JEE Main 2024 Jan 27 (Shift 2) Question Paper

Question 1: Considering only the principal values of inverse trigonometric functions, the number of positive real values of x satisfying $\tan^{-1}(x) + \tan^{-1}(2x) = \frac{\pi}{4}$ is:

Options:

(1) More than 2

(2) 1

(3) 2

(4) 0

Question 2: Consider the function $f : (0,2) \to \mathbb{R}$ defined by $f(x) = \frac{x}{2} + \frac{2}{x}$ and the function $g(x)$ defined by

$$g(x) = \begin{cases} \min\{f(t)\} & \text{for } 0 < t \le x \text{ and } 0 < x \le 1 \\ \frac{3}{2} + x & \text{for } 1 < x < 2 \end{cases}.$$

Then:

Options:

(1) g is continuous but not differentiable at $x = 1$

(2) g is not continuous for all $x \in (0,2)$

(3) g is neither continuous nor differentiable at $x = 1$

(4) g is continuous and differentiable for all $x \in (0,2)$

Question 3: Let the image of the point $(1,0,7)$ in the line $\frac{x}{1} = \frac{y-1}{2} = \frac{z-2}{3}$ be the point (α, β, γ). Then which one of the following points lies on the line passing through (α, β, γ) and making angles $\frac{2\pi}{3}$ and $\frac{3\pi}{4}$ with y-axis and z-axis respectively and an acute angle with x-axis?

Options:

(1) $\left(1, -2, 1 + \sqrt{2}\right)$

(2) $\left(1, 2, 1 - \sqrt{2}\right)$

(3) $\left(3, 4, 3 - 2\sqrt{2}\right)$

(4) $\left(3, -4, 3 + 2\sqrt{2}\right)$

Question 4: Let R be the interior region between the lines $3x - y + 1 = 0$ and $x + 2y - 5 = 0$ containing the origin. The set of all values of a, for which the points $(a^2, a + 1)$ lie in R, is:

Options:

(1) $(-3, -1) \cup \left(-\frac{1}{3}, 1\right)$

(2) $(-3, 0) \cup \left(-\frac{1}{3}, 1\right)$

(3) $(-3, 0) \cup \left(\frac{2}{3}, 1\right)$

(4) $(-3, -1) \cup \left(-\frac{1}{3}, 1\right)$

Question 5: The 20th term from the end of the progression $20, 19\frac{1}{4}, 18\frac{1}{2}, 17\frac{3}{4}, \ldots, -129\frac{1}{4}$ is:

Options:

(1) -118

(2) -110

(3) -115

(4) -100

Question 6: Let $f : \mathbb{R} \setminus \left\{-\frac{1}{2}\right\} \to \mathbb{R}$ and $g : \mathbb{R} \setminus \left\{-\frac{5}{2}\right\} \to \mathbb{R}$ be defined as $f(x) = \frac{2x+3}{2x+1}$ and $g(x) = \frac{|x|+1}{2x+5}$. Then the domain of the function $f \circ g$ is:

Options:

(1) $\mathbb{R} \setminus \left\{-\frac{5}{2}\right\}$

(2) $\mathbb{R}$

(3) $\mathbb{R} \setminus \left\{-\frac{7}{4}\right\}$

(4) $\mathbb{R} \setminus \left\{-\frac{5}{2}, -\frac{7}{4}\right\}$

Question 7: For $0 < a < 1$, the value of the integral $\int_0^\pi \frac{dx}{1 - 2a\cos x + a^2}$ is:

Options:

(1) $\frac{\pi^2}{\pi + a^2}$

(2) $\frac{\pi^2}{\pi - a^2}$

(3) $\frac{\pi}{1 - a^2}$

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

Question 8: Let $g(x) = 3f\left(\frac{x}{3}\right) + f(3 - x)$ and $f''(x) > 0$ for all $x \in (0, 3)$. If g is decreasing in $(0, \alpha)$ and increasing in $(\alpha, 3)$, then 8α is:

Options:

(1) 24

(2) 0

(3) 18

(4) 20

Question 9: If $\lim_{x \to 0} \frac{3 + \alpha \sin x + \beta \cos x + \log_e(1 - x)}{3 \tan^2 x} = \frac{1}{3}$, then $2\alpha - \beta$ is equal to:

Options:

(1) 2

(2) 7

(3) 5

(4) 1

Question 10: If α, β are the roots of the equation $x^2 - x - 1 = 0$ and $S_n = 2023\alpha^n + 2024\beta^n$, then:

Options:

(1) $2S_{12} = S_{11} + S_{10}$

(2) $S_{12} = S_{11} + S_{10}$

(3) $2S_{11} = S_{12} + S_{10}$

(4) $S_{11} = S_{10} + S_{12}$

Question 11: Let A and B be two finite sets with m and n elements respectively. The total number of subsets of the set A is **56** more than the total number of subsets of B. Then the distance of the point $P(m, n)$ from the point $Q(-2, -3)$ is:

Options:

(1) 10

(2) 6

(3) 4

(4) 8

Question 12: The values of α for which

$$\begin{vmatrix} 1 & \frac{3}{2} & \alpha + \frac{3}{2} \\ 1 & \frac{1}{3} & \alpha + \frac{1}{3} \\ 2\alpha + 3 & 3\alpha + 1 & 0 \end{vmatrix} = 0$$

lie in the interval:

Options:

(1) $(-2, 1)$

(2) $(-3, 0)$

(3) $\left(-\frac{3}{2}, \frac{3}{2}\right)$

(4) $(0, 3)$

Question 13: An urn contains 6 white and 9 black balls. Two successive draws of 4 balls are made without replacement. The probability that the first draw gives all white balls and the second draw gives all black balls is:

Options:

(1) $\frac{5}{256}$

(2) $\frac{5}{715}$

(3) $\frac{3}{715}$

(4) $\frac{3}{256}$

Question 14: The integral $\int \frac{(x^8 - x^2)dx}{(x^{12} + 3x^6 + 1) \tan^{-1}\left(x^3 + \frac{1}{x^3}\right)}$ **is equal to:**

Options:

(1) $\log_e \left[\tan^{-1}\left(x^3 + \frac{1}{x^3}\right)\right]^{1/3} + C$

(2) $\log_e \left[\tan^{-1}\left(x^3 + \frac{1}{x^3}\right)\right]^{1/2} + C$

(3) $\log_e \left[\tan^{-1}\left(x^3 + \frac{1}{x^3}\right)\right] + C$

(4) $\log_e \left[\tan^{-1}\left(x^3 + \frac{1}{x^3}\right)\right]^{3} + C$

Question 15: If $2\tan^2\theta - 5\sec\theta = 1$ **has exactly 7 solutions in the interval** $\left[0, \frac{n\pi}{2}\right]$**, for the least value of** $n \in \mathbb{N}$**, then** $\sum_{k=1}^{n} \frac{k}{2^k}$ **is equal to:**

Options:

(1) $\frac{1}{2^{15}}(2^{14} - 14)$

(2) $\frac{1}{2^{14}}(2^{15} - 15)$

(3) $1 - \frac{15}{2^{13}}$

(4) $\frac{1}{2^{13}}(2^{14} - 15)$

Question 16: The position vectors of the vertices A, B, **and** C **of a triangle are** $\vec{A} = 2\vec{i} - 3\vec{j} + 3\vec{k}$, $\vec{B} = 2\vec{i} + 2\vec{j} + 3\vec{k}$, **and** $\vec{C} = -\vec{i} + \vec{j} + 3\vec{k}$ **respectively. Let** ℓ **denote the length of the angle bisector** AD **of** $\angle BAC$ **where** D **is on the line segment** BC**. Then** $2\ell^2$ **equals:**

Options:

(1) 49

(2) 42

(3) 50

(4) 45

Question 17: If $y = y(x)$ **is the solution curve of the differential equation** $(x^2 - 4)dy - (y^2 -$

5

$3y)dx = 0$, $x > 2$, $y(4) = \frac{3}{2}$, **and the slope of the curve is never zero, then the value of** $y(10)$ **equals:**

Options:

(1) $\frac{3}{1+(8)^{1/4}}$

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

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

(4) $\frac{3}{1-(8)^{1/4}}$

Question 18: Let e_1 **be the eccentricity of the hyperbola** $\frac{x^2}{16} - \frac{y^2}{9} = 1$ **and** e_2 **be the eccentricity of the ellipse** $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$, $a > b$, **which passes through the foci of the hyperbola. If** $e_1 e_2 = 1$, **then the length of the chord of the ellipse parallel to the** x**-axis and passing through** $(0, 2)$ **is:**

Options:

(1) $4\sqrt{5}$

(2) $\frac{8\sqrt{5}}{3}$

(3) $\frac{10\sqrt{5}}{3}$

(4) $3\sqrt{5}$

Question 19: Let $\alpha = \frac{(4!)!}{(4!)^{3!}}$ **and** $\beta = \frac{(5!)!}{(5!)^{4!}}$. **Then:**

Options:

(1) $\alpha \in \mathbb{N}$ and $\beta \notin \mathbb{N}$

(2) $\alpha \notin \mathbb{N}$ and $\beta \in \mathbb{N}$

(3) $\alpha \in \mathbb{N}$ and $\beta \in \mathbb{N}$

(4) $\alpha \notin \mathbb{N}$ and $\beta \notin \mathbb{N}$

Question 20: Let the position vectors of the vertices A, B **and** C **of a triangle be** $2\vec{i} + 2\vec{j} + \vec{k}$, $\vec{i} + 2\vec{j} + 2\vec{k}$, **and** $2\vec{i} + \vec{j} + 2\vec{k}$ **respectively. Let** l_1, l_2 **and** l_3 **be the lengths of perpendiculars drawn from the orthocenter of the triangle on the sides** AB, BC **and** CA **respectively, then** $l_1^2 + l_2^2 + l_3^2$

equals:

Options:

(1) $\frac{1}{5}$

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

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

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

Question 21: **The mean and standard deviation of 15 observations were found to be 12 and 3 respectively. On rechecking, it was found that an observation was read as 10 in place of 12. If μ and σ^2 denote the mean and variance of the correct observations respectively, then $15(\mu + \mu^2 + \sigma^2)$ is equal to:**

Options:

(1) 2521

(2) 2436

(3) 2485

(4) 2500

Question 22: **If the area of the region $\{(x,y) : 0 \le y \le \min(2x, 6x - x^2)\}$ is A, then $12A$ is equal to:**

Options:

(1) 288

(2) 304

(3) 324

(4) 336

Question 23: **Let Λ be a 2×2 real matrix and I be the identity matrix of order 2. If the roots of the equation $|\Lambda - xI| = 0$ be -1 and 3, then the sum of the diagonal elements of the matrix Λ^2 is:**

Options:

(1) 8

(2) 10

(3) 12

(4) 14

Question 24: If the sum of squares of all real values of α, for which the lines $2x - y + 3 = 0$, $6x + 3y + 1 = 0$, and $ax + 2y - 2 = 0$ do not form a triangle is p, then the greatest integer less than or equal to p is:

Options:

(1) 32

(2) 30

(3) 28

(4) 24

Question 25: The coefficient of x^{2012} in the expansion of $(1 - x)^{2008}(1 + x + x^2)^{2007}$ is equal to:

Options:

(1) 0

(2) 2012

(3) 2008

(4) 4014

Question 26: If the solution curve of the differential equation $\frac{dy}{dx} = \frac{x+y-2}{x-y}$ passing through the point $(2, 1)$ is

$$\tan^{-1}\left(\frac{y-1}{x-1}\right) - \frac{1}{\beta}\log_e\left(\alpha + \left(\frac{y-1}{x-1}\right)^2\right) = \log_e|x - 1|,$$

then $5\beta + \alpha$ is equal to:

(1) 9

(2) 10

(3) 11

(4) 12

Question 27: Let $f(x) = \int_0^x g(t) \log_e \left(\frac{1-t}{1+t}\right) dt$, **where** g **is a continuous odd function. If**

$$I = \int_{-\pi/2}^{\pi/2} (f(x) \cdot \frac{x^2 \cos x}{1 + e^x}) dx = \left(\frac{\pi}{\alpha}\right)^2 - \alpha,$$

then α **is equal to:**

Options:

(1) 1

(2) 2

(3) 3

(4) 4

Question 28: Consider a circle $(x - \alpha)^2 + (y - \beta)^2 = 50$, **where** $\alpha, \beta > 0$. **If the circle touches the line** $y + x = 0$ **at the point** P, **whose distance from the origin is** $4\sqrt{2}$, **then** $(\alpha + \beta)^2$ **is equal to:**

Options:

(1) 36

(2) 64

(3) 81

(4) 100

Question 29: The lines $\frac{x-2}{1} = \frac{y-1}{-1} = \frac{z-7}{8}$ **and** $\frac{x+3}{4} = \frac{y+2}{3} = \frac{z+2}{1}$ **intersect at the point** P. **If the distance of** P **from the line** $\frac{x+1}{2} = \frac{y-1}{3} = \frac{z-1}{1}$ **is** l, **then** $14l^2$ **is equal to:**

Options:

(1) 108

(2) 112

(3) 120

(4) 128

Question 30: Let the complex numbers α and $\frac{1}{\alpha}$ lie on the circles $|z - z_0|^2 = 4$ and $|z - z_0|^2 = 16$ respectively, where $z_0 = 1 + i$. Then, the value of $100|\alpha|^2$ is:

Options:

(1) 20

(2) 40

(3) 60

(4) 80

Question 31: The equation of state of a real gas is given by $\left(P + \frac{a}{V^2}\right)(V - b) = RT$, where P, V, and T are pressure, volume, and temperature respectively and R is the universal gas constant. The dimensions of $\frac{a}{b^2}$ is similar to that of:

Options:

(1) PV

(2) P

(3) RT

(4) R

Question 32: Wheatstone bridge principle is used to measure the specific resistance (S_l) of a given wire, having length L and radius r. If X is the resistance of the wire, then specific resistance is: $S_l = X\left(\frac{\pi r^2}{L}\right)$. If the length of the wire gets doubled, then the value of specific resistance will be:

Options:

(1) $\frac{S_l}{4}$

(2) $2S_l$

(3) $\frac{S_l}{2}$

(4) S_l

Question 33: Given below are two statements: one is labelled as Assertion (A) and the other is labelled as Reason (R).

Assertion (A): The angular speed of the moon in its orbit about the earth is more than the angular speed of the earth in its orbit about the sun.

Reason (R): The moon takes less time to move around the earth than the time taken by the earth to move around the sun.

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

Options:

(1) (A) is correct but (R) is not correct

(2) Both (A) and (R) are correct and (R) is the correct explanation of (A)

(3) Both (A) and (R) are correct but (R) is not the correct explanation of (A)

(4) (A) is not correct but (R) is correct

Question 34: Given below are two statements:

Statement I: The limiting force of static friction depends on the area of contact and is independent of materials.

Statement II: The limiting force of kinetic friction is independent of the area of contact and depends on materials.

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) Statement I is incorrect but Statement II is correct

(3) Both Statement I and Statement II are incorrect

(4) Both Statement I and Statement II are correct

Question 35: The truth table of the given circuit diagram is:
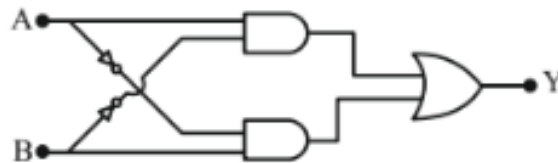
Options:

(1)

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

(2)

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

(3)

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

(4)

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

Question 36: A current of 200 μA deflects the coil of a moving coil galvanometer through $60°$. The current to cause deflection through $\frac{\pi}{10}$ radian is:

Options:

(1) 30 μA

(2) 120 μA

(3) 60 μA

(4) 180 μA

Question 37: The atomic mass of $_6\text{C}^{12}$ is 12.000000 u and that of $_6\text{C}^{13}$ is 13.003354 u. The required energy to remove a neutron from $_6\text{C}^{13}$, if the mass of the neutron is 1.008665 u, will be:
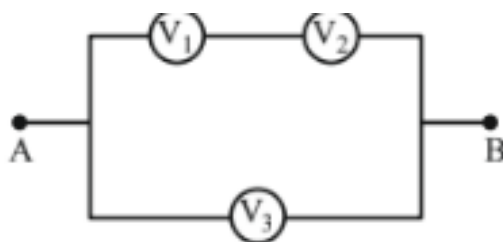
Options:

(1) 62.5 MeV

(2) 6.25 MeV

(3) 4.95 MeV

(4) 49.5 MeV

Question 38: A ball suspended by a thread swings in a vertical plane so that its magnitude of acceleration in the extreme position and lowest position are equal. The angle (θ) of thread deflection in the extreme position will be:

Options:

(1) $\tan^{-1}(\sqrt{2})$

(2) $2\tan^{-1}\left(\frac{1}{2}\right)$

(3) $\tan^{-1}\left(\frac{1}{2}\right)$

(4) $2\tan^{-1}\left(\frac{1}{\sqrt{5}}\right)$

Question 39: Three voltmeters, all having different internal resistances are joined as shown in figure. When some potential difference is applied across A and B, their readings are V_1, V_2, and V_3. Choose the correct option.

Options:

(1) $V_1 = V_2$

(2) $V_1 \neq V_3 - V_2$

(3) $V_1 + V_2 > V_3$

(4) $V_1 + V_2 = V_3$

Question 40: The total kinetic energy of 1 mole of oxygen at 27°C is:

Options:

(1) 6845.5 J

(2) 5942.0 J

(3) 6232.5 J

(4) 5670.5 J

Question 41: Given below are two statements: one is labelled as Assertion (A) and the other is labelled as Reason (R).

Assertion (A): In a Vernier calliper, if a positive zero error exists, then while taking measurements, the reading taken will be more than the actual reading.

Reason (R): The zero error in a Vernier calliper might have happened due to manufacturing defect or due to rough handling.

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

(1) Both (A) and (R) are correct and (R) is the correct explanation of (A)

(2) Both (A) and (R) are correct but (R) is not the correct explanation of (A)

(3) (A) is true but (R) is false

(4) (A) is false but (R) is true

Question 42: Primary side of a transformer is connected to 230 V, 50 Hz supply. Turns ratio of primary to secondary winding is 10 : 1. Load resistance connected to secondary side is 46 Ω. The power consumed in it is:

Options:

(1) 12.5 W

(2) 10.0 W

(3) 11.5 W

(4) 12.0 W

Question 43: During an adiabatic process, the pressure of a gas is found to be proportional to the cube of its absolute temperature. 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) $\frac{9}{7}$

Question 44: The threshold frequency of a metal with work function 6.63 eV is:

Options:

(1) 16×10^{15} Hz

(2) 16×10^{12} Hz

(3) 1.6×10^{12} Hz

(4) 1.6×10^{15} Hz

Question 45: Given below are two statements: one is labelled as Assertion (A) and the other is labelled as Reason (R).

Assertion (A): The property of a body, by virtue of which it tends to regain its original shape when the external force is removed, is Elasticity.

Reason (R): The restoring force depends upon the bonded interatomic and intermolecular force of solids.

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

(1) (A) is false but (R) is true

(2) (A) is true but (R) is false

(3) Both (A) and (R) are true and (R) is the correct explanation of (A)

(4) Both (A) and (R) are true but (R) is not the correct explanation of (A)

Question 46: When a polaroid sheet is rotated between two crossed polaroids, then the transmitted light intensity will be maximum for a rotation of:

Options:

(1) $60°$

(2) $30°$

(3) $90°$

(4) $45°$

Question 47: An object is placed in a medium of refractive index 3. An electromagnetic wave of intensity 6×10^8 W/m^2 falls normally on the object and it is absorbed completely. The radiation pressure on the object would be (speed of light in free space $c = 3 \times 10^8$ m/s):

Options:

(1) 36 Nm^{-2}

(2) 18 Nm^{-2}

(3) 6 Nm^{-2}

(4) 2 Nm^{-2}

Question 48: Given below are two statements: one is labelled as Assertion (A) and the other is labelled as Reason (R).

Assertion (A): Work done by electric field on moving a positive charge on an equipotential surface is always zero.

Reason (R): Electric lines of forces are always perpendicular to equipotential surfaces.

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

(1) Both (A) and (R) are correct but (R) is not the correct explanation of (A)

(2) (A) is correct but (R) is not correct

(3) (A) is not correct but (R) is correct

(4) Both (A) and (R) are correct and (R) is the correct explanation of (A)

Question 49: A heavy iron bar of weight 12 kg is having its one end on the ground and the other on the shoulder of a man. The rod makes an angle $60°$ with the horizontal, the weight experienced by the man is:

Options:

(1) 6 kg

(2) 12 kg

(3) 3 kg

(4) $6\sqrt{3}$ kg

Question 50: A bullet is fired into a fixed target and loses one third of its velocity after travelling 4 cm. It penetrates further $D \times 10^{-3}$ m before coming to rest. The value of D is:

Options:

(1) 2

(2) 5

(3) 3

(4) 4

Question 51: The magnetic field at the centre of a wire loop formed by two semicircular wires of radii $R_1 = 2$ m and $R_2 = 4$ m carrying current $I = 4$ A as per figure given below is $\alpha \times 10^{-7}$ T. The value of α is _____. (Centre O is common for all segments)
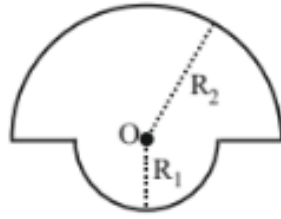
Question 52: Two charges of $-4\,\mu$C and $+4\,\mu$C are placed at the points $\mathbf{A}(1, 0, 4)$ m and $\mathbf{B}(2, -1, 5)$ m located in an electric field $\vec{E} = 0.20i$ V/cm. The magnitude of the torque acting on the dipole is $8\sqrt{\alpha} \times 10^{-5}$ Nm, where $\alpha =$ _____.

Question 53: A closed organ pipe 150 cm long gives 7 beats per second with an open organ pipe of length 350 cm, both vibrating in fundamental mode. The velocity of sound is _____ m/s.

Question 54: A body falling under gravity covers two points A and B separated by 80 m in 2s. The distance of upper point A from the starting point is _____ m (use $g = 10\,\text{m/s}^2$).

Question 55: The reading of a pressure meter attached with a closed pipe is $4.5 \times 10^4\,\text{N/m}^2$. On opening the valve, water starts flowing and the reading of pressure meter falls to $2.0 \times 10^4\,\text{N/m}^2$. The velocity of water is found to be $\sqrt{V}$ m/s. The value of V is _____.

Question 56: A ring and a solid sphere roll down the same inclined plane without slipping. They start from rest. The radii of both bodies are identical and the ratio of their kinetic energies is $\frac{7}{x}$ where x is _____.

Question 57: A parallel beam of monochromatic light of wavelength $5000\,\text{Å}$ is incident normally on a single narrow slit of width $0.001\,\text{mm}$. The light is focused by a convex lens on a screen, placed on its focal plane. The first minima will be formed for the angle of diffraction of _____ (degree).


Question 58: The electric potential at the surface of an atomic nucleus $(Z = 50)$ of radius

18

9×10^{-13} **cm is** _____ $\times 10^6$ **V.**

Question 59: If Rydberg's constant is R, the longest wavelength of radiation in the Paschen series will be $\frac{\alpha}{7R}$, where $\alpha =$ _____ **.**

Question 60: A series LCR circuit with $L = \frac{100}{\pi}$ mH, $C = 10^{-3}$ F, and $R = 10\,\Omega$, is connected across an ac source of 220 V, 50 Hz supply. The power factor of the circuit would be _____ **.**

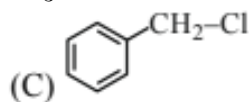**Question 61: The order of relative stability of the contributing structures is:**
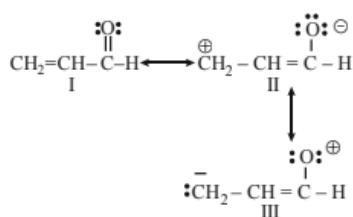
Options:

(1) I > II > III

(2) II > I > III

(3) I = II = III

(4) III > II > I

Question 62: Which among the following halide(s) will not show S_N1 reaction:

Options:

(A) $H_2C = CH - CH_2Cl$

(B) $CH_3 - CH = CH - Cl$

(C)

(D)
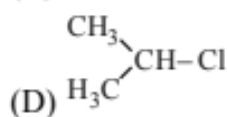
Choose the most appropriate answer from the options given below:

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

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(2) (A) and (B) only

(3) (B) and (C) only

(4) (B) only

Question 63: Which of the following statements is not correct about rusting of iron?

Options:

(1) Coating of iron surface by tin prevents rusting, even if the tin coating is peeled off.

(2) When pH lies above 9 or 10, rusting of iron does not take place.

(3) Dissolved acidic oxides SO_2, NO_2 in water act as catalyst in the process of rusting.

(4) Rusting of iron is envisaged as setting up of electrochemical cell on the surface of iron object.

Question 64: Given below are two statements:

Statement (I): In the Lanthanides, the formation of Ce^{4+} is favored by its noble gas configuration.

Statement (II): Ce^{4+} is a strong oxidant reverting to the common +3 state.

Choose the correct option:

(1) Statement I is false but Statement II is true

(2) Both Statement I and Statement II are true

(3) Statement I is true but Statement II is false

(4) Both Statement I and Statement II are false

Question 65: Choose the correct option having all the elements with d^{10} electronic configuration from the following:

Options:

(1) Zn, Co^{2+}, Ni, Fe^{2+}, Cr

(2) Cu, Zn, Ag, Cd

(3) Pd, Ni, Fe^{2+}, Cr

(4) Ni, Zn, Fe^{2+}, Cu

Question 66: Phenolic group can be identified by a positive:

Options:

(1) Phthalein dye test

(2) Lucas test

(3) Tollen's test

(4) Carbylamine test

Question 67: The molecular formula of second homologue in the homologous series of mono carboxylic acids is:
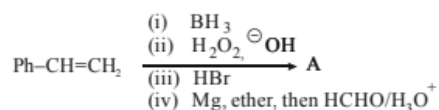
Options:

(1) $C_3H_6O_2$

(2) $C_2H_4O_2$

(3) CH_2O

(4) $C_2H_2O_2$

Question 68: The technique used for purification of steam volatile water immiscible substance is:

Options:

(1) Fractional distillation

(2) Fractional distillation under reduced pressure
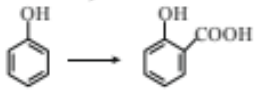
(3) Distillation

(4) Steam distillation
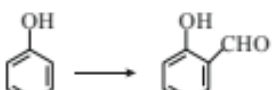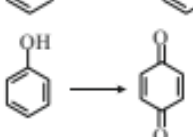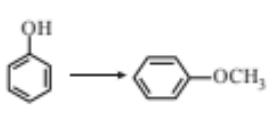
Question 69: The final product A, formed in the following reaction sequence is:

$$Ph-CH=CH_2 \xrightarrow[\substack{\text{(iii) HBr} \\ \text{(iv) Mg, ether, then HCHO/H}_3O^+}]{\substack{\text{(i) BH}_3 \\ \text{(ii) H}_2O_2, \ominus OH}} A$$

Options:

(1) Ph - CH$_2$ - CH$_2$ - CH$_3$

(2) Ph - CH - CH$_3$ (with CH$_3$ substituent on the CH carbon)

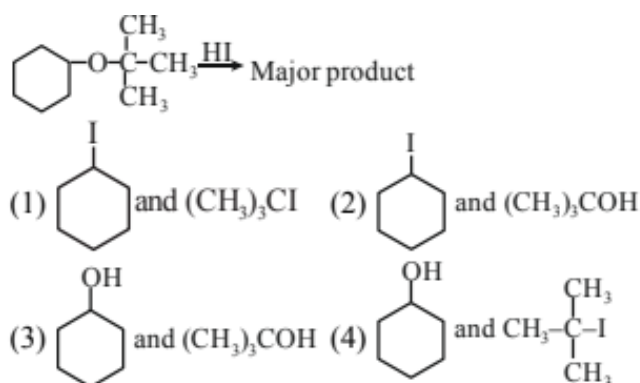(3) Ph - CH - CH$_3$ (with CH$_2$OH substituent on the CH carbon)

(4) Ph - CH$_2$ - CH$_2$ - CH$_2$ - OH

Question 70: Match List-I with List-II.

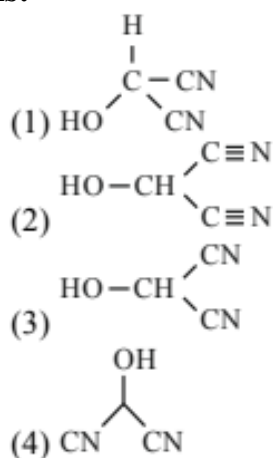| List – I (Reaction)	List – II (Reagent(s))
(A) phenol → salicylic acid (2-hydroxybenzoic acid)	(I) Na$_2$Cr$_2$O$_7$, H$_2$SO$_4$
(B) phenol → 2-hydroxybenzaldehyde (salicylaldehyde)	(II) (i) NaOH (ii) CH$_3$Cl
(C) phenol → benzoquinone	(III) (i) NaOH, CHCl$_3$ (ii) NaOH (iii) HCl
(D) phenol → anisole (–OCH$_3$)	(IV) (i) NaOH (ii) CO$_2$ (iii) HCl

Correct Matching:

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

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

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

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

Question 71: Major product formed in the following reaction is a mixture of:

Cyclohexyl ether structure with CH_3, $-O-C-CH_3$, CH_3, $\xrightarrow{HI}$ Major product

(1) [cyclohexyl with I] and $(CH_3)_3CI$ (2) [cyclohexyl with I] and $(CH_3)_3COH$

(3) [cyclohexyl with OH] and $(CH_3)_3COH$ (4) [cyclohexyl with OH] and $CH_3-\overset{CH_3}{\underset{CH_3}{C}}-I$

Question 72: The bond line formula of $HOCH(CN)_2$ is:

Options:

(1) $HO-\overset{H}{\underset{CN}{C}}-CN$

(2) $HO-CH\underset{C\equiv N}{\overset{C\equiv N}{<}}$

(3) $HO-CH\underset{CN}{\overset{CN}{<}}$

(4) $\underset{CN \quad CN}{\overset{OH}{\wedge}}$

Question 73 : Given below are two statements:

Statement (I) : Oxygen being the first member of group 16 exhibits only -2 oxidation state.

Statement (II) : Down the group 16, stability of +4 oxidation state decreases and +6 oxidation state increases.

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

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

(2) Both Statement I and Statement II are correct

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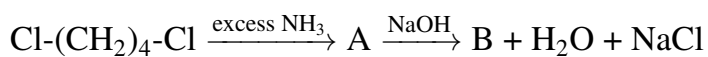
(4) Statement I is incorrect but Statement II is correct

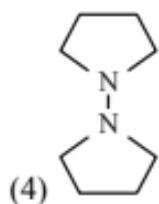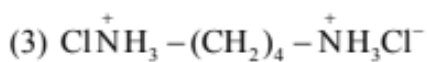**Question 74 : Identify from the following species in which d^2sp^3 hybridization is shown by**

central atom:

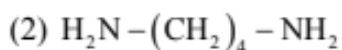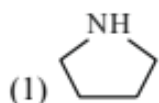**Options:**

(1) $[Co(NH_3)_6]^{3+}$

(2) BrF_5

(3) $[PtCl_4]^{2-}$

(4) SF_6

Question 75 : Identify B formed in the reaction.

$$Cl\text{-}(CH_2)_4\text{-}Cl \xrightarrow{\text{excess } NH_3} A \xrightarrow{\text{NaOH}} B + H_2O + NaCl$$

Options:

(1)

(2) $H_2N-(CH_2)_4-NH_2$

(3) $Cl\overset{+}{N}H_3-(CH_2)_4-\overset{+}{N}H_3Cl^-$

(4)

Question 76 : The quantity which changes with temperature is:

Options:

(1) Molarity

(2) Mass percentage

(3) Molality

(4) Mole fraction

Question 77 : Which structure of protein remains intact after coagulation of egg white on boiling?

Options:

(1) Primary

(2) Tertiary

(3) Secondary

(4) Quaternary

Question 78 : Which of the following cannot function as an oxidising agent?

Options:

(1) N^{3-}

(2) SO_4^{2-}

(3) BrO_3^-

(4) MnO_4^-

Question 79 : The incorrect statement regarding conformations of ethane is:

Options:

(1) Ethane has an infinite number of conformations

(2) The dihedral angle in staggered conformation is 60°

(3) Eclipsed conformation is the most stable conformation

(4) The conformations of ethane are inter-convertible to one another

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Question 80 : Identify the incorrect pair from the following:

Options:

(1) Photography - AgBr

(2) Polythene preparation - $TiCl_4$, $Al(CH_3)_3$

(3) Haber process - Iron

(4) Wacker process - $PtCl_2$

Question 81 : Total number of ions from the following with noble gas configuration is

Options:

Sr^{2+} (Z = 38), Cs^+ (Z = 55), La^{3+} (Z = 57), Pb^{2+} (Z = 82), Yb^{2+} (Z = 70) and Fe^{2+} (Z = 26)

Question 82 : The number of non-polar molecules from the following is

HF, H_2O, SO_2, H_2, CO_2, CH_4, NH_3, HCl, $CHCl_3$, BF_3

Question 83 : Time required for completion of 99.9% of a first-order reaction is _____ times of half life (t$_{1/2}$) of the reaction.

Question 84 : The spin-only magnetic moment value of square planar complex [Pt(NH$_3$)$_2$Cl(NH$_2$CH$_3$)]Cl is _____ B.M. (Nearest integer)

Question 85 : For a certain thermochemical reaction M $\rightarrow$ N at T = 400 K, $\triangle H^\circ = 77.2$ kJ mol^{-1}, $\triangle S^\circ = 122$ JK^{-1}, log equilibrium constant (log K) is _____ x 10^{-1}.
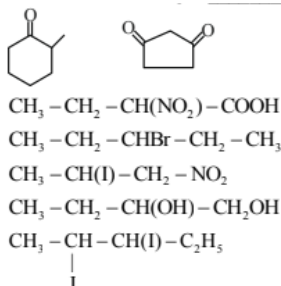
Question 86 : Volume of 3 M NaOH (formula weight 40 g mol^{-1}) which can be prepared from 84 g of NaOH is _____ x 10^{-1} dm^3.

Question 87 : 1 mole of PbS is oxidized by "X" moles of O$_3$ to get "Y" moles of O$_2$. X + Y = _____

Question 88 : The hydrogen electrode is dipped in a solution of pH = 3 at 25°C. The potential of the electrode will be - _____ $\times 10^{-2} V$.

Question 89 : 9.3 g of aniline is subjected to reaction with excess of acetic anhydride to prepare acetanilide. The mass of acetanilide produced if the reaction is 100% completed is _____ $\times 10^{-1} g. (Given molar mass in g mol^{-1} N : 14, O : 16, C : 12, H : 1)$

Question 90 : Total number of compounds with chiral carbon atoms from following is _____.

$CH_3 - CH_2 - CH(NO_2) - COOH$
$CH_3 - CH_2 - CHBr - CH_2 - CH_3$
$CH_3 - CH(I) - CH_2 - NO_2$
$CH_3 - CH_2 - CH(OH) - CH_2OH$
$CH_3 - CH - CH(I) - C_2H_5$
           $|$
           I

JEE Main - 27 Jan (Shift 2) Answer Key

Question No.	Answer
1	2
2	1
3	3
4	2
5	3
6	1
7	3
8	3
9	3
10	2
11	1
12	2
13	3
14	1
15	4
16	4
17	1
18	3
19	3
20	2
21	2521
22	304

23	10
24	32
25	0
26	11
27	2
28	100
29	108
30	20
31	2
32	4
33	2
34	2
35	2
36	3
37	3
38	2
39	4
40	3
41	2
42	3
43	2
44	4
45	3 or 4
46	4
47	3
48	4
49	3 kg

50	Bonus
51	1
52	2
53	4
54	1
55	4
56	3
57	4
58	8.00
59	144.00
60	1.00
61	1
62	4
63	1
64	3
65	2
66	4
67	3
68	1
69	4
70	3
71	1
72	2
73	4
74	1
75	3
76	2

77	4
78	3
79	1
80	4
81	3
82	2
83	4
84	1
85	3
86	2
87	4
88	3
89	1
90	2