JEE Mains 1 Feb 2024 Shift 2 Question Paper

Mathematics
SECTION-A

1. Let $f(x) = |2x^2 + 5||x| - 3$, $x \in \mathbb{R}$. If m and n denote the number of points where f is not continuous and not differentiable respectively, then $m + n$ is equal to:

(1) 5
(2) 2
(3) 0
(4) 3

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2. Let α and β be the roots of the equation $px^2 + qx - r = 0$, where $p \neq 0$. If p, q, r are the consecutive terms of a non-constant G.P. and $\frac{1}{\alpha} + \frac{1}{\beta} = \frac{3}{4}$, then the value of $(\alpha - \beta)^2$ is:

(1) $\frac{80}{9}$
(2) 9
(3) $\frac{20}{3}$
(4) 8

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3. The number of solutions of the equation $4\sin^2 x - 4\cos^3 x + 9 - 4\cos x = 0$, for $x \in [-2\pi, 2\pi]$, is:

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

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4. The value of $\int_0^1 (2x^3 - 3x^2 - x + 1)^{\frac{1}{3}}\, dx$ is equal to:

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

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5. Let P be a point on the ellipse $\frac{x^2}{9} + \frac{y^2}{4} = 1$. Let the line passing through P and parallel to the y-axis meet the circle $x^2 + y^2 = 9$ at point Q such that P and Q are on the same side of the x-axis. Then, the eccentricity of the locus of the point R on PQ such that PR : RQ = 4 : 3 as P moves on the ellipse, is:

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6. Let m and n be the coefficients of seventh and thirteenth terms respectively in the expansion of

$$\left(\frac{1}{3}x^{\frac{1}{3}} + \frac{1}{2x^{\frac{2}{3}}} + 1\right)^{18}.$$

Then $\frac{n}{m}^{\frac{1}{3}}$ is:

(1) $\frac{4}{9}$
(2) $\frac{1}{9}$
(3) $\frac{1}{4}$
(4) $\frac{9}{4}$

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7. Let α be a non-zero real number. Suppose $f : \mathbb{R} \to \mathbb{R}$ is a differentiable function such that $f(0) = 2$ and $\lim_{x\to\infty} f(x) = 1$. If $f'(x) = \alpha f(x) + 3$, then $f(-\log 2)$ is equal to:
(1) 3
(2) 5
(3) 9
(4) 7

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8. Let P and Q be the points on the line $\frac{x+3}{8} = \frac{y-4}{2} = \frac{z+1}{2}$ which are at a distance of 6 units from the point $R(1, 2, 3)$. If the centroid of the triangle PQR is (α, β, γ), then $\alpha^2 + \beta^2 + \gamma^2$ is:
(1) 26
(2) 36
(3) 18
(4) 24

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9. Consider a triangle ABC where A(1,2,3), B(-2,8,0) and C(3,6,7). If the angle bisector of $\angle BAC$ meets the line BC at D, then the length of the projection of the vector $\overrightarrow{AD}$ on the vector $\overrightarrow{AC}$ is:
(1) $\frac{37}{2\sqrt{38}}$
(2) $\frac{\sqrt{38}}{2}$
(3) $\frac{39}{2\sqrt{38}}$
(4) $\sqrt{19}$

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10. Let S_n denote the sum of the first n terms of an arithmetic progression. If $S_{10} = 390$ and the ratio of the tenth and fifth terms is $15 : 7$, then $S_{15} - S_5$ is equal to:
(1) 800
(2) 890
(3) 790
(4) 690

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11. If $\int_0^{\frac{\pi}{3}} \cos^4 x \, dx = a\pi + b\sqrt{3}$, where a and b are rational numbers, then $9a + 8b$ is equal to:
(1) 2
(2) 1
(3) 3
(4) $\frac{3}{2}$

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12. If z is a complex number such that $|z| \geq 1$, then the minimum value of $\left|z + \frac{1}{2}(3+4i)\right|$ is:
(1) $\frac{5}{2}$
(2) 2
(3) 3
(4) $\frac{3}{2}$

