JEE MAIN

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QUESTION PAPER

2022

JOINT ENTRANCE EXAMINATION - MAIN

PREVIOUS YEAR QUESTION PAPER

Paper:	B.E_B.Tech
Set Name:	Set 04
Exam Date:	29 July 2022
Exam Shift:	2
Langauge:	English

Topic:	Mathematics-Section A
Item No:	1
Question ID:	**15477154601**
Question Type:	MCQ
Question:	If $z \neq 0$ be a complex number such that $\left\|z-\frac{1}{z}\right\|=2$, then the maximum value of $\|z\|$ is :
A:	$\sqrt{2}$
B:	1
C:	$\sqrt{2}-1$
D:	$\sqrt{2}+1$

Topic:	Mathematics-Section A
Item No:	2
Question ID:	**15477154602**
Question Type:	MCQ
Question:	Which of the following matrices can **NOT** be obtained from the matrix $\begin{bmatrix}-1 & 2\\ 1 & -1\end{bmatrix}$ by a single elementary row operation ?
A:	$\begin{bmatrix}0 & 1\\ 1 & -1\end{bmatrix}$
B:	$\begin{bmatrix}1 & -1\\ -1 & 2\end{bmatrix}$
C:	$\begin{bmatrix}-1 & 2\\ -2 & 7\end{bmatrix}$
D:	$\begin{bmatrix}-1 & 2\\ -1 & 3\end{bmatrix}$

Topic:	Mathematics-Section A
Item No:	3
Question ID:	**15477154603**
Question Type:	MCQ

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Question:	If the system of equations $x + y + z = 6$ $2x + 5y + \alpha z = \beta$ $x + 2y + 3z = 14$ has infinitely many solutions, then $\alpha + \beta$ is equal to
A:	8
B:	36
C:	44
D:	48

Topic:	Mathematics-Section A
Item No:	4
Question ID:	**15477154604**
Question Type:	MCQ
Question:	Let the function $f(x) = \begin{cases} \frac{\log_e(1+5x) - \log_e(1+\alpha x)}{x} & ;if\ x \neq 0 \\ 10 & ;if\ x = 0 \end{cases}$ be continuous at $x = 0$. Then α is equal to
A:	10
B:	-10
C:	5
D:	-5

Topic:	Mathematics-Section A
Item No:	5
Question ID:	**15477154605**
Question Type:	MCQ
Question:	If $[t]$ denotes the greatest integer $\leq t$, then the value of $\int_0^1 \left[2x - \left|3x^2 - 5x + 2\right| + 1\right] dx$ is :
A:	$\frac{\sqrt{37} + \sqrt{13} - 4}{6}$
B:	$\frac{\sqrt{37} - \sqrt{13} - 4}{6}$
C:	$\frac{-\sqrt{37} - \sqrt{13} + 4}{6}$
D:	$\frac{-\sqrt{37} + \sqrt{13} + 4}{6}$

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Topic:	Mathematics-Section A
Item No:	6
Question ID:	**15477154606**
Question Type:	MCQ
Question:	Let $\{a_n\}_{n=0}^{\infty}$ be a sequence such that $a_0 = a_1 = 0$ and $a_{n+2} = 3a_{n+1} - 2a_n + 1, \forall\, n \geq 0.$ Then $a_{25}a_{23} - 2a_{25}a_{22} - 2a_{23}a_{24} + 4a_{22}a_{24}$ is equal to
A:	483
B:	528
C:	575
D:	624

Topic:	Mathematics-Section A
Item No:	7
Question ID:	**15477154607**
Question Type:	MCQ
Question:	$\sum_{r=1}^{20}\left(r^2+1\right)(r!)$ is equal to
A:	$22! - 21!$
B:	$22! - 2\,(21!)$
C:	$21! - 2\,(20!)$
D:	$21! - 20!$

Topic:	Mathematics-Section A
Item No:	8
Question ID:	**15477154608**
Question Type:	MCQ
Question:	For $I(x) = \int \frac{\sec^2 x - 2022}{\sin^{2022} x}\,dx$, if $I\left(\frac{\pi}{4}\right) = 2^{1011}$, then
A:	$3^{1010}\, I\left(\frac{\pi}{3}\right) - I\left(\frac{\pi}{6}\right) = 0$
B:	$3^{1010}\, I\left(\frac{\pi}{6}\right) - I\left(\frac{\pi}{3}\right) = 0$
C:	$3^{1011}\, I\left(\frac{\pi}{3}\right) - I\left(\frac{\pi}{6}\right) = 0$

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D:	$3^{1011}\, I\left(\frac{\pi}{6}\right) - I\left(\frac{\pi}{3}\right) = 0$

Topic:	Mathematics-Section A
Item No:	9
Question ID:	**15477154609**
Question Type:	MCQ
Question:	If the solution curve of the differential equation $\frac{dy}{dx} = \frac{x+y-2}{x-y}$ passes through the points (2, 1) and (k + 1, 2), k > 0, then
A:	$2\tan^{-1}\left(\frac{1}{k}\right) = \log_e\left(k^2+1\right)$
B:	$\tan^{-1}\left(\frac{1}{k}\right) = \log_e\left(k^2+1\right)$
C:	$2\tan^{-1}\left(\frac{1}{k+1}\right) = \log_e\left(k^2+2k+2\right)$
D:	$2\tan^{-1}\left(\frac{1}{k}\right) = \log_e\left(\frac{k^2+1}{k^2}\right)$

Topic:	Mathematics-Section A
Item No:	10
Question ID:	**154771546010**
Question Type:	MCQ
Question:	Let $y = y(x)$ be the solution curve of the differential equation $\frac{dy}{dx} + \left(\frac{2x^2+11x+13}{x^3+6x^2+11x+6}\right) y = \frac{(x+3)}{x+1}$, $x > -1$, which passes through the point (0, 1). Then $y(1)$ is equal to :
A:	$\frac{1}{2}$
B:	$\frac{3}{2}$
C:	$\frac{5}{2}$
D:	$\frac{7}{2}$

Topic:	Mathematics-Section A
Item No:	11

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Question ID:	**154771546011**
Question Type:	MCQ
Question:	Let m_1, m_2 be the slopes of two adjacent sides of a square of side a such that $a^2 + 11a + 3(m_1^2 + m_2^2) = 220$. If one vertex of the square is $(10(\cos\alpha - \sin\alpha), 10(\sin\alpha + \cos\alpha))$, where $\alpha \in \left(0, \frac{\pi}{2}\right)$ and the equation of one diagonal is $(\cos\alpha - \sin\alpha)x + (\sin\alpha + \cos\alpha)y = 10$, then $72(\sin^4\alpha + \cos^4\alpha) + a^2 - 3a + 13$ is equal to :
A:	119
B:	128
C:	145
D:	155

Topic:	Mathematics-Section A
Item No:	12
Question ID:	**154771546012**
Question Type:	MCQ
Question:	The number of elements in the set $S = \left\{x \in \mathbb{R} : 2\cos\left(\frac{x^2 + x}{6}\right) = 4^x + 4^{-x}\right\}$ is :
A:	1
B:	3
C:	0
D:	infinite

Topic:	Mathematics-Section A
Item No:	13
Question ID:	**154771546013**
Question Type:	MCQ
Question:	Let A $(\alpha, -2)$, B $(\alpha, 6)$ and C $\left(\frac{\alpha}{4}, -2\right)$ be vertices of a ΔABC. If $\left(5, \frac{\alpha}{4}\right)$ is the circumcentre of ΔABC, then which of the following is **NOT** correct about ΔABC ?
A:	area is 24
B:	perimeter is 25
C:	circumradius is 5
D:	inradius is 2

Topic:	Mathematics-Section A

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Item No:	14
Question ID:	**154771546014**
Question Type:	MCQ
Question:	Let Q be the foot of perpendicular drawn from the point P (1, 2, 3) to the plane $x+2y+z=14$. If R is a point on the plane such that $\angle PRQ=60^{\circ}$, then the area of ΔPQR is equal to :
A:	$\frac{\sqrt{3}}{2}$
B:	$\sqrt{3}$
C:	$2\sqrt{3}$
D:	3

Topic:	Mathematics-Section A
Item No:	15
Question ID:	**154771546015**
Question Type:	MCQ
Question:	If (2, 3, 9), (5, 2, 1), (1, λ, 8) and (λ, 2, 3) are coplanar, then the product of all possible values of λ is :
A:	$\frac{21}{2}$
B:	$\frac{59}{8}$
C:	$\frac{57}{8}$
D:	$\frac{95}{8}$

Topic:	Mathematics-Section A
Item No:	16
Question ID:	**154771546016**
Question Type:	MCQ
Question:	Bag I contains 3 red, 4 black and 3 white balls and Bag II contains 2 red, 5 black and 2 white balls. One ball is transferred from Bag I to Bag II and then a ball is drawn from Bag II. The ball so drawn is found to be black in colour. Then the probability, that the transferred ball is red, is :
A:	$\frac{4}{9}$
B:	$\frac{5}{18}$

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C:	$\frac{1}{6}$
D:	$\frac{3}{10}$

Topic:	Mathematics-Section A
Item No:	17
Question ID:	**154771546017**
Question Type:	MCQ
Question:	Let $S=\{z=x+iy:\|z-1+i\|\geq\|z\|,\|z\|<2,\|z+i\|=\|z-1\|\}$. Then the set of all values of x, for which $w = 2x + iy \in S$ for some $y \in \mathbb{R}$, is
A:	$\left(-\sqrt{2},\frac{1}{2\sqrt{2}}\right]$
B:	$\left(-\frac{1}{\sqrt{2}},\frac{1}{4}\right]$
C:	$\left(-\sqrt{2},\frac{1}{2}\right]$
D:	$\left(-\frac{1}{\sqrt{2}},\frac{1}{2\sqrt{2}}\right]$

Topic:	Mathematics-Section A
Item No:	18
Question ID:	**154771546018**
Question Type:	MCQ
Question:	Let $\vec{a},\vec{b},\vec{c}$ be three coplanar concurrent vectors such that angles between any two of them is same. If the product of their magnitudes is 14 and $(\vec{a}\times\vec{b})\cdot(\vec{b}\times\vec{c})+(\vec{b}\times\vec{c})\cdot(\vec{c}\times\vec{a})+(\vec{c}\times\vec{a})\cdot(\vec{a}\times\vec{b})=168$, then $\|\vec{a}\|+\|\vec{b}\|+\|\vec{c}\|$ is equal to :
A:	10
B:	14
C:	16
D:	18

Topic:	Mathematics-Section A
Item No:	19
Question ID:	**154771546019**
Question Type:	MCQ
Question:	The domain of the function $f(x)=\sin^{-1}\left(\frac{x^2-3x+2}{x^2+2x+7}\right)$ is :
A:	$[1,\infty)$

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B:	$[-1, 2]$
C:	$[-1, \infty)$
D:	$(-\infty, 2]$

Topic:	Mathematics-Section A
Item No:	20
Question ID:	**154771546020**
Question Type:	MCQ
Question:	The statement $(p \Rightarrow q) \vee (p \Rightarrow r)$ is **NOT** equivalent to
A:	$(p \wedge (\sim r)) \Rightarrow q$
B:	$(\sim q) \Rightarrow ((\sim r) \vee p)$
C:	$p \Rightarrow (q \vee r)$
D:	$(p \wedge (\sim q)) \Rightarrow r$

Topic:	Mathematics-Section B
Item No:	21
Question ID:	**154771546021**
Question Type:	Numeric Answer
Question:	The sum and product of the mean and variance of a binomial distribution are 82·5 and 1350 respectively. Then the number of trials in the binomial distribution is _____.

Topic:	Mathematics-Section B
Item No:	22
Question ID:	**154771546022**
Question Type:	Numeric Answer
Question:	Let α, β $(\alpha > \beta)$ be the roots of the quadratic equation $x^2 - x - 4 = 0$. If $P_n = \alpha^n - \beta^n$, $n \in N$, then $\frac{P_{15}P_{16} - P_{14}P_{16} - P_{15}^2 + P_{14}P_{15}}{P_{13}P_{14}}$ is equal to _____.

Topic:	Mathematics-Section B
Item No:	23
Question ID:	**154771546023**
Question Type:	Numeric Answer

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Question:	Let $X=\begin{bmatrix}1\\1\\1\end{bmatrix}$ and $A=\begin{bmatrix}-1 & 2 & 3\\0 & 1 & 6\\0 & 0 & -1\end{bmatrix}$. For k $\in$ N, if $X'A^kX=33$, then k is equal to _____.

Topic:	Mathematics-Section B
Item No:	24
Question ID:	**154771546024**
Question Type:	Numeric Answer
Question:	The number of natural numbers lying between 1012 and 23421 that can be formed using the digits 2, 3, 4, 5, 6 (repetition of digits is not allowed) and divisible by 55 is _____.

Topic:	Mathematics-Section B
Item No:	25
Question ID:	**154771546025**
Question Type:	Numeric Answer
Question:	If $\sum_{k=1}^{10} K^2\left(10_{C_K}\right)^2 = 22000L$, then L is equal to _____.

Topic:	Mathematics-Section B
Item No:	26
Question ID:	**154771546026**
Question Type:	Numeric Answer
Question:	If $[t]$ denotes the greatest integer $\le t$, then the number of points, at which the function $f(x)=4\lvert 2x+3\rvert+9\left[x+\frac{1}{2}\right]-12[x+20]$ is not differentiable in the open interval (–20, 20), is _____.

Topic:	Mathematics-Section B
Item No:	27
Question ID:	**154771546027**
Question Type:	Numeric Answer
Question:	If the tangent to the curve $y=x^3-x^2+x$ at the point (a, b) is also tangent to the curve $y=5x^2+2x-25$ at the point (2, –1), then $\lvert 2a+9b\rvert$ is equal to _____

Topic:	Mathematics-Section B
Item No:	28
Question ID:	**154771546028**
Question Type:	Numeric Answer

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Question:	Let AB be a chord of length 12 of the circle $(x-2)^2+(y+1)^2=\frac{169}{4}$. If tangents drawn to the circle at points A and B intersect at the point P, then five times the distance of point P from chord AB is equal to _____.

Topic:	Mathematics-Section B
Item No:	29
Question ID:	**154771546029**
Question Type:	Numeric Answer
Question:	Let $\vec{a}$ and $\vec{b}$ be two vectors such that $\lvert\vec{a}+\vec{b}\rvert^2=\lvert\vec{a}\rvert^2+2\lvert\vec{b}\rvert^2$, $\vec{a}\cdot\vec{b}=3$ and $\lvert\vec{a}\times\vec{b}\rvert^2=75$. Then $\lvert\vec{a}\rvert^2$ is equal to _____.

Topic:	Mathematics-Section B
Item No:	30
Question ID:	**154771546030**
Question Type:	Numeric Answer
Question:	Let $S=\{(x,y)\in\mathbb{N}\times\mathbb{N}:9(x-3)^2+16(y-4)^2\le 144\}$ and $T=\{(x,y)\in\mathbb{R}\times\mathbb{R}:(x-7)^2+(y-4)^2\le 36\}$. Then $n(S\cap T)$ is equal to _____

Topic:	Physics-Section A
Item No:	31
Question ID:	**1269431**
Question Type:	MCQ
Question:	Two identical metallic spheres A and B when placed at certain distance in air repel each other with a force of F. Another identical uncharged sphere C is first placed in contact with A and then in contact with B and finally placed at midpoint between spheres A and B. The force experienced by sphere C will be:
A:	3F/2
B:	3F/4
C:	F
D:	2F

Topic:	Physics-Section A
Item No:	32
Question ID:	**1269432**
Question Type:	MCQ

Question:	Match List I with List II. List I: A. Torque; B. Stress; C. Latent Heat; D. Power List II: I. Nms^{-1}; II. $J\,kg^{-1}$; III. Nm; IV. Nm^{-2} Choose the correct answer from the options given below:
A:	A-III, B-II, C-I, D-IV
B:	A-III, B-IV, C-II, D-I
C:	A-IV, B-I, C-III, D-II
D:	A-II, B-III, C-I, D-IV

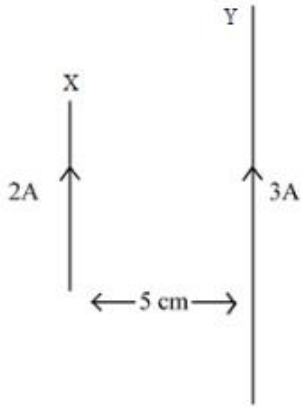
Topic:	Physics-Section A
Item No:	33
Question ID:	**1269433**
Question Type:	MCQ
Question:	Two identical thin metal plates has charge q_1 and q_2 respectively such that $q_1 > q_2$. The plates were brought close to each other to form a parallel plate capacitor of capacitance C. The potential difference between them is :
A:	$\frac{(q_1+q_2)}{C}$
B:	$\frac{(q_1-q_2)}{C}$
C:	$\frac{(q_1-q_2)}{2C}$
D:	$\frac{2(q_1-q_2)}{C}$

Topic:	Physics-Section A
Item No:	34
Question ID:	**1269434**
Question Type:	MCQ

Question:	Given below are two statements: one is labelled as **Assertion A** and the other is labelled as **Reason R**. **Assertion A:** Alloys such as constantan and manganin are used in making standard resistance coils. **Reason R:** Constantan and manganin have very small value of temperature coefficient of resistance. In the light of the above statements, choose the ***correct*** answer from the options given below.
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.

Topic:	Physics-Section A
Item No:	35
Question ID:	**1269435**
Question Type:	MCQ
Question:	A 1 m long wire is broken into two unequal parts X and Y. The X part of the wire is streched into another wire W. Length of W is twice the length of X and the resistance of W is twice that of Y. Find the ratio of length of X and Y.
A:	1:4
B:	1:2
C:	4:1
D:	2:1

Topic:	Physics-Section A
Item No:	36
Question ID:	**1269436**
Question Type:	MCQ

Question:	A wire X of length 50 cm carrying a current of 2 A is placed parallel to a long wire Y of length 5 m. The wire Y carries a current of 3 A. The distance between two wires is 5 cm and currents flow in the same direction. The force acting on the wire Y is 
A:	1.2×10^{-5} N directed towards wire X.
B:	1.2×10^{-4} N directed away from wire X.
C:	1.2×10^{-4} N directed towards wire X.
D:	2.4×10^{-5} N directed towards wire X.

Topic:	Physics-Section A
Item No:	37
Question ID:	**1269437**
Question Type:	MCQ
Question:	A juggler throws balls vertically upwards with same initial velocity in air. When the first ball reaches its highest position, he throws the next ball. Assuming the juggler throws n balls per second, the maximum height the balls can reach is
A:	g/2n
B:	g/n
C:	2gn
D:	$g/2n^2$

Topic:	Physics-Section A
Item No:	38
Question ID:	**1269438**
Question Type:	MCQ
Question:	A circuit element X when connected to an a.c. supply of peak voltage 100 V gives a peak current of 5 A which is in phase with the voltage. A second element Y when connected to the same a.c. supply also gives the same value of peak current which lags behind the voltage by $\frac{\pi}{2}$. If X and Y are connected in series to the same supply, what will be the rms value of the current in ampere?

A:	$\frac{10}{\sqrt{2}}$
B:	$\frac{5}{\sqrt{2}}$
C:	$5\sqrt{2}$
D:	$\frac{5}{2}$

Topic:	Physics-Section A
Item No:	39
Question ID:	**1269439**
Question Type:	MCQ
Question:	An unpolarised light beam of intensity $2I_0$ is passed through a polaroid P and then through another polaroid Q which is oriented in such a way that its passing axis makes an angle of 30° relative to that of P. The intensity of the emergent light is
A:	$\frac{I_0}{4}$
B:	$\frac{I_0}{2}$
C:	$\frac{3I_0}{4}$
D:	$\frac{3I_0}{2}$

Topic:	Physics-Section A
Item No:	40
Question ID:	**1269440**
Question Type:	MCQ
Question:	An α particle and a proton are accelerated from rest through the same potential difference. The ratio of linear momenta acquired by above two particals will be:
A:	$\sqrt{2}:1$
B:	$2\sqrt{2}:1$
C:	$4\sqrt{2}:1$
D:	$8:1$

Topic:	Physics-Section A
Item No:	41
Question ID:	**1269441**
Question Type:	MCQ

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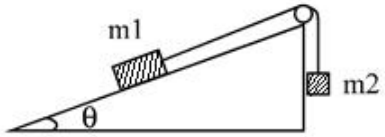
Question:	Read the following statements: (A) Volume of the nucleus is directly proportional to the mass number. (B) Volume of the nucleus is independent of mass number. (C) Density of the nucleus is directly proportional to the mass number. (D) Density of the nucleus is directly proportional to the cube root of the mass number. (E) Density of the nucleus is independent of the mass number. Choose the correct option from the following options.
A:	(A) and (D) only.
B:	(A) and (E) only.
C:	(B) and (E) only.
D:	(A) and (C) only

Topic:	Physics-Section A
Item No:	42
Question ID:	**1269442**
Question Type:	MCQ
Question:	An object of mass 1 kg is taken to a height from the surface of earth which is equal to three times the radius of earth. The gain in potential energy of the object will be [If, g=10ms^{-2} and radius of earth = 6400 km]
A:	48 MJ
B:	24 MJ
C:	36 MJ
D:	12 MJ

Topic:	Physics-Section A
Item No:	43
Question ID:	**1269443**
Question Type:	MCQ
Question:	A ball is released from a height h. If t_1 and t_2 be the time required to complete first half and second half of the distance respectively. Then, choose the correct relation between t_1 and t_2.
A:	$t_1 = \left(\sqrt{2}\right)t_2$
B:	$t_1 = \left(\sqrt{2}-1\right)t_2$
C:	$t_2 = \left(\sqrt{2}+1\right)t_1$
D:	$t_2 = \left(\sqrt{2}-1\right)t_1$

Topic:	Physics-Section A

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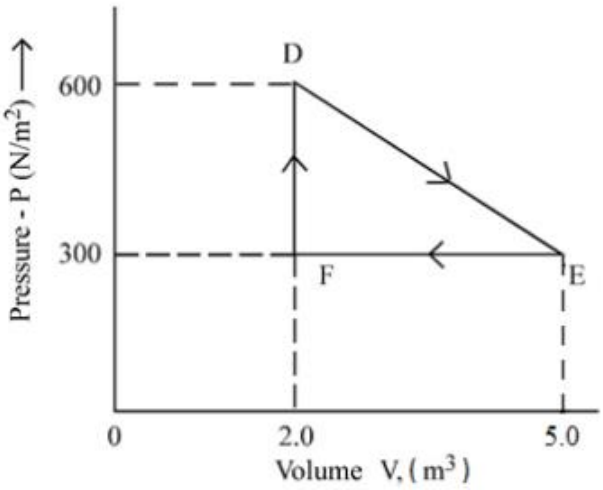
Item No:	44
Question ID:	**1269444**
Question Type:	MCQ
Question:	Two bodies of masses $m_1 = 5$ kg and $m_2 = 3$ kg are connected by a light string going over a smooth light pulley on a smooth inclined plane as shown in the figure. The system is at rest. The force exerted by the inclined plane on the body of mass m_1 will be :[Take $g = 10\ ms^{-2}$] 
A:	30 N
B:	40 N
C:	50 N
D:	60 N

Topic:	Physics-Section A
Item No:	45
Question ID:	**1269445**
Question Type:	MCQ
Question:	If momentum of a body is increased by 20%, then its kinetic energy increases by
A:	36%
B:	40%
C:	44%
D:	48%

Topic:	Physics-Section A
Item No:	46
Question ID:	**1269446**
Question Type:	MCQ
Question:	The torque of a force $5\hat{i}+3\hat{j}-7\hat{k}$ about the origin is τ. If the force acts on a particle whose position vector is $2\hat{i}+2\hat{j}+\hat{k}$, then the value of τ will be
A:	$11\hat{i}+19\hat{j}-4\hat{k}$
B:	$-11\hat{i}+9\hat{j}-16\hat{k}$
C:	$-17\hat{i}+19\hat{j}-4\hat{k}$
D:	$17\hat{i}+9\hat{j}+16\hat{k}$

Topic:	Physics-Section A

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Item No:	47
Question ID:	**1269447**
Question Type:	MCQ
Question:	A thermodynamic system is taken from an original state D to an intermediate state E by the linear process shown in the figure. Its volume is then reduced to the original volume from E to F by an isobaric process. The total work done by the gas from D to E to F will be 
A:	−450 J
B:	450 J
C:	900 J
D:	1350 J

Topic:	Physics-Section A
Item No:	48
Question ID:	**1269448**
Question Type:	MCQ
Question:	The vertical component of the earth's magnetic field is 6×10^{-5} T at any place where the angle of dip is 37°. The earth's resultant magnetic field at that place will be (Given $\tan 37° = \frac{3}{4}$)
A:	8×10^{-5} T
B:	6×10^{-5} T
C:	5×10^{-4} T
D:	1×10^{-4} T

Topic:	Physics-Section A
Item No:	49
Question ID:	**1269449**
Question Type:	MCQ

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Question:	The root mean square speed of smoke particles of mass 5×10^{-17} kg in their Brownian motion in air at NTP is approximately. [Given k = 1.38×10^{-23} JK^{-1}]
A:	60 mm s^{-1}
B:	12 mm s^{-1}
C:	15 mm s^{-1}
D:	36 mm s^{-1}

Topic:	Physics-Section A
Item No:	50
Question ID:	**1269450**
Question Type:	MCQ
Question:	Light enters from air into a given medium at an angle of 45° with interface of the air-medium surface. After refraction, the light ray is deviated through an angle of 15° from its original direction. The refractive index of the medium is :
A:	1.732
B:	1.333
C:	1.414
D:	2.732

Topic:	Physics-Section B
Item No:	51
Question ID:	**1269451**
Question Type:	Numeric Answer
Question:	A tube of length 50 cm is filled completely with an incompressible liquid of mass 250 g and closed at both ends. The tube is then rotated in horizontal plane about one of its ends with a uniform angular velocity $x\sqrt{F}$ rad s^{-1}. If F be the force exerted by the liquid at the other end then the value of x will be____.

Topic:	Physics-Section B
Item No:	52
Question ID:	**1269452**
Question Type:	Numeric Answer
Question:	Nearly 10% of the power of a 110 W light bulb is converted to visible radiation. The change in average intensities of visible radiation, at a distance of 1 m from the bulb to a distance of 5 m is $a \times 10^{-2}$ W/m^2. The value of 'a' will be _____.

Topic:	Physics-Section B
Item No:	53
Question ID:	**1269453**

Question Type:	Numeric Answer
Question:	A metal wire of length 0.5 m and cross-sectional area 10^{-4} m^2 has breaking stress 5×10^8 Nm^{-2}. A block of 10 kg is attached at one end of the string and is rotating in a horizontal circle. The maximum linear velocity of block will be ____ ms^{-1}.

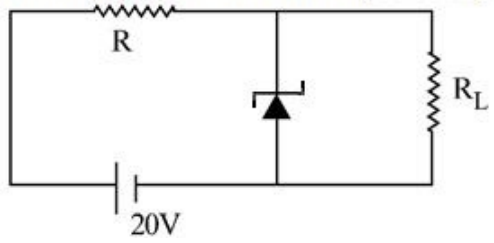
Topic:	Physics-Section B
Item No:	54
Question ID:	**1269454**
Question Type:	Numeric Answer
Question:	The velocity of a small ball of mass 0.3 g and density 8 g/cc when dropped in a container filled with glycerine becomes constant after some time. If the density of glycerine is 1.3 g/cc, then the value of viscous force acting on the ball will be $x \times 10^{-4}$ N, The value of x is _____. [use g = 10m/s^2]

Topic:	Physics-Section B
Item No:	55
Question ID:	**1269455**
Question Type:	Numeric Answer
Question:	A modulating signal $2\sin(6.28 \times 10^6)t$ is added to the carrier signal $4\sin(12.56 \times 10^9)t$ for amplitude modulation. The combined signal is passed through a non-linear square law device. The output is then passed through a band pass filter. The bandwidth of the output signal of band pass filter will be __ MHz.

Topic:	Physics-Section B
Item No:	56
Question ID:	**1269456**
Question Type:	Numeric Answer
Question:	The speed of a transverse wave passing through a string of length 50 cm and mass 10 g is 60 ms^{-1}. The area of cross-section of the wire is 2.0 mm^2 and its Young's modulus is 1.2×10^{11} Nm^{-2}. The extension of the wire over its natural length due to its tension will be $x \times 10^{-5}$ m. The value of x is__.

Topic:	Physics-Section B
Item No:	57
Question ID:	**1269457**
Question Type:	Numeric Answer
Question:	The metallic bob of simple pendulum has the relative density 5. The time period of this pendulum is 10 s. If the metallic bob is immersed in water, then the new time period becomes $5\sqrt{x}$ s. The value of x will be __.

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Topic:	Physics-Section B
Item No:	58
Question ID:	**1269458**
Question Type:	Numeric Answer
Question:	A 8 V Zener diode along with a series resistance R is connected across a 20 V supply (as shown in the figure). If the maximum Zener current is 25 mA, then the minimum value of R will be_____Ω. 

Topic:	Physics-Section B
Item No:	59
Question ID:	**1269459**
Question Type:	Numeric Answer
Question:	Two radioactive materials A and B have decay constants 25λ and 16λ respectively. If initially they have the same number of nuclei, then the ratio of the number of nuclei of B to that of A will be "e" after a time $\frac{1}{a\lambda}$. The value of a is _____.

Topic:	Physics-Section B
Item No:	60
Question ID:	**1269460**
Question Type:	Numeric Answer
Question:	A capacitor of capacitance 500 μF is charged completely using a dc supply of 100 V. It is now connected to an inductor of inductance 50 mH to form an LC circuit. The maximum current in LC circuit will be ___ A.

Topic:	Chemistry-Section A
Item No:	61
Question ID:	**1269461**
Question Type:	MCQ
Question:	Consider the reaction $4\ HNO_3(l) + 3\ KCl(s) \rightarrow Cl_2(g) + NOCl(g) + 2\ H_2O(g) + 3\ KNO_3(s)$ The amount of HNO_3 required to produce 110.0 g of KNO_3 is (Given: Atomic masses of H, O, N and K are 1, 16, 14 and 39, respectively.)
A:	32.2 g
B:	69.4 g
C:	91.5 g

D:	162.5 g

Topic:	Chemistry-Section A
Item No:	62
Question ID:	**1269462**
Question Type:	MCQ
Question:	Given below are the quantum numbers for 4 electrons. A. $n = 3, l = 2, m_l = 1, m_s = +1/2$ B. $n = 4, l = 1, m_l = 0, m_s = +1/2$ C. $n = 4, l = 2, m_l = -2, m_s = -1/2$ D. $n = 3, l = 1, m_l = -1, m_s = +1/2$ The correct order of increasing energy is
A:	D < B < A < C
B:	D < A < B < C
C:	B < D < A < C
D:	B < D < C < A

Topic:	Chemistry-Section A
Item No:	63
Question ID:	**1269463**
Question Type:	MCQ
Question:	$C(s) + O_2(g) \longrightarrow CO_2(g) + 400\ kJ$ $C(s) + \frac{1}{2}O_2(g) \longrightarrow CO(g) + 100\ kJ$ When coal of purity 60% is allowed to burn in presence of insufficient oxygen, 60% of carbon is converted into 'CO' and the remaining is converted into 'CO_2'. The heat generated when 0.6 kg of coal is burnt is _____.
A:	1600 kJ
B:	3200 kJ
C:	4400 kJ
D:	6600 kJ

Topic:	Chemistry-Section A
Item No:	64
Question ID:	**1269464**
Question Type:	MCQ
Question:	200 mL of 0.01 M HCl is mixed with 400 mL of 0.01M H_2SO_4. The pH of the mixture is __. Given: log 2 = 0.30, log 3 = 0.48, log 5 = 0.70, log 7 = 0.84, log 11 = 1.04
A:	1.14

B:	1.78
C:	2.34
D:	3.02

Topic:	Chemistry-Section A
Item No:	65
Question ID:	**1269465**
Question Type:	MCQ
Question:	Given below are the critical temperatures of some of the gases: **Gas** / **Critical temperature (K)** He — 5.2 CH_4 — 190.0 CO_2 — 304.2 NH_3 — 405.5 The gas showing least adsorption on a definite amount of charcoal is
A:	He
B:	CH_4
C:	CO_2
D:	NH_3

Topic:	Chemistry-Section A
Item No:	66
Question ID:	**1269466**
Question Type:	MCQ
Question:	In liquation process used for tin (Sn), the metal
A:	is reacted with acid.
B:	is dissolved in water.
C:	is brought to molten form which is made to flow on a slope.
D:	is fused with NaOH

Topic:	Chemistry-Section A
Item No:	67
Question ID:	**1269467**
Question Type:	MCQ

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Question:	Given below are two statements. Statement I: Stannane is an example of a molecular hydride. Statement II: Stannane is a planar molecule. In the light of the above statement, choose the ***most appropriate*** answer from the options given below.
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.

Topic:	Chemistry-Section A
Item No:	68
Question ID:	**1269468**
Question Type:	MCQ
Question:	Portland cement contains 'X' to enhance the setting time. What is 'X'?
A:	$CaSO_4 \cdot \frac{1}{2}H_2O$
B:	$CaSO_4 \cdot 2H_2O$
C:	$CaSO_4$
D:	$CaCO_3$

Topic:	Chemistry-Section A
Item No:	69
Question ID:	**1269469**
Question Type:	MCQ
Question:	When borax is heated with CoO on a platinum loop, blue coloured bead formed is largely due to
A:	B_2O_3
B:	$Co(BO_2)_2$
C:	CoB_4O_7
D:	$Co[B_4O_5(OH)_4]$

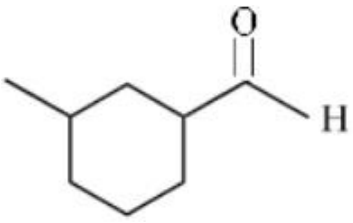
Topic:	Chemistry-Section A
Item No:	70
Question ID:	**1269470**
Question Type:	MCQ
Question:	Which of the following 3d-metal ion will give the lowest enthalpy of hydration ($\Delta_{hyd}H$) when dissolved in water ?
A:	Cr^{2+}

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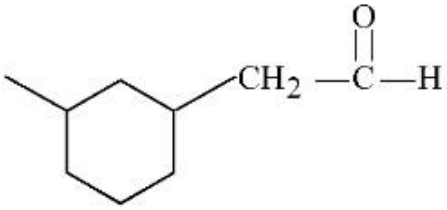
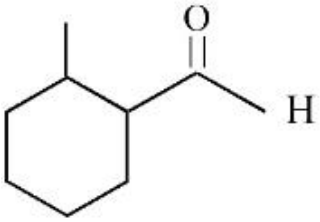
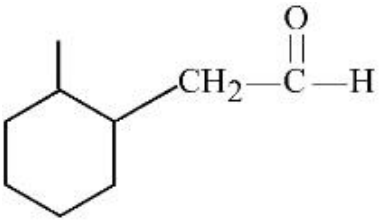
B:	Mn^{2+}
C:	Fe^{2+}
D:	Co^{2+}

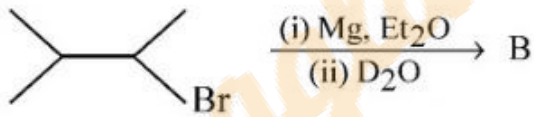
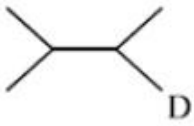
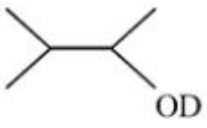
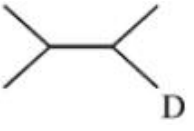
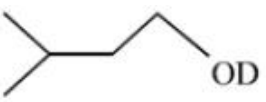
Topic:	Chemistry-Section A
Item No:	71
Question ID:	**1269471**
Question Type:	MCQ
Question:	Octahedral complexes of copper(II) undergo structural distortion (Jahn-Teller). Which one of the given copper (II) complexes will show the maximum structural distortion?(en – ethylenediamine; $H_2N\text{-}CH_2\text{-}CH_2\text{-}NH_2$)
A:	$[Cu(H_2O)_6]SO_4$
B:	$[Cu(en)(H_2O)_4]SO_4$
C:	cis-$[Cu(en)_2Cl_2]$
D:	trans-$[Cu(en)_2Cl_2]$

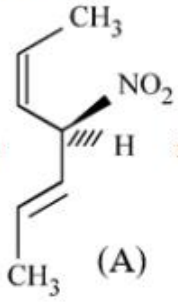
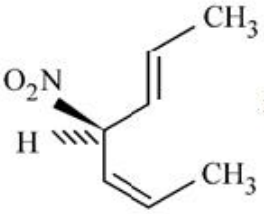
Topic:	Chemistry-Section A
Item No:	72
Question ID:	**1269472**
Question Type:	MCQ
Question:	Dinitrogen is a robust compound, but reacts at high altitudes to form oxides. The oxide of nitrogen that can damage plant leaves and retard photosynthesis is
A:	NO
B:	NO_3^-
C:	NO_2
D:	NO_2^-

Topic:	Chemistry-Section A
Item No:	73
Question ID:	**1269473**
Question Type:	MCQ
Question:	Correct structure of γ-methylcyclohexane carbaldehyde is
A:	

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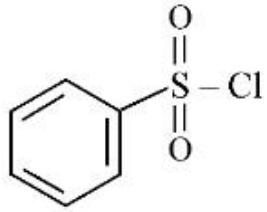
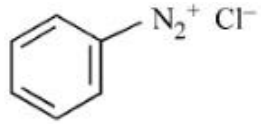
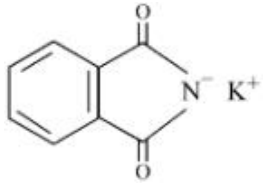
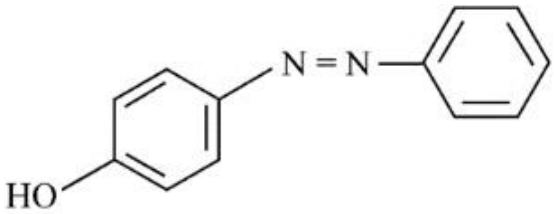
B:	
C:	
D:	

Topic:	Chemistry-Section A
Item No:	74
Question ID:	**1269474**
Question Type:	MCQ
Question:	Compound '*A*' undergoes following sequence of reactions to give compound '*B*'. The correct structure and chirality of compound 'B' is [where Et is $-C_2H_5$]  Compound 'A'
A:	 , Achiral
B:	 , Chiral
C:	 , Chiral
D:	 , Achiral

Topic:	Chemistry-Section A
Item No:	75
Question ID:	**1269475**
Question Type:	MCQ
Question:	Given below are two statements. Statement I: The compound  is optically active. (A) Statement II:  is mirror image of above compound A. In the light of the above statement, choose the ***most appropriate*** answer from the options given below.
A:	Both Statement I and Statement II are correct.
B:	Both Statement I and Statement II are incorrect.
C:	Statement I is correct but Statement II is incorrect.
D:	Statement I is incorrect but Statement II is correct.

Topic:	Chemistry-Section A
Item No:	76
Question ID:	**1269476**
Question Type:	MCQ
Question:	When enthanol is heated with conc. H_2SO_4, a gas is produced. The compound formed, when this gas is treated with cold dilute aqueous solution of Baeyer's reagent, is
A:	formaldehyde
B:	formic acid
C:	glycol
D:	ethanoic acid

Topic:	Chemistry-Section A
Item No:	77
Question ID:	**1269477**
Question Type:	MCQ

Question:	The Hinsberg reagent is
A:	
B:	
C:	
D:	

Topic:	Chemistry-Section A
Item No:	78
Question ID:	**1269478**
Question Type:	MCQ
Question:	Which of the following is **NOT** a natural polymer?
A:	Protein
B:	Starch
C:	Rubber
D:	Rayon

Topic:	Chemistry-Section A
Item No:	79
Question ID:	**1269479**
Question Type:	MCQ
Question:	Given below are two statements. One is labelled as **Assertion A** and the other is labelled as **Reason R.** **Assertion A**: Amylose is insoluble in water. **Reason R**: Amylose is a long linear molecule with more than 200 glucose units. In the light of the above statements, choose the ***correct*** answer from the options given below.
A:	Both **A** and **R** are correct and **R** is the correct explanation of **A.**

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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.

Topic:	Chemistry-Section A
Item No:	80
Question ID:	**1269480**
Question Type:	MCQ
Question:	A compound 'X' is a weak acid and it exhibits colour change at pH close to the equivalence point during neutralization of NaOH with CH_3COOH. Compound 'X' exists in ionized form in basic medium. The compound 'X' is
A:	methyl orange
B:	methyl red
C:	phenolphthalein
D:	erichrome Black T

Topic:	Chemistry-Section B
Item No:	81
Question ID:	**1269481**
Question Type:	Numeric Answer
Question:	'x' g of molecular oxygen (O_2) is mixed with 200 g of neon (Ne). The total pressure of the non-reactive mixture of O_2 and Ne in the cylinder is 25 bar. The partial pressure of Ne is 20 bar at the same temperature and volume. The value of 'x' is ___. [Given: Molar mass of O_2 = 32 g mol^{-1}. Molar mass of Ne = 20 g mol^{-1}]

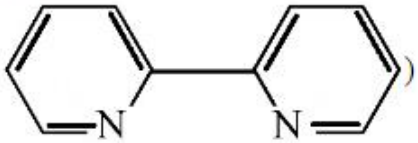
Topic:	Chemistry-Section B
Item No:	82
Question ID:	**1269482**
Question Type:	Numeric Answer
Question:	Consider, PF_5, BrF_5, PCl_3, SF_6, $[ICl_4]^-$, ClF_3 and IF_5. Amongst the above molecule(s)/ion(s), the number of molecule(s)/ion(s) having sp^3d^2 hybridisation is ____.

Topic:	Chemistry-Section B
Item No:	83
Question ID:	**1269483**

Question Type:	Numeric Answer
Question:	1.80 g of solute A was dissolved in 62.5 cm^3 of ethanol and freezing point of the solution was found to be 155.1 K. The molar mass of solute A is __ $g\ mol^{-1}$. [Given: Freezing point of ethanol is 156.0 K. Density of ethanol is 0.80 $g\ cm^{-3}$. Freezing point depression constant of ethanol is 2.00 $K\ kg\ mol^{-1}$]

Topic:	Chemistry-Section B
Item No:	84
Question ID:	**1269484**
Question Type:	Numeric Answer
Question:	For a cell, $Cu(s) \mid Cu^{2+}(0.001M) \parallel Ag^{+}(0.01M) \mid Ag(s)$ the cell potential is found to be 0.43 V at 298 K. The magnitude of standard electrode potential for Cu^{2+}/Cu is ____ $\times 10^{-2}$ V. $\left[\text{Given : } E^{\ominus}_{Ag^{+}/Ag} = 0.80\text{ V and } \frac{2.303RT}{F} = 0.06\text{ V}\right]$

Topic:	Chemistry-Section B
Item No:	85
Question ID:	**1269485**
Question Type:	Numeric Answer
Question:	Assuming 1μg of trace radioactive element X with a half life of 30 years is absorbed by a growing tree. The amount of X remaining in the tree after 100 years is ____ $\times 10^{-1}$μg. [Given: ln 10 = 2.303; log 2 = 0.30]

Topic:	Chemistry-Section B
Item No:	86
Question ID:	**1269486**
Question Type:	Numeric Answer
Question:	Sum of oxidation state (magnitude) and coordination number of cobalt in $Na[Co(bpy)Cl_4]$ is ____. (Given: bpy = )

Topic:	Chemistry-Section B
Item No:	87
Question ID:	**1269487**

Question Type:	Numeric Answer
Question:	Consider the following sulphur based oxoacids. H_2SO_3 , H_2SO_4 , $H_2S_2O_8$ and $H_2S_2O_7$. Amongst these oxoacids, the number of those with peroxo (O-O) bond is _____

Topic:	Chemistry-Section B
Item No:	88
Question ID:	**1269488**
Question Type:	Numeric Answer
Question:	A 1.84 mg sample of polyhydric alcoholic compound 'X' of molar mass 92.0 g/mol gave 1.344 mL of H_2 gas at STP. The number of alcoholic hydrogens present in compound 'X' is _____.

Topic:	Chemistry-Section B
Item No:	89
Question ID:	**1269489**
Question Type:	Numeric Answer
Question:	The number of stereoisomers formed in a reaction of (±)Ph(C=O)C(OH)(CN)Ph with HCN is _____ . [where Ph is -C_6H_5]

Topic:	Chemistry-Section B
Item No:	90
Question ID:	**1269490**
Question Type:	Numeric Answer
Question:	The number of chlorine atoms in bithionol is _____ .

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