

JEE Main 2024 Question Paper

Total Time Allowed : 180 minutes	Maximum Marks : 300	Total Questions : 90	Questions to be answered : 90
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Question 1: Let $f : [-1, 2] \rightarrow R$ be given by

$$f(x) = 2x^2 + x + \lfloor x^2 \rfloor - \lfloor x \rfloor,$$

where $\lfloor t \rfloor$ denotes the greatest integer less than or equal to t . The number of points where f is not continuous is:

Options:

- (1) 6
- (2) 3
- (3) 4
- (4) 5

Question 2: The differential equation of the family of circles passing the origin and having center at the line $y = x$ is:

Options:

- (1) $(x^2 - y^2 + 2xy)dx = (x^2 - y^2 + 2xy)dy$
- (2) $(x^2 + y^2 + 2xy)dx = (x^2 + y^2 - 2xy)dy$
- (3) $(x^2 - y^2 + 2xy)dx = (x^2 - y^2 - 2xy)dy$
- (4) $(x^2 + y^2 - 2xy)dx = (x^2 + y^2 + 2xy)dy$

Question 3: Let $S_1 = \{z \in C : |z| \leq 5\}$, $S_2 = \left\{z \in C : \operatorname{Im} \left(\frac{z+(1-\sqrt{3}i)}{1-\sqrt{3}i} \right) \geq 0\right\}$, and $S_3 = \{z \in C : \operatorname{Re}(z) \geq 0\}$. Then:

Options:

- (1) $\frac{125\pi}{6}$
- (2) $\frac{125\pi}{24}$
- (3) $\frac{125\pi}{4}$
- (4) $\frac{125\pi}{12}$

Question 4: The area enclosed between the curves $y = x|x|$ and $y = x - |x|$ is:

Options:

- (1) $\frac{8}{3}$

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

Question 5: 60 words can be made using all the letters of the word BHBJO, with or without meaning. If these words are written as in a dictionary, then the 50th word is:

Options:

- (1) OBBHJ
 (2) HBBJO
 (3) OBBJH
 (4) JBBOH

Question 6: Let $\vec{a} = 2\hat{i} + 5\hat{j} - \hat{k}$, $\vec{b} = 2\hat{i} - 2\hat{j} + 2\hat{k}$, and $\vec{c}$ be three vectors such that

$$(\vec{c} + \hat{i}) \times (\vec{a} + \vec{b} + \hat{i}) = \vec{a} \times (\vec{c} + \hat{i}),$$

$$\vec{a} \cdot \vec{c} = -29.$$

Then $\vec{c} \cdot (-2\hat{i} + \hat{j} + \hat{k})$ is equal to:

Options:

- (1) 10
 (2) 5
 (3) 15
 (4) 12

Question 7: Consider three vectors $\vec{a}, \vec{b}, \vec{c}$. Let $|\vec{a}| = 2, |\vec{b}| = 3$ and $\vec{a} = \vec{b} \times \vec{c}$. If $\alpha \in [0, \frac{\pi}{3}]$ is the angle between the vectors $\vec{b}$ and $\vec{c}$, then the minimum value of $27|\vec{c} - \vec{a}|^2$ is equal to:

Options:

- (1) 110
 (2) 105
 (3) 124
 (4) 121

Question 8: Let $A(-1, 1)$ and $B(2, 3)$ be two points and P be a variable point above the line AB such that the area of $\triangle PAB$ is 10. If the locus of P is $ax + by = 15$, then $5a + 2b$ is:

Options:

- (1) $-\frac{12}{5}$
 - (2) $-\frac{6}{5}$
 - (3) 4
 - (4) 6
-

Question 9: Let (α, β, γ) be the point $(8, 5, 7)$ in the line $\frac{x-1}{2} = \frac{y+1}{3} = \frac{z-2}{5}$. Then $\alpha + \beta + \gamma$ is equal to:

Options:

- (1) 16
 - (2) 18
 - (3) 14
 - (4) 20
-

Question 10: If the constant term in the expansion of

$$\left(\frac{\sqrt[3]{5}}{x} + \frac{2x}{\sqrt[3]{5}} \right)^{12}, \quad x \neq 0,$$

is $\alpha x^2 \times \sqrt[3]{5}$, then 25α is equal to:

Options:

- (1) 639
 - (2) 724
 - (3) 693
 - (4) 742
-

Question 11: Let $f, g : R \rightarrow R$ be defined as: $f(x) = |x - 1|$ and

$$g(x) = \begin{cases} e^x, & x \geq 0 \\ x + 1, & x \leq 0 \end{cases}. \text{ Then the function } f(g(x)) \text{ is}$$

Options:

- (1) neither one-one nor onto.
 - (2) one-one but not onto.
 - (3) both one-one and onto.
 - (4) onto but not one-one.
-

Question 12: Let the circle $C_1 : x^2 + y^2 - 2(x + y) + 1 = 0$ and C_2 be a circle having centre at $(-1, 0)$ and radius 2. If the line of the common chord of C_1

and C_2 intersects the y-axis at the point P , then the square of the distance of P from the centre of C_1 is:

Options:

- (1) 2
 - (2) 1
 - (3) 6
 - (4) 4
-

Question 13: Let the set $S = \{2, 4, 8, 16, \dots, 512\}$ be partitioned into 3 sets A, B, C with an equal number of elements such that $A \cup B \cup C = S$ and $A \cap B = B \cap C = A \cap C = \emptyset$. The maximum number of such possible partitions of S is equal to:

Options:

- (1) 1680
 - (2) 1520
 - (3) 1710
 - (4) 1640
-

Question 14: The values of m, n for which the system of equations

$$x + y + z = 4,$$

$$2x + 5y + 5z = 17,$$

$$x + 2y + mz = n$$

has infinitely many solutions, satisfy the equation:

Options:

- (1) $m^2 + n^2 - m - n = 46$
 - (2) $m^2 + n^2 + m + n = 64$
 - (3) $m^2 + n^2 + mn = 68$
 - (4) $m^2 + n^2 - mn = 39$
-

Question 15: The coefficients a, b, c in the quadratic equation $ax^2 + bx + c = 0$ are from the set $\{1, 2, 3, 4, 5, 6\}$. If the probability of this equation having one real root bigger than the other is p , then $216p$ equals:

Options:

- (1) 57
- (2) 38
- (3) 19

(4) 76

Question 16: Let $ABCD$ and $AEFG$ be squares of side 4 and 2 units, respectively. The point E is on the line segment AB and the point F is on the diagonal AC . Then the radius r of the circle passing through the point F and touching the line segments BC and CD satisfies:

Options:

- (1) $r = 1$
- (2) $r^2 - 8r + 8 = 0$
- (3) $2r^2 - 4r + 1 = 0$
- (4) $2r^2 - 8r + 7 = 0$

Question 17: Let $\beta(m, n) = \int_0^1 x^{m-1}(1-x)^{n-1} dx$, $m, n > 0$. If

$$\int_0^1 (1-x^{10})^{20} dx = a \times \beta(b, c),$$

then $100(a+b+c)$ equals:

Options:

- (1) 1021
- (2) 1120
- (3) 2012
- (4) 2120

Question 18: Let $\alpha\beta \neq 0$ and $A = \begin{bmatrix} \beta & \alpha & 3 \\ \alpha & \alpha & \beta \\ -\beta & \alpha & 2\alpha \end{bmatrix}$. If

$B = \begin{bmatrix} 3\alpha & -9 & 3\alpha \\ -\alpha & 7 & -2\alpha \\ -2\alpha & 5 & -2\beta \end{bmatrix}$ is the matrix of cofactors of the elements of A , then $\det(AB)$ is equal to:

Options:

- (1) 343
- (2) 125
- (3) 64
- (4) 216

Question 19: If

$$y(\theta) = \frac{2 \cos \theta + \cos 2\theta - 1}{4 \cos^3 \theta + 8 \cos^2 \theta + 5 \cos \theta + 2},$$

then at $\theta = \frac{\pi}{2}$, $y'' + y' + y$ is equal to:

Options:

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

Question 20: For $x \geq 0$, the least value of K for which $4^{1+x} + 4^{1-x}$, $\frac{K}{2}$, $16^x + 16^{-x}$ are three consecutive terms of an arithmetic progression (A.P.) is equal to:

Options:

- (1) 10
- (2) 4
- (3) 8
- (4) 16

Question 21: Let the mean and the standard deviation of the probability distribution given by:

X	α	1	0	-3
$P(X)$	$\frac{1}{3}$	K	$\frac{1}{6}$	$\frac{1}{4}$

be μ and σ , respectively. If $\sigma - \mu = 2$, then $\sigma + \mu$ is equal to:

Options:

- (1) 3
- (2) 4
- (3) 2
- (4) 5

Question 22: Let $y = y(x)$ be the solution of the differential equation

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

Then the area enclosed by the curve

$$f(x) = y(x)e^{\frac{1}{1+x^2}}$$

and the line $y - x = 4$ is equal to:

Question 23: The number of solutions of

$$\sin^2 x + (2 + 2x - x^2) \sin x - 3(x - 1)^2 = 0, \quad \text{where } -\pi \leq x \leq \pi,$$

is:

Options:

- (1) 1
- (2) 2
- (3) 3
- (4) 4

Question 24: Let the point $(-1, \alpha, \beta)$ lie on the line of the shortest distance between the lines

$$\frac{x+2}{-3} = \frac{y-2}{4} = \frac{z-5}{2} \quad \text{and} \quad \frac{x+2}{-1} = \frac{y+6}{2} = \frac{z-1}{0}.$$

Then $(\alpha - \beta)^2$ is equal to:

Question 25: If

$$1 + \frac{\sqrt{3} - \sqrt{2}}{2\sqrt{3}} + \frac{5 - 2\sqrt{6}}{18} + \frac{9\sqrt{3} - 11\sqrt{2}}{36\sqrt{3}} + \frac{49 - 20\sqrt{6}}{180} + \dots$$

up to $\infty = 2 \left(\sqrt{\frac{b}{a} + 1} \right) \log_e \left(\frac{a}{b} \right)$, where a and b are integers with $\gcd(a, b) = 1$, then $11a + 18b$ is equal to:

Question 26: Let $a > 0$ be a root of the equation

$$2x^2 + x - 2 = 0.$$

If

$$\lim_{x \rightarrow 1/a} 16 \left(\frac{1 - \cos(2 + x - 2x^2)}{1 - ax^2} \right) = \alpha + \beta\sqrt{17},$$

where $\alpha, \beta \in \mathbb{Z}$, then $\alpha + \beta$ is equal to:

Question 27: If

$$f(t) = \int_0^\pi \frac{2x \, dx}{1 - \cos^2 t \sin^2 x}, \quad 0 < t < \pi,$$

then the value of

$$\int_0^{\frac{\pi}{2}} \frac{\pi^2 \, dt}{f(t)}$$

is equal to:

Question 28: Let the maximum and minimum values of

$$\left(\sqrt{8x - x^2 - 12} - 4 \right)^2 + (x - 7)^2, \quad x \in \mathbb{R}$$

be M and m respectively. Then $M^2 - m^2$ is equal to:

Question 29: Let a line perpendicular to the line $2x - y = 10$ touch the parabola

$$y^2 = 4(x - 9)$$

at the point P . The distance of the point P from the centre of the circle

$$x^2 + y^2 - 14x - 8y + 56 = 0$$

is equal to:

Question 30: The number of real solutions of the equation

$$x|x + 5| + 2|x + 7| - 2 = 0$$

is:

Physics

Question 31: Given below are two statements:

Statement I: When the white light passed through a prism, the red light bends lesser than yellow and violet.

Statement II: The refractive indices are different for different wavelengths in dispersive medium.

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

Options:

- (1) Both Statement I and Statement II are true.
 - (2) Statement I is true but Statement II is false.
 - (3) Both Statement I and Statement II are false.
 - (4) Statement I is false but Statement II is true.
-

Question 32: Which of the following statement is not true about stopping potential (V_0)?

Options:

- (1) It depends on the nature of emitter material.
- (2) It depends upon frequency of the incident light.
- (3) It increases with increase in intensity of the incident light.
- (4) It is $1/e$ times the maximum kinetic energy of electrons emitted.

Question 33: The angular momentum of an electron in a hydrogen atom is proportional to (where r is the radius of orbit of the electron):

Options:

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

Question 34: A galvanometer of resistance $100\ \Omega$ when connected in series with $400\ \Omega$ measures a voltage of up to $10\ V$. The value of resistance required to convert the galvanometer into an ammeter to read up to $10\ A$ is $x \times 10^{-2}\ \Omega$. The value of x is:

Options:

- (1) 2
- (2) 800
- (3) 20
- (4) 200

Question 35: The vehicles carrying inflammable fluids usually have metallic chains touching the ground:

Options:

- (1) To conduct excess charge due to air friction to ground and prevent sparking.
- (2) To alert other vehicles.
- (3) To protect tyres from catching dirt from ground.
- (4) It is a custom.

Question 36: If n is the number density and d is the diameter of the molecule, then the average distance covered by a molecule between two successive collisions (i.e., mean free path) is represented by:

Options:

- (1) $\frac{1}{\sqrt{2}\pi d^2}$
 - (2) $\sqrt{2}\pi d^2$
 - (3) $\frac{1}{\sqrt{2}\pi d^2 n}$
 - (4) $\frac{1}{\sqrt{2}n\pi^2 d^2}$
-

Question 37: A particle moves in the x - y plane under the influence of a force $\vec{F}$ such that its linear momentum is

$$\vec{P}(t) = \hat{i} \cos(kt) - \hat{j} \sin(kt).$$

If k is constant, the angle between $\vec{F}$ and $\vec{P}$ will be:

Options:

- (1) $\frac{\pi}{2}$
 - (2) $\frac{\pi}{6}$
 - (3) $\frac{\pi}{4}$
 - (4) $\frac{\pi}{3}$
-

Question 38: The electrostatic force ($\vec{F}_1$) and magnetic force ($\vec{F}_2$) acting on a charge q moving with velocity $\vec{v}$ can be written as:

Options:

- (1) $\vec{F}_1 = q\vec{v} \cdot \vec{E}$, $\vec{F}_2 = q(\vec{B} \cdot \vec{v})$
 - (2) $\vec{F}_1 = q\vec{B}$, $\vec{F}_2 = q(\vec{B} \times \vec{v})$
 - (3) $\vec{F}_1 = q\vec{E}$, $\vec{F}_2 = q(\vec{v} \times \vec{B})$
 - (4) $\vec{F}_1 = q\vec{E}$, $\vec{F}_2 = q(\vec{B} \times \vec{v})$
-

Question 39: A man carrying a monkey on his shoulder cycles smoothly on a circular track of radius 9 m and completes 120 revolutions in 3 minutes. The magnitude of centripetal acceleration of the monkey is (in m/s^2):

Options:

- (1) zero
 - (2) $16\pi^2 \text{ m/s}^2$
 - (3) $4\pi^2 \text{ m/s}^2$
 - (4) $57600\pi^2 \text{ m/s}^2$
-

Question 40: A series LCR circuit is subjected to an AC signal of 200 V , 50 Hz . If the voltage across the inductor ($L = 10 \text{ mH}$) is 31.4 V , then the current in this circuit is:

Options:

- (1) 68 A
 - (2) 63 A
 - (3) 10 A
 - (4) 10 mA
-

Question 41: What is the dimensional formula of ab^{-1} in the equation

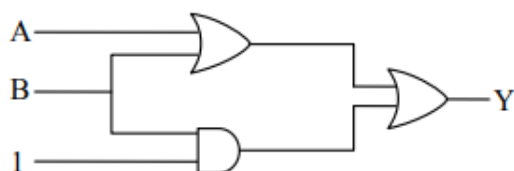
$$\left(P + \frac{a}{V^2}\right)(V - b) = RT,$$

where letters have their usual meaning?

Options:

- (1) $[M^0 L^3 T^{-2}]$
- (2) $[ML^2 T^{-2}]$
- (3) $[M^1 L^5 T^{-2}]$
- (4) $[M^4 L^7 T^4]$

Question 42: The output (Y) of the logic circuit given below is 0 only when:



Options:

- (1) $A = 1, B = 0$
- (2) $A = 0, B = 0$
- (3) $A = 1, B = 1$
- (4) $A = 0, B = 1$

Question 43: A body is moving unidirectionally under the influence of a constant power source. Its displacement in time t is proportional to:

Options:

- (1) t^2
- (2) $t^{2/3}$
- (3) $t^{3/2}$
- (4) t

Question 44: Match List-I with List-II:

List-I (EM-Wave)	List-II (Wavelength Range)
(A) Infra-red	(I) $< 10^{-3}$ nm
(B) Ultraviolet	(II) 400 nm to 1 nm
(C) X-rays	(III) 1 mm to 700 nm
(D) Gamma rays	(IV) 1 nm to 10^{-3} nm

Choose the correct answer from the options given below:

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

Question 45: During an adiabatic process, if the pressure of a gas is found to be proportional to the cube of its absolute temperature, then the ratio of $\frac{C_P}{C_V}$ for the gas is:

Options:

- (1) $\frac{5}{3}$
 (2) $\frac{3}{2}$
 (3) $\frac{7}{5}$
 (4) $\frac{3}{2}$

Question 46:

Match List-I with List-II :

	List-I		List-II
(A)	A force that restores an elastic body of unit area to its original state	(I)	Bulk modulus
(B)	Two equal and opposite forces parallel to opposite faces	(II)	Young's modulus
(C)	Forces perpendicular everywhere to the surface per unit area same everywhere	(III)	Stress
(D)	Two equal and opposite forces perpendicular to opposite faces	(IV)	Shear modulus

Choose the correct answer from the options given below :

Options:

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

Question 47: A vernier calipers has 20 divisions on the vernier scale, which coincides with the 19th division on the main scale. The least count of the instrument is 0.1 mm. One main scale division is equal to mm .

Options:

- (1) 1
 - (2) 0.5
 - (3) 2
 - (4) 5
-

Question 48: A heavy box of mass 50 kg is moving on a horizontal surface. If the coefficient of kinetic friction between the box and the horizontal surface is 0.3, then the force of kinetic friction is:

Options:

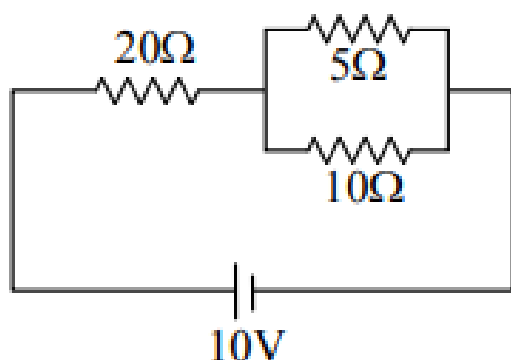
- (1) 14.7 N
 - (2) 147 N
 - (3) 1.47 N
 - (4) 1470 N
-

Question 49: A satellite revolving around a planet in a stationary orbit has a time period of 6 hours. The mass of the planet is one-fourth the mass of Earth. The radius of the orbit of the planet is (Given: Radius of geo-stationary orbit for Earth is $4.2 \times 10^4 \text{ km}$):

Options:

- (1) $1.4 \times 10^4 \text{ km}$
 - (2) $8.4 \times 10^4 \text{ km}$
 - (3) $1.68 \times 10^5 \text{ km}$
 - (4) $1.05 \times 10^4 \text{ km}$
-

Question 50: The ratio of heat dissipated per second through the resistances 5Ω and 10Ω in the circuit given below is:



Options:

- (1) 1 : 2
- (2) 2 : 1
- (3) 4 : 1
- (4) 1 : 1

Question 51: A solenoid of length 0.5 m has a radius of 1 cm and is made up of m number of turns. It carries a current of 5 A. If the magnitude of the magnetic field inside the solenoid is 6.28×10^{-3} T, then the value of m is:

Question 52: The shortest wavelength of the spectral lines in the Lyman series of the hydrogen spectrum is $915 \text{ \AA}$. The longest wavelength of spectral lines in the Balmer series will be $\text{--- \AA}$.

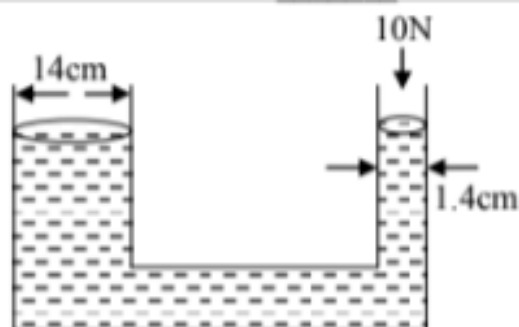
Question 53: In a single slit experiment, a parallel beam of green light of wavelength 550 nm passes through a slit of width 0.20 mm. The transmitted light is collected on a screen 100 cm away. The distance of first order minima from the central maximum will be $x \times 10^{-5}$ m. The value of x is:

Question 54: A sonometer wire of resonating length 90 cm has a fundamental frequency of 400 Hz when kept under some tension. The resonating length of the wire with a fundamental frequency of 600 Hz under the same tension is _____ cm.

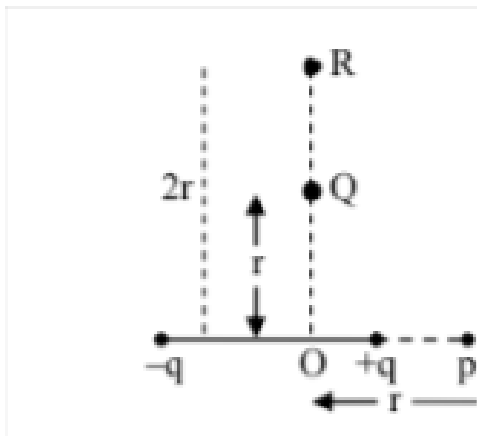
Question 55: A hollow sphere is rolling on a plane surface about its axis of symmetry. The ratio of rotational kinetic energy to its total kinetic energy is $\frac{x}{5}$. The value of x is _____.

Question 56: A hydraulic press containing water has two arms with diameters as mentioned in the figure. A force of 10 N is applied on the surface of water

in the thinner arm. The force required to be applied on the surface of water in the thicker arm to maintain equilibrium of water is _____ N.



Question 57: The electric field at point P due to an electric dipole is E . The electric field at point R on the equatorial line will be $\frac{E}{x}$. The value of x is:



Question 58: The maximum height reached by a projectile is 64 m. If the initial velocity is halved, the new maximum height of the projectile is _____ m.

Question 59: A wire of resistance $20\ \Omega$ is divided into 10 equal parts. A combination of two parts is connected in parallel, and so on. Now the resulting pairs of parallel combinations are connected in series. The equivalent resistance of the final combination is _____ Ω .

Question 60: The current in an inductor is given by $I = (3t + 8)$, where t is in seconds. The magnitude of the induced emf produced in the inductor is 12 mV. The self-inductance of the inductor is _____ mH.

Chemistry

Question 61: Match List-I with List-II.

List-I	List-II
(A) ICl	(I) T-Shape
(B) ICl_3	(II) Square pyramidal
(C) ClF_5	(III) Pentagonal bipyramidal
(D) IF_7	(IV) Linear

Options:

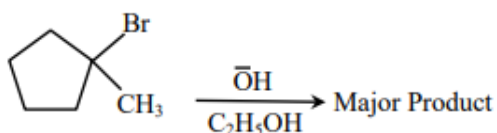
- (1) (A)–(I), (B)–(IV), C–(III), D–(II)
- (2) (A)–(I), (B)–(III), C–(II), D–(IV)
- (3) (A)–(IV), (B)–(I), C–(II), D–(III)
- (4) (A)–(IV), (B)–(III), C–(II), D–(I)

Question 62: While preparing crystals of Mohr's salt, dil. H_2SO_4 is added to a mixture of ferrous sulphate and ammonium sulphate. Before dissolving this mixture in water, dil. H_2SO_4 is added here to:

Options:

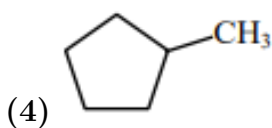
- (1) prevent the hydrolysis of ferrous sulphate
- (2) prevent the hydrolysis of ammonium sulphate
- (3) make the medium strongly acidic
- (4) increase the rate of formation of crystals

Question 63: Identify the major product in the following reaction.

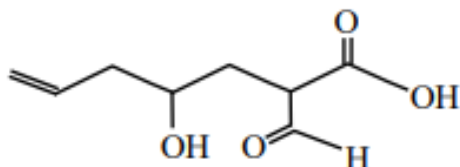


Options:

- (1)
- (2)
- (3)



Question 64: The correct nomenclature for the following compound is:



Options:

- (1) 2-carboxy-4-hydroxyhept-6-enal
- (2) 2-carboxy-4-hydroxyhept-7-enal
- (3) 2-formyl-4-hydroxyhept-6-enoic acid
- (4) 2-formyl-4-hydroxyhept-7-enoic acid

Question 65: Given below are two statements: one is labeled as Assertion (A) and the other is labeled as Reason (R).

Assertion (A): NH_3 and NF_3 molecules have a pyramidal shape with a lone pair of electrons on the nitrogen atom. The resultant dipole moment of NH_3 is greater than that of NF_3 .

Reason (R): In NH_3 , the orbital dipole due to the lone pair is in the same direction as the resultant dipole moment of the $N-H$ bonds. F is the most electronegative element.

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

Options:

- (1) Both (A) and (R) are true, and (R) is the correct explanation of (A).
- (2) (A) is false, but (R) is true.
- (3) (A) is true, but (R) is false.
- (4) Both (A) and (R) are true, but (R) is NOT the correct explanation of (A).

Question 66: Given below are two statements:

Statement I: On passing $HCl(g)$ through a saturated solution of $BaCl_2$, at room temperature, white turbidity appears.

Statement II: When $HCl(g)$ is passed through a saturated solution of $NaCl$, sodium chloride is precipitated due to the common ion effect.

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

Options:

- (1) Statement I is correct but Statement II is incorrect
 - (2) Both Statement I and Statement II are incorrect
 - (3) Statement I is incorrect but Statement II is correct
 - (4) Both Statement I and Statement II are correct
-

Question 67:

The metal atom present in the complex $MABXL$ (where A , B , X , and L are unidentate ligands and M is metal) involves sp^3 hybridization. The number of geometrical isomers exhibited by the complex is:

Options:

- (1) 4
 - (2) 0
 - (3) 2
 - (4) 3
-

Question 68: Match List-I with List-II.

List-I (Pair of Compounds)	List-II (Isomerism)
(A) n -propanol and isopropanol	(I) Metamerism
(B) Methoxypropane and ethoxyethane	(II) Chain Isomerism
(C) Propanone and propanal	(III) Position Isomerism
(D) Neopentane and isopentane	(IV) Functional Isomerism

Options:

- (1) (A)–(III), (B)–(I), (C)–(IV), (D)–(II)
 - (2) (A)–(II), (B)–(I), (C)–(IV), (D)–(III)
 - (3) (A)–(I), (B)–(III), (C)–(IV), (D)–(II)
 - (4) (A)–(IV), (B)–(I), (C)–(III), (D)–(II)
-

Question 69: The quantity of silver deposited when one coulomb charge is passed through $AgNO_3$ solution:

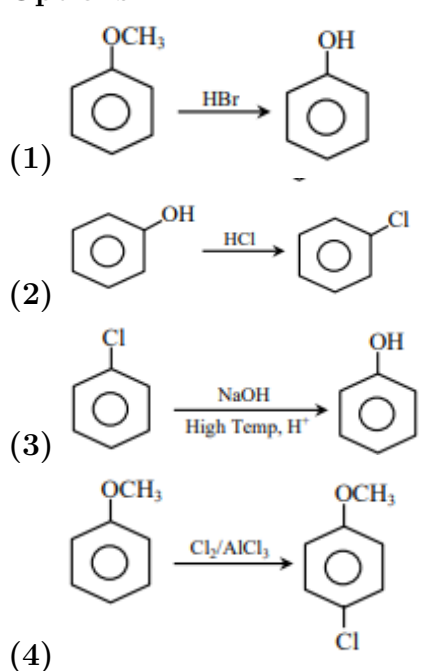
Options:

- (1) 0.1 g atom of silver
- (2) 1 chemical equivalent of silver
- (3) 1 g of silver

(4) 1 electrochemical equivalent of silver

Question 70: Which one of the following reactions is NOT possible?

Options:



Question 71: Given below are two statements:

Statement I: The metallic radius of Na is $1.86 \text{ \AA}$, and the ionic radius of Na^+ is lesser than $1.86 \text{ \AA}$.

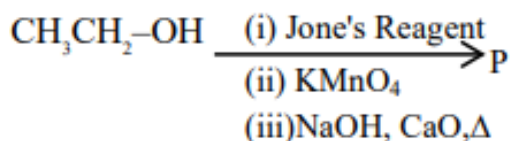
Statement II: Ions are always smaller in size than the corresponding elements.

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

Options:

- (1) Statement I is correct but Statement II is false
- (2) Both Statement I and Statement II are true
- (3) Both Statement I and Statement II are false
- (4) Statement I is incorrect but Statement II is true

Question 72:

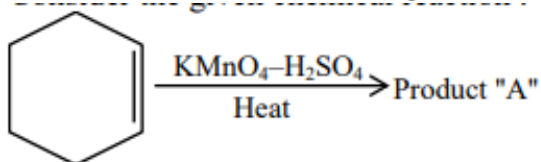


Consider the above reaction sequence and identify the major product *P*.

Options:

- (1) Methane
- (2) Methanal
- (3) Methoxymethane
- (4) Methanoic acid

Question 73: Consider the given chemical reaction:

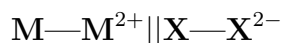


Product "A" is:

Options:

- (1) Picric acid
- (2) Oxalic acid
- (3) Acetic acid
- (4) Adipic acid

Question 74: For the electrochemical cell:



If:

$$E^\circ(\text{M}^{2+}/\text{M}) = 0.46 \text{ V}, \quad E^\circ(\text{X}/\text{X}^{2-}) = 0.34 \text{ V},$$

Which of the following is correct?

Options:

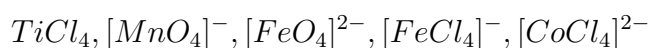
- (1) $E_{\text{cell}} = -0.80 \text{ V}$
- (2) $\text{M} + \text{X}^{2-} \rightarrow \text{M}^{2+} + \text{X}$ is a spontaneous reaction
- (3) $\text{M}^{2+} + \text{X}^{2-} \rightarrow \text{M} + \text{X}$ is a spontaneous reaction
- (4) $E_{\text{cell}} = 0.80 \text{ V}$

Question 75: The number of moles of methane required to produce 11 g of $\text{CO}_2(g)$ after complete combustion is:
(Given molar mass of methane in g mol^{-1} : 16)

Options:

- (1) 0.75
 (2) 0.25
 (3) 0.35
 (4) 0.5

Question 76: The number of complexes from the following with no electrons in the t_2 orbital is:



Options:

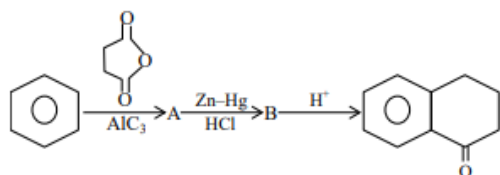
- (1) 3
 (2) 1
 (3) 4
 (4) 2

Question 77: The number of ions from the following that have the ability to liberate hydrogen from a dilute acid is _____: Ti^{2+}, Cr^{2+}, V^{2+}

Options:

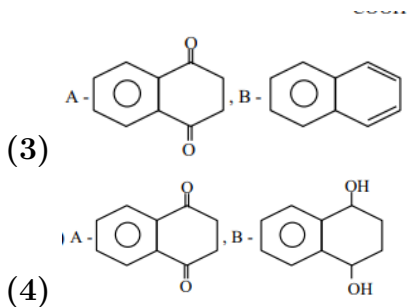
- (1) 0
 (2) 2
 (3) 3
 (4) 1

Question 78: Identify A and B in the given chemical reaction sequence : -



Options:

- (1) A - B -
 (2) A - B -



Question 79: The correct statements from the following are:

- (A) The decreasing order of atomic radii of group 13 elements is $Tl > In > Ga > Al > B$.
- (B) Down the group 13, electronegativity decreases from top to bottom.
- (C) Al dissolves in dilute HCl and liberates H_2 , but concentrated HNO_3 renders Al passive by forming a protective oxide layer on the surface.
- (D) All elements of group 13 exhibit a highly stable +1 oxidation state.
- (E) Hybridization of Al in $[Al(H_2O)_6]^{3+}$ ion is sp^3d^2 .

Choose the correct answer from the options given below:

Options:

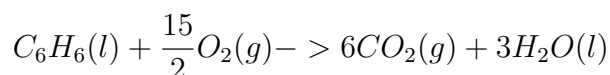
- (1) (C) and (E) only
- (2) (A), (C) and (E) only
- (3) (A), (B), (C) and (E) only
- (4) (A) and (C) only

Question 80: Coagulation of egg, on heating, is because of:

Options:

- (1) Denaturation of protein occurs
- (2) The secondary structure of protein remains unchanged
- (3) Breaking of the peptide linkage in the primary structure of protein occurs
- (4) Biological property of protein remains unchanged

Question 81: Combustion of 1 mole of benzene is expressed as:



The standard enthalpy of combustion of 2 mol of benzene is $-x$ kJ. Calculate the value of x given the following data:

Standard enthalpy of formation of $C_6H_6(l)$: 48.5 kJ mol^{-1} .

Standard enthalpy of formation of $CO_2(g)$: $-393.5 \text{ kJ mol}^{-1}$.

Standard enthalpy of formation of $H_2O(l)$: -286 kJ mol^{-1} .

Question 82:

The fusion of chromite ore with sodium carbonate in the presence of air leads to the formation of products A and B along with the evolution of CO_2 . The sum of spin-only magnetic moment values of A and B is ____ B.M. (Nearest integer).

(Given atomic numbers: $C = 6, Na = 11, O = 8, Fe = 26, Cr = 24$)

Question 83: X of ethanamine was subjected to reaction with $NaNO_2/HCl$ followed by hydrolysis to liberate N_2 and HCl . The HCl generated was completely neutralized by 0.2 moles of $NaOH$. X is ____ g.

Question 84: In an atom, the total number of electrons having quantum numbers $n = 4$, $|m_l| = 1$, and $m_s = -\frac{1}{2}$ is:

Question 85: Using the given figure, the ratio of R_f values of sample A and sample C is $x \times 10^{-2}$. Value of x is:

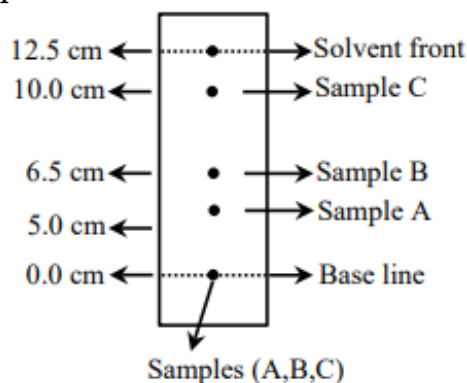
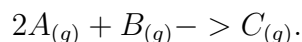


Fig : Paper chromatography of Samples

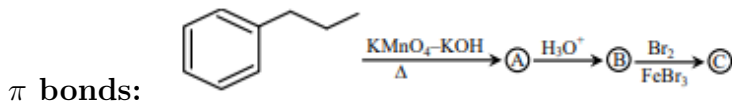
Question 86: In the Claisen-Schmidt reaction to prepare 351 g of dibenzalacetone using 87 g of acetone, the amount of benzaldehyde required is ____ g. (Nearest integer)

Question 87: Consider the following single-step reaction in the gas phase at constant temperature:



The initial rate of the reaction is recorded as r_1 , when the reaction starts with 1.5 atm pressure of A and 0.7 atm pressure of B . After some time, the rate r_2 is recorded when the pressure of C becomes 0.5 atm. The ratio $\frac{r_1}{r_2}$ is ____ $\times 10^{-1}$ (Nearest integer).

Question 88: The product *C* in the following sequence of reactions has -----



Question 89: Considering acetic acid dissociates in water, its dissociation constant is 6.25×10^{-5} . If 5 mL of acetic acid is dissolved in 1 litre of water, the solution will freeze at $-x \times 10^{-2} ^\circ\text{C}$, provided pure water freezes at 0°C . $x = \text{---}$. (nearest Integer) Given:

- K_f of water = $1.86 \text{ K kg mol}^{-1}$,
- Density of acetic acid = 1.2 g cm^{-3} ,
- Molar mass of water = 18 g mol^{-1} ,
- Molar mass of acetic acid = 60 g mol^{-1} ,
- Density of water = 1 g cm^{-3} .

Acetic acid dissociates as:



Question 90: The number of compounds from the following with zero dipole moment is -----:

