

JEE Main 2023 Paper 1 (B.E./B.Tech) 13 April 2023 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) 2023 - Session 2**, conducted by the National Testing Agency (NTA) in Computer Based Test (CBT) mode on 13 April 2023, Shift 2. The total duration is **3 hours**.
- (ii) The paper has **90 questions**, of which **75 are to be attempted**, and a maximum of **300 marks**: Mathematics, Physics and Chemistry carry 30 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 **10 numerical value questions**; attempt **any 5** of them.
- (iv) **All Section A questions are compulsory**. Attempt only the specified number of Section B questions. 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 unanswered 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. Let $a_1, a_2, a_3, \dots$ be a G.P. of increasing positive numbers. Let the sum of its 6th and 8th terms be 2 and the product of its 3rd and 5th terms be $\frac{1}{9}$. Then $6(a_2 + a_4)(a_4 + a_6)$ is equal to

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

2. Let

$$|\vec{a}| = 2, |\vec{b}| = 3$$

and the angle between the vectors $\vec{a}$ and $\vec{b}$ be $\frac{\pi}{4}$. Then $|(\vec{a} + 2\vec{b}) \times (2\vec{a} - 3\vec{b})|^2$ is equal to :

- (A) 441 (B) 482
(C) 841 (D) 882

3. All words, with or without meaning, are made using all the letters of the word MONDAY. These words are written as in a dictionary with serial numbers. The serial number of the word MONDAY is :

- (A) 324 (B) 328
(C) 326 (D) 327

4. Let

$$S = \{z \in \mathbb{C} : \bar{z} = i(z^2 + \operatorname{Re}(\bar{z}))\}$$

. Then

$$\sum_{z \in S} |z|^2$$

is equal to :

- (A) $\frac{7}{2}$
(B) 4
(C) 3
(D) $\frac{5}{2}$

5. If

$$\lim_{x \rightarrow 0} \frac{e^{ax} - \cos(bx) - \frac{cx e^{-cx}}{2}}{1 - \cos(2x)} = 17$$

, then $5a^2 + b^2$ is equal to

- (A) 64 (B) 68
(C) 72 (D) 76

6. The line, that is coplanar to the line

$$\frac{x+3}{-3} = \frac{y-1}{1} = \frac{z-5}{5}$$

, is :

- (A) $\frac{x+1}{-1} = \frac{y-2}{2} = \frac{z-5}{4}$
(B) $\frac{x+1}{-1} = \frac{y-2}{2} = \frac{z-5}{5}$
(C) $\frac{x-1}{-1} = \frac{y-2}{2} = \frac{z-5}{5}$
(D) $\frac{x+1}{1} = \frac{y-2}{2} = \frac{z-5}{5}$

7. The coefficient of x^5 in the expansion of

$$\left(2x^3 - \frac{1}{3x^2}\right)^5$$

is :

- (A) $\frac{26}{3}$
(B) $\frac{80}{9}$
(C) 9
(D) 8

8. Let α, β be the roots of the equation

$$x^2 - \sqrt{2}x + 2 = 0$$

. Then $\alpha^{14} + \beta^{14}$ is equal to

- (A) -64
 (B) $-64\sqrt{2}$
 (C) $-128\sqrt{2}$
 (D) -128

9. Let (α, β) be the centroid of the triangle formed by the lines

$$15x - y = 82, 6x - 5y = -4$$

and $9x + 4y = 17$. Then $\alpha + 2\beta$ and $2\alpha - \beta$ are the roots of the equation :

- (A) $x^2 - 7x + 12 = 0$
 (B) $x^2 - 13x + 42 = 0$
 (C) $x^2 - 14x + 48 = 0$
 (D) $x^2 - 10x + 25 = 0$

10. If the system of equations

$$\begin{aligned} 2x + y - z &= 5 \\ 2x - 5y + \lambda z &= \mu \\ x + 2y - 5z &= 7 \end{aligned}$$

has infinitely many solutions, then $(\lambda + \mu)^2 + (\lambda - \mu)^2$ is equal to

- (A) 916 (B) 912
 (C) 920 (D) 904

11. The area of the region $\{(x, y) : x^2 \leq y \leq |x^2 - 4|, y \geq 1\}$ is

- (A) $\frac{4}{3}(4\sqrt{2} + 1)$
 (B) $\frac{3}{4}(4\sqrt{2} + 1)$
 (C) $\frac{4}{3}(4\sqrt{2} - 1)$
 (D) $\frac{3}{4}(4\sqrt{2} - 1)$

12. The value of

$$\frac{e^{-\frac{\pi}{4}} + \int_0^{\frac{\pi}{4}} e^{-x} \tan^{50} x dx}{\int_0^{\frac{\pi}{4}} e^{-x} (\tan^{49} x + \tan^{51} x) dx}$$

is

- (A) 51 (B) 50
 (C) 25 (D) 49

13. The range of

$$f(x) = 4 \sin^{-1} \left(\frac{x^2}{x^2 + 1} \right)$$

is

- (A) $[0, 2\pi]$
 (B) $[0, 2\pi)$
 (C) $[0, \pi)$
 (D) $[0, \pi]$

14. Let for a triangle ABC,

$$\begin{aligned} \vec{AB} &= -2\hat{i} + \hat{j} + 3\hat{k} \\ \vec{CB} &= \alpha\hat{i} + \beta\hat{j} + \gamma\hat{k} \\ \vec{CA} &= 4\hat{i} + 3\hat{j} + \delta\hat{k} \end{aligned}$$

If

$\delta > 0$ and the area of the triangle ABC is $5\sqrt{6}$, then $\vec{CB} \cdot \vec{CA}$ is equal to

- (A) 60 (B) 54
 (C) 120 (D) 108

15. Let the centre of a circle C be (α, β) and its radius $r < 8$. Let $3x + 4y = 24$ and $3x - 4y = 32$ be two tangents and $4x + 3y = 1$ be a normal to C. Then $(\alpha - \beta + r)$ is equal to :

- (A) 7 (B) 9
(C) 5 (D) 6

16. The plane, passing through the points $(0, -1, 2)$ and $(-1, 2, 1)$ and parallel to the line passing through $(5, 1, -7)$ and $(1, -1, -1)$, also passes through the point :

- (A) $(0, 5, -2)$
(B) $(2, 0, 1)$
(C) $(1, -2, 1)$
(D) $(-2, 5, 0)$

17. Let for

$$A = \begin{bmatrix} 1 & 2 & 3 \\ \alpha & 3 & 1 \\ 1 & 1 & 2 \end{bmatrix}, |A| = 2$$

. If

$$|2 \operatorname{adj}(2 \operatorname{adj}(2A))| = 32^n$$

, then $3n + \alpha$ is equal to

- (A) 11 (B) 9
(C) 12 (D) 10

18. Let N be the foot of perpendicular from the point $P(1, -2, 3)$ on the line passing through the points $(4, 5, 8)$ and $(1, -7, 5)$. Then the distance of N from the plane $2x - 2y + z + 5 = 0$ is :

- (A) 7 (B) 6
(C) 9 (D) 8

19. The statement $(p \wedge (\sim q)) \vee ((\sim p) \wedge q) \vee ((\sim p) \wedge (\sim q))$ is equivalent to _____.

- (A) $(\sim p) \vee (\sim q)$
(B) $p \vee (\sim q)$
(C) $p \vee q$
(D) $(\sim p) \vee q$

20. The random variable X follows binomial distribution $B(n, p)$, for which the difference of the mean and the variance is 1. If

$$2P(X = 2) = 3P(X = 1)$$

, then

$$n^2 P(X > 1)$$

is equal to :

- (A) 15 (B) 12
(C) 11 (D) 16

21. The mean and standard deviation of the marks of 10 students were found to be 50 and 12 respectively. Later, it was observed that two marks 20 and 25 were wrongly read as 45 and 50 respectively. Then the correct variance is _____

22. Let

$$A = \{-4, -3, -2, 0, 1, 3, 4\}$$

and

$$R = \{(a, b) \in A \times A : b = |a|$$

or

$$b^2 = a + 1\}$$

be a relation on A. Then the minimum number of elements, that must be added to the relation R so that it becomes reflexive and symmetric, is _____

23. Let

$$f_n = \int_0^{\frac{\pi}{2}} \left(\sum_{k=1}^n \sin^{k-1} x \right) \left(\sum_{k=1}^n (2k-1) \sin^{k-1} x \right) \cos x dx, n \in \mathbb{N}$$

. Then $f_{21} - f_{20}$ is equal to _____

24. The remainder, when 7^{103} is divided by 17, is _____

25. Let

$$f(x) = \sum_{k=1}^{10} kx^k, x \in \mathbb{R}$$

. If

$$2f(2) + f'(2) = 119(2)^n + 1$$

then n is equal to _____

26. For $x \in (-1, 1]$, the number of solutions of the equation

$$\sin^{-1} x = 2 \tan^{-1} x$$

is equal to _____.

27. If

$$y = y(x)$$

is the solution of the differential equation

$$\frac{dy}{dx} + \frac{4x}{(x^2-1)}y = \frac{x+2}{(x^2-1)^{\frac{5}{2}}}, x > 1$$

such that

$$y(2) = \frac{2}{9} \log_e(2 + \sqrt{3}) \text{ and } y(\sqrt{2}) = \alpha$$

$$\log_e(\sqrt{\alpha} + \beta) + \beta - \sqrt{\gamma}, \alpha, \beta, \gamma \in \mathbb{N}, \text{ then } \alpha\beta\gamma$$

is equal to

:

28. Let $[\alpha]$ denote the greatest integer $\leq \alpha$. Then $[\sqrt{1}] + [\sqrt{2}] + [\sqrt{3}] + \dots + [\sqrt{120}]$ is equal to _____

29. Total numbers of 3-digit numbers that are divisible by 6 and can be formed by using the digits 1, 2, 3, 4, 5 with repetition, is _____.

30. The foci of a hyperbola are $(\pm 2, 0)$ and its eccentricity is $\frac{3}{2}$. A tangent, perpendicular to the line $2x + 3y = 6$, is drawn at a point in the first quadrant on the hyperbola. If the intercepts made by the tangent on the x - and y-axes are a and b respectively, then $|6a| + |5b|$ is equal to _____

Physics - Section A · Multiple Choice Questions

31. The distance travelled by an object in time t is given by

$$s = (2.5)t^2$$

. The instantaneous speed of the object at $t = 5$ s will be:

- (A) 5 ms^{-1}
 (B) 12.5 ms^{-1}
 (C) 62.5 ms^{-1}
 (D) 25 ms^{-1}

32. Given below are two statements:

Statement I : For a planet, if the ratio of mass of the planet to its radius increases, the escape velocity from the planet also increases.

Statement II : Escape velocity is independent of the radius of the planet.

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

- | | |
|---|--|
| (A) Both Statement I and Statement II are correct | (B) Statement I is correct but statement II is incorrect |
| (C) Both Statement I and Statement II are incorrect | (D) Statement I is incorrect but statement II is correct |

33. In the equation

$$\left[X + \frac{a}{Y^2}\right][Y - b] = RT, X$$

is pressure, Y is volume, R is universal gas constant and T is temperature. The physical quantity equivalent to the ratio $\frac{a}{b}$ is:

- | | |
|-----------------------|------------------------------|
| (A) Impulse | (B) Energy |
| (C) Pressure gradient | (D) Coefficient of viscosity |

34. The initial pressure and volume of an ideal gas are P_0 and V_0 . The final pressure of the gas when the gas is suddenly compressed to volume $\frac{V_0}{4}$ will be :

(Given γ = ratio of specific heats at constant pressure and at constant volume)

- (A) $P_0(4)^{\frac{1}{\gamma}}$
 (B) P_0
 (C) $4P_0$
 (D) $P_0(4)^\gamma$

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

Assertion **A** : A spherical body of radius $(5 \pm 0.1)\text{mm}$ having a particular density is falling through a liquid of constant density. The percentage error in the calculation of its terminal velocity is 4%.

Reason **R** : The terminal velocity of the spherical body falling through the liquid is inversely proportional to its radius.

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

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

36. A vehicle of mass 200 kg is moving along a levelled curved road of radius 70 m with angular velocity of 0.2 rad/s. The centripetal force acting on the vehicle is:

- (A) 560 N
 (B) 14 N
 (C) 2800 N
 (D) 2240 N

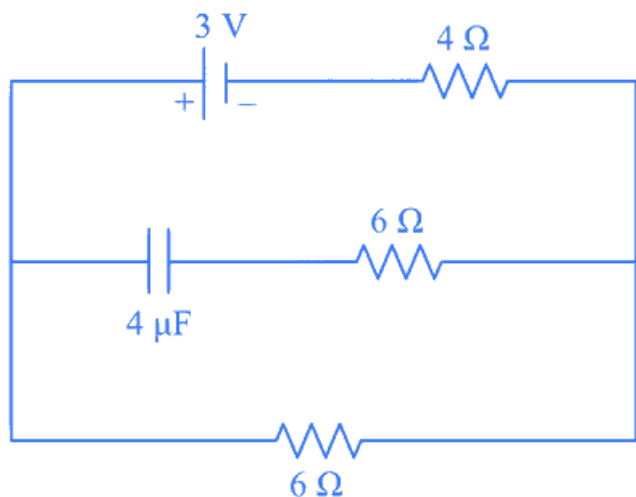
37. Two planets A and B of radii R and $1.5 R$ have densities ρ and $\rho/2$ respectively. The ratio of acceleration due to gravity at the surface of B to A is:

- (A) 2 : 1 (B) 2 : 3
(C) 4 : 3 (D) 3 : 4

38. In an electromagnetic wave, at an instant and at particular position, the electric field is along the negative z -axis and magnetic field is along the positive x -axis. Then the direction of propagation of electromagnetic wave is:

- (A) at 45° angle from positive y -axis
(B) positive y -axis
(C) negative y -axis (D) positive z -axis

39. In the network shown below, the charge accumulated in the capacitor in steady state will be:



- (A) $10.3 \mu\text{C}$ (B) $7.2 \mu\text{C}$
(C) $4.8 \mu\text{C}$ (D) $12 \mu\text{C}$

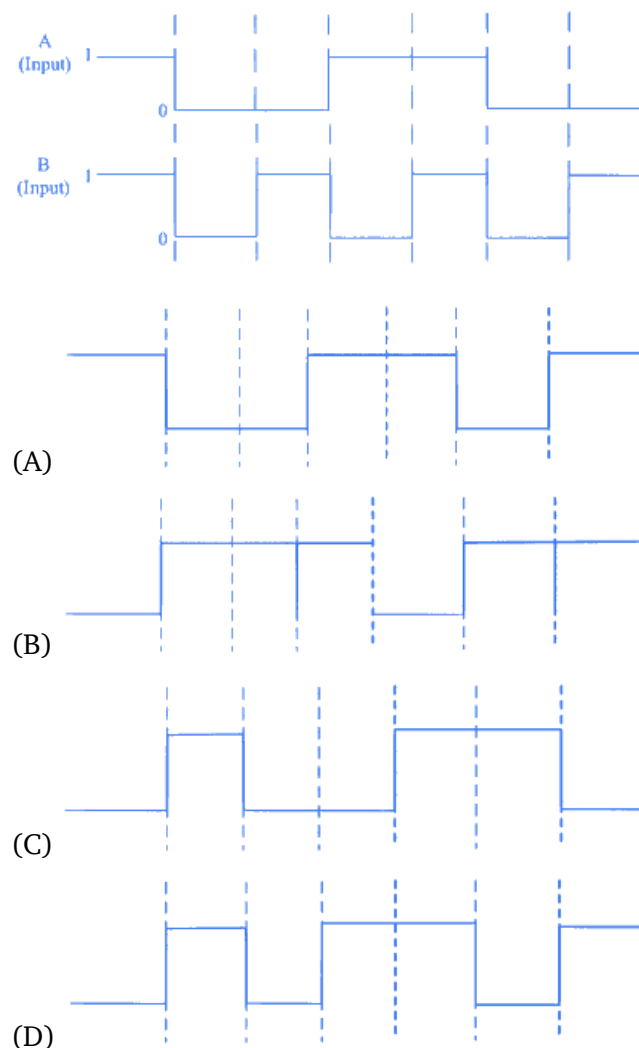
40. In a Young's double slits experiment, the ratio of amplitude of light coming from slits is 2 : 1. The ratio of the maximum to minimum intensity in the interference pattern is:

- (A) 25 : 9 (B) 9 : 1
(C) 9 : 4 (D) 2 : 1

41. The mean free path of molecules of a certain gas at STP is $1500 d$, where d is the diameter of the gas molecules. While maintaining the standard pressure, the mean free path of the molecules at 373 K is approximately:

- (A) 750 d
(B) 1500 d
(C) 2049 d
(D) 1098 d

42. The output from NAND gate having inputs A and B given below will be,



43. A $10 \mu\text{C}$ charge is divided into two parts and placed at 1 cm distance so that the repulsive force between them is maximum. The charges of the two parts are:

- (A) $9 \mu\text{C}, 1 \mu\text{C}$
(B) $5 \mu\text{C}, 5 \mu\text{C}$
(C) $8 \mu\text{C}, 2 \mu\text{C}$
(D) $7 \mu\text{C}, 3 \mu\text{C}$

44. Given below are two statements:

Statement I : An AC circuit undergoes electrical resonance if it contains either a capacitor or an inductor.

Statement II : An AC circuit containing a pure capacitor or a pure inductor consumes high power due to its non-zero power factor.

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

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

45. Given below are two statements:

Statement I : Out of microwaves, infrared rays and ultraviolet rays, ultraviolet rays are the most effective for the emission of electrons from a metallic surface.

Statement II : Above the threshold frequency, the maximum kinetic energy of photoelectrons is inversely proportional to the frequency of the incident light.

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

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

46. An electron is moving along the positive x-axis. If the uniform magnetic field is applied parallel to the negative z-axis, then

- A. The electron will experience magnetic force along positive y-axis
- B. The electron will experience magnetic force along negative y-axis
- C. The electron will not experience any force in magnetic field
- D. The electron will continue to move along the positive x-axis
- E. The electron will move along circular path in magnetic field

Choose the correct answer from the options given below:

- | | |
|------------------|------------------|
| (A) A and E only | (B) B and D only |
| (C) B and E only | (D) C and D only |

47. A particle executes SHM of amplitude A. The distance from the mean position when its kinetic energy becomes equal to its potential energy is :

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

48. A passenger sitting in a train A moving at 90 km/h observes another train B moving in the opposite direction for 8 s. If the velocity of the train B is 54 km/h, then length of train B is:

- | | |
|-----------|-----------|
| (A) 80 m | (B) 200 m |
| (C) 120 m | (D) 320 m |

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

Assertion A : The binding energy per nucleon is practically independent of the atomic number for nuclei of mass number in the range 30 to 170 .

Reason R : Nuclear force is short ranged.

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

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

50. To radiate EM signal of wavelength λ with high efficiency, the antennas should have a minimum size equal to:

- | | |
|-----|---------------------|
| (A) | $\frac{\lambda}{2}$ |
| (B) | λ |
| (C) | $\frac{\lambda}{4}$ |
| (D) | 2λ |

51. Three point charges q , $-2q$ and $2q$ are placed on x -axis at a distance

$$x = 0, x = \frac{3}{4}R$$

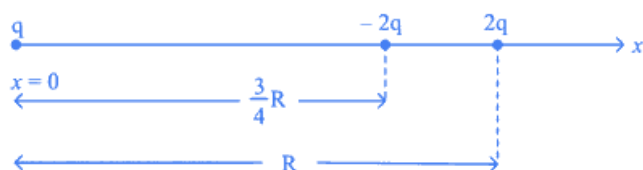
and $x = R$ respectively from origin as shown. If

$$q = 2 \times 10^{-6} \text{ C}$$

and

$$R = 2 \text{ cm}$$

, the magnitude of net force experienced by the charge $-2q$ is _____ N.



52. An atom absorbs a photon of wavelength 500 nm and emits another photon of wavelength 600 nm. The net energy absorbed by the atom in this process is $n \times 10^{-4} \text{ eV}$. The value of n is _____. [Assume the atom to be stationary during the absorption and emission process] (Take

$$h = 6.6 \times 10^{-34} \text{ Js}$$

and

$$c = 3 \times 10^8 \text{ m/s}$$

)

53. A light rope is wound around a hollow cylinder of mass 5 kg and radius 70 cm. The rope is pulled with a force of 52.5 N. The angular acceleration of the cylinder will be _____ rad s^{-2} .

54. A straight wire AB of mass 40 g and length 50 cm is suspended by a pair of flexible leads in uniform magnetic field of magnitude 0.40 T as shown in the figure. The magnitude of the current required in the wire to remove the tension in the supporting leads is _____ A.

(Take

$$g = 10 \text{ ms}^{-2}$$

).

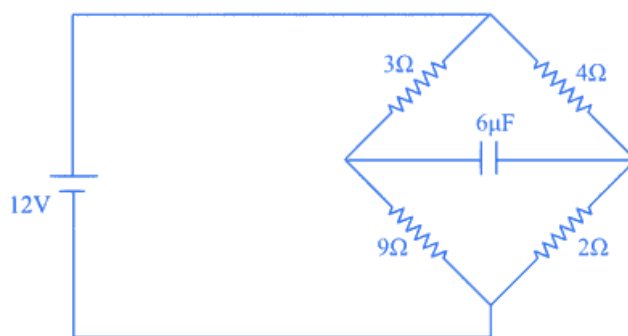


55. Two plates A and B have thermal conductivities $84 \text{ W m}^{-1} \text{ K}^{-1}$ and $126 \text{ W m}^{-1} \text{ K}^{-1}$ respectively. They have same surface area and same thickness. They are placed in contact along their surfaces. If the temperatures of the outer surfaces of A and B are kept at 100°C and 0°C respectively, then the temperature of the surface of contact in steady state is _____ $^\circ\text{C}$.

56. In an experiment with sonometer when a mass of 180 g is attached to the string, it vibrates with fundamental frequency of 30 Hz. When a mass m is attached, the string vibrates with fundamental frequency of 50 Hz. The value of m is _____ g.

57. An insulated copper wire of 100 turns is wrapped around a wooden cylindrical core of the cross-sectional area 24 cm^2 . The two ends of the wire are connected to a resistor. The total resistance in the circuit is 12Ω . If an externally applied uniform magnetic field in the core along its axis changes from 1.5 T in one direction to 1.5 T in the opposite direction, the charge flowing through a point in the circuit during the change of magnetic field will be _____ mC.

58. In the circuit shown, the energy stored in the capacitor is $n \mu\text{J}$. The value of n is _____



59. A bi convex lens of focal length 10 cm is cut in two identical parts along a plane perpendicular to the principal axis. The power of each lens after cut is _____ D.

60. A car accelerates from rest to $u \text{ m/s}$. The energy spent in this process is $E \text{ J}$. The energy required to accelerate the car from $u \text{ m/s}$ to $2u \text{ m/s}$ is $nE \text{ J}$. The value of n is _____.

61. What happens when methane undergoes combustion in systems A and B respectively?

Adiabatic system

Diathermic container

System A

System B

(A)

System A	System B
Temperature falls	Temperature rises

(B)

System A	System B
Temperature rises	Temperature remains same

(C)

System A	System B
Temperature falls	Temperature remains same

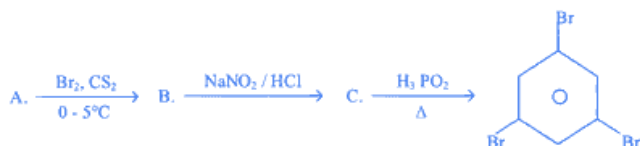
(D)

System A	System B
Temperature remains same	Temperature rises

62. In the wet tests for detection of various cations by precipitation, Ba^{2+} cations are detected by obtaining precipitate of

- (A) BaSO_4
 (B) $\text{Ba}(\text{OAc})_2$
 (C) BaCO_3
 (D) $\text{Ba}(\text{ox})$: Barium oxalate

63. Compound A from the following reaction sequence is:

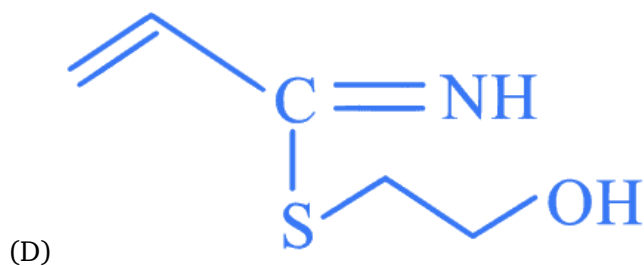
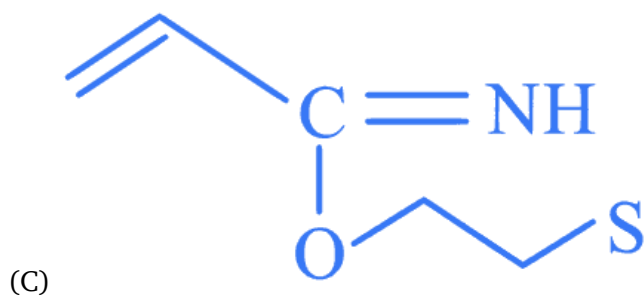


- (A) Benzoic acid
 (B) Phenol
 (C) Salicylic acid
 (D) Aniline

64. The total number of stereoisomers for the complex $[\text{Cr}(\text{ox})_2\text{ClBr}]^{3-}$ (where ox = oxalate) is :

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

65. The major product for the following reaction is:



66. The naturally occurring amino acid that contains only one basic functional group in its chemical structure is

- (A) asparagine (B) arginine
(C) histidine (D) lysine

67. Which of the following complexes will exhibit maximum attraction to an applied magnetic field?

- (A) $[\text{Ni}(\text{H}_2\text{O})_6]^{2+}$
(B) $[\text{Co}(\text{H}_2\text{O})_6]^{2+}$
(C) $[\text{Co}(\text{en})_3]^{3+}$
(D) $[\text{Zn}(\text{H}_2\text{O})_6]^{2+}$

68. Given below are two statements :
Statement I :



and H_2O both possess V-shaped structure.

Statement II : The bond angle of SO_2 is less than that of H_2O .

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

- (A) Both Statement I and Statement II are incorrect
(B) Both Statement I and Statement II are correct
(C) Statement I is correct but Statement II is incorrect
(D) Statement I is incorrect but Statement II is correct

69. The covalency and oxidation state respectively of boron in $[\text{BF}_4]^-$, are :

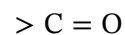
- (A) 3 and 4 (B) 4 and 3
(C) 4 and 4 (D) 3 and 5

70. Given below are two statements :

Statement I : Tropolone is an aromatic compound and has 8π electrons.

Statement II :

electrons of π



group in tropolone is involved in aromaticity.

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) Both Statement I and Statement II are false
(C) Statement I is true but Statement II is false
(D) Both Statement I and Statement II are true

71. Match List I with List II

1 - Bromopropane is reacted with reagents in List I to give product in List II

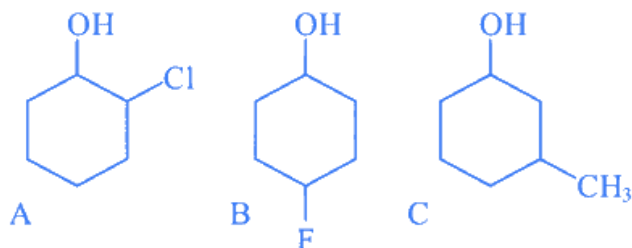
	LIST I - Reagent		LIST II - Product
A.	KOH (alc)	I.	Nitrile
B.	KCN (alc)	II.	Ester
C.	AgNO_2	III.	Alkene
D.	H_3CCOOAg	IV.	Nitroalkane

Choose the correct answer from the options given below:

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

72. Given below are two statements, one is labelled as Assertion A and the other is labelled as Reason R.

Assertion A : Order of acidic nature of the following compounds is $A > B > C$.



Reason R : Fluoro is a stronger electron withdrawing group than Chloro group.

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

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

73. The correct group of halide ions which can be oxidised by oxygen in acidic medium is :

- (A) Br^- only
 (B) Cl^- , Br^- and I^- only
 (C) Br^- and I^- only
 (D) I^- only

74. Match List I with List II

	LIST I		LIST II
A.	Weak intermolecular forces of attraction	I.	Hexamethylenediamine + adipic acid
B.	Hydrogen bonding	II.	$\text{AlEt}_3 + \text{TiCl}_4$
C.	Heavily branched polymer	III.	2-chloro-1,3-butadiene
D.	High density polymer	IV.	Phenol + formaldehyde

Choose the correct answer from the options given below:

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

75. Better method for preparation of BeF_2 , among the following is :

- (A) $\text{BeH}_2 + \text{F}_2 \xrightarrow{\Delta} \text{BeF}_2$
 (B) $(\text{NH}_4)_2\text{BeF}_4 \xrightarrow{\Delta} \text{BeF}_2$
 (C) $\text{Be} + \text{F}_2 \xrightarrow{\Delta} \text{BeF}_2$
 (D) $\text{BeO} + \text{C} + \text{F}_2 \xrightarrow{\Delta} \text{BeF}_2$

76. Given below are two statements, one is labelled as Assertion A and the other is labelled as Reason R.

Assertion A : Isotopes of hydrogen have almost same chemical properties, but difference in their rates of reaction.

Reason R : Isotopes of hydrogen have different enthalpy of bond dissociation.

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

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

77. Which of the following are the Green house gases?

- A. Water vapour
- B. Ozone
- C. I_2
- D. Molecular hydrogen

Choose the most appropriate answer from the options given below :

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

78. Given below are two statements, one is labelled as Assertion A and the other is labelled as Reason R.

Assertion A : The diameter of colloidal particles in solution should not be much smaller than wavelength of light to show Tyndall effect.

Reason R : The light scatters in all directions when the size of particles is large enough.

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

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

79. Given below are two statements related to Ellingham diagram:

Statement I : Ellingham diagrams can be constructed for formation of oxides, sulfides and halides of metals.

Statement II : It consists of plots of $\Delta_f H^0$ vs T for formation of oxides of elements.

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

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

80. Identify the correct order of standard enthalpy of formation of sodium halides :

- | | |
|-----|---------------------------|
| (A) | $NaI < NaBr < NaCl < NaF$ |
| (B) | $NaI < NaBr < NaF < NaCl$ |
| (C) | $NaF < NaCl < NaBr < NaI$ |
| (D) | $NaCl < NaF < NaBr < NaI$ |

Chemistry - Section B · Numerical Value Questions

81. $A(g) \rightarrow 2B(g) + C(g)$ is a first order reaction. The initial pressure of the system was found to be 800 mm Hg which increased to 1600 mm Hg after 10 min. The total pressure of the system after 30 min will be _____ mm Hg. (Nearest integer)

82. 0.400 g of an organic compound (X) gave 0.376 g of AgBr in Carius method for estimation of bromine. % of bromine in the compound (X) is _____.

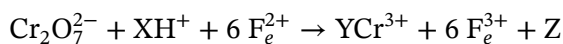
(Given: Molar mass

$$AgBr = 188 \text{ g mol}^{-1}$$

$$Br = 80 \text{ g mol}^{-1}$$

)

83. See the following chemical reaction:



The sum of X, Y and Z is _____

84. 1 g of a carbonate (M_2CO_3) on treatment with excess HCl produces 0.01 mol of CO_2 . The molar mass of M_2CO_3 is _____ g mol^{-1} . (Nearest integer)

85. The orbital angular momentum of an electron in 3s orbital is $\frac{xh}{2\pi}$. The value of x is _____ (nearest integer)

86. Sea water contains 29.25% NaCl and 19% $MgCl_2$ by weight of solution. The normal boiling point of the sea water is _____ $^{\circ}C$ (Nearest integer)

Assume 100% ionization for both NaCl and $MgCl_2$

Given :

$$K_b(H_2O) = 0.52 \text{ K kg mol}^{-1}$$

Molar mass of NaCl and $MgCl_2$ is 58.5 and 95 g mol^{-1} respectively.

87. At 298 K, the standard reduction potential for Cu^{2+}/Cu electrode is 0.34 V.

Given :

$$K_{sp}Cu(OH)_2 = 1 \times 10^{-20}$$

Take

$$\frac{2.303RT}{F} = 0.059 \text{ V}$$

The reduction potential at

$$pH = 14$$

for the above couple is $(-)x \times 10^{-2} \text{ V}$. The value of x is _____

88. 20 mL of 0.1 M NaOH is added to 50 mL of 0.1 M acetic acid solution. The pH of the resulting solution is _____ $\times 10^{-2}$ (Nearest integer)

Given :

$$pK_a(CH_3COOH) = 4.76$$

$$\log 2 = 0.30$$

$$\log 3 = 0.48$$

89. If the formula of Borax is $Na_2B_4O_x(OH)_y \cdot zH_2O$, then $x + y + z =$ _____

90. Sodium metal crystallizes in a body centred cubic lattice with unit cell edge length of

$$4 \overset{\circ}{A}$$

. The radius of sodium atom is _____ $\times 10^{-1}$

$$\overset{\circ}{A}$$

(Nearest integer)

- End of Question Paper -