experiment 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

The minimum energy that must be possessed by photons in order to produce the photoelectric effect with platinum metal is :

[Given : The threshold frequency of platinum is $1.3 \times 10^{15}\ s^{-1}$ and $h = 6.6 \times 10^{-34}$ J s.]

Options :

A. 3.21×10^{-14} J

B. 6.24×10^{-16} J

C. 8.58×10^{-19} J

D. 9.76×10^{-20} J

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

At 25°C and 1 atm pressure, the enthalpy of combustion of benzene (I) and acetylene (g) are -3268 kJ mol^{-1} and -1300 kJ mol^{-1}, respectively. The change in enthalpy for the reaction 3 $C_2H_2(g) \rightarrow C_6H_6$ (I), is :

Options :

A. $+324$ kJ mol^{-1}

B. $+632$ kJ mol^{-1}

C. -632 kJ mol^{-1}

D. -732 kJ mol^{-1}

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

Solute A associates in water. When 0.7 g of solute A is dissolved in 42.0 g of water, it depresses the freezing point by 0.2°C. The percentage association of solute A in water, is :

[Given : Molar mass of A = 93 g mol^{-1}. Molal depression constant of water is 1.86 K kg mol^{-1}.]

Options :

A. 50%

B. 60%

C. 70%

D. 80%

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 K_{sp} for bismuth sulphide (Bi_2S_3) is 1.08×10^{-73}. The solubility of Bi_2S_3 in mol L^{-1} at 298 K is :

Options :

A. 1.0×10^{-15}

B. 2.7×10^{-12}

C. 3.2×10^{-10}

D. 4.2×10^{-8}

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

The correct order of electron gain enthalpies of Cl, F, Te and Po is

Options :

A. F < Cl < Te < Po

B. Po < Te < F < Cl

C. Te < Po < Cl < F

D. Cl < F < Te < Po

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

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

Assertion A : The amphoteric nature of water is explained by using Lewis acid/base concept.

Reason R : Water acts as an acid with NH_3 and as a base with H_2S.

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

Options :

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

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

C. A is true but R is false.

D. A is false but R is true.

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 correct order of reduction potentials of the following pairs is

A. Cl_2/Cl^-

B. I^2/I^-

C. Ag^+/Ag

D. Na^+/Na

E. Li^+/Li

Choose the correct answer from the options given below.

Options :

A. A > C > B > D > E

B. A > B > C > D > E

C. A > C > B > E > D

D. A > B > C > E > D

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

The metal ion (in gaseous state) with lowest spin-only magnetic moment value is :

Options :

A. V^{2+}

B. Ni^{2+}

C. Cr^{2+}

D. Fe^{2+}

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

Assertion A : A mixture contains benzoic acid and napthalene. The pure benzoic acid can be separated out by the use of benzene.

Reason R : Benzoic acid is soluble in hot water.

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

Options :

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

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

C. A is true but R is false.

D. A is false but R is true.

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

During halogen test, sodium fusion extract is boiled with concentrated HNO_3 to

Options :

A. remove unreacted sodium

B. decompose cyanide or sulphide of sodium

C. extract halogen from organic compound

D. maintain the pH of extract.

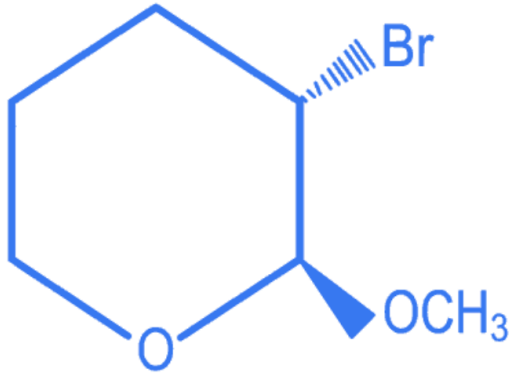
Question Number : 71 Question Type : MCQ Option Shuffling : Yes Display Question Number : Yes Is Question Mandatory : No Single Line Question Option : No Option Orientation : Vertical