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13. If the domain of the function $f(x) = \frac{\sqrt{x^2-25}}{(4-x^2)} + \log_{10}(x^2+2x-15)$ is $(-\infty, \alpha) \cup [\beta, \infty)$, then $\alpha^2 + \beta^3$ is:
(1) 140
(2) 175
(3) 150
(4) 125

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14. Consider the relations R_1 and R_2 defined as $aR_1b \iff a^2 + b^2 = 1$ for all $a, b \in \mathbb{R}$, and $(a,b)R_2(c,d) \iff a + d = b + c$ for all $(a,b),(c,d) \in \mathbb{N} \times \mathbb{N}$. Then:
(1) Only R_1 is an equivalence relation
(2) Only R_2 is an equivalence relation
(3) R_1 and R_2 both are equivalence relations
(4) Neither R_1 nor R_2 is an equivalence relation

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15. If the mirror image of the point $P(3,4,9)$ in the line $\frac{x-1}{3} = \frac{y+1}{2} = \frac{z-2}{1}$ is (α, β, γ), then $14(\alpha+\beta+\gamma)$ is:
(1) 102
(2) 138
(3) 108
(4) 132

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16. Let $f(x) = \begin{cases} x-1, & x \text{ is even}, \\ 2x, & x \text{ is odd}, \end{cases}$ $x \in \mathbb{N}$. If for some $a \in \mathbb{N}$, $f(f(f(a))) = 21$, then:

$$\lim_{x \to a^-} \left\{ \frac{|x|^3}{a} - \left\lfloor \frac{x}{a} \right\rfloor \right\},$$

where $[t]$ denotes the greatest integer less than or equal to t, is equal to:
(1) 121
(2) 144
(3) 169
(4) 225

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17. Let the system of equations:

$$x + 2y + 3z = 5, \quad 2x + 3y + z = 9, \quad 4x + 3y + \lambda z = \mu,$$

have an infinite number of solutions. Then $\lambda + 2\mu$ is equal to:

(1) 28
(2) 17
(3) 22
(4) 15

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18. Consider 10 observations $x_1, x_2, \ldots, x_{10}$ such that:

$$\sum_{i=1}^{10}(x_i - \alpha) = 2 \quad \textbf{and} \quad \sum_{i=1}^{10}(x_i - \beta)^2 = 40,$$

where α, β are positive integers. Let the mean and variance of the observations be $\frac{6}{5}$ and $\frac{84}{25}$, respectively. The ratio $\frac{\beta}{\alpha}$ is equal to:
(1) 2
(2) $\frac{3}{2}$
(3) $\frac{5}{2}$
(4) 1

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19. Let Ajay not appear in the JEE exam with probability $p = \frac{2}{7}$, while both Ajay and Vijay will appear with probability $q = \frac{1}{5}$. Then the probability that Ajay will appear and Vijay will not appear is:
(1) $\frac{9}{35}$
(2) $\frac{18}{35}$
(3) $\frac{24}{35}$
(4) $\frac{3}{35}$

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20. Let the locus of the midpoints of the chords of circle $x^2 + (y-1)^2 = 1$ drawn from the origin intersect the line $x + y = 1$ at P and Q. Then, the length of PQ is:
(1) $\frac{1}{\sqrt{2}}$
(2) $\sqrt{2}$
(3) $\frac{1}{2}$
(4) 1

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21. If three successive terms of a G.P. with common ratio $r(r > 1)$ are the lengths of the sides of a triangle and $[r]$ denotes the greatest integer less than or equal to r, then $3[r] + \lfloor -r \rfloor$ is equal to:

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22. Let $A = I_2 - MM^\top$, where M is a real matrix of order 2×1 such that the relation $M^\top M = I_1$ holds. If λ is a real number such that the relation $AX = \lambda X$ holds for some non-zero real matrix X of order 2×1, then the sum of squares of all possible values of λ is equal to:

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23. Let $f : (0, \infty) \to \mathbb{R}$ and $F(x) = \int_0^x tf(t)\,dt$. If $F(x^2) = x^4 + x^5$, then $\sum_{r=1}^{12} f(r^2)$ is equal to:

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24. If $y = \frac{\sqrt{x+1}(x^2-\sqrt{x})}{x\sqrt{x}+x+\sqrt{x}} + \frac{1}{15}(3\cos^2 x - 5)\cos^3 x$, then $96y'\left(\frac{\pi}{6}\right)$ is equal to:

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25. Let $\vec{a} = \hat{i} + \hat{j} + \hat{k}$, $\vec{b} = -\hat{i} - 8\hat{j} + 2\hat{k}$, and $\vec{c} = 4\hat{i} + c_2\hat{j} + c_3\hat{k}$ be three vectors such that $\vec{b} \times \vec{a} = \vec{c} \times \vec{a}$. If the angle between the vector $\vec{c}$ and $3\hat{i} + 4\hat{j} + \hat{k}$ is θ, then the greatest integer less than or equal to $\tan^2\theta$ is:

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26. The lines $L_1, L_2, \ldots, L_{20}$ are distinct. For $n = 1, 2, 3, \ldots, 10$, all the lines L_{2n-1} are parallel to each other, and all the lines L_{2n} pass through a given point P. The maximum number of points of intersection of pairs of lines from the set $\{L_1, L_2, \ldots, L_{20}\}$ is equal to:

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27. Three points $O(0,0), P(a, a^2), Q(-b, b^2)$, where $a > 0$ and $b > 0$, are on the parabola $y = x^2$. Let S_1 be the area of the region bounded by the line PQ and the parabola, and S_2 be the area of the triangle OPQ. If the minimum value of $\frac{S_1}{S_2}$ is $\frac{m}{n}$, where $\gcd(m, n) = 1$, then $m + n$ is:

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28. The sum of squares of all possible values of k, for which the area of the region bounded by the parabolas $2y^2 = kx$ and $ky^2 = 2(y - x)$ is maximum, is equal to:

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29. If $\frac{dx}{dy} = 1 + x - y^2$ and $x(1) = 1$, then $5x(2)$ is equal to:

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30. Let $\triangle ABC$ be an isosceles triangle where $A = (-1, 0)$, $AB = AC$, and $BC = 4$. If the line BC intersects the line $y = x + 3$ at (α, β), then β^4 is equal to:

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31. In an ammeter, 5% of the main current passes through the galvanometer. If the resistance of the galvanometer is G, the resistance of the ammeter will be:

(1) $\frac{G}{200}$
(2) $\frac{G}{199}$
(3) $199G$
(4) $200G$

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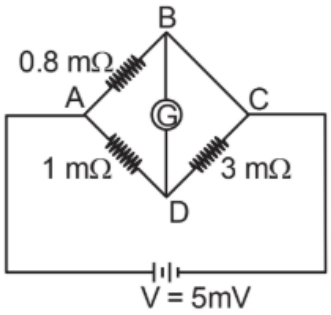
32. To measure the temperature coefficient of resistivity α of a semiconductor, an electrical arrangement is prepared. Arm BC is made of the semiconductor, with an initial resistance of 3 mΩ. If the galvanometer shows no deflection after 10 seconds as BC is cooled at 2°C/s, then α is:



(1) $-2 \times 10^{-2}\,^{\circ}\text{C}^{-1}$
(2) $-1.5 \times 10^{-2}\,^{\circ}\text{C}^{-1}$
(3) $-1 \times 10^{-2}\,^{\circ}\text{C}^{-1}$
(4) $-2.5 \times 10^{-2}\,^{\circ}\text{C}^{-1}$

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33. From the statements given below: (A) The angular momentum of an electron in the n^{th} orbit is an integral multiple of h.
(B) Nuclear forces do not obey inverse square law.
(C) Nuclear forces are spin-dependent.
(D) Nuclear forces are central and charge independent.
(E) Stability of nucleus is inversely proportional to the value of packing fraction.

