JEE Main 2024 6 Apr Shift 1 Question Paper

Mathematics

Q.1 If $f(x) = \begin{cases} x^3 \sin\left(\frac{1}{x}\right), & x \neq 0, \\ 0, & x = 0, \end{cases}$ **then:**

(1) $f''(0) = 1$

(2) $f''\left(\frac{2}{\pi}\right) = \frac{24-\pi^2}{2\pi}$

(3) $f''\left(\frac{2}{\pi}\right) = \frac{12-\pi^2}{2\pi}$

(4) $f''(0) = 0$

Q.2 If $A(3, 1, -1)$, $B\left(\frac{5}{3}, \frac{7}{3}, \frac{1}{3}\right)$, $C(2, 2, 1)$, **and** $D\left(\frac{10}{3}, \frac{2}{3}, -\frac{1}{3}\right)$ **are the vertices of a quadrilateral** $ABCD$**, then its area is:**

(1) $\frac{4\sqrt{2}}{3}$

(2) $\frac{5\sqrt{2}}{3}$

(3) $2\sqrt{2}$

(4) $\frac{2\sqrt{2}}{3}$

Q.3 $\int_0^{\pi/4} \frac{\cos^2 x \sin^2 x}{\left(\cos^3 x + \sin^3 x\right)^2} dx$ **is equal to:**

(1) $1/12$

(2) $1/9$

(3) $1/6$

(4) $1/3$

Q.4 The mean and standard deviation of 20 observations are found to be 10 and 2, respectively. On rechecking, it was found that an observation by mistake was taken as 8 instead of 12. The correct standard deviation is:

(1) $\sqrt{3.86}$

(2) 1.8

(3) $\sqrt{3.96}$

(4) 1.94

Q.5 The function $f(x) = \frac{x^2+2x-15}{x^2-4x+9}$, $x \in \mathbb{R}$, is:

(1) both one-one and onto.

(2) onto but not one-one.

(3) neither one-one nor onto.

(4) one-one but not onto.

Q.6 Let $A = \{n \in [100, 700] \cap \mathbb{N} : n$ is neither a multiple of 3 nor a multiple of $4\}$. Then the number of elements in A is:

(1) 300

(2) 280

(3) 310

(4) 290

Q.7 Let C be the circle of minimum area touching the parabola $y = 6 - x^2$ and the lines $y = \sqrt{3}|x|$. Then, which one of the following points lies on the circle C?

(1) $(2, 4)$

(2) $(1, 2)$

(3) $(2, 2)$

(4) $(1, 1)$

Q.8 For $\alpha, \beta \in \mathbb{R}$ and a natural number n, let

$$A_r = \begin{vmatrix} r & 1 & \frac{n^2}{2} + \alpha \\ 2r & 2 & n^2 - \beta \\ 3r - 2 & 3 & n(3n-1)/2 \end{vmatrix}.$$

Then $2A_{10} - A_5$ is:

(1) $4\alpha + 2\beta$

(2) $2\alpha + 4\beta$

(3) $2n$

(4) 0

Q.9 The shortest distance between the lines:

$$\frac{x-3}{2} = \frac{y+15}{-7} = \frac{z-9}{5} \quad \text{and} \quad \frac{x+1}{2} = \frac{y-1}{1} = \frac{z-9}{-3},$$

is:

(1) $6\sqrt{3}$

(2) $4\sqrt{3}$

(3) $5\sqrt{3}$

(4) $8\sqrt{3}$

Q.10 A company has two plants A and B to manufacture motorcycles. 60% motorcycles are manufactured at plant A and the remaining are manufactured at plant B. 80% of the motorcycles manufactured at plant A are rated of the standard quality, while 90% of the motorcycles manufactured at plant B are rated of the standard quality. A motorcycle picked up randomly from the total production is found to be of the standard quality. If p is the probability that it was manufactured at plant B, then $126p$ is:

(1) 54

(2) 64

(3) 66

(4) 56

Q.11 Let α, β be the distinct roots of the equation:

$$x^2 - (t^2 - 5t + 6)x + 1 = 0,\ t \in \mathbb{R},$$

and $a_n = \alpha^n + \beta^n$. Then the minimum value of $\frac{a_{2023}+a_{2025}}{a_{2024}}$ is:

(1) $1/4$

(2) $-1/2$

(3) $-1/4$

(4) $1/2$

Q.12 Let the relations R_1 and R_2 on the set $X = \{1, 2, 3, \ldots, 20\}$ be given by:

$R_1 = \{(x, y) : 2x - 3y = 2\}$ **and** $R_2 = \{(x, y) : -5x + 4y = 0\}$**. If M and N be the minimum number of elements required to be added in R_1 and R_2, respectively, in order to make the relations symmetric, then $M + N$ equals:**

(1) 8

(2) 16

(3) 12

(4) 10

Q.13 Let a variable line of slope $m > 0$ passing through the point $(4, -9)$ intersect the coordinate axes at the points A and B. The minimum value of the sum of the distances of A and B from the origin is:

(1) 25

(2) 30

(3) 15

(4) 10

Q.14 The interval in which the function $f(x) = x^x, x > 0$, is strictly increasing is:

(1) $\left(0, \frac{1}{e}\right]$

(2) $\left[\frac{1}{e^2}, 1\right)$

(3) $(0, \infty)$

(4) $\left[\frac{1}{e}, \infty\right)$

Q.15 A circle is inscribed in an equilateral triangle of side of length 12. If the area and perimeter of any square inscribed in this circle are m and n, respectively, then $m + n^2$ is equal to:

(1) 396

(2) 408

(3) 312

(4) 414

Q.16 The number of triangles whose vertices are at the vertices of a regular octagon but none of whose sides is a side of the octagon is:

(1) 24

(2) 56

(3) 16

(4) 48

Q.17 Let $y = y(x)$ be the solution of the differential equation:

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

Then $y(0)$ is:

(1) $\frac{1}{4}(e^{\pi/2} - 1)$

(2) $\frac{1}{2}\left(1-e^{-\pi/2}\right)$

(3) $\frac{1}{4}\left(1-e^{\pi/2}\right)$

(4) $\frac{1}{2}\left(e^{\pi/2}-1\right)$

Q.18 Let $y=y(x)$ be the solution of the differential equation:

$$(2x\ln x)\frac{dy}{dx}+2y=\frac{3}{x}\ln x, \quad x>0,$$

and $y(e^{-1})=0$. Then, $y(e)$ is equal to:

(1) $-\frac{3}{2e}$

(2) $-\frac{2}{3e}$

(3) $-\frac{3}{e}$

(4) $-\frac{2}{e}$

Q.19 Let the area of the region enclosed by the curves $y=3x$, $2y=27-3x$, and $y=3x-x\sqrt{x}$ be A. Then $10A$ is equal to:

(1) 184

(2) 154

(3) 172

(4) 162

Q.20 Let $f:(-\infty,\infty)\to\mathbb{R}\setminus\{0\}$ be a differentiable function such that:

$$f'(1)=\lim_{a\to\infty}a^2 f\left(\frac{1}{a}\right).$$

Then:

$$\lim_{a\to\infty}\frac{a(a+1)}{2}\tan^{-1}\left(\frac{1}{a}\right)+a^2-2\ln a$$

is equal to:

(1) $\frac{3}{2}+\frac{\pi}{4}$

(2) $\frac{3}{8}+\frac{\pi}{4}$

(3) $\frac{5}{2}+\frac{\pi}{8}$

(4) $\frac{3}{4} + \frac{\pi}{8}$

Q.21 Let $\alpha\beta\gamma = 45$; $\alpha, \beta, \gamma \in \mathbb{R}$. If:

$$x(\alpha, 1, 2) + y(1, \beta, 2) + z(2, 3, \gamma) = (0, 0, 0),$$

for some $x, y, z \in \mathbb{R}$, $xyz \neq 0$, then $6\alpha + 4\beta + \gamma$ is equal to:

(1)

(2)

(3)

(4)

Q.22 Let a conic C pass through the point $(4, -2)$ and $P(x, y)$, $x \geq 3$, be any point on C. Let the slope of the line touching the conic C only at a single point P be half the slope of the line joining the points P and $(3, -5)$. If the focal distance of the point $(7, 1)$ on C is d, then $12d$ equals:

Q.23 Let

$$I_k = \int_0^1 (1 - x)^k dx,\ k \in \mathbb{N}.$$

Then the value of

$$\sum_{k=1}^{10} \frac{1}{7(I_k - 1)}$$

is equal to _____.