Amongst the following, the major product of the given chemical reaction is

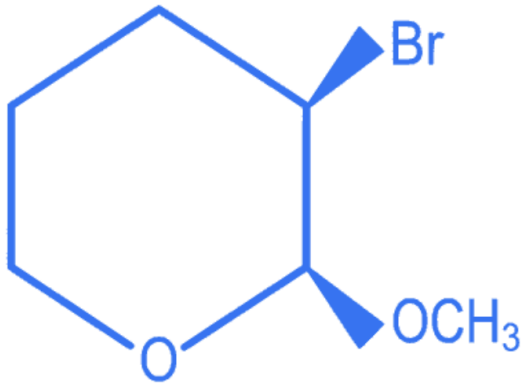


Options :

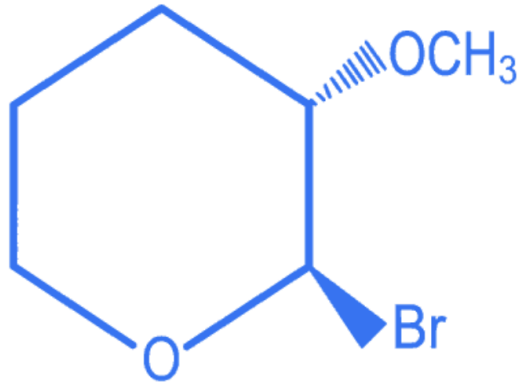
A.



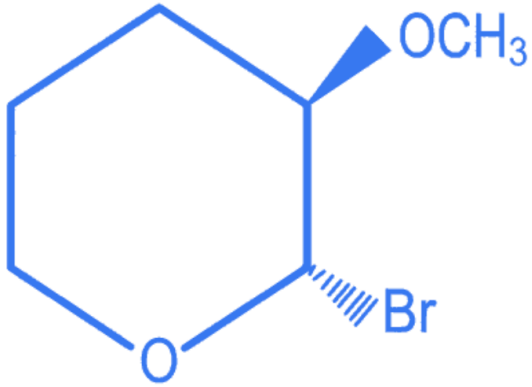
B.



C.

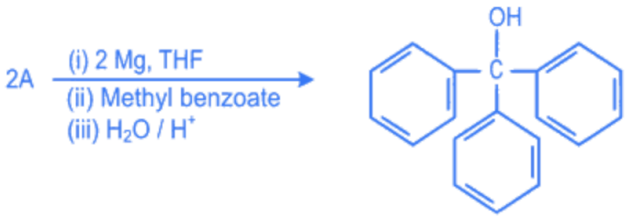


D.



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

In the given reaction



'A' can be

Options :

A. benzyl bromide

B. bromobenzene

C. cyclohexyl bromide

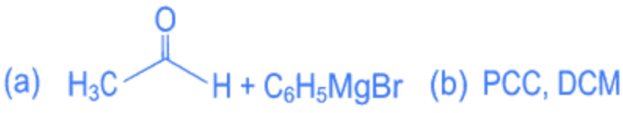
D. methyl bromide

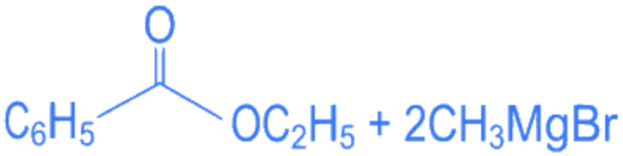
Question Number : 73 Question Type : MCQ Option Shuffling : Yes Display Question Number : Yes Is Question Mandatory : No Single Line Question Option : No Option Orientation : Vertical

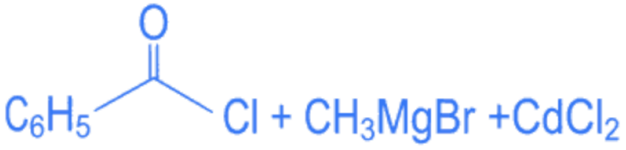
Which of the following conditions or reaction sequence will NOT give acetophenone as the major product?

Options :

A. 

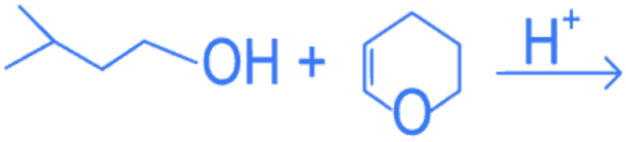
B. 