Choose the Correct Answer:
(1) (A), (B), (C), (D) only
(2) (A), (C), (D), (E) only
(3) (A), (B), (C), (E) only
(4) (B), (C), (D), (E) only

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34. A diatomic gas ($\gamma = 1.4$) does 200 J of work when it is expanded isobarically. The heat given to the gas in the process is:
(1) 850 J
(2) 800 J
(3) 600 J
(4) 700 J

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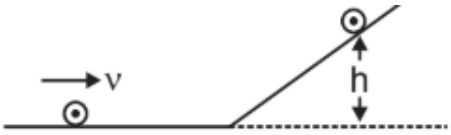
35. A disc of radius R and mass M is rolling horizontally without slipping with speed v. It then moves up an inclined smooth surface as shown. The maximum height h the disc can go up the incline is:



(1) $\frac{v^2}{g}$
(2) $\frac{3v^2}{4g}$
(3) $\frac{v^2}{2g}$

(4) $\frac{2v^2}{3g}$

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36. Conductivity of a photodiode starts changing only if the wavelength of incident light is less than 660 nm. The band gap of the photodiode is found to be $\frac{X}{8}$ eV. The value of X is:
(1) 15
(2) 11
(3) 13
(4) 21

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37. A big drop is formed by coalescing 1000 small droplets of water. The surface energy will become:
(1) 100 times
(2) 10 times
(3) $\frac{1}{100}$
(4) $\frac{1}{10}$

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38. If the frequency of an electromagnetic wave is 60 MHz and it travels in air along the z-direction, then the corresponding electric and magnetic field vectors will be mutually perpendicular to each other, and the wavelength of the wave (in m) is:
(1) 2.5
(2) 10
(3) 5
(4) 2

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39. A cricket player catches a ball of mass 120 g moving with 25 m/s speed. If the catching process is completed in 0.1 s, then the magnitude of force exerted by the ball on the hand of the player will be (in SI unit):
(1) 24
(2) 12
(3) 25
(4) 30

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40. Monochromatic light of frequency 6×10^{14} Hz is produced by a laser. The power emitted is 2×10^{-3} W. How many photons per second, on average, are emitted by the source?
(1) 9×10^{18}
(2) 6×10^{15}
(3) 5×10^{15}
(4) 7×10^{16}

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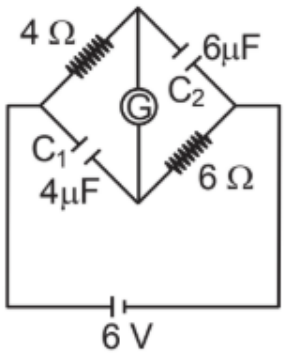
41. A microwave of wavelength 2.0 cm falls normally on a slit of width 4.0 cm. The angular spread of the central maxima of the diffraction pattern obtained on a screen 1.5 m

away from the slit, will be:



(1) $30°$
(2) $15°$
(3) $60°$
(4) $45°$

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42. C_1 **and** C_2 **are two hollow concentric cubes enclosing charges** $2Q$ **and** $3Q$**, respectively, as shown in the figure. The ratio of electric flux passing through** C_1 **and** C_2 **is:**
(1) $2 : 5$
(2) $5 : 2$
(3) $2 : 3$
(4) $3 : 2$

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43. If the root mean square velocity of a hydrogen molecule at a given temperature and pressure is 2 **km/s, the root mean square velocity of oxygen at the same condition in km/s is:**
(1) 2.0
(2) 0.5
(3) 1.5
(4) 1.0

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44. Train A is moving along two parallel rail tracks towards north with speed 72 **km/h and train B is moving towards south with speed** 108 **km/h. The velocity of train B with respect to A and velocity of ground with respect to B are (in m/s):**
(1) -30 and 50
(2) -50 and -30
(3) -50 and 30
(4) 50 and -30