Q.24 Let x_1, x_2, x_3, x_4 be the solution of the equation

$$4x^4 + 8x^3 - 17x^2 - 12x + 9 = 0$$

and

$$\left(4 + x_1^2\right)\left(4 + x_2^2\right)\left(4 + x_3^2\right)\left(4 + x_4^2\right) = \frac{125}{16}m.$$

Then the value of m is _____.

Q.25 Let L_1, L_2 be the lines passing through the point $P(0,1)$ and touching the parabola

$$9x^2 + 12x + 18y - 14 = 0.$$

Let Q and R be the points on the lines L_1 and L_2 such that the $\triangle PQR$ is an isosceles triangle with base QR. If the slopes of the lines QR are m_1 and m_2, then

$$16\left(m_1^2 + m_2^2\right)$$

is equal to:

Q26. If the second, third and fourth terms in the expansion of $(x+y)^n$ are 135, 30 and $\frac{10}{3}$, respectively, then $6(n^3 + x^2 + y)$ is equal to ____

Q27.Let the first term of a series be $T_1 = 6$ and its r^{th} term $T_r = 3T_{r-1} + 6^r$, $r = 2, 3, \ldots, n$. If the sum of the first n terms of this series is $\frac{1}{5}\left(n^2 - 12n + 39\right)(4.6^n - 5.3^n + 1)$, then n is equal to __.

Q28.For $n \in \mathbb{N}$, if $\cot^{-1} 3 + \cot^{-1} 4 + \cot^{-1} 5 + \cot^{-1} n = \frac{\pi}{4}$, then n is equal to __.

Q.29 Let $P(10, -2, -1)$ and Q be the foot of the perpendicular drawn from the point $R(1, 7, 6)$ on the line passing through the points $(2, -5, 11)$ and $(-6, 7, -5)$. Then the length of the line segment PQ is equal to __.

Q.30. Let $\vec{a} = 2\hat{i} - 3\hat{j} + 4\hat{k}$, $\vec{b} = 3\hat{i} + 4\hat{j} - 5\hat{k}$, and a vector $\vec{c}$ be such that $\vec{a} \times (\vec{b} + \vec{c}) + \vec{b} \times \vec{c} = \hat{i} + 8\hat{j} + 13\hat{k}$. If $\vec{a} \cdot \vec{c} = 13$, then $(24 - \vec{b} \cdot \vec{c})$ is equal to _____.

Q.31. To find the spring constant (k) of a spring experimentally, a student commits 2% positive error in the measurement of time and 1% negative error in the measurement of mass. The percentage error in determining the value of k is:

(1) 3%

(2) 1%

(3) 4%

(4) 5%

Q.32. A bullet of mass 50 g is fired with a speed 100 m/s on a plywood and emerges with 40 m/s. The percentage loss of kinetic energy is:

(1) 32%

(2) 44%

(3) 16%

(4) 84%

Q.33. The ratio of the shortest wavelength of Balmer series to the shortest wavelength of Lyman series for hydrogen atom is:

(1) $4:1$

(2) $1:2$

(3) $1:4$

(4) $2:1$

Q.34. To project a body of mass m from earth's surface to infinity, the required kinetic energy is (assume, the radius of earth is R_E, $g =$ acceleration due to gravity on the surface of earth):

(1) $2mgR_E$

(2) mgR_E

(3) $\frac{1}{2}mgR_E$

(4) $4mgR_E$

Q.35. Electromagnetic waves travel in a medium with speed 1.5×10^8 ms^{-1}. The relative permeability of the medium is 2.0. The relative permittivity will be:

(1) 5

(2) 1

(3) 4

(4) 2

Q.36. Which of the following phenomena does not explain by wave nature of light?

(A) reflection

(B) diffraction

(C) photoelectric effect

(D) interference

(E) polarization

Choose the most appropriate answer from the options given below:

(1) E only

(2) C only

(3) B, D only

(4) A, C only

Q.37. While measuring the diameter of a wire using a screw gauge, the following readings were noted. The main scale reading is 1 mm, and the circular scale reading is equal to 42 divisions. The pitch of the screw gauge is 1 mm, and it has 100 divisions on the circular scale. The diameter of the wire is $\frac{x}{50}$ mm. The value of x is:

(1) 142

(2) 71

(3) 42

(4) 21

Q.38. σ **is the uniform surface charge density of a thin spherical shell of radius** R**. The electric field at any point on the surface of the spherical shell is:**

(1) $\frac{\sigma}{\epsilon_0}$

(2) $\frac{\sigma}{2\epsilon_0}$

(3) $\frac{\sigma}{\epsilon_0 R}$

(4) $\frac{\sigma}{4\epsilon_0}$

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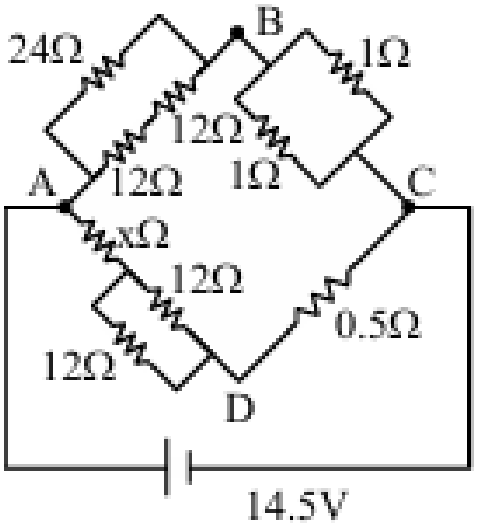
39. The value of unknown resistance (x) **for which the potential difference between** B **and** D **will be zero in the arrangement shown, is:**



(1) $3\ \Omega$

(2) $9\ \Omega$

(3) $6\ \Omega$

(4) $42\ \Omega$

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40. The specific heat at constant pressure of a real gas obeying $PV^2 = RT$ **equation is:**

(1) $C_v + R$

(2) $\frac{R}{3} + C_v$

(3) R

(4) $C_v + \frac{R}{2V}$

Q41. Match List I with List II

List I	List II
A. Torque	**I.** $[ML^2T^{-2}]$
B. Magnetic field	**II.** $[MA^{-1}T^{-2}]$
C. Magnetic moment	**III.** $[AL^2]$
D. Permeability of free space	**IV.** $[MLT^{-2}A^{-2}]$

Choose the correct answer from the options below:

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

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

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

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

Q42. Given below are two statements:

Statement I: In an LCR series circuit, current is maximum at resonance.

Statement II: Current in a purely resistive circuit can never be less than that in a series LCR circuit when connected to the same voltage source.

In the light of the above statements, choose the correct option from the given below:

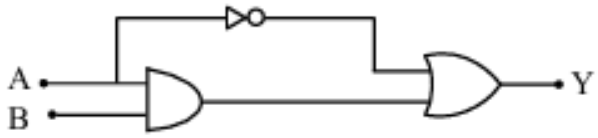
1. Statement I is true but Statement II is false.

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

3. Both Statement I and Statement II are true.

4. Both Statement I and Statement II are false.

Q43. The correct truth table for the following logic circuit is:



Options :

(1)

A	B	Y
0	0	0
0	1	1
1	0	0
1	1	1

(2)

A	B	Y
0	0	1
0	1	1
1	0	0
1	1	1

(3)

A	B	Y
0	0	1
0	1	1
1	0	0
1	1	0

(4)

A	B	Y
0	0	0
0	1	0
1	0	0
1	1	1

Q44. A sample contains a mixture of helium and oxygen gas. The ratio of root mean square speed of helium and oxygen in the sample, is:

Options:

1. $\frac{1}{32}$
2. $\frac{2\sqrt{2}}{1}$
3. $\frac{1}{4}$
4. $\frac{1}{2\sqrt{2}}$

Q45. A light string passing over a smooth light pulley connects two blocks of masses m_1 and m_2 (where $m_2 > m_1$). If the acceleration of the system is $\frac{g}{\sqrt{2}}$, then the ratio of the masses $\frac{m_1}{m_2}$ is:

Options:

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

Q46. Four particles A, B, C, D of mass $\frac{m}{2}, m, 2m, 4m$, have the same momentum, respectively. The particle with maximum kinetic energy is:

Options:

1. **D**
2. **C**
3. **A**
4. **B**

Q.47 A train starting from rest first accelerates uniformly up to a speed of 80 km/h for time t, then it moves with a constant speed for time $3t$. The average speed of the train for this duration of the journey will be (in km/h):

(1) 80

(2) 70

(3) 30

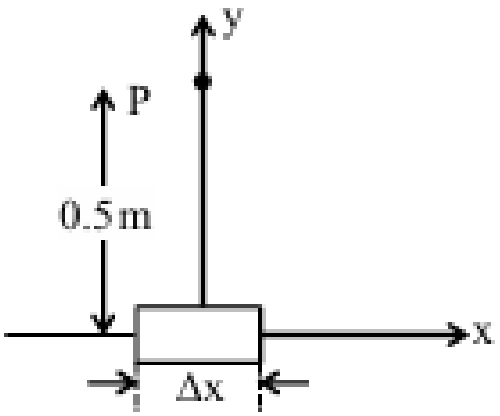
(4) 40

Q.48 An element $\Delta l = \Delta x\hat{i}$ is placed at the origin and carries a large current $I = 10$ A. The magnetic field on the y-axis at a distance of 0.5 m from the element Δx of 1 cm length is:

(1) 4×10^{-8} **T**

(2) 8×10^{-8} **T**

(3) 12×10^{-8} **T**



(4) 10×10^{-8} **T**

Q.49 A small ball of mass m and density ρ is dropped in a viscous liquid of density ρ_0. After some time, the ball falls with constant velocity. The viscous force on the ball is:

1) $mg\left(\frac{\rho_0}{\rho}-1\right)$

2) $mg\left(1+\frac{\rho}{\rho_0}\right)$

3) $mg\left(1-\rho\rho_0\right)$

4) $mg\left(1-\frac{\rho_0}{\rho}\right)$

Q.50 In photoelectric experiment, energy of 2.48 eV irradiates a photo-sensitive material. The stopping potential was measured to be 0.5 V. Work function of the photo-sensitive material is:

1) 0.5 eV

2) 1.68 eV

3) 2.48 eV

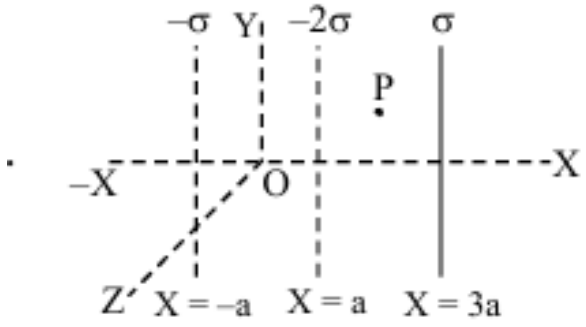
4) 1.98 eV

Q.51 If the radius of earth is reduced to three-fourth of its present value without change in its mass, then value of duration of the day of earth will be ____ hours 30 minutes.

Q.52 Three infinitely long charged thin sheets are placed as shown in figure. The magni-

tude of electric field at the point P is $\frac{x\sigma}{\epsilon_0}$. The value of x is _____

(All quantities are measured in SI units).



Q 53. A big drop is formed by coalescing 1000 small droplets of water. The ratio of surface energy of 1000 droplets to that of energy of big drop is $\frac{10}{x}$.

The value of x is _____.

Q54. When a DC voltage of $100\,V$ is applied to an inductor, a DC current of $5\,A$ flows through it. When an AC voltage of $200\,V$ peak value is connected to the inductor, its inductive reactance is found to be $20\sqrt{3}\,\Omega$. The power dissipated in the circuit is ____ W.

Q55. The refractive index of prism is $\mu = \sqrt{3}$ and the ratio of the angle of minimum deviation to the angle of prism is one. The value of angle of prism is ____ °.

Q56. A wire of resistance R and radius r is stretched till its radius became $r/2$. If the new resistance of the stretched wire is xR, then the value of x is ____.

Q57. Radius of a certain orbit of hydrogen atom is 8.48 Å. If energy of electron in this orbit is E/x, then $x =$ ____.

(Given $a_0 = 0.529$ Å, $E =$ energy of electron in ground state)

(1) 8

(2) 12

(3) 16

(4) 20

Q58. A circular coil having 200 turns, 2.5×10^{-4} m^2 area and carrying $100\,\mu$A current is placed in a uniform magnetic field of 1 T. Initially the magnetic dipole moment ($\vec{M}$) was directed along $\vec{B}$. Amount of work, required to rotate the coil through 90° from its initial orientation such that $\vec{M}$ becomes perpendicular to $\vec{B}$, is _____ μJ.

Q59. A particle is doing simple harmonic motion of amplitude 0.06 m and time period 3.14 s. The maximum velocity of the particle is _____ cm/s.

Q60. For three vectors $\vec{A} = (-x\hat{i} - 6\hat{j} - 2\hat{k})$, $\vec{B} = (-\hat{i} + 4\hat{j} + 3\hat{k})$ and $\vec{C} = (-8\hat{i} - \hat{j} + 3\hat{k})$, if $\vec{A} \cdot (\vec{B} \times \vec{C}) = 0$, then the value of x is _____.

(1) 3

(2) 5

(3) 6

(4) 4

Q61. Functional group present in sulphonic acid is:

(1) SO_3H

(2) SO_3H

(3) $-S-OH$

(4) $-SO_2$

Q62. Match List I with List II:

List I (Molecule / Species)	List II (Property / Shape)
A. SO_2Cl_2	I. Paramagnetic
B. NO	II. Diamagnetic
C. NO_2^-	III. Tetrahedral
D. I_3^-	IV. Linear

Choose the correct answer from the options given below:

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

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

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

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

Q63. Given below are two statements:

Statement I: Picric acid is 2, 4, 6-trinitrotoluene.

Statement II: Phenol-2, 4-disulphuric acid is treated with conc. HNO_3 to get picric acid.

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

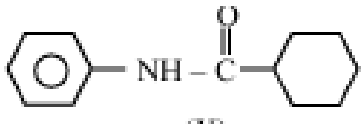
(1) Statement I is incorrect but Statement II is correct.

(2) Both Statement I and Statement II are incorrect.

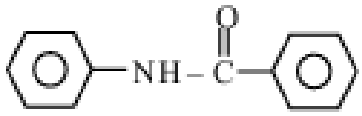
(3) Statement I is correct but Statement II is incorrect.

(4) Both Statement I and Statement II are correct.

Q64. Which of the following is a metamer of the given compound (X)?

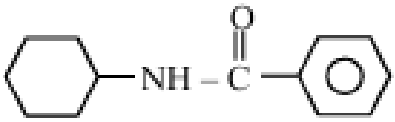


(X)

(1) 

(2) 

(3) 

(4) 

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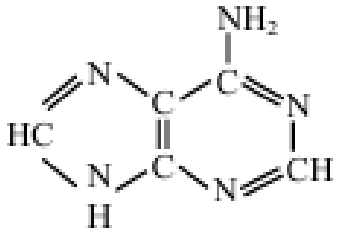
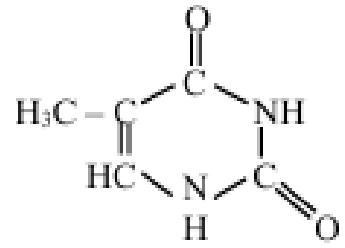
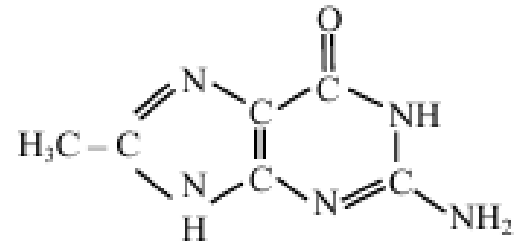
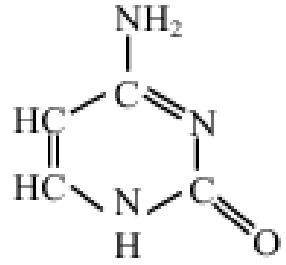
65. DNA molecule contains 4 bases whose structure are shown below. One of the structures is not correct. Identify the incorrect base structure.

(1) 

(2) 

(3) 

(4) 

66.Match List I with List II :

List I (Hybridization)	List II (Orientation in Space)
A. sp^3	**III. Tetrahedral**
B. dsp^2	**IV. Square planar**
C. sp^3d	**I. Trigonal bipyramidal**
D. sp^3d^2	**II. Octahedral**

Options:

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

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

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

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

67.Given below are two statements:

Statement I: Gallium is used in the manufacturing of thermometers.
Statement II: A thermometer containing gallium is useful for measuring the freezing point (256 K) of brine solution.
In the light of the above statements, choose the correct answer from the options given below:

(1) Both Statement I and Statement II are false.

(2) Statement I is false but Statement II is true.

(3) Both Statement I and Statement II are true.

(4) Statement I is true but Statement II is false.

68.Which of the following statements are correct?

- **A. Glycerol is purified by vacuum distillation because it decomposes at its normal boiling point.**
- **B. Aniline can be purified by steam distillation as aniline is miscible in water.**
- **C. Ethanol can be separated from ethanol-water mixture by azeotropic distillation because it forms azeotrope.**
- **D. An organic compound is pure if mixed melting point remains the same.**

Choose the most appropriate answer from the options given below:

(1)A, B, C only

(2)A, C, D only

(3)B, C, D only

(4)A, B, D only

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69. Match List I with List II:

List I (Compound/Species)	**List II (Shape/Geometry)**
A. SF_4	I. Tetrahedral
B. BrF_3	II. Pyramidal
C. BrO_3^-	III. See Saw
D. NH_4^+	IV. Bent T-shape

Choose the correct answer from the options given below:

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

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

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

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

70.In Reimer-Tiemann reaction, phenol is converted into salicylaldehyde through an intermediate. The structure of intermediate is:

Q.71. Which of the following material is not a semiconductor?

(1) Germanium

(2) Graphite

(3) Silicon

(4) Copper oxide

Q.72. Consider the following complexes:

(A) $[CoCl(NH_3)_5]^{2+}$,

(B) $[Co(CN)_6]^{3-}$

(C) $[Co(NH_3)_5(H_2O)]^{3+}$,

(D) $[Cu(H_2O)_4]^{2+}$

The correct order of A, B, C, and D in terms of wavenumber of light absorbed is:

(1) $C < D < A < B$

(2) $D < A < C < B$

(3) $A < C < B < D$

(4) $B < C < A < D$

Q.73. Match List I with List II:

List I (Precipitating reagent and conditions)	List II (Cation)
A. NH_4Cl + NH_4OH	I. Mn^{2+}
B. NH_4OH + Na_2CO_3	II. Pb^{2+}
C. NH_4OH + NH_4Cl + H_2S gas	III. Al^{3+}
D. Dilute HCl	IV. Sr^{2+}

Choose the correct answer from the options given below:

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

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

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

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

Q.74. The electron affinity values are negative for:

A. $Be \rightarrow Be^-$

B. $N \rightarrow N^-$

C. $O \rightarrow O^-$

D. $Na \rightarrow Na^-$

E. $Al \rightarrow Al^-$

Choose the most appropriate answer from the options given below:

(1) D and E only

(2) A, B, D and E only

(3) A and D only

(4) A, B and C only

Q.75. The number of elements from the following that do not belong to lanthanoids is:

Eu, Cm, Er, Tb, Yb and Lu

(1) 3

(2) 4

(3) 1

(4) 5

Q.76. The density of 'x' M solution ('x' molar) of NaOH is $1.12\,\mathrm{g\,mL^{-1}}$, while in molality, the concentration of the solution is $3\,\mathrm{m}$ (3 molal). Then x is

(1) 3.5

(2) 3.0

(3) 3.8

(4) 2.8

Q.77. Which among the following aldehydes is most reactive towards nucleophilic addition reactions?

(1) $HCHO$

(2) C_2H_5CHO

(3) CH_3CHO

(4) C_3H_7CHO

Q.78. At $-20^\circ C$ and 1 atm pressure, a cylinder is filled with an equal number of H_2, I_2, and HI molecules for the reaction:

$$H_2(g) + I_2(g) \rightleftharpoons 2HI(g), \quad K_p \text{ for the process is } x \times 10^{-1}.\ x = ?$$

Options:

(1) 2

(2) 1

(3) 10

(4) 0.01

Q.79 Match **List I** with **List II**:

List I (Compound)	**List II (Uses)**
A. Iodoform	I. Fire extinguisher
B. Carbon tetrachloride	II. Insecticide
C. CFC	III. Antiseptic
D. DDT	IV. Refrigerants

Choose the correct answer from the options given below:

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

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

Q.80 A conductivity cell with two electrodes (dark side) are half filled with infinitely dilute aqueous solution of a weak electrolyte. If volume is doubled by adding more water at constant temperature, the molar conductivity of the cell will:

1. increase sharply
2. remain same or can not be measured accurately
3. decrease sharply
4. depend upon type of electrolyte

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81. Consider the dissociation of the weak acid HX as given below:

$$HX(aq) \rightleftharpoons H^+(aq) + X^-(aq),\ K_a = 1.2 \times 10^{-5}$$

[K_a: dissociation constant]

The osmotic pressure of 0.03 M aqueous solution of HX at 300 K is ___ $\times 10^{-2}$ bar (nearest integer).

Given: $R = 0.083$ **L bar mol^{-1}K^{-1}**

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82. The difference in the 'spin-only' magnetic moment values of $KMnO_4$ and the manganese product formed during titration of $KMnO_4$ against oxalic acid in acidic medium is ___ BM (nearest integer).

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83. Time required for 99.9% completion of a first-order reaction is ___ times the time required for completion of 90% reaction (nearest integer).

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84. Number of molecules from the following which can exhibit hydrogen bonding is ___ (nearest integer).

$$CH_3OH,\ H_2O,\ C_6H_6,\ C_6H_5NO_2,\ HF,\ NH_3$$

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85. 9.3 g of pure aniline upon diazotisation followed by coupling with phenol gives an orange dye. The mass of orange dye produced (assume 100% yield/conversion) is _____ g. (nearest integer).

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86. The major product of the following reaction is P.

$$CH_3C \equiv C\text{-}CH_3 \xrightarrow{\text{(i) Na/liq. } NH_3} \xrightarrow{\text{(ii) dil. } KMnO_4,\ 273\ K} \text{'P'}$$

Number of oxygen atoms present in product 'P' is _____ (nearest integer).

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87. Frequency of the de-Broglie wave of an electron in Bohr's first orbit of the hydrogen atom is ___ $\times 10^{13}$ Hz (nearest integer).

Given: R_H (Rydberg constant) $= 2.18 \times 10^{-18}$ J, h (Planck's constant) $= 6.6 \times 10^{-34}$ J·s.

88.The major products from the following reaction sequence are product A and product B.

$$B \xrightarrow{\text{(i) } Br_2} \xrightarrow{\text{(ii) alc. KOH (3 eq.)}} A$$

$$B \xrightarrow{\text{(i) } Br_2} \xrightarrow{\text{(ii) } Na^+/O^- \text{ (1.0 eq.)}} B$$

The total sum of π electrons in product A and product B are ____ (nearest integer).

89. Among CrO, Cr_2O_3, and CrO_3, the sum of spin-only magnetic moment values of basic and amphoteric oxides is ___ $\times 10^{-2}$ BM (nearest integer).

(Given atomic number of Cr is 24)

90.An ideal gas, $C_V = \frac{5}{2}R$, is expanded adiabatically against a constant pressure of 1 atm until it doubles in volume. If the initial temperature and pressure is 298 K and 5 atm, respectively, then the final temperature is ____ K (nearest integer).

(C_V is the molar heat capacity at constant volume.)