C. 

D. 

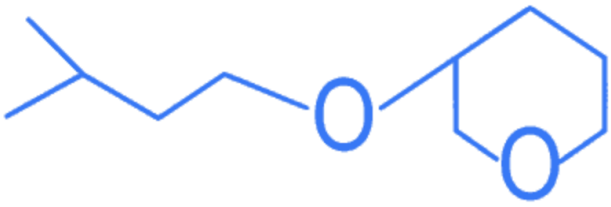
Question Number : 74 Question Type : MCQ Option Shuffling : Yes Display Question Number : Yes Is Question Mandatory : No Single Line Question Option : No Option Orientation : Vertical

The major product formed in the following reaction, is



Options :

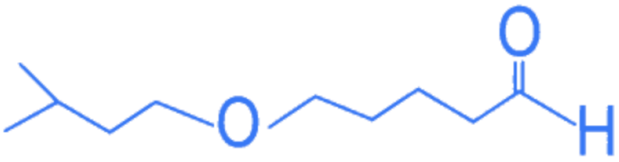
A.



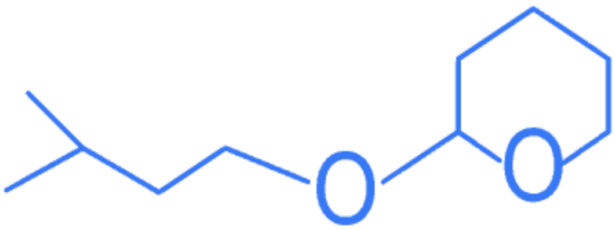
B.



C.



D.

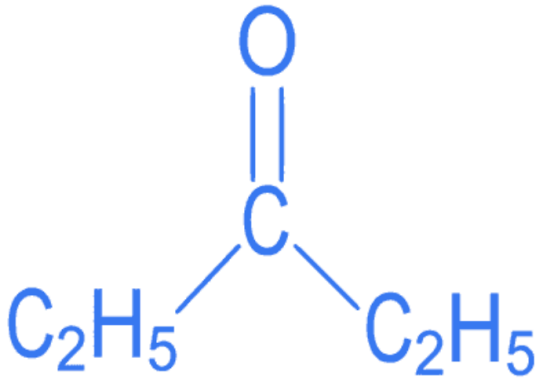


Question Number : 75 Question Type : MCQ Option Shuffling : Yes Display Question Number : Yes Is Question Mandatory : No Single Line Question Option : No Option Orientation : Vertical

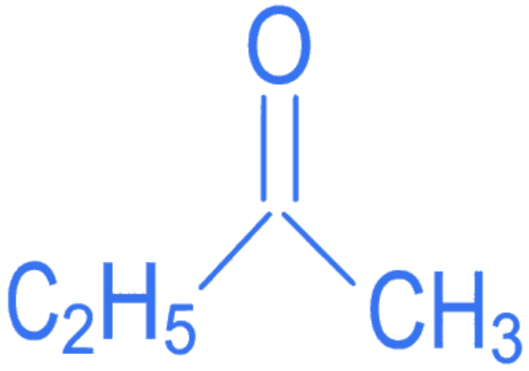
Which of the following ketone will NOT give enamine on treatment with secondary amines? [where t-Bu is $-C(CH_3)_3$]

Options :

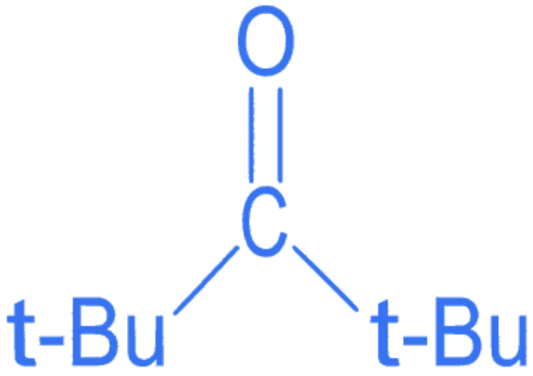
A.



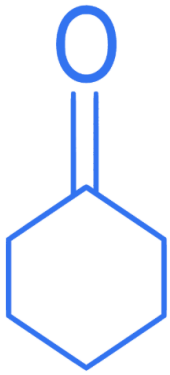
B.



C.



D.



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.	Zymase	I.	Stomach
B.	Diastase	II.	Yeast
C.	Urease	III.	Malt
D.	Pepsin	IV.	Soyabean

Choose the correct answer from the options given below :

Options :

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

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

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

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

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 : During electrolytic refining, blister copper deposits precious metals.

Statement II : In the process of obtaining pure copper by electrolysis method, copper blister is used to make the anode.

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

Options :

A. Both Statement I and Statement II are true.

B. Both Statement I and Statement II are false.

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

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

Question Number : 78 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 bridged oxygen atoms present in compound B formed from the following reactions is

$Pb(NO_3)_2$

$\xrightarrow{673\,K}$

$A + PbO + O_2$

A

$\xrightarrow{Dimerise}$

B

Options :

A. 0

B. 1

C. 2

D. 3

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

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

Assertion A : Polluted water may have a value of BOD of the order of 17 ppm.

Reason R : BOD is a measure of oxygen required to oxidise both the bio-degradable an non-biodegradable organic material in water.

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

Options :

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

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

C. A is correct but R is not correct.

D. A is not correct but R is correct.

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

An antiseptic dettol is a mixture of two compounds 'A' and 'B' where A has 6π electrons and B has 2π electrons. What is 'B'?

Options :

A. Bithionol

B. Terpineol

C. Chloroxylenol

D. Chloramphenicol

Chemistry Section B

Section Number :	6
Section type :	Online
Mandatory or Optional :	Mandatory
Number of Questions :	10
Number of Questions to be attempted :	5
Section Marks :	20
Maximum Instruction Time :	0
Sub-Section Number :	1
Question Shuffling Allowed :	Yes
Is Section Default? :	No

Question Number : 81 Question Type : SA Display Question Number : Yes Keyboard Layout : Inscript

A protein 'A' contains 0.30% of glycine (molecular weight 75). The minimum molar mass of the protein 'A' is _____ $\times 10^3$ g mol^{-1} [nearest integer]

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

Amongst BeF_2, BF_3, H_2O, NH_3, CCl_4 and HCl, the number of molecules with non-zero net dipole moment is _____.

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

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

At 345 K, the half life for the decomposition of a sample of a gaseous compound initially at 55.5 kPa was 340 s. When the pressure was 27.8 kPa, the half life was found to be 170 s. The order of the reaction is _____. [integer answer]

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

A solution of $Fe_2(SO_4)_3$ is electrolyzed for 'x' min with a current of 1.5 A to deposit 0.3482 g of Fe. The value of x is _____. [nearest integer]

Given : 1 F = 96500 C mol^{-1}

Atomic mass of Fe = 56 g mol^{-1}

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

Amongst $FeCl_3.3H_2O$, $K_3[Fe(CN)_6]$ and $[Co(NH_3)_6]Cl_3$, the spin-only magnetic moment value of the inner-orbital complex that absorbs light at shortest wavelength is _____ B.M. [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

How many of the given compounds will give a positive Biuret test _____ ?

Glycine, Glycylalanine, Tripeptide, Biuret

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 neutralization occurs when 10 mL of 0.1M acid 'A' is allowed to react with 30 mL of 0.05 M base $M(OH)_2$. The basicity of the acid 'A' is _____.

[M is a metal]

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

A rigid nitrogen tank stored inside a laboratory has a pressure of 30 atm at 06:00 am when the temperature is 27°C. At 03:00 pm, when the temperature is 45°, the pressure in the tank will be _____ atm. [nearest integer]

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

Consider the following reactions:

$PCl_3 + H_2O \rightarrow A + HCl$

$A + H_2O \rightarrow B + HCl$

The number of ionisable protons present in the product B is _____.

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

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

The Novolac polymer has mass of 963 g. The number of monomer units present in it are

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