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 08
Exam Date:	26 July 2022
Exam Shift:	2
Langauge:	English

Topic:	Mathematics-Section A
Item No:	1
Question ID:	**144961**
Question Type:	MCQ
Question:	The minimum value of the sum of the squares of the roots of $x^2 + (3 - a)x + 1 = 2a$ is:
A:	4
B:	5
C:	6
D:	8

Topic:	Mathematics-Section A
Item No:	2
Question ID:	**144962**
Question Type:	MCQ
Question:	If $z = x + iy$ satisfies $\|z\| - 2 = 0$ and $\|z - i\| - \|z + 5i\| = 0$, then
A:	$x + 2y - 4 = 0$
B:	$x^2 + y - 4 = 0$
C:	$x + 2y + 4 = 0$
D:	$x^2 - y + 3 = 0$

Topic:	Mathematics-Section A
Item No:	3
Question ID:	**144963**
Question Type:	MCQ
Question:	Let $A = \begin{bmatrix} 1 \\ 1 \\ 1 \end{bmatrix}$ and $B = \begin{bmatrix} 9^2 & -10^2 & 11^2 \\ 12^2 & 13^2 & -14^2 \\ -15^2 & 16^2 & 17^2 \end{bmatrix}$, then the value of $A'BA$ is:
A:	1224
B:	1042
C:	540

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D:	539

Topic:	Mathematics-Section A
Item No:	4
Question ID:	**144964**
Question Type:	MCQ
Question:	$\sum_{\substack{i,j=0 \\ i \neq j}}^{n} {}^{n}C_i \, {}^{n}C_j$ is equal to
A:	$2^{2n} - {}^{2n}C_n$
B:	$2^{2n-1} - {}^{2n-1}C_{n-1}$
C:	$2^{2n} - \frac{1}{2} {}^{2n}C_n$
D:	$2^{n-1} + {}^{2n-1}C_n$

Topic:	Mathematics-Section A
Item No:	5
Question ID:	**144965**
Question Type:	MCQ
Question:	Let P and Q be any points on the curves $(x-1)^2 + (y+1)^2 = 1$ and $y = x^2$, respectively. The distance between P and Q is minimum for some value of the abscissa of P in the interval
A:	$\left(0, \frac{1}{4}\right)$
B:	$\left(\frac{1}{2}, \frac{3}{4}\right)$
C:	$\left(\frac{1}{4}, \frac{1}{2}\right)$
D:	$\left(\frac{3}{4}, 1\right)$

Topic:	Mathematics-Section A
Item No:	6
Question ID:	**144966**
Question Type:	MCQ
Question:	If the maximum value of a, for which the function $f_a(x) = \tan^{-1} 2x - 3ax + 7$ is non-decreasing in $\left(-\frac{\pi}{6}, \frac{\pi}{6}\right)$, is $\bar{a}$, then $f_{\bar{a}}\left(\frac{\pi}{8}\right)$ is equal to

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A:	$8-\frac{9\pi}{4(9+\pi^2)}$
B:	$8-\frac{4\pi}{9(4+\pi^2)}$
C:	$8\left(\frac{1+\pi^2}{9+\pi^2}\right)$
D:	$8-\frac{\pi}{4}$

Topic:	Mathematics-Section A
Item No:	7
Question ID:	**144967**
Question Type:	MCQ
Question:	Let $\beta=\lim\limits_{x\to 0}\frac{\alpha x-(e^{3x}-1)}{\alpha x(e^{3x}-1)}$ for some $\alpha\in\mathbb{R}$. Then the value of $\alpha+\beta$ is :
A:	$\frac{14}{5}$
B:	$\frac{3}{2}$
C:	$\frac{5}{2}$
D:	$\frac{7}{2}$

Topic:	Mathematics-Section A
Item No:	8
Question ID:	**144968**
Question Type:	MCQ
Question:	The value of $\log_e 2\,\frac{d}{dx}\left(\log_{\cos x}\operatorname{cosec}x\right)$ at $x=\frac{\pi}{4}$ is
A:	$-2\sqrt{2}$
B:	$2\sqrt{2}$
C:	-4
D:	4

Topic:	Mathematics-Section A
Item No:	9
Question ID:	**144969**
Question Type:	MCQ

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Question:	$\int_0^{20\pi} (\lvert\sin x\rvert + \lvert\cos x\rvert)^2 \, dx$ is equal to
A:	$10(\pi + 4)$
B:	$10(\pi + 2)$
C:	$20(\pi - 2)$
D:	$20(\pi + 2)$

Topic:	Mathematics-Section A
Item No:	10
Question ID:	**1449610**
Question Type:	MCQ
Question:	Let the solution curve $y = f(x)$ of the differential equation $\frac{dy}{dx} + \frac{xy}{x^2 - 1} = \frac{x^4 + 2x}{\sqrt{1 - x^2}}$, $x \in (-1, 1)$ pass through the origin. Then $\int_{-\frac{\sqrt{3}}{2}}^{\frac{\sqrt{3}}{2}} f(x)dx$ is equal to
A:	$\frac{\pi}{3} - \frac{1}{4}$
B:	$\frac{\pi}{3} - \frac{\sqrt{3}}{4}$
C:	$\frac{\pi}{6} - \frac{\sqrt{3}}{4}$
D:	$\frac{\pi}{6} - \frac{\sqrt{3}}{2}$

Topic:	Mathematics-Section A
Item No:	11
Question ID:	**1449611**
Question Type:	MCQ
Question:	The acute angle between the pair of tangents drawn to the ellipse $2x^2 + 3y^2 = 5$ from the point $(1, 3)$ is
A:	$\tan^{-1}\left(\frac{16}{7\sqrt{5}}\right)$
B:	$\tan^{-1}\left(\frac{24}{7\sqrt{5}}\right)$

