JEE Main - 8 April (Shift-1) Question Paper

Question 1. The value of $k \in \mathbb{N}$ for which the integral

$$I_n = \int_0^1 (1 - x^k)^n \, dx, \; n \in \mathbb{N}, \text{ satisfies } 147\, I_{20} = 148\, I_{21}$$

is:

1. 10
2. 8
3. 14
4. 7

Question 2. The sum of all the solutions of the equation

$$(8)^{2x} - 16 \cdot (8)^x + 48 = 0$$

is:

1. $1 + \log_6(8)$
2. $\log_8(6)$
3. $1 + \log_8(6)$
4. $\log_8(4)$

Question 3. Let the circles $C_1 : (x - \alpha)^2 + (y - \beta)^2 = r_1^2$ and

$$C_2 : (x - 8)^2 + \left(y - \frac{15}{2}\right)^2 = r_2^2$$

touch each other externally at the point $(6, 6)$. If the point $(6, 6)$ divides the line segment joining the centers of the circles C_1 and C_2 internally in the ratio $2 : 1$, then:

$$(\alpha + \beta) + 4 \cdot (r_1^2 + r_2^2)$$

equals:

1. 110

2. 130

3. 125

4. 145

Question 4. Let $P(x, y, z)$ be a point in the first octant, whose projection in the xy-plane is the point Q. Let $OP = \gamma$; the angle between OQ and the positive x-axis be θ; and the angle between OP and the positive z-axis be ϕ, where O is the origin. Then the distance of P from the x-axis is:

1. $\gamma\sqrt{1 - \sin^2\theta\cos^2\phi}$

2. $\gamma\sqrt{1 + \cos^2\phi\sin^2\theta}$

3. $\gamma\sqrt{1 - \sin^2\theta\cos^2\phi}$

4. $\gamma\sqrt{1 + \cos^2\phi\sin^2\theta}$

Question 5. The number of critical points of the function $f(x) = (x-2)^{2/3}(2x+1)$ is:

1. 2

2. 0

3. 1

4. 3

Question 6.Let $f(x)$ be a positive function such that the area bounded by $y = f(x), y = 0$ from $x = 0$ to $x = a > 0$ is:

$$e^{-a} + 4a^2 + a - 1.$$

The differential equation, whose general solution is $y = c_1 f(x) + c_2$, where c_1 and c_2 are arbitrary constants, is:

1. $(8e^x - 1)\frac{d^2y}{dx^2} + \frac{dy}{dx} = 0$

2. $(8e^x + 1)\frac{d^2y}{dx^2} - \frac{dy}{dx} = 0$

3. $(8e^x + 1)\frac{d^2y}{dx^2} + \frac{dy}{dx} = 0$

4. $(8e^x - 1)\frac{d^2y}{dx^2} - \frac{dy}{dx} = 0$

Question 7. Let $f(x) = 4\cos^3(x) + 3\sqrt{3}\cos^2(x) - 10$. The number of points of local maxima of f in the interval $(0, 2\pi)$ is:

1. 1
2. 2
3. 3
4. 4

Question 8. Let $A = \begin{bmatrix} 2 & a & 0 \\ 1 & 3 & 1 \\ 0 & 5 & b \end{bmatrix}$. If $A^3 = 4A^2 - A - 21I$, where I is the identity matrix of order 3×3, then $2a + 3b$ is equal to:

1. -10
2. -13
3. -9
4. -12

Question 9. If the shortest distance between the lines:

$$L_1 : \mathbf{r} = (2 + \lambda)\hat{i} + (1 - 3\lambda)\hat{j} + (3 + 4\lambda)\hat{k},\ \lambda \in \mathbb{R},$$

$$L_2 : \mathbf{r} = 2(1 + \mu)\hat{i} + 3(1 + \mu)\hat{j} + 5(1 + \mu)\hat{k},\ \mu \in \mathbb{R},$$

is $\frac{m}{\sqrt{n}}$, where $\gcd(m, n) = 1$, then the value of $m + n$ is:

1. 384
2. 387
3. 377
4. 390

Question 10. Let the sum of two positive integers be 24. If the probability, that their product is not less than $\frac{3}{4}$ times their greatest positive product, is $\frac{m}{n}$, where $\gcd(m, n) = 1$, then $n - m$ equals:

1. 9
2. 11
3. 8
4. 10

Question 11. If $\sin x = -\frac{3}{5}$, where $\pi < x < \frac{3\pi}{2}$, then $80(\tan^2 x - \cos x)$ is equal to:

1. 109
2. 108
3. 18
4. 19

Question 12. Let $I(x) = \int \frac{6}{\sin^2 x(1-\cot x)^2}\, dx$. If $I(0) = 3$, then $I\left(\frac{\pi}{12}\right)$ is equal to:

1. $\sqrt{3}$
2. $3\sqrt{3}$
3. $6\sqrt{3}$
4. $2\sqrt{3}$

Question 13. The equations of two sides AB and AC of a triangle ABC are $4x + y = 14$ and $3x - 2y = 5$, respectively. The point $\left(2, -\frac{4}{3}\right)$ divides the third side BC internally in the ratio $2 : 1$. The equation of the side BC is:

1. $x - 6y - 10 = 0$
2. $x - 3y - 6 = 0$
3. $x + 3y + 2 = 0$
4. $x + 6y + 6 = 0$

Question 14. Let $[t]$ be the greatest integer less than or equal to t. Let A be the set of all prime factors of 2310 and

$$f : A \to \mathbb{Z},\ f(x) = \left[\log_2\left(x^2 + \frac{x^3}{5}\right)\right].$$

The number of one-to-one functions from A to the range of f is:

1. 20
2. 120
3. 25
4. 24

Question 15. Let z be a complex number such that $|z+2|=1$ and

$$\text{Im}\left(\frac{z+1}{z+2}\right)=\frac{1}{5}.$$

Then the value of $|\text{Re}(z+2)|$ is:

1. $\frac{\sqrt{6}}{5}$
2. $1+\frac{\sqrt{6}}{5}$
3. $\frac{24}{5}$
4. $\frac{2\sqrt{6}}{5}$

Question 16. If the set $R=\{(a,b): a+5b=42, a,b\in\mathbb{N}\}$ has m elements and

$$\sum_{n=1}^{m}(1-i^{n!})=x+iy,$$

where $I=\sqrt{-1}$, then the value of $m+x+y$ is:

1. 8
2. 12
3. 4
4. 5

Question 17. For the function $f(x)=(\cos x)-x+1$, $x\in\mathbb{R}$, between the following two statements:

(S1) $f(x)=0$ for only one value of x in $[0,\pi]$.

(S2) $f(x)$ is decreasing in $\left[0,\frac{\pi}{2}\right]$ and increasing in $\left[\frac{\pi}{2},\pi\right]$.

The correct answer is:

1. Both (S1) and (S2) are correct
2. Only (S1) is correct
3. Both (S1) and (S2) are incorrect
4. Only (S2) is correct

Question 18. The set of all α, for which the vector

$$\vec{a} = \alpha t\hat{i} + 6\hat{j} - 3\hat{k}, \quad \vec{b} = t\hat{i} - 2\hat{j} - 2\alpha t\hat{k}$$

are inclined at an obtuse angle for all $t \in \mathbb{R}$, is:

1. $[0, 1)$
2. $(-2, 0]$
3. $\left(-\frac{4}{3}, 0\right]$
4. $\left(-\frac{4}{3}, 1\right)$

Question 19. Let y = $y(x)$ be the solution of the differential equation:

$$(1 + y^2)e^{\tan x}dx + \cos^2 x(1 + e^{2\tan x})dy = 0,$$

with $y(0) = 1$. Then $y\left(\frac{\pi}{4}\right)$ is equal to:

1. $\frac{2}{e}$
2. $\frac{1}{e^2}$
3. $\frac{1}{e}$
4. $\frac{2}{e^2}$

Question 20. Let $H : -\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$ be the hyperbola, whose eccentricity is $\sqrt{3}$ and the length of the latus rectum is $4\sqrt{3}$. Suppose the point $(\alpha, 6), \alpha > 0$ lies on H. If β is the product of the focal distances of the point $(\alpha, 6)$, then $\alpha^2 + \beta$ is equal to:

1. 170
2. 171

3. 169

4. 172

Question 21. Let $A = \begin{bmatrix} 2 & -1 \\ 1 & 1 \end{bmatrix}$. If the sum of the diagonal elements of A^{13} is 3^n, then n is equal to:

Question 22. If the orthocentre of the triangle formed by the lines $2x + 3y - 1 = 0$, $x + 2y - 1 = 0$, and $ax + by - 1 = 0$, is the centroid of another triangle whose circumcentre and orthocentre respectively are $(3, 4)$ and $(-6, -8)$, then the value of $|a - b|$ is:

Question 23. Three balls are drawn at random from a bag containing 5 blue and 4 yellow balls. Let the random variables X and Y respectively denote the number of blue and yellow balls. If $\overline{X}$ and $\overline{Y}$ are the means of X and Y respectively, then $7\overline{X} + 4\overline{Y}$ is equal to:

Question 24. The number of 3-digit numbers, formed using the digits 2, 3, 4, 5, 7, when the repetition of digits is not allowed, and which are not divisible by 3, is equal to:

Question 25. Let the positive integers be written in the form:

$$1$$
$$2\ 3$$
$$4\ 5\ 6$$
$$7\ 8\ 9\ 10$$
$$\vdots$$

If the k^{th} row contains exactly k numbers for every natural number k, then the row in which the number 5310 will be, is:

Question 26. If the range of $f(\theta) = \frac{\sin^4\theta + 3\cos^2\theta}{\sin^4\theta + \cos^2\theta}$, $\theta \in \mathbb{R}$, is $[\alpha, \beta]$, then the sum of the infinite G.P., whose first term is 64 and the common ratio is $\frac{\alpha}{\beta}$, is equal to:

Question 27. Let $\alpha = \sum_{r=0}^{n}(4r^2+2r+1)\cdot\binom{n}{r}$ **and** $\beta = \left(\sum_{r=0}^{n}\binom{n}{r+1}\right)+\frac{1}{n+1}$**. If** $140 < \frac{2\alpha}{\beta} < 281$**, then the value of** n **is:**

Question 28. Let $\vec{a} = 9\hat{i} - 13\hat{j} + 25\hat{k}$**,** $\vec{b} = 3\hat{i} + 7\hat{j} - 13\hat{k}$**, and** $\vec{c} = 17\hat{i} - 2\hat{j} + \hat{k}$ **be three given vectors. If** $\vec{r}$ **is a vector such that** $\vec{r}\times\vec{a} = (\vec{b}+\vec{c})\times\vec{a} = 0$ **and** $\vec{r}\cdot(\vec{b}-\vec{c}) = 0$**, then**

$$\frac{|593\vec{r} + 67\vec{a}|^2}{(593)^2}$$

is equal to:

Question 29. Let the area of the region enclosed by the curve $y = \min\{\sin x, \cos x\}$ **and the x-axis between** $x = -\pi$ **to** $x = \pi$ **be** A**. Then** A^2 **is equal to:**

Question 30. The value of

$$\lim_{x\to 0} 2\cdot\frac{\left(1-\cos x\sqrt{\cos 2x}\sqrt[3]{\cos 3x}\ldots\sqrt[10]{\cos 10x}\right)}{x^2}$$

is:

Question 31. Three bodies A, B, and C have equal kinetic energies, and their masses are 400 g, 1.2 kg, and 1.6 kg, respectively. The ratio of their linear momenta is:

1. $1:\sqrt{3}:2$
2. $1:\sqrt{3}:\sqrt{2}$
3. $\sqrt{2}:\sqrt{3}:1$
4. $\sqrt{3}:\sqrt{2}:1$

Question 32. The average force exerted on a non-reflecting surface at normal incidence is 2.4×10^{-4} **N. If** 360 **W/cm**^{2} **is the light energy flux during a span of 1 hour 30 minutes, then the area of the surface is:**

1. $0.2\,\text{m}^2$

2. $0.02\,\mathrm{m}^2$

3. $20\,\mathrm{m}^2$

4. $0.1\,\mathrm{m}^2$

Question 33. A proton and an electron are associated with the same de-Broglie wavelength. The ratio of their kinetic energies is:

1. $1:1836$

2. $1:\frac{1}{1836}$

3. $1:\frac{1}{\sqrt{1836}}$

4. $1:\sqrt{1836}$

Question 34. A mixture of one mole of a monoatomic gas and one mole of a diatomic gas (rigid) are kept at room temperature (27°C). The ratio of their specific heat capacities at constant volume is:

1. $7:5$

2. $3:2$

3. $3:5$

4. $5:3$

Question 35. In an expression $a \times 10^b$:

1. a is the order of magnitude for $b \leq 5$

2. b is the order of magnitude for $a \leq 5$

3. b is the order of magnitude for $5 < a \leq 10$

4. b is the order of magnitude for $a \geq 5$

Question 36. In the given circuit, the terminal potential difference of the cell is:

1. 2 V
2. 4 V
3. 1.5 V
4. 3 V

Question 37. Binding energy of a certain nucleus is 18×10^8 J. How much is the difference between total mass of all the nucleons and nuclear mass of the given nucleus:

1. $0.2\,\mu g$
2. $20\,\mu g$
3. $2\,\mu g$
4. $10\,\mu g$

Question 38.paramagnetic substances:

1. Align themselves along the directions of external magnetic field.
2. Attract strongly towards external magnetic field.
3. Have susceptibility little more than zero.
4. Move from a region of strong magnetic field to weak magnetic field.

