JEE Main 2025 April 2 Shift 1 Question Paper

Time Allowed :3 Hours	Maximum Marks :300	Total Questions :75

General Instructions

Read the following instructions very carefully and strictly follow them:

1. Multiple choice questions (MCQs)
2. Questions with numerical values as answers.
3. There are three sections: **Mathematics, Physics, Chemistry**.
4. **Mathematics:** 25 (20+5) 10 Questions with answers as a numerical value. Out of 10 questions, 5 questions are compulsory.
5. **Physics:** 25 (20+5) 10 Questions with answers as a numerical value. Out of 10 questions, 5 questions are compulsory..
6. **Chemistry:** 25 (20+5) 10 Questions with answers as a numerical value. Out of 10 questions, 5 questions are compulsory.
7. Total: 75 Questions (25 questions each).
8. 300 Marks (100 marks for each section).
9. **MCQs:** Four marks will be awarded for each correct answer and there will be a negative marking of one mark on each wrong answer.
10. **Questions with numerical value answers:** Candidates will be given four marks for each correct answer and there will be a negative marking of 1 mark for each wrong answer.

Mathematics

Section - A

1. The largest $n \in N$ such that 3^n divides 50! is:

(1) 21 (2) 22 (3) 23 (4) 25

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2. Let one focus of the hyperbola $\frac{x^2}{a^2} - \frac{y^2}{b^2} = 1$ be at $(\sqrt{10}, 0)$, and the corresponding directrix be $x = \frac{\sqrt{10}}{2}$. If e and l are the eccentricity and the latus rectum respectively, then $9(e^2 + l)$ is equal to:

(1) 14 (2) 16 (3) 18 (4) 12

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3. The number of sequences of ten terms, whose terms are either 0 or 1 or 2, that contain exactly five 1's and exactly three 2's, is equal to:

(1) 360 (2) 45 (3) 2520 (4) 1820

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4. Let $f : R \to R$ be a twice differentiable function such that

$$f''(x)\sin\left(\frac{x}{2}\right) + f'(2x-2y) = (\cos x)\sin(y+2x) + f(2x-2y)$$

for all $x, y \in R$. If $f(0) = 1$, then the value of $24f^{(4)}\left(\frac{5\pi}{3}\right)$ is:

(1) 2 (2) –3 (3) 1 (4) 3

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5. Let $A = \begin{bmatrix} \alpha & -1 \\ 6 & \beta \end{bmatrix}$, $\alpha > 0$, such that $\det(A) = 0$ and $\alpha + \beta = 1$. If I denotes the 2×2 identity matrix, then the matrix $(1 + A)^5$ is:

(1) $\begin{bmatrix} 4 & -1 \\ 6 & -1 \end{bmatrix}$ (2) $\begin{bmatrix} 257 & -64 \\ 514 & -127 \end{bmatrix}$ (3) $\begin{bmatrix} 1025 & -511 \\ 2024 & -1024 \end{bmatrix}$ (4) $\begin{bmatrix} 766 & -255 \\ 1530 & -509 \end{bmatrix}$

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6. The term independent of x in the expansion of

$$\left(\frac{x+1}{x^{3/2}+1-\sqrt{x}} \cdot \frac{x+1}{x-\sqrt{x}}\right)^{10}$$

for $x > 1$ is:

(1) 210 (2) 150 (3) 240 (4) 120

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7. If $\theta \in [-2\pi,\ 2\pi]$, then the number of solutions of

$$2\sqrt{2}\cos^2\theta + (2-\sqrt{6})\cos\theta - \sqrt{3} = 0$$

is:

(1) 12 (2) 6 (3) 8 (4) 10

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8. Let $a_1, a_2, a_3, \ldots$ be in an A.P. such that

$$\sum_{k=1}^{12} 2a_{2k-1} = \frac{72}{5}, \quad \text{and} \quad \sum_{k=1}^{n} a_k = 0,$$

then n is:

(1) 11 (2) 10 (3) 18 (4) 17

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9. If the function $f(x) = 2x^3 - 9ax^2 + 12a^2x + 1$, where $a > 0$, attains its local maximum and minimum at p and q, respectively, such that $p^2 = q$, then $f(3)$ is equal to:

(1) 55 (2) 10 (3) 23 (4) 37

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10. Let z be a complex number such that $|z| = 1$. If

$$\frac{2 + kz}{k + z} = kz,\ k \in R,$$

then the maximum distance of $k + ik^2$ from the circle $|z - (1 + 2i)| = 1$ is:

(1) $\sqrt{5} + 1$ (2) 2 (3) 3 (4) $\sqrt{5} + \sqrt{1}$

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11. If $\vec{a}$ is a non-zero vector such that its projections on the vectors $2\hat{i} - \hat{j} + 2\hat{k}$, $\hat{i} + 2\hat{j} - 2\hat{k}$, and $\hat{k}$ are equal, then a unit vector along $\vec{a}$ is:

(1) $\frac{1}{\sqrt{155}}(7\hat{i}+9\hat{j}+5\hat{k})$ (2) $\frac{1}{\sqrt{155}}(7\hat{i}+9\hat{j}-5\hat{k})$ (3) $\frac{1}{\sqrt{155}}(7\hat{i}+9\hat{j}+5\hat{k})$ (4) $\frac{1}{\sqrt{155}}(7\hat{i}+9\hat{j}-5\hat{k})$

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12. Let A be the set of all functions $f : Z \to Z$ and R be a relation on A such that

$$R = \{(f, g) : f(0) = g(1) \text{ and } f(1) = g(0)\}$$

Then R is:

(1) Symmetric and transitive but not reflective (2) Symmetric but neither reflective nor transitive

(3) Reflexive but neither symmetric nor transitive (4) Transitive but neither reflexive nor symmetric

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13. For $\alpha, \beta, \gamma \in R$, if

$$\lim_{x \to 0} \frac{x^2 \sin \alpha x + (\gamma - 1)e^{x^2} - 3}{\sin 2x - \beta x} = 3,$$

then $\beta + \gamma - \alpha$ is equal to:

(1) 7 (2) 4 (3) 6 (4) –1

---

14. If the system of equations:

$$\begin{aligned} 3x + y + \beta z &= 3 \\ 2x + \alpha y + z &= 2 \\ x + 2y + z &= 4 \end{aligned}$$

has infinitely many solutions, then the value of $22\beta - 9\alpha$ is:

(1) 49 (2) 31 (3) 43 (4) 37

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15. Let $P_n = \alpha^n + \beta^n$, $n \in N$. If $P_{10} = 123,\ P_9 = 76,\ P_8 = 47$ and $P_1 = 1$, then the quadratic equation having roots α and $\frac{1}{\beta}$ is:

(1) $x^2 - x + 1 = 0$ (2) $x^2 + x - 1 = 0$ (3) $x^2 - x - 1 = 0$ (4) $x^2 + x + 1 = 0$

---

16. If S and S' are the foci of the ellipse $\frac{x^2}{18} + \frac{y^2}{9} = 1$, and P is a point on the ellipse, then $\min(\vec{SP} \cdot \vec{S'P}) + \max(\vec{SP} \cdot \vec{S'P})$ is equal to:

(1) $3(1 + \sqrt{2})$ (2) $3(6 + \sqrt{2})$ (3) 9 (4) 27

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17. Let the vertices Q and R of the triangle PQR lie on the line $\frac{x+3}{5} = \frac{y-1}{2} = \frac{z+4}{3}$, $QR = 5$, and the coordinates of the point P be $(0, 2, 3)$. If the area of the triangle PQR is $\frac{m}{n}$, then:
(1) $m - 5\sqrt{21}n = 0$
(2) $2m - 5\sqrt{21}n = 0$
(3) $5m - 2\sqrt{21}n = 0$
(4) $5m - 21\sqrt{2}n = 0$

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18. Let ABCD be a tetrahedron such that the edges AB, AC and AD are mutually perpendicular. Let the areas of the triangles ABC, ACD, and ADB be 5, 6 and 7 square units respectively. Then the area (in square units) of the tetrahedron ABCD is equal to:

(1) $\sqrt{30}$ (2) 12 (3) $\sqrt{10}$ (4) $7\sqrt{5}$

---

19. Let $A \in R$ be a matrix of order 3x3 such that

$$\det(A) = -4 \quad \text{and} \quad A + I = \begin{bmatrix} 1 & 1 & 1 \\ 2 & 0 & 1 \\ 4 & 1 & 2 \end{bmatrix}$$

where I is the identity matrix of order 3. If $\det((A + I) \cdot \text{adj}(A + I))$ is 2^m, then m is equal to:

(1) 14 (2) 31 (3) 16 (4) 13

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20. Let the focal chord PQ of the parabola $y^2 = 4x$ make an angle of 60° with the positive x-axis, where P lies in the first quadrant. If the circle, whose one diameter is PS, S being the focus of the parabola, touches the y-axis at the point $(0, \alpha)$, then $5\alpha^2$ is equal to:

(1) 15 (2) 25 (3) 30 (4) 20

Mathematics

SECTION-B

21. Let [.] denote the greatest integer function. If

$$\int_1^e \frac{1}{xe^x}dx = \alpha - \log 2, \quad \text{then} \quad \alpha^2 \text{ is equal to:}$$

(1) 8 (2) 9 (3) 16 (4) 10

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23. If the area of the region

$$\{(x, y) : |4 - x^2| \leq y \leq x^2, y \geq 0\}$$

is $\frac{80\sqrt{2}}{\alpha-\beta}$, $\alpha, \beta \in N$, then $\alpha + \beta$ is equal to:

(1) 16 (2) 12 (3) 22 (4) 18

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24. Three distinct numbers are selected randomly from the set $\{1, 2, 3, \ldots, 40\}$. If the probability that the selected numbers are in an increasing G.P. is $\frac{m}{n}$, where $\gcd(m, n) = 1$, then $m + n$ is equal to:

(1) 14 (2) 31 (3) 16 (4) 13

---

25. The absolute difference between the squares of the radii of the two circles passing through the point $(-9, 4)$ and touching the lines $x + y = 3$ and $x - y = 3$, is equal to:

(1) 768 (2) 550 (3) 860 (4) 999

Physics

SECTION-A

26. A light wave is propagating with plane wave fronts of the type $x + y + z =$ constant. The angle made by the direction of wave propagation with the x-axis is:

(1) $\cos^{-1}\left(\frac{1}{\sqrt{3}}\right)$ (2) $\cos^{-1}\left(\frac{\sqrt{3}}{3}\right)$ (3) $\cos^{-1}\left(\frac{1}{\sqrt{2}}\right)$ (4) $\cos^{-1}\left(\frac{1}{\sqrt{5}}\right)$

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27. The equation for real gas is given by $\left(P + \frac{a}{V^2}\right)(V - b) = RT$, where P, V, T, and R are the pressure, volume, temperature and gas constant, respectively. The dimension of ab is equivalent to that of:

(1) Planck's constant (2) Compressibility (3) Strain (4) Energy density

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28. A cord of negligible mass is wound around the rim of a wheel supported by spokes with negligible mass. The mass of the wheel is 10 kg and radius is 10 cm and it can freely rotate without any friction. Initially the wheel is at rest. If a steady pull of 20 N is applied on the cord, the angular velocity of the wheel, after the cord is unwound by 1 m, will be:

(1) 20 rad/s (2) 30 rad/s (3) 10 rad/s (4) 0 rad/s

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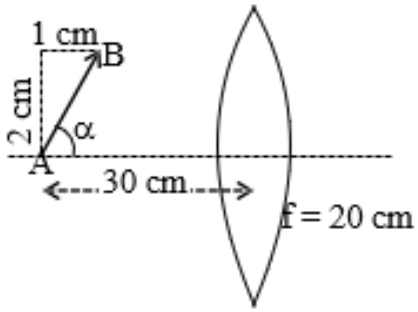
29. A slanted object AB is placed on one side of convex lens as shown in the diagram. The image is formed on the opposite side. Angle made by the image with principal axis is:



(1) $\frac{-\alpha}{2}$ (2) $-45°$ (3) $+45°$ (4) $-\alpha$

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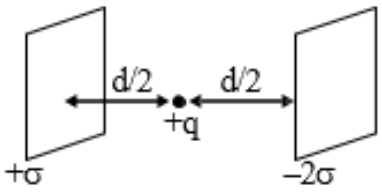
30. Consider two infinitely large plane parallel conducting plates as shown below. The plates are uniformly charged with a surface charge density $+\sigma$ and $-\sigma$. The force experienced by a point charge $+q$ placed at the mid point between the plates will be:



(1) $\frac{3q\sigma}{4\epsilon_0}$ (2) $\frac{3q\sigma}{2\epsilon_0}$ (3) $\frac{3q\sigma}{4\epsilon_0}$ (4) $\frac{q\sigma}{2\epsilon_0}$

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31. A river is flowing from west to east direction with speed of 9 km/hr. If a boat capable of moving at a maximum speed of 27 km/hr in still water, crosses the river in half a minute, while moving with maximum speed at an angle of 150° to direction of river flow, then the width of the river is:

(1) 300 m (2) 112.5 m (3) 75 m (4) $112.5 \times \sqrt{3}$ m

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32. A point charge $+q$ is placed at the origin. A second point charge $+9q$ is placed at $(d, 0, 0)$ in Cartesian coordinate system. The point in between them where the electric field vanishes is:

(1) $\left(\frac{4d}{3}, 0, 0\right)$ (2) $\left(\frac{d}{4}, 0, 0\right)$ (3) $\left(\frac{3d}{4}, 0, 0\right)$ (4) $\left(\frac{d}{3}, 0, 0\right)$

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33. The battery of a mobile phone is rated as 4.2 V, 5800 mAh. How much energy is stored in it when fully charged?

(1) 43.8 kJ (2) 48.7 kJ (3) 87.7 kJ (4) 24.4 kJ

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34. A particle is subjected to simple harmonic motions as:
$x_1 = \sqrt{7}\sin 5t\,\text{cm}$ $x_2 = 2\sqrt{7}\sin\left(5t + \frac{\pi}{3}\right)\,\text{cm}$

where x is displacement and t is time in seconds.
The maximum acceleration of the particle is $x \times 10^{-2}\,\text{m/s}^2$. The value of x is:

(1) 175 (2) 25 $\sqrt{7}$ (3) $5\sqrt{7}$ (4) 125

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35. The relationship between the magnetic susceptibility χ and the magnetic permeability μ is given by:
μ_0 is the permeability of free space and μ_r is relative permeability.

(1) $\chi = \frac{\mu}{\mu_0} - 1$ (2) $\chi = \frac{\mu+1}{\mu_0}$ (3) $\chi = \mu_r + 1$ (4) $\chi = 1 - \frac{\mu}{\mu_0}$

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36. A zener diode with 5V zener voltage is used to regulate an unregulated dc voltage input of 25V. For a 400 Ω resistor connected in series, the zener current is found to be 4 times load current. The load current I_L and load resistance R_L are:

(1) $I_L = 20\,\text{mA};\ R_L = 250\,\Omega$ (2) $I_L = 10\,\text{A};\ R_L = 0.5\,\Omega$ (3) $I_L = 0.02\,\text{mA};\ R_L =$

$250\,\Omega$ (4) $I_L = 10\,\text{mA};\ R_L = 500\,\Omega$

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37. In an adiabatic process, which of the following statements is true?

(1) The molar heat capacity is infinite (2) Work done by the gas equals the increase in internal energy
(3) The molar heat capacity is zero (4) The internal energy of the gas decreases as the temperature increases

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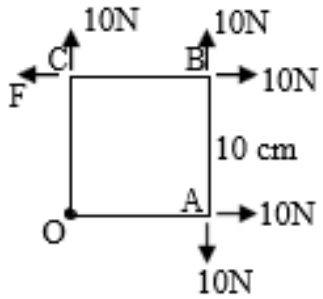
38. A square Lamina OABC of length 10 cm is pivoted at O. Forces act at Lamina as shown in figure. If Lamina remains stationary, then the magnitude of F is:



(1) 20 N (2) 0 (zero) (3) 10 N (4) $10\sqrt{2}$ N

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39. Let B_1 be the magnitude of magnetic field at the center of a circular coil of radius R carrying current I. Let B_2 be the magnitude of magnetic field at an axial distance x from the center. For $x : R = 3 : 4$, $\frac{B_2}{B_1}$ is:

(1) 4 : 5 (2) 16 : 25 (3) 64 : 125 (4) 25 : 16

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40. Considering Bohr's atomic model for hydrogen atom :

(1) (B), (C) only (2) (A), (B) only (3) (A), (D) only (4) (A), (C) only

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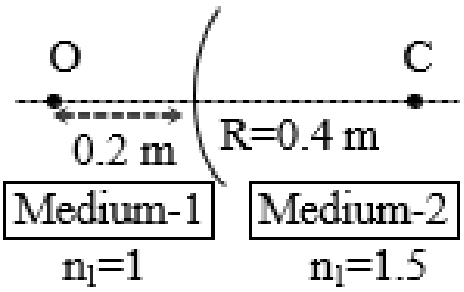
41. Moment of inertia of a rod of mass M and length L about an axis passing through its center and normal to its length is α. Now the rod is cut into two equal parts and these parts are joined symmetrically to form a cross shape. Moment of inertia of cross about an axis passing through its center and normal to the plane containing cross is:

(1) α (2) $\frac{\alpha}{4}$ (3) $\frac{\alpha}{8}$ (4) $\frac{\alpha}{2}$

42.



A spherical surface separates two media of refractive indices $n_1 = 1$ and $n_2 = 1.5$ as shown in the figure. Distance of the image of an object O, if C is the center of curvature of the spherical surface and R is the radius of curvature, is:

(1) 0.24 m right to the spherical surface (2) 0.24 m left to the spherical surface
(3) 0.24 m left to the spherical surface (4) 0.4 m right to the spherical surface

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43. Match List-I with List-II.

List-I

- (A) Coefficient of viscosity
- (B) Intensity of wave
- (C) Pressure gradient
- (D) Compressibility

List-II

- (I) $[ML^{-1}T^{-1}]$
- (II) $[ML^{-2}T^{-3}]$
- (III) $[ML^{-1}T^{-2}]$
- (IV) $[ML^{-1}T^{-2}]$

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

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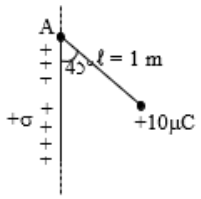
44. A small bob of mass 100 mg and charge +10 μC is connected to an insulating string of length 1 m. It is brought near to an infinitely long non-conducting sheet of charge density σ as shown in figure. If the string subtends an angle of 45° with the sheet at equilibrium, the charge density of sheet will be :



(1) 0.885 nC/cm^2 (2) 17.7 nC/cm^2 (3) 885 nC/cm^2 (4) 1.77 nC/cm^2

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45. A monochromatic light is incident on a metallic plate having work function ϕ. An electron, emitted normally to the plate from a point A with maximum kinetic energy, enters a constant magnetic field, perpendicular to the initial velocity of the electron. The electron passes through a curve and hits back the plate at a point B. The distance between A and B is:

(1) $\sqrt{\frac{2m\left(\frac{hc}{\lambda}-\phi\right)}{eB}}$ (2) $\frac{m\left(\frac{hc}{\lambda}-\phi\right)}{eB}$ (3) $\sqrt{8m\left(\frac{hc}{\lambda}-\phi\right)} \div eB$ (4) $2\frac{m\left(\frac{hc}{\lambda}-\phi\right)}{eB}$

Physics

SECTION-B

46. A vessel with square cross-section and height of 6 m is vertically partitioned. A small window of 100 cm^2 with hinged door is fitted at a depth of 3 m in the partition wall. One part of the vessel is filled completely with water and the other side is filled with the liquid having density 1.5×10^3 kg/m^3. What force one needs to apply on the hinged door so that it does not open?

(1) 150 N (2) 200 N (3) 100 N (4) 250 N

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47. A steel wire of length 2 m and Young's modulus 2.0×10^{11} N/m^2 is stretched by a force. If Poisson's ratio and transverse strain for the wire are 0.2 and 10^{-3} respectively, then the elastic potential energy density of the wire is ___ $\times 10^6$ (in SI units).

(1) 15 (2) 25 (3) 35 (4) 45

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48. If the measured angular separation between the second minimum to the left of the central maximum and the third minimum to the right of the central maximum is 30° in a single slit diffraction pattern recorded using 628 nm light, then the width of the slit is μm.

(1) 2 μm (2) 8 μm (3) 6 μm (4) 4 μm

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49. γ_A is the specific heat ratio of monoatomic gas A having 3 translational degrees of freedom. γ_B is the specific heat ratio of polyatomic gas B having 3 translational, 3 rotational degrees of freedom and 1 vibrational mode. If

$$\frac{\gamma_A}{\gamma_B} = \left(1 + \frac{1}{n}\right)$$

then the value of n is _____.

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

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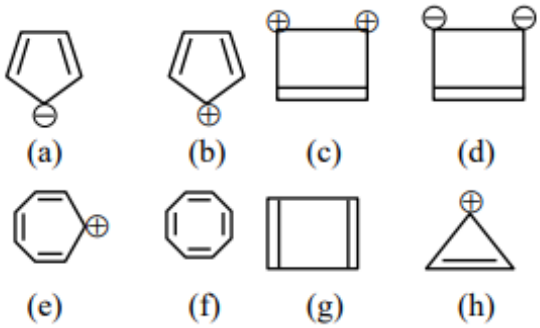
50. A person travelling on a straight line moves with a uniform velocity v_1 for a distance x and with a uniform velocity v_2 for the next $\frac{3x}{2}$ distance. The average velocity in this motion is $\frac{50}{7}$ m/s. If v_1 is 5 m/s, then v_2 is $_{m/s.}$
(1) 10 m/s (2) 12 m/s (3) 15 m/s (4) 18 m/s

Chemistry

SECTION-A

Here's the properly formatted question with solution in the requested format:
51. Designate whether each of the following compounds is aromatic or not aromatic.



(1) e, g aromatic and a, b, c, d, f, h not aromatic
(2) b, e, f, g aromatic and a, c, d, h not aromatic
(3) a, b, c, d aromatic and e, f, g, h not aromatic
(4) a, c, d, e, h aromatic and b, f, g not aromatic

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52. An optically active alkyl halide C_4H_9Br [A] reacts with hot KOH dissolved in ethanol and forms alkene [B] as major product which reacts with bromine to give dibromide [C]. The compound [C] is converted into a gas [D] upon reacting with alcoholic $NaNH_2$. During hydration 18 gram of water is added to 1 mole of gas [D] on warming with mercuric sulphate and dilute acid at 333 K to form compound [E]. The IUPAC name of compound [E] is :

(1) But-2-yne (2) Butan-2-ol (3) Butan-2-one (4) Butan-1-al

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53. The property/properties that show irregularity in the first four elements of group-17 are:
(A) Covalent radius
(B) Electron affinity
(C) Ionic radius
(D) First ionization energy

Choose the correct answer from the options given below: (1) B and D only (2) A and C only (3) B only (4) A, B, C and D

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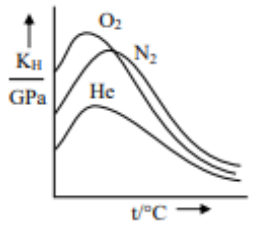
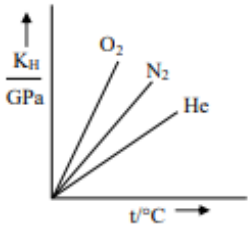
54. Which of the following graph correctly represents the plots of K_H at 1 bar gases in water versus temperature?

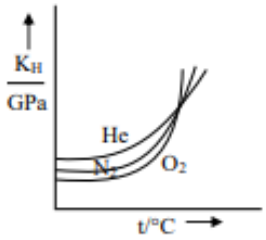
(1)



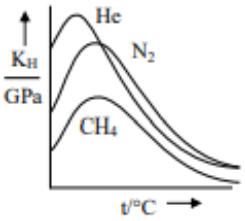
(2)



(3)



(4)



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55. According to Bohr's model of hydrogen atom, which of the following statement is incorrect?

(1) Radius of 3rd orbit is nine times larger than that of 1st orbit. (2) Radius of 8th orbit is four times larger than that of 4th orbit. (3) Radius of 6th orbit is three times larger than that of 4th orbit. (4) Radius of 4th orbit is four times larger than that of 2nd orbit.

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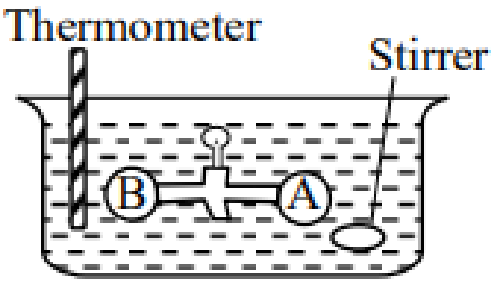
56. Two vessels A and B are connected via stopcock. Vessel A is filled with a gas at a certain pressure. The entire assembly is immersed in water and allowed to come to thermal equilibrium with water. After opening the stopcock the gas from vessel A expands into vessel B and no change in temperature is observed in the thermometer. Which of the following statement is true?



(1) $dw = 0$
(2) $dq = 0$
(3) $du = 0$
(4) The pressure in the vessel B before opening the stopcock is zero

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57. A solution is made by mixing one mole of volatile liquid A with 3 moles of volatile liquid B. The vapor pressure of pure A is 200 mm Hg and that of the solution is 500 mm Hg. The vapor pressure of pure B and the least volatile component of the solution, respectively, are:

(1) 1400 mm Hg, A (2) 1400 mm Hg, B
(3) 600 mm Hg, A (4) 600 mm Hg, B

---

58. Consider the above reaction, what mass of CaCl will be formed if 250 ml of 0.76 M HCl reacts with 1000 g of CaCO?

(1) 3.908 g (2) 2.636 g
(3) 10.545 g (4) 5.272 g

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59. If equal volumes of AB and XY (both are salts) aqueous solutions are mixed, which of the following combination will give precipitate of AY, at 300 K?

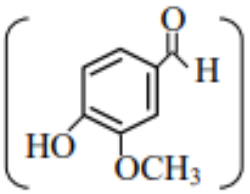
(1) K (300 K) for $AB = 5.2 \times 10^3$
(2) K (300 K) for $AB = 1.0 \times 10^3$
(3) K for 10^{-10} M AB, 5×10^{-10} M XY
(4) K for 15×10^{-10} M XY

---

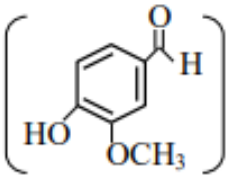
60. Among SO, NF, NH, XeF, CIF, and SF, the hybridization of the molecule with non-zero dipole moment and one or more lone-pairs of electrons on the central atom is:

(1) sp^3
(2) sp^2
(3) sp^3d^2
(4) sp^3d

61. Given below are two statements:
Statement I: Vanillin will react with NaOH and also with Tollen's reagent.



Statement II: Vanillin will undergo self-aldol condensation very easily.



In the 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) 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

---

62. Identify the correct statement among the following:

(1) All naturally occurring amino acids except glycine contain one chiral centre.
(2) All naturally occurring amino acids are optically active.
(3) Glutamic acid is the only amino acid that contains a –COOH group at the side chain.
(4) Amino acid, cysteine easily undergoes dimerization due to the presence of free SH group.

---

63. The correct order of basic nature on aqueous solution for the bases NH_3, NH_2, CH_3NH_2, $CH_3CH_2NH_2$, $(CH_3CH_2)_2NH$ is:

(1) $NH_3 > NH_2 > CH_3NH_2 > CH_3CH_2NH_2 > (CH_3CH_2)_2NH$
(2) $NH_2 > NH_3 > CH_3NH_2 > CH_3CH_2NH_2 > (CH_3CH_2)_2NH$
(3) $NH_3 > CH_3NH_2 > NH_2 > CH_3CH_2NH_2 > (CH_3CH_2)_2NH$
(4) $NH_3 > CH_3CH_2NH_2 > NH_2 > CH_3NH_2 > (CH_3CH_2)_2NH$

64. Given below are two statements:
Statement I: The metallic radius of Al is less than that of Ga.

Statement II: The ionic radius of Al^{3+} is less than that of Ga^{3+}.

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

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

---

65. Given below are two statements:
Statement I: High spin complexes have high values of Δ_o.

Statement II: Low spin complexes are formed when Δ_o is high.

In the 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) 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

---

66. Choose the correct sets with respective observations:
(1) $CuSO_4$ (acidified with acetic acid) + $K_2Fe(CN)_6$ (neutralized with NaOH) $\rightarrow$ Blue precipitate

(2) $2CuSO_4 + K_2Fe(CN)_6 \rightarrow$ Blue precipitate

(3) $4FeCl_3 + 3K_4Fe(CN)_6 \rightarrow \frac{1}{2}K_4Fe(CN)_6$

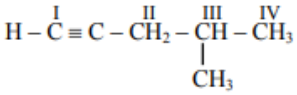
(4) $37Cl_2 + 2KFe(CN)_6 \rightarrow 6KC1$

In the light of the above options, choose the correct set:

(1) (A), (B), (C) (2) (A), (B), (D) (3) (C), (D) (4) (B), (D)

---

68. Consider the following compound (X):



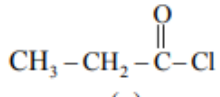
(X)

The most stable and least stable carbon radicals, respectively, produced by homolytic cleavage of corresponding C - H bond are:

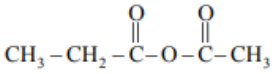
(1) I, IV (2) III, II (3) II, IV (4) I, III

---

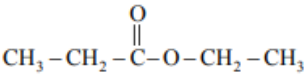
69. Consider the following molecules:



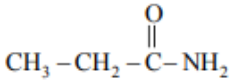
(p)



(q)



(r)



(s)

The order of rate of hydrolysis is:

(1) $r > q > p > s$ (2) $q > p > r > s$
(3) $p > r > q > s$ (4) $p > q > r > s$

---

70. A molecule with the formula AX_2Y_2 has all it's elements from p-block. Element A is rarest, monotomic, non-radioactive from its group and has the lowest ionization energy value among X and Y. Elements X and Y have first and second highest electronegativity values respectively among all the known elements. The shape of the molecule is:

(1) Square pyramidal
(2) Octahedral
(3) Planar

(4) Tetrahedral

Chemistry

SECTION-B

71. A transition metal (M) among Mn, Cr, Co, and Fe has the highest standard electrode potential M^n/M^{n+1}. It forms a metal complex of the type $[M\text{CN}]^{n+}$. The number of electrons present in the e-orbital of the complex is .....

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

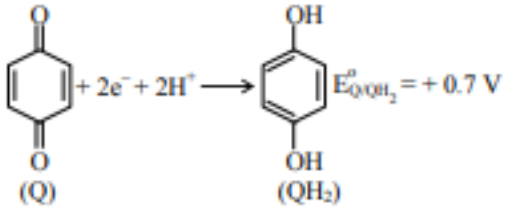
---

72. Consider the following electrochemical cell at standard condition.

$$\text{Au(s)} \text{ — } \text{QH}_2 \text{ — } \text{QH}_X(0.01M) \text{ — } \text{Ag(1M)} \text{ — } \text{Ag(s)} \;\; E_{\text{cell}} = +0.4V$$

The couple QH/Q represents quinhydrone electrode, the half cell reaction is given below:

$$\text{QH}_2 \rightarrow \text{Q} + 2e^- + 2H^+ \; E^\circ_{\text{QH/Q}} = +0.7V$$



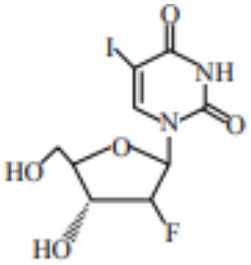
$$\left[\text{Given : } E^\circ_{Ag^+/Ag} = +0.8\text{V and } \frac{2.303RT}{F} = 0.06\text{V}\right]$$

The pK_b value of the ammonium halide salt (NH_4X) used here is _____. (nearest integer)

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

---

73. 0.1 mol of the following given antiviral compound (P) will weigh .....x 10^{-1} g.



(P)

(Given : molar mass in g mol^{-1} H: 1, C : 12, N : 14, O : 16, F : 19, I : 127)

(1) 372 (2) 450 (3) 500 (4) 350

---

74. Consider the following equilibrium,

$$CO(g) + H_2(g) \rightleftharpoons CH_3OH(g)$$

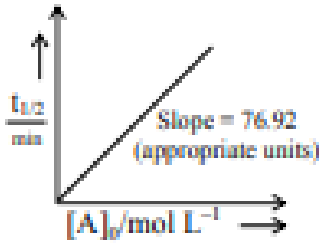
0.1 mol of CO along with a catalyst is present in a 2 dm^3 flask maintained at 500 K. Hydrogen is introduced into the flask until the pressure is 5 bar and 0.04 mol of CH_3OH is formed. The K_p is ..... x 10^7 (nearest integer).

Given: $R = 0.08\,dm^3\,bar\,K^{-1}\,mol^{-1}$

Assume only methanol is formed as the product and the system follows ideal gas behavior.
(1) 74 (2) 67 (3) 54 (4) 85

---

75. For the reaction $A \rightarrow$ products,



The concentration of A at 10 minutes is _____

$\times 10^{-1}$ mol L^{-1} (nearest integer).

The reaction was started with 2.5 mol L^{-1} of A.

(1) 2435 (2) 2000 (3) 1000 (4) 3000