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C:	$\tan^{-1}\left(\frac{32}{7\sqrt{5}}\right)$
D:	$\tan^{-1}\left(\frac{3+8\sqrt{5}}{35}\right)$

Topic:	Mathematics-Section A
Item No:	12
Question ID:	**1449612**
Question Type:	MCQ
Question:	The equation of a common tangent to the parabolas $y = x^2$ and $y = -(x-2)^2$ is
A:	$y = 4(x-2)$
B:	$y = 4(x-1)$
C:	$y = 4(x+1)$
D:	$y = 4(x+2)$

Topic:	Mathematics-Section A
Item No:	13
Question ID:	**1449613**
Question Type:	MCQ
Question:	Let the abscissae of the two points P and Q on a circle be the roots of $x^2 - 4x - 6 = 0$ and the ordinates of P and Q be the roots of $y^2 + 2y - 7 = 0$. If PQ is a diameter of the circle $x^2 + y^2 + 2ax + 2by + c = 0$, then the value of $(a + b - c)$ is _____.
A:	12
B:	13
C:	14
D:	16

Topic:	Mathematics-Section A
Item No:	14
Question ID:	**1449614**
Question Type:	MCQ
Question:	If the line $x - 1 = 0$ is a directrix of the hyperbola $kx^2 - y^2 = 6$, then the hyperbola passes through the point
A:	$\left(-2\sqrt{5}, 6\right)$
B:	$\left(-\sqrt{5}, 3\right)$

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C:	$\left(\sqrt{5}, -2\right)$
D:	$\left(2\sqrt{5}, 3\sqrt{6}\right)$

Topic:	Mathematics-Section A
Item No:	15
Question ID:	**1449615**
Question Type:	MCQ
Question:	A vector $\vec{a}$ is parallel to the line of intersection of the plane determined by the vectors $\hat{i}, \hat{i}+\hat{j}$ and the plane determined by the vectors $\hat{i}-\hat{j}, \hat{i}+\hat{k}$. The obtuse angle between $\vec{a}$ and the vector $\vec{b} = \hat{i}-2\hat{j}+2\hat{k}$ is
A:	$\frac{3\pi}{4}$
B:	$\frac{2\pi}{3}$
C:	$\frac{4\pi}{5}$
D:	$\frac{5\pi}{6}$

Topic:	Mathematics-Section A
Item No:	16
Question ID:	**1449616**
Question Type:	MCQ
Question:	If $0 < x < \frac{1}{\sqrt{2}}$ and $\frac{\sin^{-1}x}{\alpha} = \frac{\cos^{-1}x}{\beta}$, then a value of $\sin\left(\frac{2\pi\alpha}{\alpha+\beta}\right)$ is
A:	$4\sqrt{\left(1-x^2\right)}\left(1-2x^2\right)$
B:	$4x\sqrt{\left(1-x^2\right)}\left(1-2x^2\right)$
C:	$2x\sqrt{\left(1-x^2\right)}\left(1-4x^2\right)$
D:	$4\sqrt{\left(1-x^2\right)}\left(1-4x^2\right)$

Topic:	Mathematics-Section A
Item No:	17
Question ID:	**1449617**
Question Type:	MCQ

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Question:	Negation of the Boolean expression $p \Leftrightarrow (q \Rightarrow p)$ is
A:	$(\sim p) \wedge q$
B:	$p \wedge (\sim q)$
C:	$(\sim p) \vee (\sim q)$
D:	$(\sim p) \wedge (\sim q)$

Topic:	Mathematics-Section A
Item No:	18
Question ID:	**1449618**
Question Type:	MCQ
Question:	Let X be a binomially distributed random variable with mean 4 and variance $\frac{4}{3}$. Then, $54\,P(X \le 2)$ is equal to
A:	$\frac{73}{27}$
B:	$\frac{146}{27}$
C:	$\frac{146}{81}$
D:	$\frac{126}{81}$

Topic:	Mathematics-Section A
Item No:	19
Question ID:	**1449619**
Question Type:	MCQ
Question:	The integral $\int \frac{\left(1-\frac{1}{\sqrt{3}}\right)(\cos x-\sin x)}{\left(1+\frac{2}{\sqrt{3}}\sin 2x\right)}dx$ is equal to
A:	$\frac{1}{2}\log_e\left\lvert\frac{\tan\left(\frac{x}{2}+\frac{\pi}{12}\right)}{\tan\left(\frac{x}{2}+\frac{\pi}{6}\right)}\right\rvert+C$
B:	$\frac{1}{2}\log_e\left\lvert\frac{\tan\left(\frac{x}{2}+\frac{\pi}{6}\right)}{\tan\left(\frac{x}{2}+\frac{\pi}{3}\right)}\right\rvert+C$

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C:	$\log_e \left\lvert \frac{\tan\left(\frac{x}{2}+\frac{\pi}{6}\right)}{\tan\left(\frac{x}{2}+\frac{\pi}{12}\right)} \right\rvert + C$
D:	$\frac{1}{2}\log_e \left\lvert \frac{\tan\left(\frac{x}{2}-\frac{\pi}{12}\right)}{\tan\left(\frac{x}{2}-\frac{\pi}{6}\right)} \right\rvert + C$