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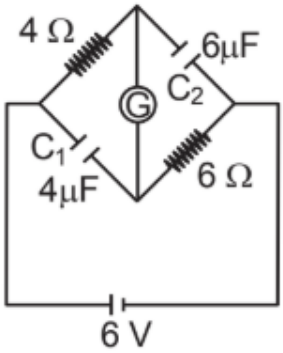
45. A galvanometer G **of** $2\,\Omega$ **resistance is connected in the given circuit. The ratio of charge stored in** C_1 **and** C_2 **is:**



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

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46. In a metre-bridge, when a resistance in the left gap is $2\,\Omega$ and an unknown resistance in the right gap, the balance length is found to be 40 cm. On shunting the unknown resistance with $2\,\Omega$, the balance length changes by:

(1) 22.5 cm
(2) 20 cm
(3) 62.5 cm
(4) 65 cm

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47. Match List-I with List-II:

List - I (Number)	**List - II (Significant figure)**
(A) 1001	(I) 3
(B) 010.1	(II) 4
(C) 100.100	(III) 5
(D) 0.0010010	(IV) 6

Choose the **Correct Answer** from the options given below:

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

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48. A transformer has an efficiency of 80% and works at 10 V and 4 kW. If the secondary voltage is 240 V, then the current in the secondary coil is:

(1) 1.59 A
(2) 13.33 A
(3) 1.33 A
(4) 15.1 A

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49. A light planet is revolving around a massive star in a circular orbit of radius R with a period T. If the force of attraction between the planet and the star is proportional to $R^{-3/2}$, then T^2 is proportional to:
(1) $R^{5/2}$
(2) $R^{7/2}$
(3) $R^{3/2}$
(4) R^3

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50. A body of mass 4 kg experiences two forces $\mathbf{F}_1 = 5\hat{i} + 8\hat{j} + 7\hat{k}$ and $\mathbf{F}_2 = 3\hat{i} - 4\hat{j} - 3\hat{k}$. The acceleration acting on the body is:
(1) $-2\hat{i} - \hat{j} - \hat{k}$
(2) $4\hat{i} + 2\hat{j} + 2\hat{k}$
(3) $2\hat{i} + \hat{j} + \hat{k}$
(4) $4\hat{i} + 3\hat{j} + 3\hat{k}$

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51. A mass m is suspended from a spring of negligible mass, and the system oscillates with a frequency f_1. The frequency of oscillations if a mass $9m$ is suspended from the same spring is f_2. The value of $\frac{f_1}{f_2}$ is:

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52. A particle initially at rest starts moving from the reference point $x = 0$ along the x-axis, with velocity v that varies as $v = 4\sqrt{x}$ m/s. The acceleration of the particle is ___ m/s^2:

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53. A moving coil galvanometer has 100 turns, and each turn has an area of 2.0 cm^2. The magnetic field produced by the magnet is 0.01 T, and the deflection in the coil is 0.05 rad when a current of 10 mA is passed through it. The torsional constant of the suspension wire is $x \times 10^{-5}$ N-m/rad. The value of x is:

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54. One end of a metal wire is fixed to a ceiling, and a load of 2 kg hangs from the other end. A similar wire is attached to the bottom of the load, and another load of 1 kg hangs from this lower wire. Then the ratio of longitudinal strain of the upper wire to that of the lower wire will be:

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55. A particular hydrogen-like ion emits radiation of frequency 3×10^{15} Hz when it makes a transition from $n = 2$ to $n = 1$. The frequency of radiation emitted in the transition from $n = 3$ to $n = 1$ is $\frac{x}{9} \times 10^{15}$ Hz. The value of x is:

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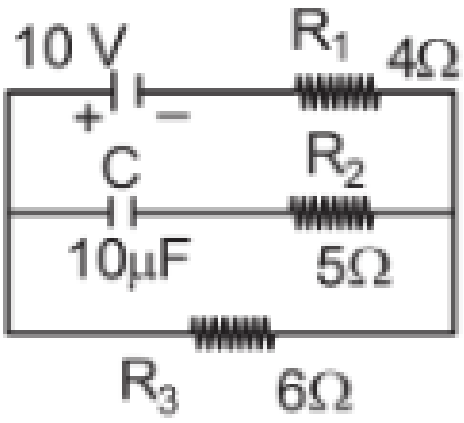
56. In the electrical circuit drawn below, the amount of charge stored in the capacitor is ___ μC:



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57. A coil of 200 turns and area $0.20\,\text{m}^2$ is rotated at half a revolution per second in a uniform magnetic field of $0.01\,\text{T}$ perpendicular to the axis of rotation of the coil. The maximum voltage generated in the coil is $\frac{2\pi}{\beta}$ volts. The value of β is:

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58. In Young's double slit experiment, monochromatic light of wavelength $5000\,\text{Å}$ is used. The slits are $1.0\,\text{mm}$ apart, and the screen is placed at $1.0\,\text{m}$ away from the slits. The distance from the center of the screen where intensity becomes half of the maximum intensity for the first time is $\_\_\_ \times 10^{-6}\,\text{m}$:

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59. A uniform rod AB of mass $2\,\text{kg}$ and length $30\,\text{cm}$ is at rest on a smooth horizontal surface. An impulse of $0.2\,\text{Ns}$ is applied to end B. The time taken by the rod to turn through a right angle will be $\frac{\pi}{x}\,\text{s}$, where $x = \_\_\_$:

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60. Suppose a uniformly charged wall provides a uniform electric field of $2 \times 10^4\,\text{N/C}$ normally. A charged particle of mass $2\,\text{g}$ is suspended through a silk thread of length $20\,\text{cm}$ and remains at a distance of $10\,\text{cm}$ from the wall. The charge on the particle will be $\frac{1}{\sqrt{x}}\,\mu\text{C}$, where $x = \_\_\_$:

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61. The transition metal having the highest 3rd ionisation enthalpy is:
(1) Cr
(2) Mn
(3) V
(4) Fe

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62. Given below are two statements:
Statement I: A π-bonding MO has lower electron density above and below the inter-nuclear axis.
Statement II: The π-antibonding MO has a node between the nuclei.
(1) Both Statement I and Statement II are false
(2) Both Statement I and Statement II are true
(3) Statement I is false but Statement II is true

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

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63. Given below are two statements:
Assertion (A): In aqueous solutions, Cr^{2+} is reducing while Mn^{3+} is oxidising in nature.
Reason (R): Extra stability of half-filled electronic configuration is observed than incompletely filled configurations.
(1) Both (A) and (R) are true, and (R) is the correct explanation of (A).
(2) Both (A) and (R) are true, but (R) is not the correct explanation of (A).
(3) (A) is false, but (R) is true.
(4) (A) is true, but (R) is false.

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64. Match List-I with List-II:

Reactants (List-I)	Products (List-II)
(A) Phenol, Zn/Δ	(I) Salicylaldehyde
(B) Phenol, $CHCl_3$, NaOH, HCl	(II) Salicylic acid
(C) Phenol, CO_2, NaOH, HCl	(III) Benzene
(D) Phenol, Conc. HNO_3	(IV) Picric acid

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

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65. Given below are two statements:
Statement I: Both metal and non-metal exist in p- and d-block elements.
Statement II: Non-metals have higher ionisation enthalpy and higher electronegativity than metals.
(1) Both Statement I and Statement II are false
(2) Statement I is false, but Statement II is true
(3) Statement I is true, but Statement II is false
(4) Both Statement I and Statement II are true

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66. The strongest reducing agent among the following is:
(1) NH_3
(2) SbH_3
(3) BiH_3
(4) PH_3

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67. Which of the following compounds show colour due to d-d transition?
(1) $CuSO_4.5H_2O$
(2) $K_2Cr_2O_7$
(3) K_2CrO_4
(4) $KMnO_4$

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68. The set of meta-directing functional groups from the following sets is:
(1) $-CN, -NH_2, -NHR, -OCH_3$
(2) $-NO_2, -NH_2, -COOH, -COOR$
(3) $-NO_2, -CHO, -SO_3H, -COR$
(4) $-CN, -CHO, -NHCOCH_3, -COOR$

