Joint Entrance Examination (Main) - JEE(Main)

Paper Name	B.E/B.Tech.(Paper I)
Test Date	29-06-2022
Slot	SLOT -1
Lang	English

Q:1
Topic Name: Mathematics-Section A

ItemCode:101761

Question: The probability that a randomly chosen 2×2 matrix with all the entries from the set of first 10 primes, is singular, is equal to :

A	$\frac{133}{10^4}$
B	$\frac{18}{10^3}$
C	$\frac{19}{10^3}$
D	$\frac{271}{10^4}$

Q:2
Topic Name: Mathematics-Section A

ItemCode:101762

Question: Let the solution curve of the differential equation $x\frac{dy}{dx}-y=\sqrt{y^2+16x^2}$, $y(1)=3$ be $y=y(x)$. Then $y(2)$ is equal to :

A	15
B	11
C	13
D	17

Q:3
Topic Name: Mathematics-Section A

ItemCode:101763

Question: If the mirror image of the point (2, 4, 7) in the plane $3x-y+4z=2$ is (a, b, c), then $2a+b+2c$ is equal to :

A	54
B	50
C	-6
D	-42

Q:4
Topic Name: Mathematics-Section A

ItemCode:101764

Let $f : \mathbf{R} \to \mathbf{R}$ be a function defined by :

$$f(x) = \begin{cases} \max\limits_{t \le x} \{t^3 - 3t\} & ; \quad x \le 2 \\ x^2 + 2x - 6 & ; \quad 2 < x < 3 \\ [x - 3] + 9 & ; \quad 3 \le x \le 5 \\ 2x + 1 & ; \quad x > 5 \end{cases}$$

where [t] is the greatest integer less than or equal to t. Let m be the number of points where f is not differentiable and $I = \int_{-2}^{2} f(x)\,dx$. Then the ordered pair (m, I) is equal to :

Question:

A $\left(3, \frac{27}{4}\right)$

B $\left(3, \frac{23}{4}\right)$

C $\left(4, \frac{27}{4}\right)$

D $\left(4, \frac{23}{4}\right)$

Q:5
Topic Name: Mathematics-Section A

ItemCode:101765

Let $\vec{a} = \alpha\hat{i} + 3\hat{j} - \hat{k}$, $\vec{b} = 3\hat{i} - \beta\hat{j} + 4\hat{k}$ and $\vec{c} = \hat{i} + 2\hat{j} - 2\hat{k}$ where $\alpha, \beta \in \mathbf{R}$, be three vectors. If the projection of $\vec{a}$ on $\vec{c}$ is $\frac{10}{3}$ and $\vec{b} \times \vec{c} = -6\hat{i} + 10\hat{j} + 7\hat{k}$, then the value of $\alpha + \beta$ is equal to :

Question:

A 3

B 4

C 5

D 6

Q:6
Topic Name: Mathematics-Section A

ItemCode:101766

The area enclosed by $y^2 = 8x$ and $y = \sqrt{2}\,x$ that lies outside the triangle formed by $y = \sqrt{2}\,x$, $x = 1$, $y = 2\sqrt{2}$, is equal to :

Question:

A $\frac{16\sqrt{2}}{6}$

B	$\frac{11\sqrt{2}}{6}$
C	$\frac{13\sqrt{2}}{6}$
D	$\frac{5\sqrt{2}}{6}$

Q:7
Topic Name: Mathematics-Section A

ItemCode:101767

Question: If the system of linear equations

$$2x + y - z = 7$$

$$x - 3y + 2z = 1$$

$$x + 4y + \delta z = k, \text{ where } \delta, k \in \mathbf{R}$$

has infinitely many solutions, then $\delta + k$ is equal to :

A	-3
B	3
C	6
D	9

Q:8
Topic Name: Mathematics-Section A

ItemCode:101768

Question: Let α and β be the roots of the equation $x^2 + (2i - 1) = 0$. Then, the value of $|\alpha^8 + \beta^8|$ is equal to :

A	50
B	250
C	1250
D	1500

Q:9
Topic Name: Mathematics-Section A

ItemCode:101769

Question: Let $\Delta \in \{\wedge, \vee, \Rightarrow, \Leftrightarrow\}$ be such that $(p \wedge q)\ \Delta\ ((p \vee q) \Rightarrow q)$ is a tautology. Then Δ is equal to :

A	$\wedge$
B	$\vee$
C	$\Rightarrow$
D	$\Leftrightarrow$

Q:10
Topic Name: Mathematics-Section A

ItemCode:101770

Question: Let $A=[a_{ij}]$ be a square matrix of order 3 such that $a_{ij}=2^{j-i}$, for all $i, j=1, 2, 3$. Then, the matrix $A^2+A^3+\ldots+A^{10}$ is equal to :

A $\left(\frac{3^{10}-3}{2}\right)A$

B $\left(\frac{3^{10}-1}{2}\right)A$

C $\left(\frac{3^{10}+1}{2}\right)A$

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

Q:11
Topic Name: Mathematics-Section A

ItemCode:101771

Question: Let a set $A=A_1\cup A_2\cup\ldots\cup A_k$, where $A_i\cap A_j=\phi$ for $i\neq j, 1\leq i, j\leq k$. Define the relation R from A to A by $R=\{(x, y) : y\in A_i$ if and only if $x\in A_i, 1\leq i\leq k\}$. Then, R is :

A reflexive, symmetric but not transitive

B reflexive, transitive but not symmetric

C reflexive but not symmetric and transitive

D an equivalence relation

Q:12
Topic Name: Mathematics-Section A

ItemCode:101772

Question: Let $\{a_n\}_{n=0}^{\infty}$ be a sequence such that $a_0=a_1=0$ and $a_{n+2}=2a_{n+1}-a_n+1$ for all $n\geq 0$.

Then, $\sum_{n=2}^{\infty}\frac{a_n}{7^n}$ is equal to :

A $\frac{6}{343}$

B $\frac{7}{216}$

C $\frac{8}{343}$

D $\frac{49}{216}$

Q:13
Topic Name: Mathematics-Section A

ItemCode:101773

Question: The distance between the two points A and A' which lie on $y=2$ such that both the line segments AB and A' B (where B is the point (2, 3)) subtend angle $\frac{\pi}{4}$ at the origin, is equal to :

A	10
B	$\frac{48}{5}$
C	$\frac{52}{5}$
D	3

Q:14
Topic Name: Mathematics-Section A

ItemCode:101774

Question: A wire of length 22 m is to be cut into two pieces. One of the pieces is to be made into a square and the other into an equilateral triangle. Then, the length of the side of the equilateral triangle, so that the combined area of the square and the equilateral triangle is minimum, is :

A	$\frac{22}{9+4\sqrt{3}}$
B	$\frac{66}{9+4\sqrt{3}}$
C	$\frac{22}{4+9\sqrt{3}}$
D	$\frac{66}{4+9\sqrt{3}}$

Q:15
Topic Name: Mathematics-Section A

ItemCode:101775

Question: The domain of the function $\cos^{-1}\left(\frac{2\sin^{-1}\left(\frac{1}{4x^2-1}\right)}{\pi}\right)$ is :

A	$\mathbf{R}-\left\{-\frac{1}{2},\frac{1}{2}\right\}$
B	$(-\infty,-1]\cup[1,\infty)\cup\{0\}$
C	$\left(-\infty,\frac{-1}{2}\right)\cup\left(\frac{1}{2},\infty\right)\cup\{0\}$

D	$\left(-\infty, \frac{-1}{\sqrt{2}}\right] \cup \left[\frac{1}{\sqrt{2}}, \infty\right) \cup \{0\}$

Q:16
Topic Name: Mathematics-Section A

ItemCode:101776

Question: If the constant term in the expansion of $\left(3x^3 - 2x^2 + \frac{5}{x^5}\right)^{10}$ is $2^k \cdot l$, where l is an odd integer, then the value of k is equal to :

A	6
B	7
C	8
D	9

Q:17
Topic Name: Mathematics-Section A

ItemCode:101777

Question: $\int_0^5 \cos\left(\pi\left(x - \left[\frac{x}{2}\right]\right)\right) dx$, where [t] denotes greatest integer less than or equal to t, is equal to :

A	-3
B	-2
C	2
D	0

Q:18
Topic Name: Mathematics-Section A

ItemCode:101778

Question: Let PQ be a focal chord of the parabola $y^2 = 4x$ such that it subtends an angle of $\frac{\pi}{2}$ at the point (3, 0). Let the line segment PQ be also a focal chord of the ellipse $E: \frac{x^2}{a^2} + \frac{y^2}{b^2} = 1, a^2 > b^2$. If e is the eccentricity of the ellipse E, then the value of $\frac{1}{e^2}$ is equal to :

A	$1 + \sqrt{2}$
B	$3 + 2\sqrt{2}$
C	$1 + 2\sqrt{3}$
D	$4 + 5\sqrt{3}$

Q:19
Topic Name: Mathematics-Section A

ItemCode:101779

Question: Let the tangent to the circle $C_1 : x^2+y^2=2$ at the point $M(-1, 1)$ intersect the circle $C_2 : (x-3)^2+(y-2)^2=5$, at two distinct points A and B. If the tangents to C_2 at the points A and B intersect at N, then the area of the triangle ANB is equal to :

A	$\frac{1}{2}$
B	$\frac{2}{3}$
C	$\frac{1}{6}$
D	$\frac{5}{3}$

Q:20
Topic Name: Mathematics-Section A

ItemCode:101780

Question: Let the mean and the variance of 5 observations x_1, x_2, x_3, x_4, x_5 be $\frac{24}{5}$ and $\frac{194}{25}$ respectively.

If the mean and variance of the first 4 observation are $\frac{7}{2}$ and a respectively, then $(4a+x_5)$ is equal to :

A	13
B	15
C	17
D	18

Q:21
Topic Name: Mathematics-Section B

ItemCode:101781

Question: Let $S=\{z\in \mathbf{C} : |z-2| \le 1, z(1+i)+\bar{z}(1-i) \le 2\}$. Let $|z-4i|$ attains minimum and maximum values, respectively, at $z_1 \in S$ and $z_2 \in S$. If $5(|z_1|^2+|z_2|^2)=\alpha+\beta\sqrt{5}$, where α and β are integers, then the value of $\alpha+\beta$ is equal to _____.

Q:22
Topic Name: Mathematics-Section B

ItemCode:101782

Question: Let $y=y(x)$ be the solution of the differential equation

$$\frac{dy}{dx}+\frac{\sqrt{2}y}{2\cos^4 x-\cos 2x}=xe^{\tan^{-1}(\sqrt{2}\cot 2x)},\ 0<x<\pi/2 \text{ with } y\left(\frac{\pi}{4}\right)=\frac{\pi^2}{32}.$$

If $y\left(\frac{\pi}{3}\right)=\frac{\pi^2}{18}e^{-\tan^{-1}(\alpha)}$, then the value of $3\alpha^2$ is equal to _____.

Q:23
Topic Name: Mathematics-Section B

ItemCode:101783

Question: Let d be the distance between the foot of perpendiculars of the points P(1, 2, −1) and Q(2, −1, 3) on the plane $-x+y+z=1$. Then d^2 is equal to _____.

Q:24
Topic Name: Mathematics-Section B

ItemCode:101784

Question: The number of elements in the set $S=\{\theta\in[-4\pi, 4\pi] : 3\cos^2 2\theta+6\cos 2\theta-10\cos^2\theta+5=0\}$ is _____.

Q:25
Topic Name: Mathematics-Section B

ItemCode:101785

Question: The number of solutions of the equation $2\theta-\cos^2\theta+\sqrt{2}=0$ in **R** is equal to _____.

Q:26
Topic Name: Mathematics-Section B

ItemCode:101786

Question: $50\tan\left(3\tan^{-1}\left(\frac{1}{2}\right)+2\cos^{-1}\left(\frac{1}{\sqrt{5}}\right)\right)+4\sqrt{2}\tan\left(\frac{1}{2}\tan^{-1}(2\sqrt{2})\right)$ is equal to _____.

Q:27
Topic Name: Mathematics-Section B

ItemCode:101787

Question: Let c, k $\in$ **R**. If $f(x)=(c+1)x^2+(1-c^2)x+2k$ and $f(x+y)=f(x)+f(y)-xy$, for all $x, y\in$ **R**, then the value of $|2(f(1)+f(2)+f(3)+.....+f(20))|$ is equal to _____.

Q:28
Topic Name: Mathematics-Section B

ItemCode:101788

Question: Let $H: \frac{x^2}{a^2} - \frac{y^2}{b^2} = 1, a > 0, b > 0$, be a hyperbola such that the sum of lengths of the transverse and the conjugate axes is $4(2\sqrt{2} + \sqrt{14})$. If the eccentricity H is $\frac{\sqrt{11}}{2}$, then the value of $a^2 + b^2$ is equal to _____.

Q:29
Topic Name: Mathematics-Section B

ItemCode:101789

Question: Let $P_1 : \vec{r} \cdot (2\hat{i} + \hat{j} - 3\hat{k}) = 4$ be a plane. Let P_2 be another plane which passes through the points $(2, -3, 2), (2, -2, -3)$ and $(1, -4, 2)$. If the direction ratios of the line of intersection of P_1 and P_2 be 16, α, β, then the value of $\alpha + \beta$ is equal to _____.

Q:30
Topic Name: Mathematics-Section B

ItemCode:101790

Question: Let $b_1b_2b_3b_4$ be a 4-element permutation with $b_i \in \{1, 2, 3, ..., 100\}$ for $1 \le i \le 4$ and $b_i \ne b_j$ for $i \ne j$, such that either b_1, b_2, b_3 are consecutive integers or b_2, b_3, b_4 are consecutive integers. Then the number of such permutations $b_1b_2b_3b_4$ is equal to _____.

Q:31
Topic Name: Physics-Section A

ItemCode:101701

Question: Two balls A and B are placed at the top of 180 m tall tower. Ball A is released from the top at t = 0 s. Ball B is thrown vertically down with an initial velocity 'u' at t = 2 s. After a certain time, both balls meet 100 m above the ground. Find the value of 'u' in ms^{-1}. [use $g = 10\ ms^{-2}$] :

A	10
B	15
C	20
D	30

Q:32
Topic Name: Physics-Section A

ItemCode:101702

Question: A body of mass M at rest explodes into three pieces, in the ratio of masses 1 : 1 : 2. Two smaller pieces fly off perpendicular to each other with velocities of 30 ms^{-1} and 40 ms^{-1} respectively. The velocity of the third piece will be :

A	15 ms^{-1}
B	25 ms^{-1}
C	35 ms^{-1}

D	$50\ ms^{-1}$

Q:33
Topic Name: Physics-Section A

ItemCode:101703

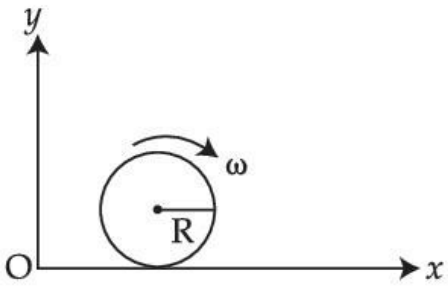
Question: The activity of a radioactive material is 2.56×10^{-3} Ci. If the half life of the material is 5 days, after how many days the activity will become 2×10^{-5} Ci ?

A	30 days
B	35 days
C	40 days
D	25 days

Q:34
Topic Name: Physics-Section A

ItemCode:101704

Question: A spherical shell of 1 kg mass and radius R is rolling with angular speed ω on horizontal plane (as shown in figure). The magnitude of angular momentum of the shell about the origin O is $\frac{a}{3} R^2\omega$. The value of a will be :



A	2
B	3
C	5
D	4

Q:35
Topic Name: Physics-Section A

ItemCode:101705

Question: A cylinder of fixed capacity of 44.8 litres contains helium gas at standard temperature and pressure. The amount of heat needed to raise the temperature of gas in the cylinder by 20.0°C will be :
(Given gas constant R = 8.3 JK^{-1}-mol^{-1})

A	249 J
B	415 J
C	498 J

D	830 J

Q:36
Topic Name: Physics-Section A

ItemCode:101706

Question: A wire of length L is hanging from a fixed support. The length changes to L_1 and L_2 when masses 1 kg and 2 kg are suspended respectively from its free end. Then the value of L is equal to :

A	$\sqrt{L_1 L_2}$
B	$\frac{L_1 + L_2}{2}$
C	$2L_1 - L_2$
D	$3L_1 - 2L_2$

Q:37
Topic Name: Physics-Section A

ItemCode:101707

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

Assertion A : The photoelectric effect does not takes place, if the energy of the incident radiation is less than the work function of a metal.

Reason R : Kinetic energy of the photoelectrons is zero, if the energy of the incident radiation is equal to the work function of a metal.

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

Q:38
Topic Name: Physics-Section A

ItemCode:101708

Question: A particle of mass 500 gm is moving in a straight line with velocity $v = b\,x^{5/2}$. The work done by the net force during its displacement from $x = 0$ to $x = 4$ m is : (Take $b = 0.25\ m^{-3/2}\ s^{-1}$).

A	2 J
B	4 J
C	8 J
D	16 J

Q:39
Topic Name: Physics-Section A

ItemCode:101709

Question: A charge particle moves along circular path in a uniform magnetic field in a cyclotron. The kinetic energy of the charge particle increases to 4 times its initial value. What will be the ratio of new radius to the original radius of circular path of the charge particle :

A	1 : 1
B	1 : 2
C	2 : 1
D	1 : 4

Q:40
Topic Name: Physics-Section A

ItemCode:101710

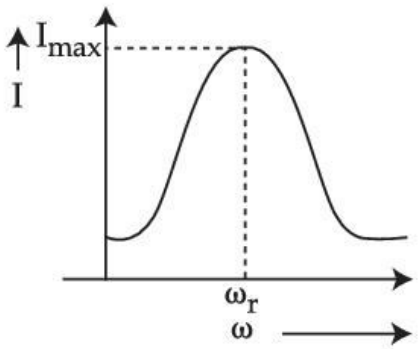
Question: For a series LCR circuit, I vs ω curve is shown :

(a) To the left of ω_r, the circuit is mainly capacitive.

(b) To the left of ω_r, the circuit is mainly inductive.

(c) At ω_r, impedance of the circuit is equal to the resistance of the circuit.

(d) At ω_r, impedance of the circuit is 0.



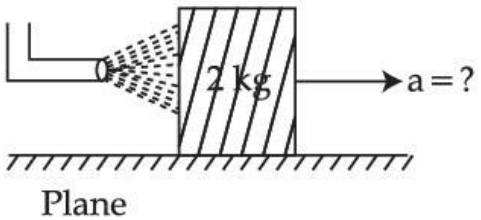
Choose the **most appropriate** answer from the options given below :

A	(a) and (d) only
B	(b) and (d) only
C	(a) and (c) only
D	(b) and (c) only

Q:41
Topic Name: Physics-Section A

ItemCode:101711

Question: A block of metal weighing 2 kg is resting on a frictionless plane (as shown in figure). It is struck by a jet releasing water at a rate of 1 kgs^{-1} and at a speed of 10 ms^{-1}. Then, the initial acceleration of the block, in ms^{-2}, will be :



A	3
B	6
C	5
D	4

Q:42
Topic Name: Physics-Section A

ItemCode:101712

Question: In van dar Wall equation $\left[P + \frac{a}{V^2}\right][V - b] = RT$; P is pressure, V is volume, R is universal gas constant and T is temperature. The ratio of constants $\frac{a}{b}$ is dimensionally equal to :

A	$\frac{P}{V}$
B	$\frac{V}{P}$
C	PV
D	PV^3

Q:43
Topic Name: Physics-Section A

ItemCode:101713

Question: Two vectors $\vec{A}$ and $\vec{B}$ have equal magnitudes. If magnitude of $\vec{A} + \vec{B}$ is equal to two times the magnitude of $\vec{A} - \vec{B}$, then the angle between $\vec{A}$ and $\vec{B}$ will be :

A	$\sin^{-1}\left(\frac{3}{5}\right)$
B	$\sin^{-1}\left(\frac{1}{3}\right)$
C	$\cos^{-1}\left(\frac{3}{5}\right)$
D	$\cos^{-1}\left(\frac{1}{3}\right)$

Q:44
Topic Name: Physics-Section A

ItemCode:101714

Question: The escape velocity of a body on a planet 'A' is 12 kms^{-1}. The escape velocity of the body on another planet 'B', whose density is four times and radius is half of the planet 'A', is :

A	12 kms^{-1}

B	$24\ \text{kms}^{-1}$
C	$36\ \text{kms}^{-1}$
D	$6\ \text{kms}^{-1}$

Q:45
Topic Name: Physics-Section A

ItemCode:101715

Question: At a certain place the angle of dip is 30° and the horizontal component of earth's magnetic field is 0.5 G. The earth's total magnetic field (in G), at that certain place, is :

A	$\frac{1}{\sqrt{3}}$
B	$\frac{1}{2}$
C	$\sqrt{3}$
D	1

Q:46
Topic Name: Physics-Section A

ItemCode:101716

Question: A longitudinal wave is represented by $x = 10 \sin 2\pi\left(\text{nt} - \frac{x}{\lambda}\right)$ cm. The maximum particle velocity will be four times the wave velocity if the determined value of wavelength is equal to :

A	2π
B	5π
C	π
D	$\frac{5\pi}{2}$

Q:47
Topic Name: Physics-Section A

ItemCode:101717

Question: A parallel plate capacitor filled with a medium of dielectric constant 10, is connected across a battery and is charged. The dielectric slab is replaced by another slab of dielectric constant 15. Then the energy of capacitor will :

A	increase by 50%
B	decrease by 15%
C	increase by 25%
D	increase by 33%

Q:48
Topic Name: Physics-Section A

ItemCode:101718

Question: A positive charge particle of 100 mg is thrown in opposite direction to a uniform electric field of strength 1×10^5 NC^{-1}. If the charge on the particle is 40 μC and the initial velocity is 200 ms^{-1}, how much distance it will travel before coming to the rest momentarily :

A	1 m
B	5 m
C	10 m
D	0.5 m

Q:49
Topic Name: Physics-Section A

ItemCode:101719

Question: Using Young's double slit experiment, a monochromatic light of wavelength 5000 Å produces fringes of fringe width 0.5 mm. If another monochromatic light of wavelength 6000 Å is used and the separation between the slits is doubled, then the new fringe width will be :

A	0.5 mm
B	1.0 mm
C	0.6 mm
D	0.3 mm

Q:50
Topic Name: Physics-Section A

ItemCode:101720

Question: Only 2% of the optical source frequency is the available channel bandwidth for an optical communicating system operating at 1000 nm. If an audio signal requires a bandwidth of 8 kHz, how many channels can be accommodated for transmission :

A	375×10^7
B	75×10^7
C	375×10^8
D	75×10^9

Q:51
Topic Name: Physics-Section B

ItemCode:101721

Question: Two coils require 20 minutes and 60 minutes respectively to produce same amount of heat energy when connected separately to the same source. If they are connected in parallel arrangement to the same source; the time required to produce same amount of heat by the combination of coils, will be _____ min.

Q:52
Topic Name: Physics-Section B

ItemCode:101722

Question:

The intensity of the light from a bulb incident on a surface is 0.22 W/m^2. The amplitude of the magnetic field in this light-wave is _____ $\times 10^{-9}$ T.

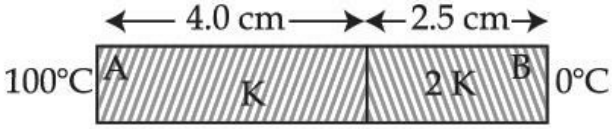
(Given : Permittivity of vacuum $\epsilon_0 = 8.85 \times 10^{-12}$ C^2 N^{-1}-m^{-2}, speed of light in vacuum $c = 3 \times 10^8 ms^{-1}$)

Q:53
Topic Name: Physics-Section B

ItemCode:101723

Question:

As per the given figure, two plates A and B of thermal conductivity K and 2 K are joined together to form a compound plate. The thickness of plates are 4.0 cm and 2.5 cm respectively and the area of cross-section is 120 cm^2 for each plate. The equivalent thermal conductivity of the compound plate is $\left(1 + \frac{5}{\alpha}\right)$ K, then the value of α will be _____.



Q:54
Topic Name: Physics-Section B

ItemCode:101724

Question:

A body is performing simple harmonic with an amplitude of 10 cm. The velocity of the body was tripled by air Jet when it is at 5 cm from its mean position. The new amplitude of vibration is $\sqrt{x}$ cm. The value of x is _____.

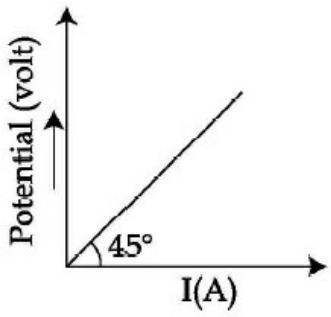
Q:55
Topic Name: Physics-Section B

ItemCode:101725

Question:

The variation of applied potential and current flowing through a given wire is shown in figure. The length of wire is 31.4 cm. The diameter of wire is measured as 2.4 cm. The resistivity of the given wire is measured as $x \times 10^{-3}$ Ω cm. The value of x is _____.

[Take $\pi = 3.14$]



Q:56
Topic Name: Physics-Section B

ItemCode:101726

Question:

300 cal. of heat is given to a heat engine and it rejects 225 cal. of heat. If source temperature is 227°C, then the temperature of sink will be _____ °C.

Q:57

Topic Name: Physics-Section B

ItemCode:101727

Question: $\sqrt{d_1}$ and $\sqrt{d_2}$ are the impact parameters corresponding to scattering angles 60° and 90° respectively, when an α particle is approaching a gold nucleus. For $d_1 = x\ d_2$, the value of x will be _____.

Q:58

Topic Name: Physics-Section B

ItemCode:101728

Question: A transistor is used in an amplifier circuit in common emitter mode. If the base current changes by 100 μA, it brings a change of 10 mA in collector current. If the load resistance is 2 kΩ and input resistance is 1 kΩ, the value of power gain is $x \times 10^4$. The value of x is _____.

Q:59

Topic Name: Physics-Section B

ItemCode:101729

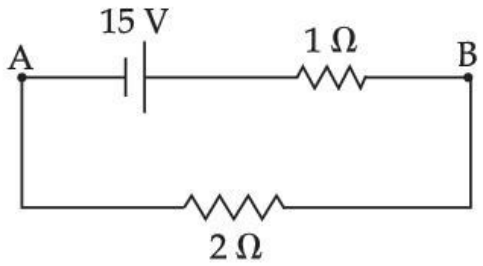
Question: A parallel beam of light is allowed to fall on a transparent spherical globe of diameter 30 cm and refractive index 1.5. The distance from the centre of the globe at which the beam of light can converge is _____ mm.

Q:60

Topic Name: Physics-Section B

ItemCode:101730

Question: For the network shown below, the value of $V_B - V_A$ is _____V.



Q:61

Topic Name: Chemistry-Section A

ItemCode:101731

Question: Production of iron in blast furnace follows the following equation

$$Fe_3O_4(s) + 4CO(g) \rightarrow 3Fe(l) + 4CO_2(g)$$

when 4.640 kg of Fe_3O_4 and 2.520 kg of CO are allowed to react then the amount of iron (in g) produced is :

[Given : Molar Atomic mass (g mol^{-1}) : Fe = 56

Molar Atomic mass (g mol^{-1}) : O = 16

Molar Atomic mass (g mol^{-1}) : C = 12]

A	1400
B	2200
C	3360
D	4200

Q:62
Topic Name: Chemistry-Section A

ItemCode:101732

Question:
Which of the following statements are **correct** ?

(A) The electronic configuration of Cr is [Ar] $3d^5\ 4s^1$.

(B) The magnetic quantum number may have a negative value.

(C) In the ground state of an atom, the orbitals are filled in order of their increasing energies.

(D) The total number of nodes are given by $n-2$.

Choose the **most appropriate** answer from the options given below :

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

Q:63
Topic Name: Chemistry-Section A

ItemCode:101733

Question:
Arrange the following in the decreasing order of their covalent character :

(A) LiCl

(B) NaCl

(C) KCl

(D) CsCl

Choose the **most appropriate** answer from the options given below :

A	(A) > (C) > (B) > (D)
B	(B) > (A) > (C) > (D)
C	(A) > (B) > (C) > (D)
D	(A) > (B) > (D) > (C)

Q:64
Topic Name: Chemistry-Section A

ItemCode:101734

Question:
The solubility of AgCl will be maximum in which of the following ?

A	0.01 M KCl
B	0.01 M HCl
C	0.01 M $AgNO_3$
D	Deionised water

Q:65
Topic Name: Chemistry-Section A

ItemCode:101735

Question: Which of the following is a **correct** statement ?

A	Brownian motion destabilises sols.
B	Any amount of dispersed phase can be added to emulsion without destabilising it.
C	Mixing two oppositely charged sols in equal amount neutralises charges and stabilises colloids.
D	Presence of equal and similar charges on colloidal particles provides stability to the colloidal solution.

Q:66
Topic Name: Chemistry-Section A

ItemCode:101736

Question: The electronic configuration of Pt (atomic number 78) is :

A	[Xe] $4f^{14}\ 5d^{9}\ 6s^{1}$
B	[Kr] $4f^{14}\ 5d^{10}$
C	[Xe] $4f^{14}\ 5d^{10}$
D	[Xe] $4f^{14}\ 5d^{8}\ 6s^{2}$

Q:67
Topic Name: Chemistry-Section A

ItemCode:101737

Question: In isolation of which one of the following metals from their ores, the use of cyanide salt is not commonly involved ?

A	Zinc
B	Gold
C	Silver
D	Copper

Q:68
Topic Name: Chemistry-Section A

ItemCode:101738

Question: Which one of the following reactions indicates the reducing ability of hydrogen peroxide in basic medium ?

A	$HOCl + H_2O_2 \rightarrow H_3O^+ + Cl^- + O_2$
B	$PbS + 4H_2O_2 \rightarrow PbSO_4 + 4H_2O$
C	$2MnO_4^- + 3H_2O_2 \rightarrow 2MnO_2 + 3O_2 + 2H_2O + 2OH^-$
D	$Mn^{2+} + H_2O_2 \rightarrow Mn^{4+} + 2OH^-$

Q:69
Topic Name: Chemistry-Section A

ItemCode:101739

Question: Match **List - I** with **List - II**.

	List - I (Metal)		**List - II (Emitted light wavelength (nm))**
(A)	Li	(I)	670.8
(B)	Na	(II)	589.2
(C)	Rb	(III)	780.0
(D)	Cs	(IV)	455.5

Choose the **most appropriate** answer from the options given below :

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

Q:70
Topic Name: Chemistry-Section A

ItemCode:101740

Question: Match **List - I** with **List - II**.

	List - I (Metal)		**List - II (Application)**
(A)	Cs	(I)	High temperature thermometer
(B)	Ga	(II)	Water repellent sprays
(C)	B	(III)	Photoelectric cells
(D)	Si	(IV)	Bullet proof vest

Choose the **most appropriate** answer from the options given below :

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

Q:71
Topic Name: Chemistry-Section A

ItemCode:101741

Question: The oxoacid of phosphorus that is easily obtained from a reaction of alkali and white phosphorus and has two P–H bonds, is :

A	Phosphonic acid
B	Phosphinic acid
C	Pyrophosphorus acid

D	Hypophosphoric acid

Q:72
Topic Name: Chemistry-Section A

ItemCode:101742

Question: The acid that is believed to be mainly responsible for the damage of Taj Mahal is

A	sulfuric acid.
B	hydrofluoric acid.
C	phosphoric acid.
D	hydrochloric acid.

Q:73
Topic Name: Chemistry-Section A

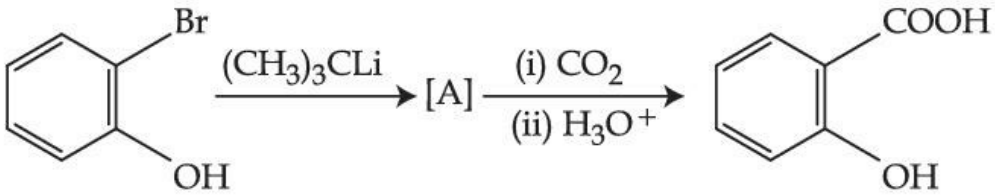
ItemCode:101743

Question: Two isomers 'A' and 'B' with molecular formula C_4H_8 give different products on oxidation with $KMnO_4$ in acidic medium. Isomer 'A' on reaction with $KMnO_4/H^+$ results in effervescence of a gas and gives ketone. The compound 'A' is

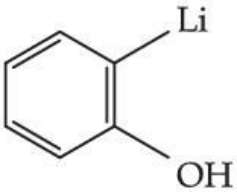
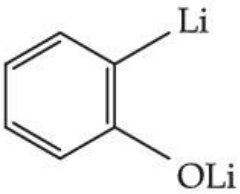
A	But-1-ene.
B	cis-But-2-ene.
C	trans-But-2-ene.
D	2-methyl propene.

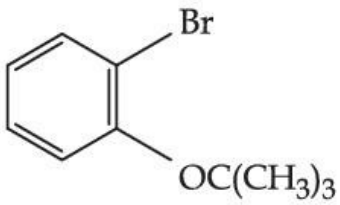
Q:74
Topic Name: Chemistry-Section A

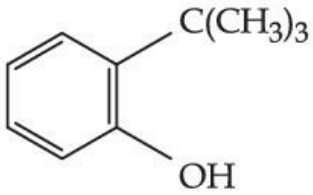
ItemCode:101744



Question: In the given conversion the compound A is :

A	
B	

C 

D 

Q:75
Topic Name: Chemistry-Section A

ItemCode:101745

Question:

Given below are two statements :

Statement I : The esterification of carboxylic acid with an alcohol is a nucleophilic acyl substitution.

Statement II : Electron withdrawing groups in the carboxylic acid will increase the rate of esterification reaction.

Choose the **most appropriate** option :

A Both **Statement I** and **Statement II** are correct.

B Both **Statement I** and **Statement II** are incorrect.

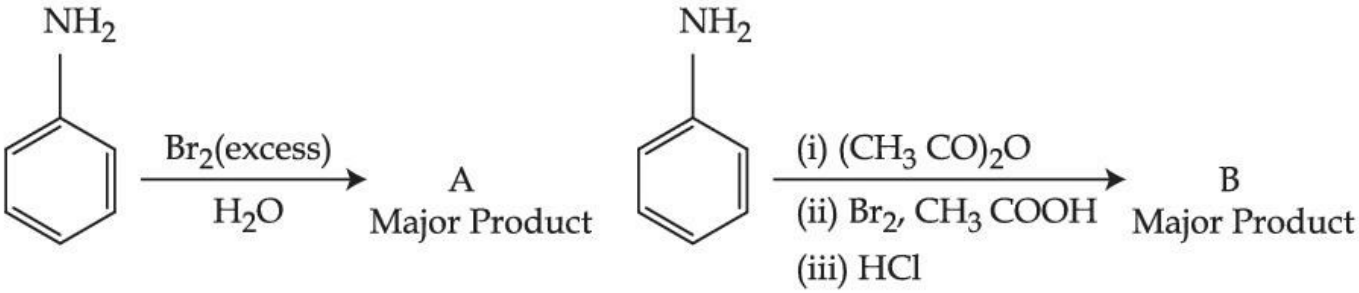
C **Statement I** is correct but **Statement II** is incorrect.

D **Statement I** is incorrect but **Statement II** is correct.

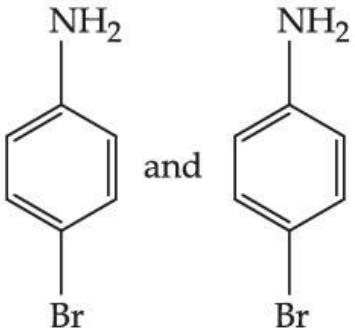
Q:76
Topic Name: Chemistry-Section A

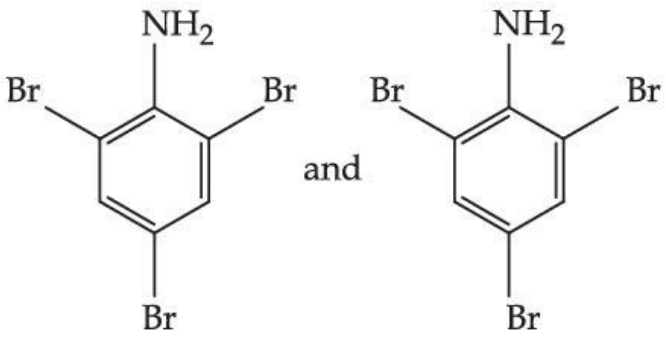
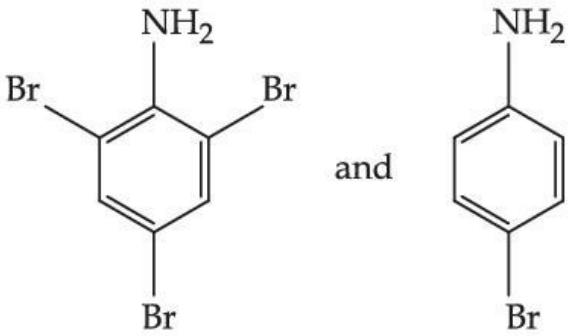
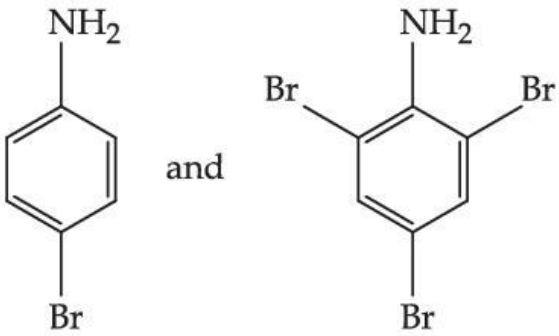
ItemCode:101746

Question:



Consider the above reactions, the product A and product B respectively are

A 

B	
C	
D	

Q:77
Topic Name: Chemistry-Section A

ItemCode:101747

Question: The polymer, which can be stretched and retains its original status on releasing the force is

A	Bakelite.
B	Nylon 6,6.
C	Buna-N.
D	Terylene.

Q:78
Topic Name: Chemistry-Section A

ItemCode:101748

Question: Sugar moiety in DNA and RNA molecules respectively are

A	β-D-2-deoxyribose, β-D-deoxyribose.
B	β-D-2-deoxyribose, β-D-ribose
C	β-D-ribose, β-D-2-deoxyribose.
D	β-D-deoxyribose, β-D-2-deoxyribose.

Q:79
Topic Name: Chemistry-Section A

ItemCode:101749

Question: Which of the following compound **does not** contain sulfur atom ?

A	Cimetidine
B	Ranitidine
C	Histamine
D	Saccharin

Q:80
Topic Name: Chemistry-Section A

ItemCode:101750

Question: Given below are two statements.

Statement I : Phenols are weakly acidic.

Statement II : Therefore they are freely soluble in NaOH solution and are weaker acids than alcohols and water.

Choose the **most appropriate** option :

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.

Q:81
Topic Name: Chemistry-Section B

ItemCode:101751

Question: Geraniol, a volatile organic compound, is a component of rose oil. The density of the vapour is 0.46 gL^{-1} at 257°C and 100 mm Hg. The molar mass of geraniol is _____ g mol^{-1}. (Nearest Integer)

[Given : R = 0.082 L atm K^{-1} mol^{-1}]

Q:82
Topic Name: Chemistry-Section B

ItemCode:101752

Question: 17.0 g of NH_3 completely vapourises at −33.42°C and 1 bar pressure and the enthalpy change in the process is 23.4 kJ mol^{-1}. The enthalpy change for the vapourisation of 85 g of NH_3 under the same conditions is _____ kJ.

Q:83
Topic Name: Chemistry-Section B

ItemCode:101753

Question:

1.2 mL of acetic acid is dissolved in water to make 2.0 L of solution. The depression in freezing point observed for this strength of acid is 0.0198°C. The percentage of dissociation of the acid is _____. (Nearest integer)

[Given : Density of acetic acid is 1.02 g mL^{-1}

Molar mass of acetic acid is 60 g mol^{-1}

$K_f(H_2O) = 1.85$ K kg mol^{-1}]

Q:84

Topic Name: Chemistry-Section B

ItemCode:101754

Question:

A dilute solution of sulphuric acid is electrolysed using a current of 0.10 A for 2 hours to produce hydrogen and oxygen gas. The total volume of gases produced at STP is _____ cm^3. (Nearest integer)

[Given : Faraday constant $F = 96500$ C mol^{-1} at STP, molar volume of an ideal gas is 22.7 L mol^{-1}]

Q:85

Topic Name: Chemistry-Section B

ItemCode:101755

Question:

The activation energy of one of the reactions in a biochemical process is 532611 J mol^{-1}. When the temperature falls from 310 K to 300 K, the change in rate constant observed is $k_{300} = x \times 10^{-3}\, k_{310}$. The value of x is _____.

[Given : $\ln 10 = 2.3$

$R = 8.3$ J K^{-1} mol^{-1}]

Q:86

Topic Name: Chemistry-Section B

ItemCode:101756

Question:

The number of terminal oxygen atoms present in the product B obtained from the following reaction is _____.

$$FeCr_2O_4 + Na_2CO_3 + O_2 \rightarrow A + Fe_2O_3 + CO_2$$

$$A + H^+ \rightarrow B + H_2O + Na^+$$

Q:87

Topic Name: Chemistry-Section B

ItemCode:101757

Question:

An acidified manganate solution undergoes disproportionation reaction. The spin-only magnetic moment value of the product having manganese in higher oxidation state is _____ B.M. (Nearest integer)

Q:88

Topic Name: Chemistry-Section B

ItemCode:101758

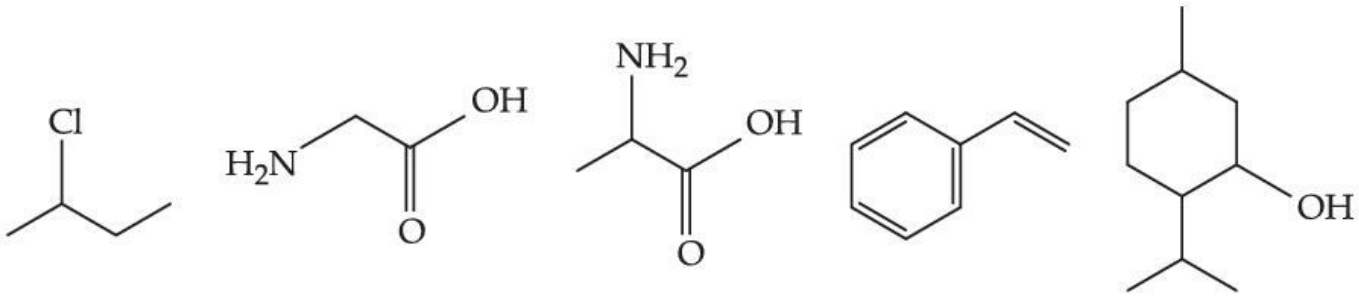
Question: Kjeldahl's method was used for the estimation of nitrogen in an organic compound. The ammonia evolved from 0.55 g of the compound neutralised 12.5 mL of 1 M H_2SO_4 solution. The percentage of nitrogen in the compound is _____. (Nearest integer)

Q:89

Topic Name: Chemistry-Section B

ItemCode:101759

Question: Observe structures of the following compounds



The total number of structures/compounds which possess asymmetric carbon atoms is ————————.

Q:90

Topic Name: Chemistry-Section B

ItemCode:101760

Question: $C_6H_{12}O_6 \xrightarrow{\text{Zymase}} A \xrightarrow[\Delta]{\text{NaOI}} B + CHI_3$

The number of carbon atoms present in the product B is _____.