Topic:	Mathematics-Section A
Item No:	20
Question ID:	**1449620**
Question Type:	MCQ
Question:	The area bounded by the curves $y = \lvert x^2 - 1 \rvert$ and $y = 1$ is
A:	$\frac{2}{3}\left(\sqrt{2}+1\right)$
B:	$\frac{4}{3}\left(\sqrt{2}-1\right)$
C:	$2\left(\sqrt{2}-1\right)$
D:	$\frac{8}{3}\left(\sqrt{2}-1\right)$

Topic:	Mathematics-Section B
Item No:	21
Question ID:	**1449621**
Question Type:	Numeric Answer
Question:	Let $A = \{1, 2, 3, 4, 5, 6, 7\}$ and $B = \{3, 6, 7, 9\}$. Then the number of elements in the set $\{C \subseteq A : C \cap B \neq \phi\}$ is _____

Topic:	Mathematics-Section B
Item No:	22
Question ID:	**1449622**
Question Type:	Numeric Answer
Question:	The largest value of a, for which the perpendicular distance of the plane containing the lines $\vec{r} = \left(\hat{i}+\hat{j}\right)+\lambda\left(\hat{i}+a\hat{j}-\hat{k}\right)$ and $\vec{r} = \left(\hat{i}+\hat{j}\right)+\mu\left(-\hat{i}+\hat{j}-a\hat{k}\right)$ from the point $(2, 1, 4)$ is $\sqrt{3}$, is_____.

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Topic:	Mathematics-Section B
Item No:	23
Question ID:	**1449623**
Question Type:	Numeric Answer
Question:	Numbers are to be formed between 1000 and 3000, which are divisible by 4, using the digits 1, 2, 3, 4, 5 and 6 without repetition of digits. Then the total number of such numbers is _____.

Topic:	Mathematics-Section B
Item No:	24
Question ID:	**1449624**
Question Type:	Numeric Answer
Question:	If $\sum_{k=1}^{10} \frac{k}{k^4+k^2+1} = \frac{m}{n}$, where m and n are co-prime, then $m+n$ is equal to _____

Topic:	Mathematics-Section B
Item No:	25
Question ID:	**1449625**
Question Type:	Numeric Answer
Question:	If the sum of solutions of the system of equations $2\sin^2\theta - \cos2\theta = 0$ and $2\cos^2\theta + 3\sin\theta = 0$ in the interval $[0, 2\pi]$ is $k\pi$, then k is equal to _____.

Topic:	Mathematics-Section B
Item No:	26
Question ID:	**1449626**
Question Type:	Numeric Answer
Question:	The mean and standard deviation of 40 observations are 30 and 5 respectively. It was noticed that two of these observations 12 and 10 were wrongly recorded. If σ is the standard deviation of the data after omitting the two wrong observations from the data, then $38\sigma^2$ is equal to _____.

Topic:	Mathematics-Section B
Item No:	27
Question ID:	**1449627**
Question Type:	Numeric Answer
Question:	The plane passing through the line L: $lx - y + 3(1-l)z = 1$, $x + 2y - z = 2$ and perpendicular to the plane $3x + 2y + z = 6$ is $3x - 8y + 7z = 4$. If θ is the acute angle between the line L and the y-axis, then $415\cos^2\theta$ is equal to _____.

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Topic:	Mathematics-Section B
Item No:	28
Question ID:	**1449628**
Question Type:	Numeric Answer
Question:	Suppose $y = y(x)$ be the solution curve to the differential equation $\frac{dy}{dx} - y = 2 - e^{-x}$ such that $\lim\limits_{x \to \infty} y(x)$ is finite. If a and b are respectively the x - and y - intercepts of the tangent to the curve at $x = 0$, then the value of $a - 4b$ is equal to _____.

Topic:	Mathematics-Section B
Item No:	29
Question ID:	**1449629**
Question Type:	Numeric Answer
Question:	Different A.P.'s are constructed with the first term 100, the last term 199, and integral common differences. The sum of the common differences of all such A.P.'s having at least 3 terms and at most 33 terms is _____.

Topic:	Mathematics-Section B
Item No:	30
Question ID:	**1449630**
Question Type:	Numeric Answer
Question:	The number of matrices $A = \begin{pmatrix} a & b \\ c & d \end{pmatrix}$, where $a, b, c, d \in \{-1, 0, 1, 2, 3, \ldots\ldots, 10\}$, such that $A = A^{-1}$, is _____.

Topic:	Physics-Section A
Item No:	31
Question ID:	**1449631**
Question Type:	MCQ
Question:	Two projectiles are thrown with same initial velocity making an angle of 45° and 30° with the horizontal respectively. The ratio of their respective ranges will be :
A:	$1:\sqrt{2}$
B:	$\sqrt{2}:1$
C:	$2:\sqrt{3}$
D:	$\sqrt{3}:2$

Topic:	Physics-Section A
Item No:	32
Question ID:	**1449632**

Question Type:	MCQ
Question:	In a Vernier Calipers, 10 divisions of Vernier scale is equal to the 9 divisions of main scale. When both jaws of Vernier calipers touch each other, the zero of the Vernier scale is shifted to the left of zero of the main scale and 4^{th} Vernier scale division exactly coincides with the main scale reading. One main scale division is equal to 1 mm. While measuring diameter of a spherical body, the body is held between two jaws. It is now observed that zero of the Vernier scale lies between 30 and 31 divisions of main scale reading and 6^{th} Vernier scale division exactly coincides with the main scale reading. The diameter of the spherical body will be :
A:	3.02 cm
B:	3.06 cm
C:	3.10 cm
D:	3.20 cm