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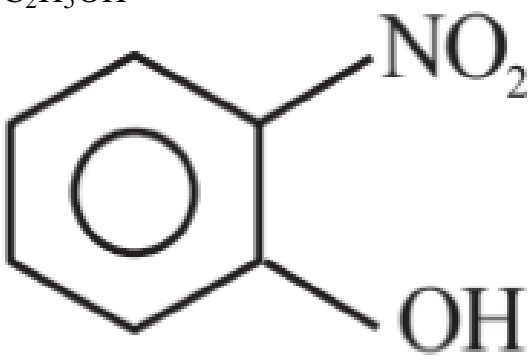
69. Select the compound from the following that will show intramolecular hydrogen bonding:
(1) H_2O
(2) NH_3
(3) C_2H_5OH



(4)

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70. Lassaigne's test is used for the detection of:
(1) Nitrogen and Sulphur only
(2) Nitrogen, Sulphur, and Phosphorus only
(3) Phosphorus and halogens only
(4) Nitrogen, Sulphur, Phosphorus, and Halogens

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71. Which among the following has the highest boiling point?
(1) $CH_3CH_2CH_3$
(2) $CH_3CH_2CH_2OH$
(3) CH_3CH_2CHO
(4) $CH_3C(=O) - CH_2CH_3$

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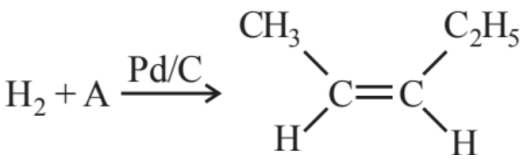
72. In the given reactions, identify A and B:



$$CH_3C \equiv CH + H_2 \xrightarrow{Pd/C} A \xrightarrow{Na/Liquid\ NH_3} B$$

(1) A: 2-Pentyne, B : trans $-$ 2-butene

(2) A: n-Pentane, B : trans $-$ 2-butene
(3) A: 2-Pentyne, B : cis $-$ 2-butene
(4) A: n-Pentane, B : cis $-$ 2-butene

---

73. The number of radial nodes for a $3p$-orbital is:
(1) 1
(2) 2
(3) 3
(4) 4

---

74. Match List-I with List-II:

List-I (Compound)	List-II (Use)
(A) Carbon tetrachloride	(I) Paint remover
(B) Methylene chloride	(II) Refrigerators and air conditioners
(C) DDT	(III) Fire extinguisher
(D) Freons	(IV) Non-biodegradable insecticide

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

---

75. The functional group that shows negative resonance effect is:
(1) $-NH_2$
(2) $-OH$
(3) $-COOH$
(4) $-OR$

---

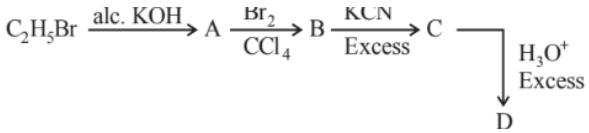
76. $[Co(NH_3)_6]^{3+}$ and $[CoF_6]^{3-}$ are respectively known as:
(1) Spin free Complex, Spin paired Complex
(2) Spin paired Complex, Spin free Complex
(3) Outer orbital Complex, Inner orbital Complex
(4) Inner orbital Complex, Spin paired Complex

---

77. Given below are two statements:
Statement I: SiO_2 and GeO_2 are acidic while SnO and PbO are amphoteric in nature.
Statement II: Allotropic forms of carbon are due to the property of catenation and $p\pi - p\pi$ bond formation.
(1) Both Statement I and Statement II are false
(2) Both Statement I and Statement II are true
(3) Statement I is true, but Statement II is false
(4) Statement I is false, but Statement II is true

---

78. Acid D formed in the reaction is:



(1) Gluconic acid
(2) Succinic acid
(3) Oxalic acid
(4) Malonic acid

---

79. Solubility of calcium phosphate (molecular mass, M) in water is W g per 100 mL at 25°C. Its solubility product at 25°C will be approximately:

(1) $10^7 \left(\frac{W}{M}\right)^3$
(2) $10^7 \left(\frac{W}{M}\right)^5$
(3) $10^7 \left(\frac{W}{M}\right)^5$
(4) $10^7 \left(\frac{W}{M}\right)^7$

---

80. Given below are two statements:
Statement I: Dimethyl glyoxime forms a six-membered covalent chelate when treated with $NiCl_2$ solution in the presence of NH_4OH.
Statement II: Prussian blue precipitate contains iron both in (+2) and (+3) oxidation states.
(1) Statement I is false, but Statement II is true
(2) Both Statement I and Statement II are true
(3) Both Statement I and Statement II are false
(4) Statement I is true, but Statement II is false

---

81. Total number of isomeric compounds (including stereoisomers) formed by monochlorination of 2-methylbutane is:

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82. The following data were obtained during the first-order thermal decomposition of a gas A at constant volume:

$$\mathbf{A(g) \longrightarrow 2B(g) + C(g)}$$

S.No	Time (s)	Total Pressure (atm)
1	0	0.1
2	115	0.28

The rate constant of the reaction is $\_\_\_ \times 10^{-2}\ s^{-1}$ (nearest integer):

---

83. The number of tripeptides formed by three different amino acids using each amino acid once is:

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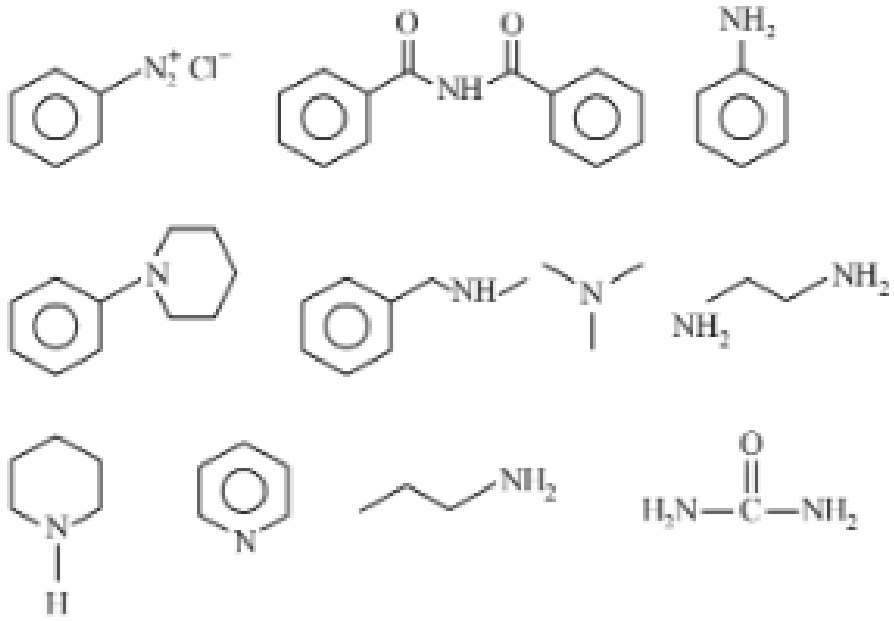
84. Number of compounds which give reaction with Hinsberg's reagent is:



85. Mass of ethylene glycol (antifreeze) to be added to 18.6 kg of water to protect the freezing point at -24°C is:

86. Following Kjeldahl's method, 1g of organic compound released ammonia, that neutralised 10 mL of 2M H2SO4. The percentage of nitrogen in the compound is ____

87. The amount of electricity in Coulombs required for the oxidation of 1 mol of H_2O to O_2 is $___\times 10^5$C:

88. For a certain reaction at 300 K, $K = 10$. Then ΔG° for the same reaction is $\_\_\_\times 10^{-1}$ kJ/mol:

90. 10 mL of gaseous hydrocarbon on combustion gives 40 mL of CO_2 and 50 mL of water vapour. Total number of carbon and hydrogen atoms in the hydrocarbon is: