

JEE Main 2025 Paper 1 (B.E./B.Tech) 3 April 2025 Shift 2 Question Paper



Conducted by the National Testing Agency (NTA)

Time Allowed: 3 Hours

Paper 1: B.E./B.Tech.

Maximum Marks: 300

General Instructions

- (i) This paper is **Paper 1 (B.E./B.Tech.)** of **JEE (Main) 2025 - Session 2**, conducted by the National Testing Agency (NTA) in Computer Based Test (CBT) mode on 3 April 2025, Shift 2. The total duration is **3 hours**.
- (ii) The paper has **75 questions** and a maximum of **300 marks**: Mathematics, Physics and Chemistry carry 25 questions (100 marks) each, in that order.
- (iii) Each subject has **two sections**. **Section A** has **20 multiple choice questions** (MCQs) with four options each. Select the most appropriate answer. **Section B** has **5 numerical value questions**.
- (iv) **All questions are compulsory**. For Section B, the answer is an integer value; the answer should be **rounded off to the nearest integer**. Use only the constants given in the question while calculating.
- (v) **Marking scheme** (Sections A and B): **+4** for a correct answer, **–1** for an incorrect answer, and **0** for an unanswred or marked-for-review question.
- (vi) All calculations and rough work are to be done on the rough sheets only. Calculators, log tables, slide rules and electronic gadgets are not allowed.

1. The area of the region $\{(x, y) : |x - y| \leq y \leq 4\sqrt{x}\}$ is

- (A) $\frac{512}{3}$ (B) $\frac{2048}{3}$
(C) 512 (D) $\frac{1024}{3}$

2. Line L_1 of slope 2 and line L_2 of slope $\frac{1}{2}$ intersect at the origin O. In the first quadrant, $P_1, P_2, \dots, P_{12}$ are 12 points on line L_1 and $Q_1, Q_2, \dots, Q_9$ are 9 points on line L_2 . Then the total number of triangles, that can be formed having vertices at three of the 22 points O, $P_1, P_2, \dots, P_{12}, Q_1, Q_2, \dots, Q_9$, is:

- (A) 1026 (B) 1188
(C) 1134 (D) 1080

3. Each of the angles β and γ that a given line makes with the positive y - and z -axes, respectively, is half of the angle that this line makes with the positive x -axis. Then the sum of all possible values of the angle β is

- (A) $\frac{\pi}{2}$ (B) π
(C) $\frac{3\pi}{4}$ (D) $\frac{3\pi}{2}$

4.

If $z_1, z_2, z_3 \in \mathbb{C}$ are the vertices of an equilateral triangle, whose centroid is z_0 , then

$\sum_{k=1}^3 (z_k - z_0)^2$ is equal to

- (A) 0 (B) 1
(C) i (D) $-i$

5. Let C be the circle of minimum area enclosing the ellipse $E : \frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$ with eccentricity $\frac{1}{2}$ and foci $(\pm 2, 0)$. Let PQR be a variable triangle, whose vertex P is on the circle C and the side QR of length $2a$ is parallel to the major axis of E and contains the point of intersection of E with the negative y -axis. Then the maximum area of the triangle PQR is :

- (A) $8(3 + \sqrt{2})$ (B) $8(2 + \sqrt{3})$
(C) $6(3 + \sqrt{2})$ (D) $6(2 + \sqrt{3})$

6. The shortest distance between the curves $y^2 = 8x$ and $x^2 + y^2 + 12y + 35 = 0$ is:

- (A) $2\sqrt{3} - 1$ (B) $2\sqrt{2} - 1$
(C) $3\sqrt{2} - 1$ (D) $\sqrt{2}$

7. Consider the lines $x(3\lambda + 1) + y(7\lambda + 2) = 17\lambda + 5$, λ being a parameter, all passing through a point P. One of these lines (say L) is farthest from the origin. If the distance of L from the point $(3, 6)$ is d , then the value of d^2 is

- (A) 10 (B) 20
(C) 15 (D) 30

8. Let $y = y(x)$ be the solution of the differential equation

$$\frac{dy}{dx} + 3(\tan^2 x)y + 3y = \sec^2 x, y(0) = \frac{1}{3} + e^3.$$

Then $y\left(\frac{\pi}{4}\right)$ is equal to :

- (A) $\frac{4}{3}$ (B) $\frac{2}{3} + e^3$
(C) $\frac{4}{3} + e^3$ (D) $\frac{2}{3}$

9. Let f be a function such that $f(x) + 3f\left(\frac{24}{x}\right) = 4x, x \neq 0$. Then $f(3) + f(8)$ is equal to

- (A) 13 (B) 11
(C) 10 (D) 12

10. Let the equation $x(x+2)(12-k)=2$ have equal roots. Then the distance of the point $(k, \frac{k}{2})$ from the line $3x+4y+5=0$ is

- (A) 15 (B) 12
(C) $5\sqrt{3}$ (D) $15\sqrt{5}$

11. Let $A = \{-2, -1, 0, 1, 2, 3\}$. Let R be a relation on A defined by xRy if and only if $y = \max\{x, 1\}$. Let l be the number of elements in R . Let m and n be the minimum number of elements required to be added in R to make it reflexive and symmetric relations, respectively. Then $l+m+n$ is equal to

- (A) 11 (B) 12
(C) 14 (D) 13

12. Let the Mean and Variance of five observations $x_1=1, x_2=3, x_3=a, x_4=7$ and $x_5=b, a>b$, be 5 and 10 respectively. Then the Variance of the observations $n+x_n, n=1, 2, \dots, 5$ is

- (A) 17 (B) 16
(C) 16.4 (D) 17.4

13. The integral $\int_0^\pi \frac{8x dx}{4\cos^2 x + \sin^2 x}$ is equal to

- (A) $2\pi^2$ (B) $4\pi^2$
(C) π^2 (D) $\frac{3\pi^2}{2}$

14. The distance of the point $(7, 10, 11)$ from the line $\frac{x-4}{1} = \frac{y-4}{2} = \frac{z-2}{3}$ along the line $\frac{x-9}{2} = \frac{y-13}{3} = \frac{z-17}{6}$ is

- (A) 16 (B) 12
(C) 18 (D) 14

15. If the probability that the random variable X takes the value x is given by $P(X=x) = k(x+1)3^{-x}, x=0, 1, 2, 3, \dots$, where k is a constant, then $P(X \geq 3)$ is equal to

- (A) $\frac{1}{9}$ (B) $\frac{8}{27}$
(C) $\frac{7}{27}$ (D) $\frac{4}{9}$

16. The number of solutions of the equation

$$(4 - \sqrt{3}) \sin x - 2\sqrt{3} \cos^2 x = -\frac{4}{1 + \sqrt{3}},$$

$$x \in \left[-2\pi, \frac{5\pi}{2}\right]$$

is

- (A) 4 (B) 3
(C) 6 (D) 5

17. If the domain of the function $f(x) = \log_7(1 - \log_4(x^2 - 9x + 18))$ is $(\alpha, \beta) \cup (\gamma, \delta)$, then $\alpha + \beta + \gamma + \delta$ is equal to

- (A) 17 (B) 15
(C) 16 (D) 18

18. Let $f: \mathbb{R} \rightarrow \mathbb{R}$ be a function defined by $f(x) = ||x+2| - 2|x||$. If m is the number of points of local minima and n is the number of points of local maxima of f , then $m+n$ is

- (A) 3 (B) 4
(C) 2 (D) 5

19. The sum $1 + \frac{1+3}{2!} + \frac{1+3+5}{3!} + \frac{1+3+5+7}{4!} + \dots$ upto ∞ terms, is equal to

- (A) $3e$ (B) $2e$
(C) $4e$ (D) $6e$

20. If the four distinct points $(4, 6), (-1, 5), (0, 0)$ and $(k, 3k)$ lie on a circle of radius r , then $10k + r^2$ is equal to

- (A) 34 (B) 32
(C) 35 (D) 33

21.

If $\lim_{x \rightarrow 0} \left(\frac{\tan x}{x} \right)^{\frac{1}{x^2}} = p$, then $96 \log_e p$ is equal to _____.

22. If the equation of the hyperbola with foci $(4, 2)$ and $(8, 2)$ is $3x^2 - y^2 - \alpha x + \beta y + \gamma = 0$, then $\alpha + \beta + \gamma$ is equal to _____.

23.

Let $(1 + x + x^2)^{10} = a_0 + a_1x + a_2x^2 + \dots + a_{20}x^{20}$. If $(a_1 + a_3 + a_5 + \dots + a_{19}) - 11a_2 = 121k$, then k is equal to _____.

24.

Let $\vec{a} = \hat{i} + 2\hat{j} + \hat{k}$, $\vec{b} = 3\hat{i} - 3\hat{j} + 3\hat{k}$, $\vec{c} = 2\hat{i} - \hat{j} + 2\hat{k}$ and $\vec{d}$ be a vector such that $\vec{b} \times \vec{d} = \vec{c} \times \vec{d}$ and $\vec{a} \cdot \vec{d} = 4$. Then $|\vec{a} \times \vec{d}|^2$ is equal to _____.

25. Let I be the identity matrix of order 3×3

and for the matrix $A = \begin{bmatrix} \lambda & 2 & 3 \\ 4 & 5 & 6 \\ 7 & -1 & 2 \end{bmatrix}$, $|A| = -1$.

Let B be the inverse of the matrix $\text{adj}(A \text{adj}(A^2))$. Then $|(\lambda B + I)|$ is equal to _____.

26. Two cylindrical vessels of equal cross sectional area of 2 m^2 contain water upto heights 10 m and 6 m, respectively. If the vessels are connected at their bottom then the work done by the force of gravity is (Density of water is 10^3 kg/m^3 and $g = 10 \text{ m/s}^2$)

- (A) $1 \times 10^5 \text{ J}$ (B) $4 \times 10^4 \text{ J}$
(C) $8 \times 10^4 \text{ J}$ (D) $6 \times 10^4 \text{ J}$

27. Two monochromatic light beams have intensities in the ratio 1:9. An interference pattern is obtained by these beams. The ratio of the intensities of maximum to minimum is

- (A) 8 : 1 (B) 4 : 1
(C) 3 : 1 (D) 9 : 1

28. A particle moves along the x -axis and has its displacement x varying with time t according to the equation:

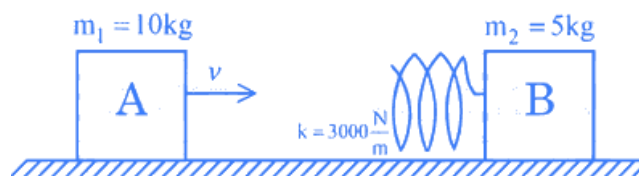
$$x = c_0(t^2 - 2) + c(t - 2)^2$$

where c_0 and c are constants of appropriate dimensions.

Then, which of the following statements is correct?

- (A) the acceleration of the particle is $2(c + c_0)$ (B) the acceleration of the particle is $2c_0$
(C) the acceleration of the particle is $2c$ (D) the initial velocity of the particle is $4c$

29.



Consider two blocks A and B of masses $m_1 = 10 \text{ kg}$ and $m_2 = 5 \text{ kg}$ that are placed on a frictionless table. The block A moves with a constant speed $v = 3 \text{ m/s}$ towards the block B kept at rest. A spring with spring constant $k = 3000 \text{ N/m}$ is attached with the block B as shown in the figure. After the collision, suppose that the blocks A and B, along with the spring in constant compression state, move together, then the compression in the spring is, (Neglect the mass of the spring)

- (A) 0.3 m (B) 0.1 m
(C) 0.4 m (D) 0.2 m

30. A magnetic dipole experiences a torque of $80\sqrt{3} \text{ N m}$ when placed in uniform magnetic field in such a way that dipole moment makes angle of 60° with magnetic field. The potential energy of the dipole is :

- (A) $-40\sqrt{3} \text{ J}$
(B) -80 J
(C) 80 J
(D) -60 J

31. An ideal gas exists in a state with pressure P_0 , volume V_0 . It is isothermally expanded to 4 times of its initial volume (V_0), then isobarically compressed to its original volume. Finally the system is heated isochorically to bring it to its initial state. The amount of heat exchanged in this process is

- (A) $P_0 V_0(\ln 2 - 0.75)$ (B) $P_0 V_0(2 \ln 2 - 0.75)$
(C) $P_0 V_0(2 \ln 2 - 0.25)$ (D) $P_0 V_0(\ln 2 - 0.25)$

32. Width of one of the two slits in a Young's double slit interference experiment is half of the other slit. The ratio of the maximum to the minimum intensity in the interference pattern is :

- (A) 3 : 1
 (B) $(2\sqrt{2} + 1) : (2\sqrt{2} - 1)$
 (C) 9 : 1
 (D) $(3 + 2\sqrt{2}) : (3 - 2\sqrt{2})$

33. Using a battery, a 100 pF capacitor is charged to 60 V and then the battery is removed. After that, a second uncharged capacitor is connected to the first capacitor in parallel. If the final voltage across the second capacitor is 20 V , its capacitance is: (in pF)

- (A) 600 (B) 100
 (C) 400 (D) 200

34. A motor operating on 100 V draws a current of 1 A . If the efficiency of the motor is 91.6%, then the loss of power in units of cal/s is

- (A) 6.2 (B) 2
 (C) 8.4 (D) 4

35. In the resonance experiment, two air columns (closed at one end) of 100 cm and 120 cm long, give 15 beats per second when each one is sounding in the respective fundamental modes. The velocity of sound in the air column is:

- (A) 370 m/s (B) 340 m/s
 (C) 335 m/s (D) 360 m/s

36. A block of mass 1 kg , moving along x with speed $v_i = 10$ m/s enters a rough region ranging from $x = 0.1$ m to $x = 1.9$ m. The retarding force acting on the block in this range is $F_r = -krN$, with $k = 10$ N/m. Then the final speed of the block as it crosses rough region is.

- (A) 4 m/s (B) 10 m/s
 (C) 8 m/s (D) 6 m/s

37.

The truth table corresponding to the circuit given below is:



(A)

A	B	C
0	0	0
0	1	0
1	0	1
1	1	1

(B)

A	B	C
0	0	1
1	0	0
0	1	0
1	1	0

(C)

A	B	C
0	0	1
0	1	0
1	0	0
1	1	0

(D)

A	B	C
0	0	0
1	0	0
0	1	0
1	1	1

38. A monochromatic light of frequency 5×10^{14} Hz travelling through air, is incident on a medium of refractive index ' 2 '. Wavelength of the refracted light will be :

- (A) 400 nm (B) 300 nm
 (C) 600 nm (D) 500 nm

39.

Match the LIST – I with LIST – II

LIST-I		LIST-II	
A.	Boltzmann constant	I	$\text{ML}^2 \text{T}^{-1}$
B	Coefficient of viscosity	II	$\text{MLT}^{-3} \text{K}^{-1}$
C	Planck's constant	III	$\text{ML}^2 \text{T}^{-2} \text{K}^{-1}$
D	Thermal conductivity	IV	$\text{ML}^{-1} \text{T}^{-1}$

Choose the correct answer from the options given below:

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

40. Pressure of an ideal gas, contained in a closed vessel, is increased by 0.4% when heated by 1°C . Its initial temperature must be:

- (A) 2500 K (B) 25°C
 (C) 250°C (D) 250 K

41. A solid steel ball of diameter 3.6 mm acquired terminal velocity $2.45 \times 10^{-2} \text{ m/s}$ while falling under gravity through an oil of density 925 kg m^{-3} . Take density of steel as 7825 kg m^{-3} and g as 9.8 m/s^2 . The viscosity of the oil in SI unit is

- (A) 2.18 (B) 1.68
 (C) 2.38 (D) 1.99

42. A particle is projected with velocity u so that its horizontal range is three times the maximum height attained by it. The horizontal range of the projectile is given as $\frac{nu^2}{25g}$, where value of n is: (Given, ' g ' is the acceleration due to gravity.)

- (A) 6 (B) 12
 (C) 18 (D) 24

43. Given below are two statements: one is labelled as **Assertion A** and the other is labelled as **Reason R**

Assertion A : The Bohr model is applicable to hydrogen and hydrogen-like atoms only.

Reason R : The formulation of Bohr model does not include repulsive force between electrons.

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

- (A) **A** is true but **R** is false
 (B) Both **A** and **R** are true and **R** is the correct explanation of **A**
 (C) **A** is false but **R** is true
 (D) Both **A** and **R** are true but **R** is NOT the correct explanation of **A**

44. An electric bulb rated as 100 W – 220 V is connected to an ac source of rms voltage 220 V. The peak value of current through the bulb is :

- (A) 0.32 A (B) 0.64 A
 (C) 0.45 A (D) 2.2 A

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

Assertion A : If Oxygen ion (O^{-2}) and Hydrogen ion (H^+) enter normal to the magnetic field with equal momentum, then the path of O^{-2} ion has a smaller curvature than that of H^+ .

Reason R : A proton with same linear momentum as an electron will form a path of smaller radius of curvature on entering a uniform magnetic field perpendicularly.

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

- (A) Both **A** and **R** are true but **R** is NOT the correct explanation of **A**
 (B) **A** is false but **R** is true
 (C) **A** is true but **R** is false
 (D) Both **A** and **R** are true and **R** is the correct explanation of **A**

46. An electron in the hydrogen atom initially in the fourth excited state makes a transition to n^{th} energy state by emitting a photon of energy 2.86 eV. The integer value of n will be _____.

47. Light from a point source in air falls on a spherical glass surface (refractive index, $\mu = 1.5$ and radius of curvature = 50 cm). The image is formed at a distance of 200 cm from the glass surface inside the glass. The magnitude of distance of the light source from the glass surface is _____ m.

48. Two cells of emfs 1 V and 2 V and internal resistances 2Ω and 1Ω , respectively, are connected in series with an external resistance of 6Ω . The total current in the circuit is I_1 . Now the same two cells in parallel configuration are connected to same external resistance. In this case, the total current drawn is I_2 . The value of $\left(\frac{I_1}{I_2}\right)$ is $\frac{x}{3}$. The value of x is _____.

49. The excess pressure inside a soap bubble A in air is half the excess pressure inside another soap bubble B in air. If the volume of the bubble A is n times the volume of the bubble B, then, the value of n is _____.

50. A physical quantity C is related to four other quantities p, q, r and s as follows

$$C = \frac{pq^2}{r^3\sqrt{s}}$$

The percentage errors in the measurement of p, q, r and s are 1%, 2%, 3% and 2%, respectively. The percentage error in the measurement of C will be _____ %

51. Given below are two statements:

Statement I : Wet cotton clothes made of cellulose based carbohydrate takes comparatively longer time to get dried than wet nylon polymer based clothes.

Statement II : Intermolecular hydrogen bonding with water molecule is more in nylon-based clothes than in the case of cotton clothes.

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

- | | |
|---|---|
| (A) Both Statement I and Statement II are false | (B) Both Statement I and Statement II are true |
| (C) Statement I is false but Statement II is true | (D) Statement I is true but Statement II is false |

52. Fat soluble vitamins are:

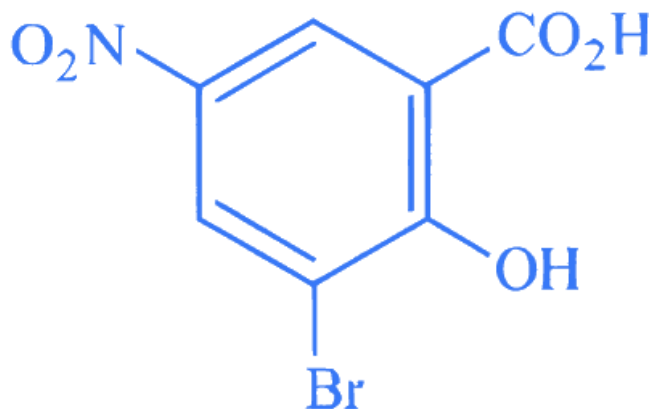
- A. Vitamin B₁
 B. Vitamin C
 C. Vitamin E
 D. Vitamin B₁₂
 E. Vitamin K

Choose the correct answer from the options given below:

- | | |
|----------------|----------------|
| (A) B & C Only | (B) C & D Only |
| (C) C & E Only | (D) A & B Only |

53.

What is the correct IUPAC name of



?

- | | |
|---|---|
| (A) 3-Bromo-2-hydroxy-5-nitrobenzoic acid | (B) 2-Hydroxy-3-bromo-5-nitrobenzoic acid |
| (C) 3-Bromo-4-hydroxy-1-nitrobenzoic acid | (D) 5-Nitro-3-bromo-2-hydroxybenzoic acid |

54. Mass of magnesium required to produce 220 mL of hydrogen gas at STP on reaction with excess of dil. HCl is

Given: Molar mass of Mg is 24 g mol^{-1} .

- | | |
|-------------|-------------|
| (A) 0.24 mg | (B) 235.7 g |
| (C) 2.444 g | (D) 236 mg |

55. Given below are two statements:

Statement I : When a system containing ice in equilibrium with water (liquid) is heated, heat is absorbed by the system and there is no change in the temperature of the system until whole ice gets melted.

Statement II : At melting point of ice, there is absorption of heat in order to overcome intermolecular forces of attraction within the molecules of water in ice and kinetic energy of molecules is not increased at melting point.

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

- | | |
|---|---|
| (A) Both Statement I and Statement II are false | (B) Statement I is true but Statement II is false |
| (C) Both Statement I and Statement II are true | (D) Statement I is false but Statement II is true |

56. The correct orders among the following are

Atomic radius : $B < Al < Ga < In < Tl$

Electronegativity : $Al < Ga < In < Tl < B$

Density : $Tl < In < Ga < Al < B$

1st Ionisation Energy : $In < Al < Ga < Tl < B$

Choose the correct answer from the options given below:

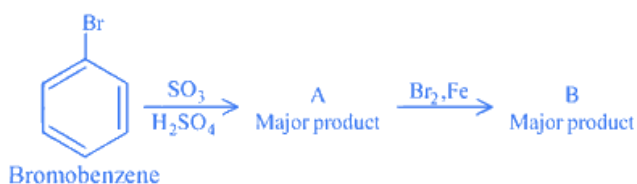
- | | |
|------------------|------------------|
| (A) B and D Only | (B) A and B Only |
| (C) C and D Only | (D) A and C Only |

57. 10 mL of 2 M NaOH solution is added to 20 mL of 1 M HCl solution kept in a beaker. Now, 10 mL of this mixture is poured into a volumetric flask of 100 mL containing 2 moles of HCl and made the volume upto the mark with distilled water. The solution in this flask is :

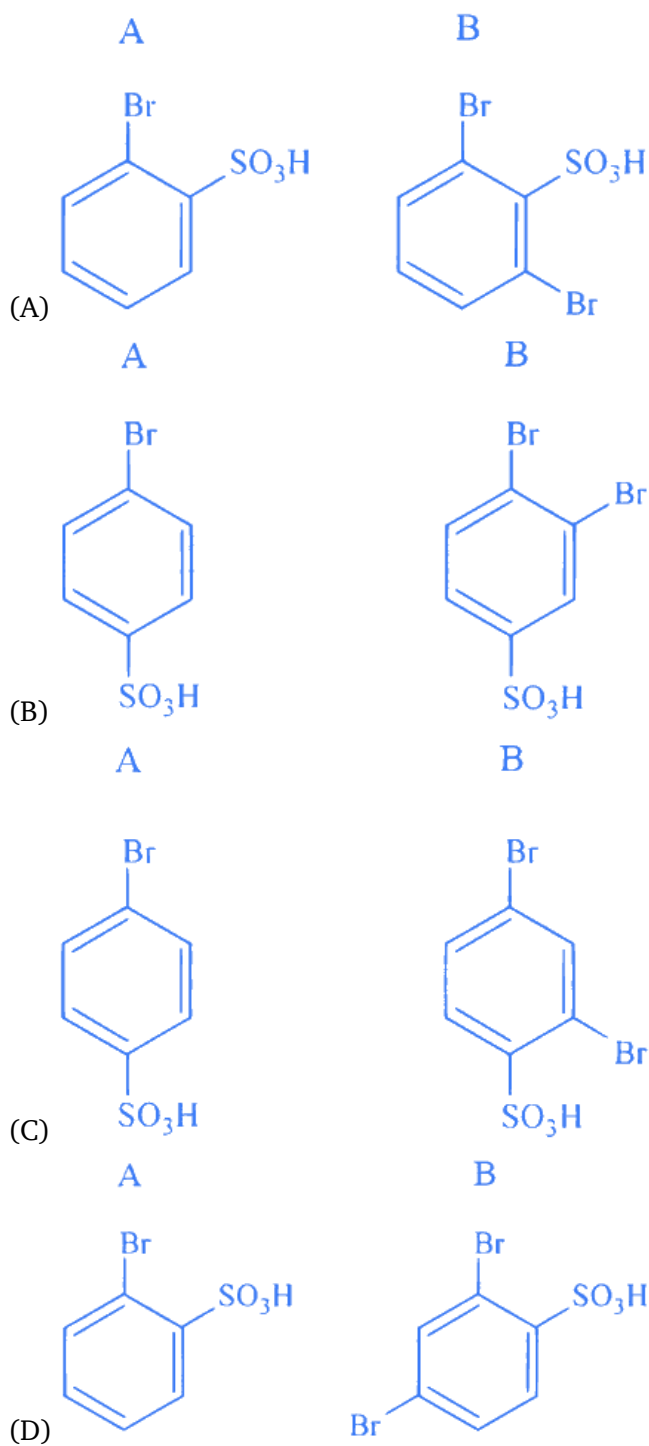
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|-------------------------|-----------------------|
| (A) 0.2 M NaCl solution | (B) 20 M HCl solution |
| (C) Neutral solution | (D) 10 M HCl solution |

58.

In the following series of reactions identify the major products A & B respectively



58. (continued)



59. Identify the diamagnetic octahedral complex ions from below ;

- A. $[\text{Mn}(\text{CN})_6]^{3-}$
- B. $[\text{Co}(\text{NH}_3)_6]^{3+}$
- C. $[\text{Fe}(\text{CN})_6]^{4-}$
- D. $[\text{Co}(\text{H}_2\text{O})_3\text{F}_3]$

Choose the correct answer from the options given below:

- | | |
|------------------|------------------|
| (A) B and C Only | (B) A and C Only |
| (C) B and D Only | (D) A and D Only |

60. Given below are two statements:

Statement I : CrO_3 is a stronger oxidizing agent than MoO_3

Statement II : Cr(VI) is more stable than Mo(VI)

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

- | | |
|---|---|
| (A) Statement I is true but Statement II is false | (B) Both Statement I and Statement II are true |
| (C) Both Statement I and Statement II are false | (D) Statement I is false but Statement II is true |

61. Consider the following statements related to temperature dependence of rate constants.

Identify the correct statements.

- A. The Arrhenius equation holds true only for an elementary homogenous reaction.
- B. The unit of A is same as that of k in Arrhenius equation.
- C. At a given temperature, a low activation energy means a fast reaction.
- D. A and E_a as used in Arrhenius equation depend on temperature.
- E. When $E_a \gg RT$, A and E_a become interdependent.

Choose the correct answer from the options given below:

- | | |
|---------------------|---------------------|
| (A) A, C and D Only | (B) B, D and E Only |
| (C) B and C Only | (D) A and B Only |

62. Given below are two statements :

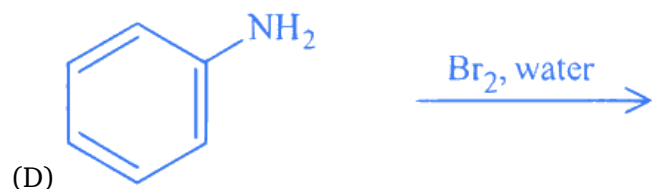
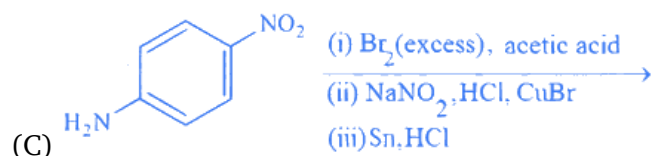
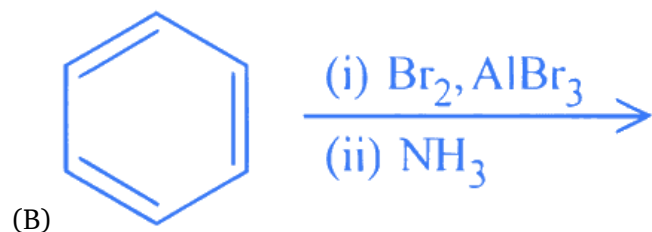
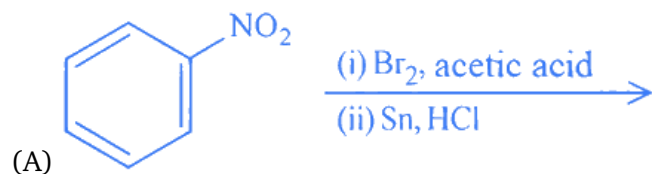
Statement I : Hyperconjugation is not a permanent effect.

Statement II : In general, greater the number of alkyl groups attached to a positively charged Cation, greater is the hyperconjugation interaction and stabilization of the cation.

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

- | | |
|---|---|
| (A) Statement I is false but Statement II is true | (B) Statement I is true but Statement II is false |
| (C) Both Statement I and Statement II are false | (D) Both Statement I and Statement II are true |

63. The sequence from the following that would result in giving predominantly 3,4,5-Tribromoaniline is :



64.

Match the LIST – I with LIST – II

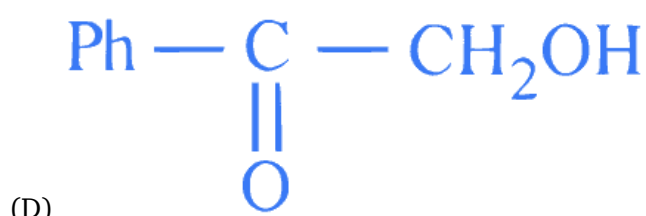
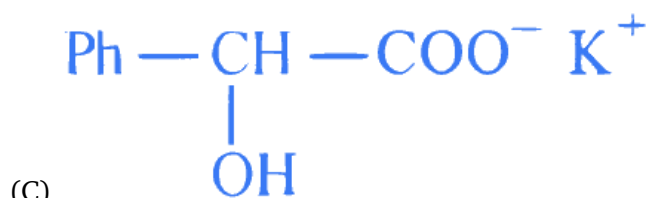
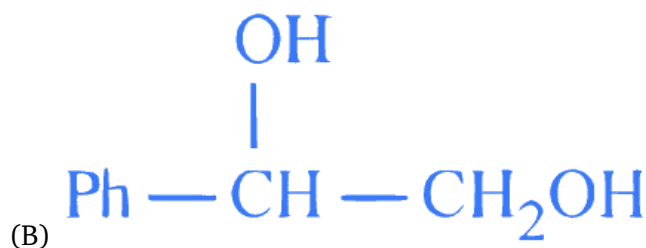
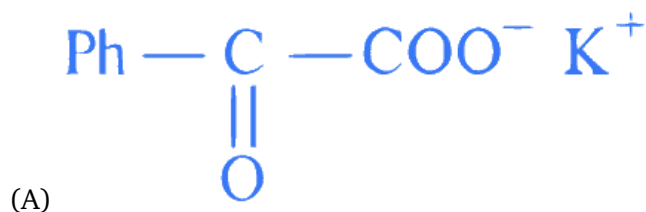
LIST-I (Family)		LIST-II (Symbol of Element)	
A.	Pnictogen (group 15)	I	Ts
B	Chalcogen	II	Og
C	Halogen	III	Lv
D	Noble gas	IV	Mc

Choose the correct answer from the options given below:

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

65.

The major product (P) in the following reaction is :



66. The standard cell potential ($E_{\text{cell}}^{\ominus}$) of a fuel cell based on the oxidation of methanol in air that has been used to power television relay station is measured as 1.21 V. The standard half cell reduction potential for O_2 ($E_{\text{O}_2/\text{H}_2\text{O}}^{\ominus}$) is 1.229 V.

Choose the correct statement :

- (A) Reactants are fed at one go to each electrode. (B) Oxygen is formed at the anode.
 (C) The standard half cell reduction potential for the reduction of CO_2 ($E_{\text{CO}_2/\text{CH}_3\text{OH}}^{\ominus}$) is 19 mV (D) Reduction of methanol takes place at the cathode.

67. For electrons in '2s' and '2p' orbitals, the orbital angular momentum values, respectively are:

- (A) 0 and $\sqrt{6}\frac{h}{2\pi}$ (B) 0 and $\sqrt{2}\frac{h}{2\pi}$
 (C) $\sqrt{2}\frac{h}{2\pi}$ and 0 (D) $\frac{h}{2\pi}$ and $\sqrt{2}\frac{h}{2\pi}$

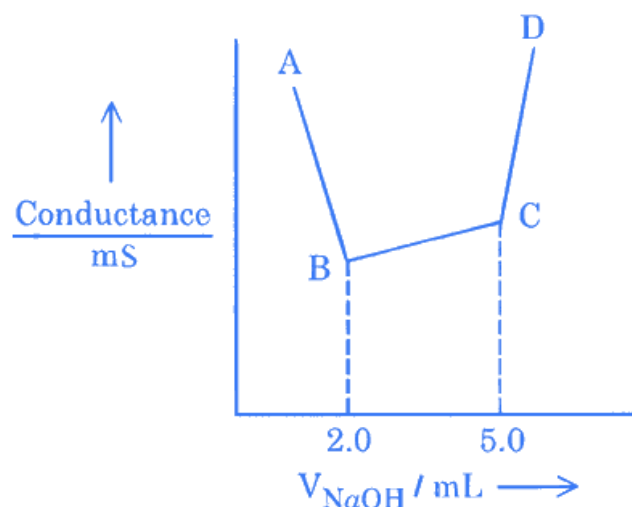
68. Compounds that should not be used as primary standards in titrimetric analysis are :

- A. $\text{Na}_2\text{Cr}_2\text{O}_7$
 B. Oxalic acid
 C. NaOH
 D. $\text{FeSO}_4 \cdot 6\text{H}_2\text{O}$
 E. Sodium tetraborate

Choose the most appropriate answer from the options given below:

- (A) C, D and E Only (B) B and D Only
 (C) D and E Only (D) A, C and D Only

69. 40 mL of a mixture of CH_3COOH and HCl (aqueous solution) is titrated against 0.1 M NaOH solution conductometrically. Which of the following statement is correct?



- (A) The concentration of CH_3COOH in the original mixture is 0.005 M (B) The concentration of HCl in the original mixture is 0.005 M
 (C) CH_3COOH is neutralised first followed by neutralisation of HCl (D) Point 'C' indicates the complete neutralisation of HCl

70. In Dumas' method for estimation of nitrogen 0.4 g of an organic compound gave 60 mL of nitrogen collected at 300 K temperature and 715 mm Hg pressure. The percentage composition of nitrogen in the compound is (Given : Aqueous tension at 300 K = 15 mmHg)

- (A) 15.71% (B) 17.46%
 (C) 7.85% (D) 20.95%

71. X g of nitrobenzene on nitration gave 4.2 g of m -dinitrobenzene. X = _____g. (nearest integer)

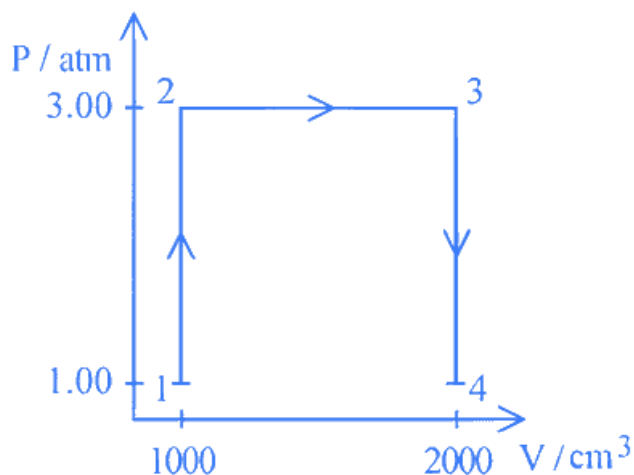
[Given : molar mass (in g mol^{-1}) C : 12, H : 1, O : 16, N : 14]

72. The total number of structural isomers possible for the substituted benzene derivatives with the molecular formula C_9H_{12} is _____.

73. Among, Sc, Mn, Co and Cu , identify the element with highest enthalpy of atomisation. The spin only magnetic moment value of that element in its +2 oxidation state is _____BM (in nearest integer).

74. A perfect gas (0.1 mol) having $\bar{C}_v = 1.50R$ (independent of temperature) undergoes the above transformation from point 1 to point 4. If each step is reversible, the total work done (w) while going from point 1 to point 4 is (–) _____J (nearest integer)

[Given: $R = 0.082 \text{ L atm K}^{-1} \text{ mol}^{-1}$]



75. A sample of n -octane (1.14 g) was completely burnt in excess of oxygen in a bomb calorimeter, whose heat capacity is 5 kJ K^{-1} . As a result of combustion reaction, the temperature of the calorimeter is increased by 5 K . The magnitude of the heat of combustion of octane at constant volume is _____ kJ mol^{-1} (nearest integer).

- End of Question Paper -