Topic:	Physics-Section A
Item No:	33
Question ID:	**1449633**
Question Type:	MCQ
Question:	A ball of mass 0.15 kg hits the wall with its initial speed of 12 ms^{-1} and bounces back without changing its initial speed. If the force applied by the wall on the ball during the contact is 100 N, calculate the time duration of the contact of ball with the wall.
A:	0.018 s
B:	0.036 s
C:	0.009 s
D:	0.072 s

Topic:	Physics-Section A
Item No:	34
Question ID:	**1449634**
Question Type:	MCQ
Question:	A body of mass 8 kg and another of mass 2 kg are moving with equal kinetic energy. The ratio of their respective momenta will be :
A:	1:1
B:	2:1
C:	1:4
D:	4:1

Topic:	Physics-Section A
Item No:	35

Question ID:	**1449635**
Question Type:	MCQ
Question:	Two uniformly charged spherical conductors A and B of radii 5 mm and 10 mm are separated by a distance of 2 cm. If the spheres are connected by a conducting wire, then in equilibrium condition, the ratio of the magnitudes of the electric fields at the surface of the sphere A and B will be :
A:	1:2
B:	2:1
C:	1:1
D:	1:4

Topic:	Physics-Section A
Item No:	36
Question ID:	**1449636**
Question Type:	MCQ
Question:	The oscillating magnetic field in a plane electromagnetic wave is given by $B_y = 5 \times 10^{-6} \sin 1000\pi(5x - 4 \times 10^8 t)T$. The amplitude of electric field will be :
A:	$15 \times 10^2\ Vm^{-1}$
B:	$5 \times 10^{-6}\ Vm^{-1}$
C:	$16 \times 10^{12}\ Vm^{-1}$
D:	$4 \times 10^2\ Vm^{-1}$

Topic:	Physics-Section A
Item No:	37
Question ID:	**1449637**
Question Type:	MCQ
Question:	Light travels in two media M_1 and M_2 with speeds $1.5 \times 10^8\ ms^{-1}$ and $2.0 \times 10^8\ ms^{-1}$ respectively. The critical angle between them is :
A:	$\tan^{-1}\left(\frac{3}{\sqrt{7}}\right)$
B:	$\tan^{-1}\left(\frac{2}{3}\right)$
C:	$\cos^{-1}\left(\frac{3}{4}\right)$
D:	$\sin^{-1}\left(\frac{2}{3}\right)$

Topic:	Physics-Section A

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Item No:	38
Question ID:	**1449638**
Question Type:	MCQ
Question:	A body is projected vertically upwards from the surface of earth with a velocity equal to one third of escape velocity. The maximum height attained by the body will be : (Take radius of earth = 6400 km and g=10 ms^{-2})
A:	800 km
B:	1600 km
C:	2133 km
D:	4800 km

Topic:	Physics-Section A
Item No:	39
Question ID:	**1449639**
Question Type:	MCQ
Question:	The maximum and minimum voltage of an amplitude modulated signal are 60 V and 20 V respectively. The percentage modulation index will be :
A:	0.5%
B:	50%
C:	2%
D:	30%

Topic:	Physics-Section A
Item No:	40
Question ID:	**1449640**
Question Type:	MCQ
Question:	A nucleus of mass M at rest splits into two parts having masses $\frac{M'}{3}$ and $\frac{2M'}{3}(M' < M)$. The ratio of de Broglie wavelength of two parts will be :
A:	1:2
B:	2:1
C:	1:1
D:	2:3

Topic:	Physics-Section A
Item No:	41
Question ID:	**1449641**

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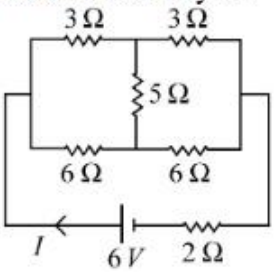
Question Type:	MCQ
Question:	An ice cube of dimensions 60 cm × 50 cm × 20 cm is placed in an insulation box of wall thickness 1 cm. The box keeping the ice cube at 0°C of temperature is brought to a room of temperature 40°C. The rate of melting of ice is approximately : (Latent heat of fusion of ice is 3.4×10^5 J kg^{-1} and thermal conducting of insulation wall is 0.05 $Wm^{-1}°C^{-1}$)
A:	61×10^{-3} kg s^{-1}
B:	61×10^{-5} kg s^{-1}
C:	208 kg s^{-1}
D:	30×10^{-5} kg s^{-1}

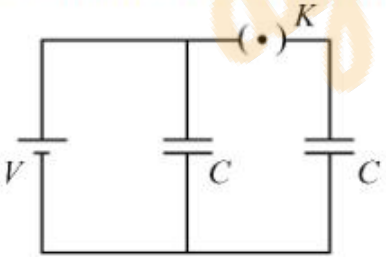
Topic:	Physics-Section A
Item No:	42
Question ID:	**1449642**
Question Type:	MCQ
Question:	A gas has n degrees of freedom. The ratio of specific heat of gas at constant volume to the specific heat of gas at constant pressure will be :
A:	$\frac{n}{n+2}$
B:	$\frac{n+2}{n}$
C:	$\frac{n}{2n+2}$
D:	$\frac{n}{n-2}$

Topic:	Physics-Section A
Item No:	43
Question ID:	**1449643**
Question Type:	MCQ
Question:	A transverse wave is represented by $y = 2\sin(\omega t - kx)$ cm. The value of wavelength (in cm) for which the wave velocity becomes equal to the maximum particle velocity, will be :
A:	4π
B:	2π
C:	π
D:	2

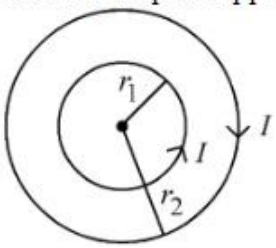
Topic:	Physics-Section A

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Item No:	44
Question ID:	**1449644**
Question Type:	MCQ
Question:	A battery of $6V$ is connected to the circuit as shown below. The current I drawn from the battery is : 
A:	$1A$
B:	$2A$
C:	$\frac{6}{11}A$
D:	$\frac{4}{3}A$

Topic:	Physics-Section A
Item No:	45
Question ID:	**1449645**
Question Type:	MCQ
Question:	A source of potential difference V is connected to the combination of two identical capacitors as shown in the figure. When key 'K' is closed, the total energy stored across the combination is E_1. Now key 'K' is opened and dielectric of dielectric constant 5 is introduced between the plates of the capacitors. The total energy stored across the combination is now E_2. The ratio E_1/E_2 will be : 
A:	$\frac{1}{10}$
B:	$\frac{2}{5}$
C:	$\frac{5}{13}$
D:	$\frac{5}{26}$

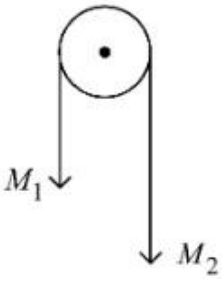
Topic:	Physics-Section A

Item No:	46
Question ID:	**1449646**
Question Type:	MCQ
Question:	Two concentric circular loops of radii r_1=30 cm and r_2=50 cm are placed in X-Y plane as shown in the figure. A current $I = 7A$ is flowing through them in the direction as shown in figure. The net magnetic moment of this system of two circular loops is approximately : 
A:	$\frac{7}{2}\hat{k}\,Am^2$
B:	$-\frac{7}{2}\hat{k}\,Am^2$
C:	$7\hat{k}\,Am^2$
D:	$-7\hat{k}\,Am^2$

Topic:	Physics-Section A
Item No:	47
Question ID:	**1449647**
Question Type:	MCQ
Question:	A velocity selector consists of electric field $\vec{E} = E\hat{k}$ and magnetic field $\vec{B} = B\hat{j}$ with $B = 12\ mT$. The value of E required for an electron of energy 728 eV moving along the positive x-axis to pass undeflected is : (Given, mass of electron = 9.1×10^{-31}kg)
A:	192 kVm^{-1}
B:	192 mVm^{-1}
C:	9600 kVm^{-1}
D:	16 kVm^{-1}

Topic:	Physics-Section A
Item No:	48
Question ID:	**1449648**
Question Type:	MCQ

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Question:	Two masses M_1 and M_2 are tied together at the two ends of a light inextensible string that passes over a frictionless pulley. When the mass M_2 is twice that of M_1, the acceleration of the system is a_1. When the mass M_2 is thrice that of M_1, the acceleration of the system is a_2. The ratio $\frac{a_1}{a_2}$ will be : 
A:	$\frac{1}{3}$
B:	$\frac{2}{3}$
C:	$\frac{3}{2}$
D:	$\frac{1}{2}$

Topic:	Physics-Section A
Item No:	49
Question ID:	**1449649**
Question Type:	MCQ
Question:	Mass numbers of two nuclei are in the ratio of 4:3. Their nuclear densities will be in the ratio of
A:	4 : 3
B:	$\left(\frac{3}{4}\right)^{\frac{1}{3}}$
C:	1 : 1
D:	$\left(\frac{4}{3}\right)^{\frac{1}{3}}$

Topic:	Physics-Section A
Item No:	50
Question ID:	**1449650**
Question Type:	MCQ

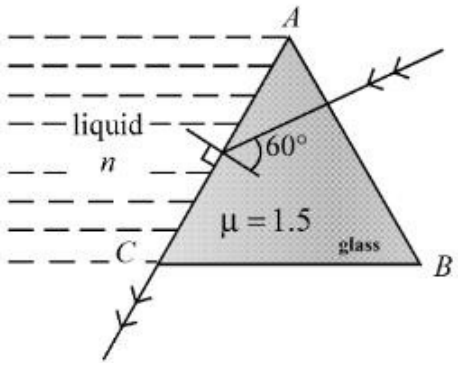
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Question:	The area of cross section of the rope used to lift a load by a crane is $2.5 \times 10^{-4} m^2$. The maximum lifting capacity of the crane is 10 metric tons. To increase the lifting capacity of the crane to 25 metric tons, the required area of cross section of the rope should be : (take g=10 ms^{-2})
A:	$6.25 \times 10^{-4} m^2$
B:	$10 \times 10^{-4} m^2$
C:	$1 \times 10^{-4} m^2$
D:	$1.67 \times 10^{-4} m^2$

Topic:	Physics-Section B
Item No:	51
Question ID:	**1449651**
Question Type:	Numeric Answer
Question:	If $\vec{A} = \left(2\hat{i}+3\hat{j}-\hat{k}\right)$ m and $\vec{B} = \left(\hat{i}+2\hat{j}+2\hat{k}\right)$ m . The magnitude of component of vector $\vec{A}$ along vector $\vec{B}$ will be _____ m.

Topic:	Physics-Section B
Item No:	52
Question ID:	**1449652**
Question Type:	Numeric Answer
Question:	The radius of gyration of a cylindrical rod about an axis of rotation perpendicular to its length and passing through the center will be _____ m. Given, the length of the rod is $10\sqrt{3}$ m.

Topic:	Physics-Section B
Item No:	53
Question ID:	**1449653**
Question Type:	Numeric Answer

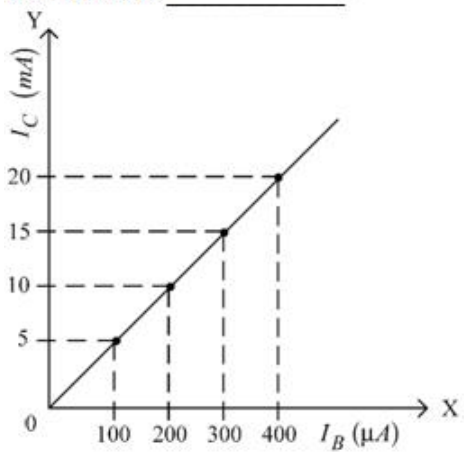
Question:	In the given figure, the face AC of the equilateral prism is immersed in a liquid of refractive index 'n'. For incident angle 60° at the side AC, the refracteel light beam just grazes along face AC. The refractive index of the liquid $n=\frac{\sqrt{x}}{4}$. The value of x is _____. (Given refractive index of glass = 1.5) 

Topic:	Physics-Section B
Item No:	54
Question ID:	**1449654**
Question Type:	Numeric Answer
Question:	Two lighter nuclei combine to form a comparatively heavier nucleus by the relation given below : $^{2}_{1}X + {}^{2}_{1}X = {}^{4}_{2}Y$ The binding energies per nucleon for $^{2}_{1}X$ and $^{4}_{2}Y$ are 1.1 MeV and 7.6 MeV respectively. The energy released in this process is _____ MeV.

Topic:	Physics-Section B
Item No:	55
Question ID:	**1449655**
Question Type:	Numeric Answer
Question:	A uniform heavy rod of mass 20 kg, cross sectional area 0.4 m^2 and length 20 m is hanging from a fixed support. Neglecting the lateral contraction, the elongation in the rod due to its own weight is $x\times10^{-9}$ m. The value of x is _____. (Given, young modulus $Y=2\times10^{11}$ Nm^{-2} and $g=10$ ms^{-2})

Topic:	Physics-Section B
Item No:	56
Question ID:	**1449656**
Question Type:	Numeric Answer

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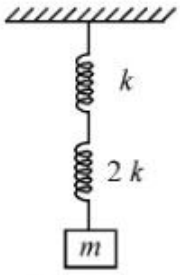
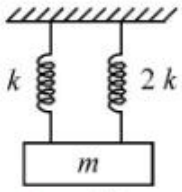
Question:	The typical transfer characteristics of a transistor in CE configuration is shown in figure. A load resistor of 2 $k\Omega$ is connected in the collector branch of the circuit used. The input resistance of the transistor is 0.50 $k\Omega$. The voltage gain of the transistor is _____. 

Topic:	Physics-Section B
Item No:	57
Question ID:	**1449657**
Question Type:	Numeric Answer
Question:	Three point charges of magnitude 5μC, 0.16μC and 0.3μC are located at the vertices A, B, C of a right angled triangle whose sides are AB = 3 cm, BC= $3\sqrt{2}$ cm and CA = 3 cm and point A is the right angle corner. Charge at point A experiences _____ N of electrostatic force due to the other two charges.

Topic:	Physics-Section B
Item No:	58
Question ID:	**1449658**
Question Type:	Numeric Answer
Question:	In a coil of resistance 8 Ω,the magnetic flux due to an external magnetic field varies with time as $\phi = \frac{2}{3}\left(9 - t^2\right)$. The value of total heat produced in the coil, till the flux becomes zero, will be _____ J.

Topic:	Physics-Section B
Item No:	59
Question ID:	**1449659**
Question Type:	Numeric Answer
Question:	A potentiometer wire of length 300 cm is connected in series with a resistance 780 Ω and a standard cell of emf 4V. A constant current flows through potentiometer wire. The length of the null point for cell of emf 20 mV is found to be 60 cm. The resistance of the potentiometer wire is _____Ω.

Topic:	Physics-Section B

Item No:	60
Question ID:	**1449660**
Question Type:	Numeric Answer
Question:	As per given figures, two springs of spring constants k and $2k$ are connected to mass m. If the period of oscillation in figure (a) is 3s, then the period of oscillation in figure (b) will be $\sqrt{x}\,s$. The value of x is _____.  figure (a)  figure (b)

Topic:	Chemistry-Section A
Item No:	61
Question ID:	**1449661**
Question Type:	MCQ
Question:	Hemoglobin contains 0.34% of iron by mass. The number of Fe atoms in 3.3 g of hemoglobin is (Given: Atomic mass of Fe is 56 u, $N_A = 6.022 \times 10^{23}\ mol^{-1}$.)
A:	1.21×10^{5}
B:	12.0×10^{16}
C:	1.21×10^{20}
D:	3.4×10^{22}

Topic:	Chemistry-Section A
Item No:	62
Question ID:	**1449662**
Question Type:	MCQ
Question:	Arrange the following in increasing order of their covalent character. A. CaF_2 B. $CaCl_2$ C. $CaBr_2$ D. CaI_2 Choose the correct answer from the options given below.
A:	B < A < C < D
B:	A < B < C < D

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C:	$A < B < D < C$
D:	$A < C < B < D$

Topic:	Chemistry-Section A
Item No:	63
Question ID:	**1449663**
Question Type:	MCQ
Question:	Class XII students were asked to prepare one litre of buffer solution of pH 8.26 by their Chemistry teacher. The amount of ammonium chloride to be dissolved by the student in 0.2 M ammonia solution to make one litre of the buffer is (Given: pK_b $(NH_3) = 4.74$ Molar mass of $NH_3 = 17\ g\ mol^{-1}$ Molar mass of $NH_4Cl = 53.5\ g\ mol^{-1}$)
A:	53.5 g
B:	72.3 g
C:	107.0 g
D:	126.0 g

Topic:	Chemistry-Section A
Item No:	64
Question ID:	**1449664**
Question Type:	MCQ
Question:	At 30°C, the half life for the decomposition of AB_2 is 200 s and is independent of the initial concentration of AB_2. The time required for 80% of the AB_2 to decompose is Given: log 2 = 0.30 log 3 = 0.48
A:	200 s
B:	323 s
C:	467 s
D:	532 s

Topic:	Chemistry-Section A
Item No:	65
Question ID:	**1449665**
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:** Finest gold is red in colour, as the size of the particles increases, it appears purple then blue and finally gold. **Reason R:** The colour of the colloidal solution depends on the wavelength of light scattered by the dispersed particles. In the light of the above statements, choose the ***most appropriate*** 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:	Chemistry-Section A
Item No:	66
Question ID:	**1449666**
Question Type:	MCQ
Question:	The metal that has very low melting point and its periodic position is closer to a metalloid is
A:	Al
B:	Ga
C:	Se
D:	In

Topic:	Chemistry-Section A
Item No:	67
Question ID:	**1449667**
Question Type:	MCQ
Question:	The metal that is not extracted from its sulfide ore is
A:	Aluminium
B:	Iron
C:	Lead
D:	Zinc

Topic:	Chemistry-Section A
Item No:	68
Question ID:	**1449668**
Question Type:	MCQ

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Question:	The products obtained from a reaction of hydrogen peroxide and acidified potassium permanganate are
A:	Mn^{4+}, H_2O only
B:	Mn^{2+}, H_2O only
C:	Mn^{4+}, H_2O, O_2 only
D:	Mn^{2+}, H_2O, O_2 only

Topic:	Chemistry-Section A
Item No:	69
Question ID:	**1449669**
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:** LiF is sparingly soluble in water. **Reason R:** The ionic radius of Li^+ ion is smallest among its group members, hence has least hydration enthalpy. In the light of the above statements, choose the ***most appropriate*** 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:	Chemistry-Section A
Item No:	70
Question ID:	**1449670**
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:** Boric acid is a weak acid. **Reason R:** Boric acid is not able to release H^+ ion on its own. It receives OH^- ion from water and releases H^+ ion. In the light of the above statements, choose the ***most appropriate*** answer from the options given below.
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.

Topic:	Chemistry-Section A

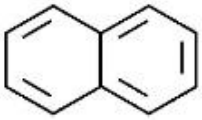
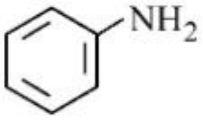
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Item No:	71
Question ID:	**1449671**
Question Type:	MCQ
Question:	The metal complex that is diamagnetic is (Atomic number: Fe,26; Cu,29)
A:	$K_3[Cu(CN)_4]$
B:	$K_2[Cu(CN)_4]$
C:	$K_3[Fe(CN)_4]$
D:	$K_4[FeCl_6]$

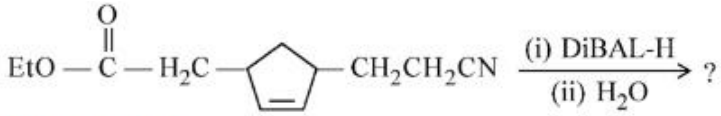
Topic:	Chemistry-Section A
Item No:	72
Question ID:	**1449672**
Question Type:	MCQ
Question:	Match **List I** with **List II**. **List I** (Pollutant) / **List II** (Source) A. Microorganisms — I. Strip mining B. Plant nutrients — II. Domestic sewage C. Toxic heavy metals — III. Chemical fertilizer D. Sediment — IV. Chemical factory Choose the correct answer from the options given below :
A:	A-II, B-III, C-IV, D-I
B:	A-II, B-I, C-IV D-III
C:	A-I, B-IV, C-II, D-III
D:	A-I, B-IV, C-III, D-II

Topic:	Chemistry-Section A
Item No:	73
Question ID:	**1449673**
Question Type:	MCQ
Question:	The correct decreasing order of priority of functional groups in naming an organic compound as per IUPAC system of nomenclature is
A:	$-COOH > -CONH_2 > -COCl > -CHO$
B:	$-SO_3H > -COCl > -CONH_2 > -CN$
C:	$-COOR > -COCl > -NH_2 > \rangle C = O$

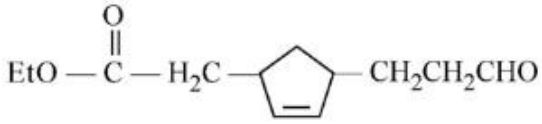
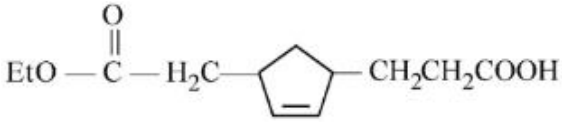
D:	$-COOH > -COOR > -CONH_2 > -COCl$

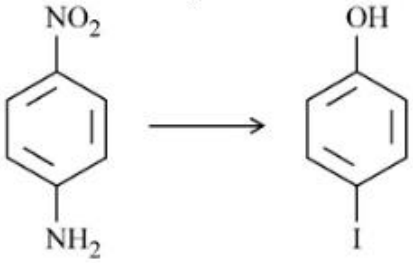
Topic:	Chemistry-Section A
Item No:	74
Question ID:	**1449674**
Question Type:	MCQ
Question:	Which of the following is not an example of benzenoid compound?
A:	
B:	
C:	
D:	

Topic:	Chemistry-Section A
Item No:	75
Question ID:	**1449675**
Question Type:	MCQ
Question:	Hydrolysis of which compound will give carbolic acid?
A:	Cumene
B:	Benzenediazonium chloride
C:	Benzal chloride
D:	Ethylene glycol ketal

Topic:	Chemistry-Section A
Item No:	76
Question ID:	**1449676**
Question Type:	MCQ
Question:	 ? [Et is $-C_2H_5$] Consider the above reaction and predict the major product.

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A:	
B:	
C:	
D:	

Topic:	Chemistry-Section A
Item No:	77
Question ID:	**1449677**
Question Type:	MCQ
Question:	The correct sequential order of the reagents for the given reaction is 
A:	HNO_2, Fe/H^+, HNO_2, KI, H_2O/H^+
B:	HNO_2, KI, Fe/H^+, HNO_2, H_2O/warm
C:	HNO_2, KI, HNO_2, Fe/H^+, H_2O/H^+
D:	HNO_2, Fe/H^+, KI, HNO_2, H_2O/warm

Topic:	Chemistry-Section A
Item No:	78
Question ID:	**1449678**
Question Type:	MCQ
Question:	Vulcanization of rubber is carried out by heating a mixture of
A:	isoprene and styrene
B:	neoprene and sulphur
C:	isoprene and sulphur
D:	neoprene and styrene

Topic:	Chemistry-Section A

Item No:	79
Question ID:	**1449679**
Question Type:	MCQ
Question:	Animal starch is the other name of
A:	amylose.
B:	maltose.
C:	glycogen.
D:	amylopectin.

Topic:	Chemistry-Section A
Item No:	80
Question ID:	**1449680**
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:**Phenolphthalein is a pH dependent indicator, remains colourless in acidic solution and gives pink colour in basic medium. **Reason R:** Phenolphthalein is a weak acid. It doesn't dissociate in basic medium. In the light of the above statements, choose the ***most appropriate*** 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:	Chemistry-Section B
Item No:	81
Question ID:	**1449681**
Question Type:	Numeric Answer
Question:	A 10 g mixture of hydrogen and helium is contained in a vessel of capacity $0.0125\ m^3$ at 6 bar and 27°C. The mass of helium in the mixture is _____ g. (nearest integer) Given: $R = 8.3\ J\ K^{-1}\ mol^{-1}$ (Atomic masses of H and He are 1 u and 4 u, respectively)

Topic:	Chemistry-Section B
Item No:	82
Question ID:	**1449682**
Question Type:	Numeric Answer

Question:	Consider an imaginary ion $^{48}_{22}X^{3-}$. The nucleus contains 'a'% more neutrons than the number of electrons in the ion. The value of 'a' is _____. [nearest integer]

Topic:	Chemistry-Section B
Item No:	83
Question ID:	**1449683**
Question Type:	Numeric Answer
Question:	For the reaction $H_2F_2(g) \rightarrow H_2(g)+F_2(g)$ $\Delta U = -59.6$ kJ mol^{-1} at 27°C. The enthalpy change for the above reaction is (–) _____ kJ mol^{-1} [nearest integer] Given: R = 8.314 J K^{-1}mol^{-1}.

Topic:	Chemistry-Section B
Item No:	84
Question ID:	**1449684**
Question Type:	Numeric Answer
Question:	The elevation in boiling point for 1 molal solution of non-volatile solute A is 3 K. The depression in freezing point for 2 molal solution of A in the same solvent is 6 K. The ratio of K_b and K_f i.e., K_b/K_f is 1: X. The value of X is [nearest integer]

Topic:	Chemistry-Section B
Item No:	85
Question ID:	**1449685**
Question Type:	Numeric Answer
Question:	20 mL of 0.02 M hypo solution is used for the titration of 10 mL of copper sulphate solution, in the presence of excess of KI using starch as an indicator. The molarity of Cu^{2+} is found to be _____ $\times 10^{-2}$ M. [nearest integer] Given : $2\,Cu^{2+} + 4\,I^- \rightarrow Cu_2I_2 + I_2$ $I_2 + 2S_2O_3^{2-} \rightarrow 2I^- + S_4O_6^{2-}$

Topic:	Chemistry-Section B
Item No:	86
Question ID:	**1449686**
Question Type:	Numeric Answer
Question:	The number of non-ionisable protons present in the product B obtained from the following reactions is _____. $C_2H_5OH + PCl_3 \rightarrow C_2H_5Cl + A$ $A + PCl_3 \rightarrow B$

Topic:	Chemistry-Section B
Item No:	87
Question ID:	**1449687**
Question Type:	Numeric Answer
Question:	The spin-only magnetic moment value of the compound with strongest oxidizing ability among MnF_4, MnF_3 and MnF_2 is _____ B.M. [nearest integer]

Topic:	Chemistry-Section B
Item No:	88
Question ID:	**1449688**
Question Type:	Numeric Answer
Question:	Total number of isomers (including stereoisomers) obtained on monochlorination of methylcyclohexane is _____.

Topic:	Chemistry-Section B
Item No:	89
Question ID:	**1449689**
Question Type:	Numeric Answer
Question:	A 100 mL solution of CH_3CH_2MgBr on treatment with methanol produces 2.24 mL of a gas at STP. The weight of gas produced is _____ mg. [nearest integer]

Topic:	Chemistry-Section B
Item No:	90
Question ID:	**1449690**
Question Type:	Numeric Answer
Question:	How many of the following drugs is/are example(s) of broad spectrum antibiotics ? Ofloxacin, Penicillin G, Terpineol, Salvarsan.

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