Choose the most appropriate answer from the options given below:

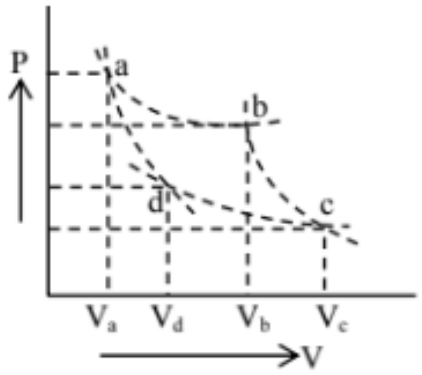
Question 39. A clock has 75 cm, 60 cm long second hand and minute hand respectively. In 30 minutes duration, the tip of the second hand will travel x distance more than the tip of the minute hand. The value of x in meters is nearly (Take $\pi = 3.14$):

1. $139.4\,\text{m}$
2. $140.5\,\text{m}$
3. $220.0\,\text{m}$
4. $118.9\,\text{m}$

Question 40. Young's modulus is determined by the equation given by $Y = \frac{49000\,M}{\ell}\ \frac{\text{dyne}}{\text{cm}^2}$, where M is the mass and ℓ is the extension of the wire used in the experiment. The error in Young's modulus (Y) is estimated by taking data from M-ℓ plot on graph paper. The smallest scale divisions are $5\,\text{g}$ and $0.02\,\text{cm}$ along the load axis and extension axis respectively. If the value of M and ℓ are $500\,\text{g}$ and $2\,\text{cm}$ respectively, then the percentage error of Y is:

1. 0.2%
2. 0.02%
3. 2%
4. 0.5%

Question 41. Two different adiabatic paths for the same gas intersect two isothermal curves as shown in P-V diagram. The relation between the ratio $\frac{V_a}{V_d}$ and $\frac{V_b}{V_c}$ is:



1. $\frac{V_a}{V_d} = \left(\frac{V_b}{V_c}\right)^{-1}$
2. $\frac{V_a}{V_d} \neq \frac{V_b}{V_c}$
3. $\frac{V_a}{V_d} = \frac{V_b}{V_c}$
4. $\frac{V_a}{V_d} = \left(\frac{V_b}{V_c}\right)^{2}$

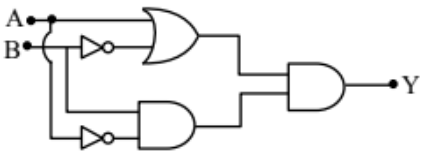
Question 42. Two planets A and B having masses m_1 and m_2 move around the sun in circular orbits of r_1 and r_2 radii respectively. If angular momentum of A is L and that of B is $3L$, the ratio of time period $\frac{T_A}{T_B}$ is:

1. $\left(\frac{r_2}{r_1}\right)^{\frac{3}{2}}$
2. $\left(\frac{r_1}{r_2}\right)^{3}$
3. $\frac{1}{27}\left(\frac{m_2}{m_1}\right)^{3}$
4. $27\left(\frac{m_1}{m_2}\right)^{3}$

Question 43. An LCR circuit is at resonance for a capacitor C, inductance L, and resistance R. Now the value of resistance is halved, keeping all other parameters the same. The current amplitude at resonance will be now:

1. Zero
2. Double
3. Same
4. Halved

Question 44. The output Y of the following circuit for given inputs is:



1. $A \cdot B \cdot (A + B)$
2. $A \cdot B$
3. 0
4. $\overline{A} \cdot B$

Question 45. Two charged conducting spheres of radii a and b are connected to each other by a conducting wire. The ratio of charges of the two spheres respectively is:

1. $\sqrt{ab}$
2. ab
3. $\frac{a}{b}$
4. $\frac{b}{a}$

Question 46. Correct Bernoulli's equation is (symbols have their usual meaning):

1. $P + mgh + \frac{1}{2}mv^2 = \text{constant}$
2. $P + \rho gh + \frac{1}{2}\rho v^2 = \text{constant}$
3. $P + \rho g + \rho v^2 = \text{constant}$
4. $P + \frac{1}{2}gh + \frac{1}{2}\rho v^2 = \text{constant}$

Question 47. A player caught a cricket ball of mass 150 g moving at a speed of 20 m/s. If the catching process is completed in 0.1 s, the magnitude of force exerted by the ball on the hand of the player is:

1. $150\,\text{N}$
2. $3\,\text{N}$

3. $30\,\text{N}$

4. $300\,\text{N}$

Question 48. A stationary particle breaks into two parts of masses m_A and m_B which move with velocities v_A and v_B respectively. The ratio of their kinetic energies $(K_B : K_A)$ is:

1. $v_B : v_A$

2. $m_B : m_A$

3. $m_B\, v_B : m_A\, v_A$

4. $1 : 1$

Question 49. Critical angle of incidence for a pair of optical media is $45°$. The refractive indices of first and second media are in the ratio:

1. $\sqrt{2} : 1$

2. $1 : 2$

3. $1 : \sqrt{2}$

4. $2 : 1$

Question 50. The diameter of a sphere is measured using a vernier caliper whose 9 divisions of the main scale are equal to 10 divisions of the vernier scale. The shortest division on the main scale is equal to $1\,\text{mm}$. The main scale reading is $2\,\text{cm}$, and the second division of the vernier scale coincides with a division on the main scale. If the mass of the sphere is $8.635\,\text{g}$, the density of the sphere is:

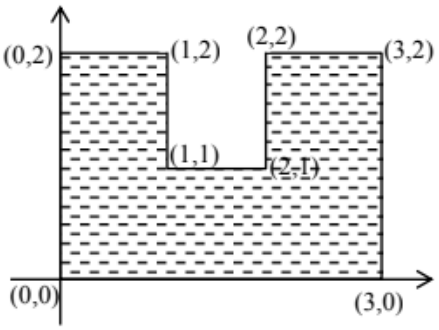
1. $2.5\,\text{g/cm}^3$

2. $1.7\,\text{g/cm}^3$

3. $2.2\,\text{g/cm}^3$

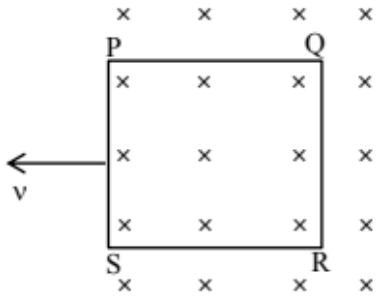
4. $2.0\,\text{g/cm}^3$

Question 51. A uniform thin metal plate of mass $10\,\text{kg}$ with dimensions is shown. The ratio of x and y coordinates of the center of mass of the plate is $\frac{n}{9}$. The value of n is:



Question 52. An electron with kinetic energy $5\,\text{eV}$ enters a region of uniform magnetic field of $3\,\mu\text{T}$ perpendicular to its direction. An electric field E is applied perpendicular to the direction of velocity and magnetic field. The value of E, so that the electron moves along the same path, is _____ N/C.

Question 53. A square loop PQRS having 10 turns, area $3.6 \times 10^{-3}\,\text{m}^2$, and resistance $100\,\Omega$ is slowly and uniformly pulled out of a uniform magnetic field of magnitude $B = 0.5\,\text{T}$ as shown. Work done in pulling the loop out of the field in $1.0\,\text{s}$ is ____ $\times 10^{-6}$ J.



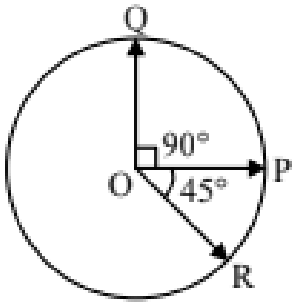
Question 54. Resistance of a wire at 0° C, 100° C, and t° C is found to be $10\,\Omega$, $10.2\,\Omega$, and $10.95\,\Omega$, respectively. The temperature t in Kelvin is ____

Question 55. An electric field, $\vec{E} = \frac{2\hat{i}+6\hat{j}+8\hat{k}}{\sqrt{6}}$, passes through the surface of $4\,\text{m}^2$ area having unit vector $\hat{n} = \frac{2\hat{i}+\hat{j}+\hat{k}}{\sqrt{6}}$. The electric flux for that surface is ____ V m.

Question 56. A liquid column of height 0.04 cm balances excess pressure of a soap bubble of certain radius. If the density of the liquid is 8×10^3 kg/m^3 and surface tension of the soap solution is $0.28\,\text{Nm}^{-1}$, then the diameter of the soap bubble is ____ cm. (Take $g = 10\,\text{ms}^{-2}$).

Question 57. A closed and an open organ pipe have the same lengths. If the ratio of frequencies of their seventh overtones is $\frac{a-1}{a}$, then the value of a is ___

Question 58. Three vectors $\overrightarrow{OP}, \overrightarrow{OQ}, \overrightarrow{OR}$, each of magnitude A, are acting as shown in the figure. The resultant of the three vectors is $A\sqrt{x}$. The value of x is ____

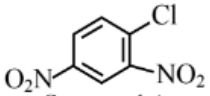


Question 59. A parallel beam of monochromatic light of wavelength 600 nm passes through a single slit of 0.4 mm width. Angular divergence corresponding to the second-order minima would be ____ $\times 10^{-3}$ rad.

Question 60. In an alpha particle scattering experiment, the distance of closest approach for the α-particle is 4.5×10^{-14} m. If the target nucleus has an atomic number 80, the maximum velocity of the α-particle is ____ $\times 10^5$ m/s approximately.

Question 61. Given below are two statements:

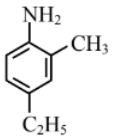
Statement I:



Compound-A

IUPAC name of Compound A is 4-chloro-1, 3-dinitrobenzene.

Statement II:



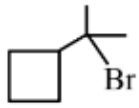
Compound-B

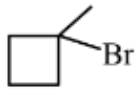
IUPAC name of Compound B is 4-ethyl-2-methylaniline.

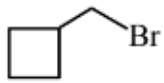
In the light of the above statements, choose the most appropriate answer from the options given below:

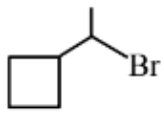
1. Both Statement I and Statement II are correct.
2. Statement I is incorrect but Statement II is correct.
3. Statement I is correct but Statement II is incorrect.
4. Both Statement I and Statement II are incorrect.

Question 62. Which among the following compounds will undergo the fastest S_N2 reaction?

(1) 

(2) 

(3) 

(4) 

Question 63. Combustion of glucose ($C_6H_{12}O_6$) produces CO_2 and water. The amount of oxygen (in g) required for the complete combustion of 900 g of glucose is:

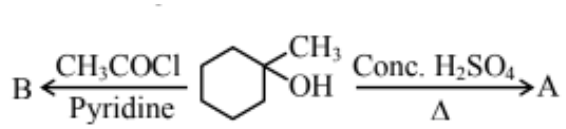
1. 480 g

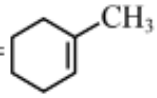
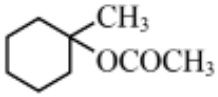
2. 960 g

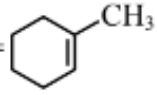
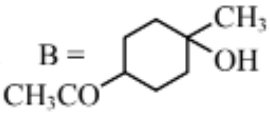
3. 800 g

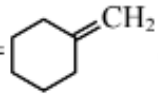
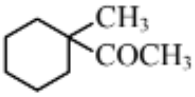
4. 32 g

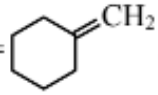
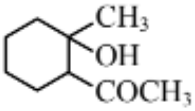
Question 64. Identify the major products A and B respectively in the following set of reactions:



(1) A=  and B= 

(2) A=  and B = 

(3) A=  and B = 

(4) A=  and B = 

Question 66. Match List-I with List-II:

List-I (Name of the Test)	List-II (Reaction Sequence Involved)
A. Borax bead test	I. $MCO_3 \rightarrow MO, \quad Co(NO_3)_2 \xrightarrow{+\Delta} CoO, MO$
B. Charcoal cavity test	II. $MCO_3 \rightarrow MCl_2 \rightarrow M^{2+}$
C. Cobalt nitrate test	III. $MSO_4 + Na_2B_4O_7 \xrightarrow{\Delta} M(BO_2)_2 \rightarrow MBO_2 \rightarrow M$
D. Flame test	IV. $MSO_4 + Na_2CO_3 \xrightarrow{\Delta} MCO_3 \rightarrow MO \rightarrow M$

Choose the correct answer from the options given below:

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

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

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

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

Question 67. Match List-I with List-II:

List-I (Molecule)	List-II (Shape)
A. NH_3	I. Square pyramidal
B. BrF_5	II. Tetrahedral
C. PCl_5	III. Trigonal pyramidal
D. CH_4	IV. Trigonal bipyramidal

Choose the correct answer from the option below:

1. A-IV, B-III, C-I, D-II
2. A-II, B-IV, C-I, D-III
3. A-III, B-I, C-IV, D-II
4. A-III, B-IV, C-I, D-II

Question 68. For the given hypothetical reactions, the equilibrium constants are as follows:

$$X \rightleftharpoons Y, \quad K_1 = 1.0$$

$$Y \rightleftharpoons Z, \quad K_2 = 2.0$$

$$Z \rightleftharpoons W, \quad K_3 = 4.0$$

The equilibrium constant for the reaction $X \rightleftharpoons W$ is:

1. 6.0
2. 12.0
3. 8.0
4. 7.0

Question 69. Thiosulphate reacts differently with iodine and bromine in the reaction given below:

$$2S_2O_3^{2-} + I_2 \rightarrow S_4O_6^{2-} + 2I^-$$

$$S_2O_3^{2-} + 5Br_2 + 5H_2O \rightarrow 2SO_4^{2-} + 4Br^- + 10H^+.$$

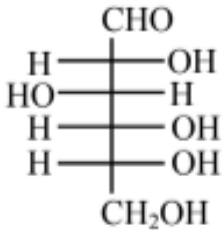
Which of the following statements justifies the above dual behaviour of thiosulphate?

1. Bromine undergoes oxidation and iodine undergoes reduction by iodine in these reactions.
2. Thiosulphate undergoes oxidation by bromine and reduction by iodine in these reactions.
3. Bromine is a stronger oxidant than iodine.
4. Bromine is a weaker oxidant than iodine.

Question 70: An octahedral complex with the formula $CoCl_3 \cdot nNH_3$ upon reaction with excess of $AgNO_3$ solution gives 2 moles of AgCl. Consider the oxidation state of Co in the complex as 'x'. The value of "x + n" is ____

1. 3
2. 6
3. 8
4. 5

Question 71:



The incorrect statement regarding the given structure is:

1. Can be oxidized to a dicarboxylic acid with Br_2 water
2. Despite the presence of –CHO, does not give Schiff's test
3. Has 4-asymmetric carbon atoms
4. Will coexist in equilibrium with 2 other cyclic structures

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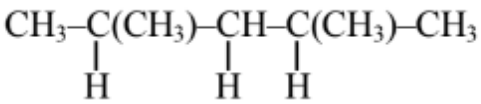
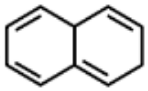
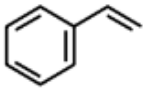
Question 72: In the given compound, the number of 2° carbon atom/s is:

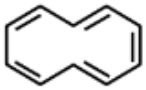


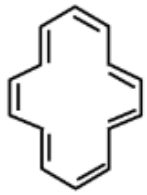
1. Three
2. One
3. Two
4. Four

Question 73: Which of the following are aromatic?

A. 

B. 

C. 

D. 

1. B and D only
2. A and C only
3. A and B only
4. C and D only

Question 74: Among the following halogens F_2, Cl_2, Br_2 and I_2, which can undergo disproportionation reaction?

1. Only I_2
2. Cl_2, Br_2 and I_2
3. F_2, Cl_2 and Br_2
4. F_2 and Cl_2

Question 75: Given below are two statements:

Statement I: $N(CH_3)_3$ and $P(CH_3)_3$ can act as ligands to form transition metal complexes.

Statement II: As N and P are from the same group, the nature of bonding of $N(CH_3)_3$ and $P(CH_3)_3$ is always the same with transition metals.

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

1. Statement I is incorrect but Statement II is correct
2. Both Statement I and Statement II are correct
3. Statement I is correct but Statement II is incorrect
4. Both Statement I and Statement II are incorrect

Question 76: Match List I with List II:

List I (Elements)	**List II (Properties in their respective groups)**
A. Cl, S	I. Elements with highest electronegativity
B. Ge, As	II. Elements with largest atomic size
C. Fr, Ra	III. Elements which show properties of both metals and non-metals
D. F, O	IV. Elements with highest negative electron gain enthalpy

Choose the correct answer from the options given below:

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

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

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

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

Question 77: Iron (III) catalyzes the reaction between iodide and persulphate ions, in which:

1. Fe^{3+} oxidises the iodide ion
2. Fe^{3+} oxidises the persulphate ion
3. Fe^{2+} reduces the iodide ion
4. Fe^{2+} reduces the persulphate ion

Choose the most appropriate answer from the options given below:

1. B and C only
2. B only
3. A only
4. A and D only

Question 78

Match List I with List II:

List I (Compound)	List II (Colour)
A. $Fe_4[Fe(CN)_6]_3 \cdot xH_2O$	I. Violet
B. $[Fe(CN)_5NOS]^4$	II. Blood Red
C. $[Fe(SCN)]^{2+}$	III. Prussian Blue
D. $(NH_4)_3PO_4 \cdot 12MoO_3$	IV. Yellow

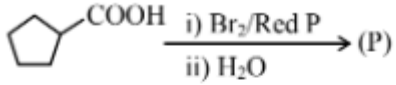
1. A-III, B-I, C-II, D-IV
2. A-IV, B-I, C-II, D-III
3. A-II, B-III, C-IV, D-I
4. A-I, B-II, C-III, D-IV

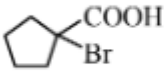
Question 79: Number of complexes with even number of electrons in t_2 orbitals is:

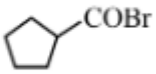
$$[Fe(H_2O)_6]^{2+}, [Co(H_2O)_6]^{2+}, [Co(H_2O)_6]^{3+}, [Cu(H_2O)_6]^{2+}, [Cr(H_2O)_6]^{3+}$$

1. 1
2. 3
3. 2
4. 5

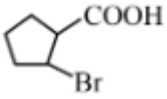
Question 80: Identify the product (P) in the following reaction:



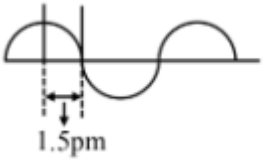
(1) 

(2) 

(3) 

(4) 

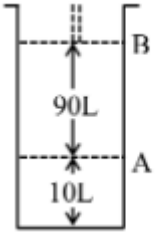
Question 81: A hypothetical electromagnetic wave is shown below.



The frequency of the wave is $x \times 10^{19}$ Hz.

$x =$ ____ (nearest integer)

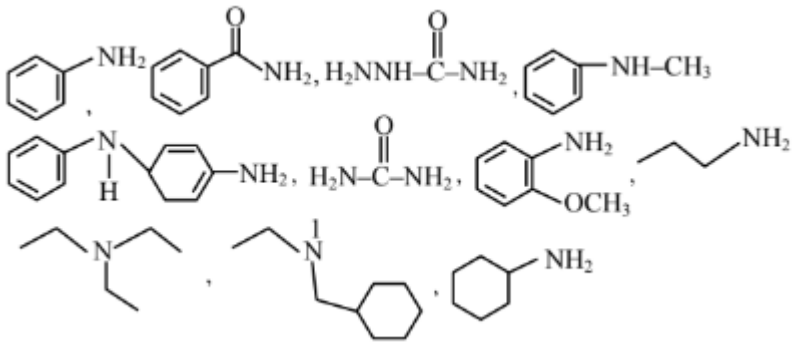
Question 82: Consider the figure provided.



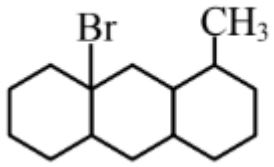
1 mol of an ideal gas is kept in a cylinder, fitted with a piston, at the position A, at 18°C. If the piston is moved to position B, keeping the temperature unchanged, then 'x' L atm work is done in this reversible process.

$x =$ ___ L atm (nearest integer)

Question 83. Number of amine compounds from the following giving solids which are soluble in NaOH upon reaction with Hinsberg's reagent is __



Question 84. The number of optical isomers in the following compound is ____



Question 85. The 'spin-only' magnetic moment value of MO_4^{2-} is ___ BM (where M is a metal having least metallic radii among Sc, Ti, V, Cr, Mn, Zn).

Question 86. Number of molecules from the following which are exceptions to the octet rule: CO_2, NO_2, H_2SO_4, BF_3, CH_4, SiF_4, ClO_2, PCl_5, BeF_2, C_2H_6, $CHCl_3$, CBF_4.

Question 87. If 279 g of aniline is reacted with one equivalent of benzenediazonium chloride, the maximum amount of aniline yellow formed will be ___ g (nearest integer). (Consider complete conversion).

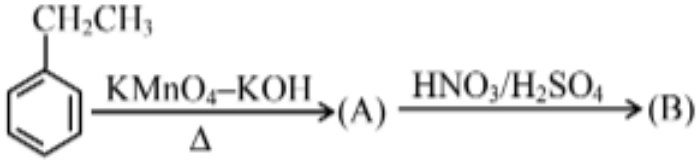
Question 88. Consider the following reaction:

$$A + B \rightarrow C.$$

The time taken for A to become $1/4$th of its initial concentration is twice the time taken to become $1/2$ of the same. Also, when the change of concentration of B is plotted against time, the resulting graph gives a straight line with a negative slope and a positive intercept on the concentration axis.

The overall order of the reaction is ___

Question 89. The major product B of the following reaction has ____ π-bonds:



Question 90. A solution containing 10 g of an electrolyte AB_2 in 100 g of water boils at $100.52°$C. The degree of ionization (α) of the electrolyte is __ $\times 10^{-1}$ (nearest integer).

Given:

- Molar mass of $AB_2 = 200$ g/mol.
- $K_b = 0.52$ K kg/mol.
- Boiling point of water = $100°$C.