



## JEE Main – 2026 | Session - 2

6<sup>th</sup> APRIL 2026 (Evening Shift)

### General Instructions

1. The test is of **3 hours** duration and the maximum marks is **300**.
2. The question paper consists of **3 Subjects** (Subject I: **Mathematics**, Subject II: **Physics**, Subject III: **Chemistry**). Each Part has **two** sections (Section 1 & Section 2).
3. **Section 1** contains **20 Multiple Choice Questions**. Each question has 4 choices (1), (2), (3) and (4), out of which **ONLY ONE CHOICE** is correct.
4. **Section 2** contains **5 Numerical Value Type Questions**. The answer to each question is an **integer** ranging from 0 to 999.
5. No candidate is allowed to carry any textual material, printed or written, bits of papers, pager, mobile phone, any electronic device, etc. inside the examination room/hall.
6. On completion of the test, the candidate must hand over the Answer Sheet to the **Invigilator** on duty in the Room/Hall. **However, the candidates are allowed to take away this Test Booklet with them.**

### Marking Scheme

1. **Section – 1:** +4 for correct answer, –1 (negative marking) for incorrect answer, 0 for all other cases.
2. **Section – 2:** +4 for correct answer, –1 (negative marking) for incorrect answer, 0 for all other cases.

**SUBJECT I: MATHEMATICS****MARKS: 100****SECTION-1**

This section contains 20 Multiple Choice Questions. Each question has 4 choices (1), (2), (3) and (4), out of which **ONLY ONE CHOICE** is correct.

- Let  $f: R \rightarrow R$  be defined as  $f(x) = \frac{2x^2 - 3x + 2}{3x^2 + x + 3}$ . Then  $f$  is:
  - both one-one and onto
  - one-one but not onto
  - onto but not one-one
  - neither one-one nor onto
- Consider the quadratic equation  $(n^2 - 2n + 2)x^2 - 3x + (n^2 - 2n + 2)^2 = 0, n \in R$ . Let  $\alpha$  be the minimum value of the product of its roots and  $\beta$  be the maximum value of the sum of its roots. Then the sum of the first six terms of the G.P., whose first term is  $\alpha$  and the common ratio is  $\frac{\alpha}{\beta}$ , is :
  - $\frac{61}{37}$
  - $\frac{121}{81}$
  - $\frac{364}{243}$
  - $\frac{1093}{729}$
- Let  $S = \{z \in \mathbb{C} : z^2 + \sqrt{6}iz - 3 = 0\}$ . Then  $\sum_{z \in S} z^8$  is equal to :
  - 162
  - 184
  - 262
  - 324
- The sum of all possible value of  $\theta \in [0, 2\pi]$ , for which the system of equations :
 
$$x \cos 3\theta - 8y - 12z = 0$$

$$x \cos 2\theta + 3y + 3z = 0$$

$$x + y + 3z = 0$$
 has a non-trivial solution, is equal to :
  - $\pi$
  - $2\pi$
  - $3\pi$
  - $4\pi$
- Let  $A = \begin{bmatrix} 1 & 0 & 0 \\ 3 & 1 & 0 \\ 9 & 3 & 1 \end{bmatrix}$  and  $B = [b_{ij}]$ ,  $1 \leq i, j \leq 3$ . If  $B = A^{99} - I$ , then the value of  $\frac{b_{31} - b_{21}}{b_{32}}$  is:
  - 99
  - 199
  - 149
  - 159
- The sum  $1 + \frac{1}{2}(1^2 + 2^2) + \frac{1}{3}(1^2 + 2^2 + 3^2) + \dots$  upto 10 terms is equal to :
  - 130
  - 155
  - $\frac{315}{2}$
  - $\frac{325}{2}$
- A building has ground floor and 10 more floors. Nine persons enter in a lift at the ground floor. The lift goes up to the 10<sup>th</sup> floor. The number of ways, in which any 4 persons exit at a floor and the remaining 5 persons exit at a different floor, if the lift does not stop at the first and the second floors, is equal to :
  - 2184
  - 3064
  - 7056
  - 11340

8. Let the mean and the variance of seven observations  $2, 4, \alpha, 8, \beta, 12, 14$ ,  $\alpha < \beta$ , be 8 and 16 respectively. Then the quadratic equation whose roots are  $3\alpha + 2$  and  $2\beta + 1$  is:
- (1)  $x^2 - 35x + 306 = 0$  (2)  $x^2 - 41x + 420 = 0$   
 (3)  $x^2 - 45x + 506 = 0$  (4)  $x^2 - 37x + 342 = 0$
9. A bag contains 6 blue and 6 green balls. Pairs of balls are drawn without replacement until the bag is empty. The probability that each drawn pair consists of one blue and one green ball is:
- (1)  $\frac{63}{925}$  (2)  $\frac{17}{231}$  (3)  $\frac{16}{231}$  (4)  $\frac{64}{925}$
10. Let C be a circle having centre in the first quadrant and touching the x-axis at a distance of 3 units from the origin. If the circle C has an intercept of length  $6\sqrt{3}$  on y-axis, then the length of the chord of the circle C on the line  $x - y = 3$  is:
- (1) 8 (2) 6 (3)  $6\sqrt{2}$  (4)  $8\sqrt{2}$
11. The eccentricity of an ellipse E with centre at the origin O is  $\frac{\sqrt{3}}{2}$  and its directrices are  $x = \pm \frac{4\sqrt{6}}{3}$ . Let  $H: \frac{x^2}{a^2} - \frac{y^2}{b^2} = 1$  be a hyperbola whose eccentricity is equal to the length of semi-major axis of E, and whose length of latus rectum is equal to the length of minor axis of E. Then the distance between the foci of H is:
- (1)  $\frac{4\sqrt{2}}{\sqrt{7}}$  (2)  $\frac{4\sqrt{2}}{7}$  (3)  $\frac{4}{\sqrt{7}}$  (4)  $\frac{8}{7}$
12. Let  $x = 9$  be a directrix of an ellipse E, whose centre is at origin and eccentricity is  $\frac{1}{3}$ . Let  $P(\alpha, 0)$ ,  $\alpha > 0$ , be a focus of E and AB be a chord passing through P. Then the locus of the mid point of AB is:
- (1)  $9y^2 = 8x(1 - x)$  (2)  $3y^2 = 4x(1 - x)$   
 (3)  $9y^2 = 8x(x - 1)$  (4)  $3y^2 = 4x(x - 1)$
13. If  $\sin(\tan^{-1}(x\sqrt{2})) = \cot(\sin^{-1}\sqrt{1 - x^2})$ ,  $x \in (0, 1)$ , then the value of x is:
- (1)  $\frac{1}{2}$  (2)  $\frac{1}{3}$  (3)  $\frac{2}{3}$  (4)  $\frac{5}{8}$
14. The shortest distance between the lines  $\frac{x-4}{1} = \frac{y-3}{2} = \frac{z-2}{-3}$  and  $\frac{x+2}{2} = \frac{y-6}{4} = \frac{z-5}{-5}$  is:
- (1)  $\frac{5\sqrt{6}}{6}$  (2)  $2\sqrt{5}$  (3)  $3\sqrt{5}$  (4)  $4\sqrt{5}$
15. Let  $\vec{a} = 2\hat{i} + 3\hat{j} + 3\hat{k}$  and  $\vec{b} = 6\hat{i} + 3\hat{j} + 3\hat{k}$ . Then the square of the area of the triangle with adjacent sides determined by the vectors  $(2\vec{a} + 3\vec{b})$  and  $(\vec{a} - \vec{b})$  is:
- (1) 450 (2) 900 (3) 1800 (4) 2400

16. Let  $\lim_{x \rightarrow 2} \frac{(\tan(x-2))(rx^2 + (p-2)x - 2p)}{(x-2)^2} = 5$  for some  $r, p \in \mathbb{R}$ . If the set of all possible values of  $q$ , such that the roots of the equation  $rx^2 - px + q = 0$  lie in  $(0, 2)$ , be the interval  $(\alpha, \beta]$ , then  $4(\alpha + \beta)$  equals :
- (1) 11 (2) 13 (3) 17 (4) 21
17. Let  $A = \begin{bmatrix} 1 & 3 & -1 \\ 2 & 1 & \alpha \\ 0 & 1 & -1 \end{bmatrix}$  be a singular matrix. Let  $f(x) = \int_0^x (t^2 + 2t + 3) dt$ ,  $x \in [1, \alpha]$ . If  $M$  and  $m$  are respectively the maximum and the minimum values of  $f$  in  $[1, \alpha]$ , then  $3(M - m)$  is equal to :
- (1) 64 (2) 68 (3) 72 (4) 76
18. Let  $f: R \rightarrow R$  be such that  $f(xy) = f(x)f(y)$ , for all  $x, y \in R$  and  $f(0) \neq 0$ . Let  $g: [1, \infty) \rightarrow R$  be a differentiable function such that
- $$x^2 g(x) = \int_1^x (t^2 f(t) - tg(t)) dt$$
- Then  $g(2)$  is equal to :
- (1)  $\frac{13}{8}$  (2)  $\frac{11}{16}$  (3)  $\frac{15}{32}$  (4)  $\frac{17}{64}$
19. The area of the region  $\{(x, y): x^2 - 8x \leq y \leq -x\}$  is:
- (1)  $\frac{343}{6}$  (2)  $\frac{637}{6}$  (3)  $\frac{437}{6}$  (4)  $\frac{523}{6}$
20. The value of the integral  $\int_{-1}^1 \left( \frac{x^3 + |x| + 1}{x^2 + 2|x| + 1} \right) dx$  is equal to :
- (1)  $3 \log_e 2$  (2)  $2 \log_e 2$  (3)  $5 \log_e 3$  (4)  $3 \log_e 3$

## SECTION-2

This section contains Five (05) Numerical Value Type Questions. The answer to each question is an integer ranging from 0 to 999.

21. Let  $R = \{(x, y) \in N \times N : \log_e(x + y) \leq 2\}$ . Then the minimum number of elements, required to be added in  $R$  to make it a transitive relation, is \_\_\_\_\_.
22. If  $(1 - x^3)^{10} = \sum_{r=0}^{10} a_r x^r (1 - x)^{30-2r}$ , then  $\frac{9a_9}{a_{10}}$  is equal to \_\_\_\_\_.
23. Let the line  $x - y = 4$  intersect the circle  $C: (x - 4)^2 + (y + 3)^2 = 9$  at the points  $Q$  and  $R$ . If  $P(\alpha, \beta)$  is a point on  $C$  such that  $PQ = PR$ , then  $(6\alpha + 8\beta)^2$  is equal to \_\_\_\_\_.

24. Let the image of the point  $P(0, -5, 0)$  in the line  $\frac{x-1}{2} = \frac{y}{1} = \frac{z+1}{-2}$  be the point R and the image of the point  $Q\left(0, \frac{-1}{2}, 0\right)$  in the line  $\frac{x-1}{-1} = \frac{y+9}{4} = \frac{z+1}{1}$  be the point S. Then the square of the area of the parallelogram PQRS is \_\_\_\_\_

25. Let  $f(x) = \begin{cases} x^3 + 8 & ; \quad x < 0, \\ x^2 - 4 & ; \quad x \geq 0, \end{cases}$  and  $g(x) = \begin{cases} (x-8)^{1/3} & ; \quad x < 0, \\ (x-4)^{1/2} & ; \quad x \geq 0, \end{cases}$

Then the number of points, where the function  $g \circ f$  is discontinuous, is \_\_\_\_\_.

**SUBJECT II: PHYSICS****MARKS: 100****SECTION-1**

This section contains 20 Multiple Choice Questions. Each question has 4 choices (1), (2), (3) and (4), out of which **ONLY ONE CHOICE** is correct.

26. The percentage error in the calculated volume of a sphere, if there is 2% error in its diameter measurement, is \_\_\_\_\_.

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

27. Match List I with List II

| List - I |                        | List - II |                      |
|----------|------------------------|-----------|----------------------|
| A        | Boltzmann constant     | I         | $[M^{-1}L^3T^{-2}]$  |
| B        | Stefan's constant      | II        | $[ML^2T^{-1}]$       |
| C        | Planck's constant      | III       | $[ML^2T^{-2}K^{-1}]$ |
| D        | Gravitational constant | IV        | $[ML^0T^{-3}K^{-4}]$ |

Choose the **correct** answer from the options given below :

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

28. A solid sphere (A) of mass  $5m$  and a spherical shell (B) of mass  $m$ , both having same radius, are placed on a rough surface. When a force of same magnitude is applied tangentially at the highest points of A and B, they start rolling without slipping with an acceleration of  $a_A$  and  $a_B$ , respectively. The ratio of  $a_A$  and  $a_B$  is:

(1) 5 : 21                      (2) 6 : 10                      (3) 21 : 25                      (4) 1 : 5

29. A body of mass 1 kg moves along a straight line with a velocity  $v = 2x^2$ . The work done by the body during displacement from  $x = 0$  to  $5m$  is \_\_\_\_\_ J.

(1) 0                      (2) 250                      (3) 1250                      (4) 1000

30. A cylinder with adiabatic walls is closed at both ends and is divided into two compartments by a frictionless adiabatic piston. Ideal gas is filled in both (left and right) the compartments at same P, V, T. Heating is started from left side until pressure changes to  $27\frac{P}{8}$ . If initial volume of each compartment was 9 litres then the final volume in right-hand side compartment is \_\_\_\_\_ litres. (for this ideal gas  $C_p / C_v = 1.5$ )

(1) 3                      (2) 4                      (3) 14                      (4) 9

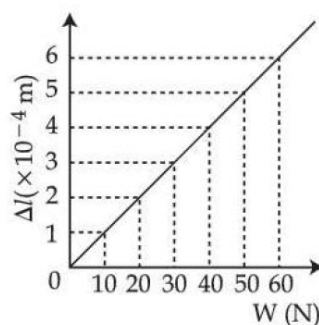
31. For an electromagnetic wave propagating through volume  $\vec{k}, \vec{E}$  and  $\omega$  represent propagation vector, electric field and angular frequency, respectively. The magnetic field associated with this wave is represented by :

(1)  $\frac{\vec{E} \times \vec{k}}{\omega}$                       (2)  $\frac{\vec{k} \times \vec{E}}{\omega}$                       (3)  $\omega(\vec{E} \times \vec{k})$                       (4)  $\omega(\vec{k} \times \vec{E})$

32. Two identical bodies A and B of equal masses have initial velocities  $\vec{v}_1 = 4\hat{i} m/s$  and  $\vec{v}_2 = 4\hat{j} m/s$  respectively. The body A has acceleration  $\vec{a}_1 = 6\hat{i} + 6\hat{j} m/s^2$  while the acceleration of the other body B is zero. The centre of mass of the two bodies moves in \_\_\_\_\_ path.

(1) circular                      (2) parabolic                      (3) straight line                      (4) elliptical

33. Figure represents the extension ( $\Delta l$ ) of a wire of length 1 meter, suspended from the ceiling of the room at one end with a load  $W$  connected to the other end. If the cross-sectional area of the wire is  $10^{-5} \text{ m}^2$  then the Young's modulus of the wire is \_\_\_\_\_  $\text{N} / \text{m}^2$



- (1)  $1.0 \times 10^{11}$       (2)  $2.0 \times 10^{10}$       (3)  $1.0 \times 10^{10}$       (4)  $2.0 \times 10^{11}$
34. A cylindrical vessel of 40 cm radius is completely filled with water and its capacity is  $528 \text{ dm}^3$  (dm : decimeter). The vessel is placed on a solid block of exactly same height as vessel. If a small hole is made at 70 cm below the top of water level, the horizontal range of water falling on the ground in the beginning is \_\_\_\_\_ cm.
- (1)  $120\sqrt{2}$       (2)  $140\sqrt{2}$       (3)  $140\sqrt{3}$       (4)  $120\sqrt{3}$
35. If 2 mole of an ideal monoatomic gas at temperature  $T$ , is mixed with 6 mole of another ideal monoatomic gas at temperature  $2T$  then the temperature of mixture is :
- (1)  $\frac{5}{2}T$       (2)  $\frac{5}{4}T$       (3)  $\frac{7}{2}T$       (4)  $\frac{7}{4}T$
36. A spring stretches by  $2 \text{ mm}$  when it is loaded with a mass of  $200 \text{ g}$ . From equilibrium position of the mass is further pulled down by  $2 \text{ mm}$  and released. The frequency associated with the system and maximum energy in the spring are \_\_\_\_\_ Hz and \_\_\_\_\_ J, respectively.
- (1)  $\frac{5\sqrt{50}}{\pi}$  and  $8 \times 10^{-3}$       (2)  $\frac{5\sqrt{50}}{\pi}$  and 8  
(3)  $10\sqrt{50}$  and  $2 \times 10^{-3}$       (4)  $\frac{5\sqrt{50}}{\pi}$  and  $16 \times 10^{-3}$
37. The electric potential as a function of  $x, y$  is given by  $V = 5(x^2 - y^2)V$ . The electric field at a point  $(2, 3) \text{ m}$  is \_\_\_\_\_ V/m.
- (1)  $(-20\hat{i} + 30\hat{j})$       (2)  $(20\hat{i} - 30\hat{j})$       (3)  $(20\hat{i} + 45\hat{j})$       (4)  $(-4\hat{i} + 6\hat{j})$
38. A current of  $30 \text{ A}$  each flows in opposite directions in two conducting wires, placed parallel to each other at a distance of  $8 \text{ cm}$ . The magnetic field at the mid point between the two wires is \_\_\_\_\_  $\mu\text{T}$ .
- $\left( \frac{\mu_0}{4\pi} = 10^{-7} \text{ N} / \text{A}^2 \right)$
- (1) 30      (2) 300      (3) 150      (4) 0.0
39. A square loop of side  $2 \text{ cm}$  is placed in a time varying magnetic field with magnitude as  $B = 0.4 \sin(300t)$  Tesla. The normal to the plane of loop makes an angle of  $60^\circ$  with the field. The maximum induced emf produced in the loop is \_\_\_\_\_ mV.
- (1) 12      (2) 18      (3) 21      (4) 24

40. A sphere of capacitance 100 pF is charged to a potential of 100 V. Another identical uncharged metal sphere is brought in contact with the charged sphere, then the change in the total energy stored on these spheres, when they touch is  $\alpha \times 10^{-7} \text{ J}$ . The value of  $\alpha$  is:

(combined capacitance of spheres is 200 pF)

- (1) 5                      (2)  $\frac{5}{7}$                       (3)  $\frac{7}{2}$                       (4)  $\frac{9}{2}$

41. The energy released if hydrogen atoms are combined to form  ${}^4_2\text{He}$  is \_\_\_\_ MeV.

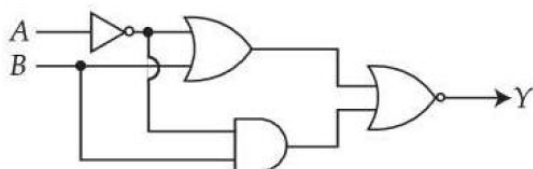
(Take binding energies per nucleon of  ${}^2_1\text{H}$  and  ${}^4_2\text{He}$  as 1.1 MeV and 7.2 MeV, respectively)

- (1) 6.1                      (2) 24.4                      (3) 26.6                      (4) 5

42. Angle of minimum deviation is equal to the half of the angle of prism in an equilateral prism. The refractive index of the prism is \_\_\_\_\_.

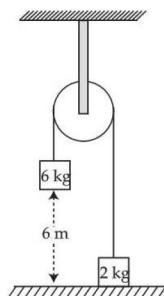
- (1) 1.5                      (2)  $\sqrt{3}$                       (3)  $\sqrt{2}$                       (4) 1.65

43. Refer to the logic circuit given below. For two input ( $A = 1, B = 1$ ) and ( $A = 0, B = 1$ ), output (Y) will be \_\_\_\_\_.



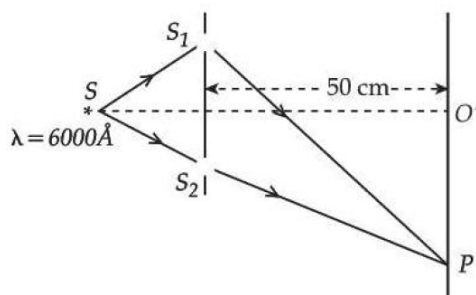
- (1) 1,0 respectively                      (2) 0,1 respectively  
(3) 0,0 respectively                      (4) 1,1 respectively

44. The velocity at which 6 kg mass (shown in figure) strikes the ground when it is released from a height of 6 m above the ground is \_\_\_\_ m/s. Assume pulley is massless and string is light and inextensible. (Take  $g = 10 \text{ m/s}^2$ )



- (1) 7.74                      (2) 7.20                      (3) 6.55                      (4) 4.50

45. In a Young double slit experiment, the wavelength of incident light is  $6000 \text{ \AA}$ , the separation between slit  $S_1$  and  $S_2$  is 5 cm and the distance between slits plane and screen is 50 cm, as shown in the figure below. If the resultant intensity at P is equal to the intensity due to individual slits, the path difference between interfering waves is \_\_\_\_  $\text{\AA}$ .



- (1) 4000                      (2) 3000                      (3) 2000                      (4) 1000

**SECTION-2**

This section contains Five (05) Numerical Value Type Questions. The answer to each question is an integer ranging from 0 to 999.

46. A block takes  $t$  time to slide down a plane inclined at  $45^\circ$  to the horizontal. If the surface is made smooth (frictionless), the block takes time  $\frac{t}{2}$  to slide down the plane. The coefficient of friction between the block and the inclined plane is  $\left(\frac{\alpha}{100}\right)$ . The value of  $\alpha$  is \_\_\_\_\_.
47. The de Broglie wavelength for an electron accelerated through the potential difference of  $V_1$  volt is  $\lambda_1$ . When the potential difference is changed to  $V_2$  volt, the associated de Broglie wavelength is increased by 50%. If  $(V_1 / V_2) = (9 / \alpha)$ , then the value of  $\alpha$  is \_\_\_\_\_.
48. A moving coil of galvanometer when shunted with  $2\Omega$  resistance gives a full scale deflection from a current of 500 mA. When a resistance of  $470\Omega$  is connected in series it gives a full scale deflection from 10 V potential applied on it. The value of resistance of galvanometer coil is \_\_\_\_\_  $\Omega$ .
49. Two cells of emfs 1V and 2V and internal resistance  $2\Omega$  and  $1\Omega$ , respectively connected in parallel, gave a current of 1 A through an external resistance. If the polarity of one cell is reversed, then value of current through the external resistance will be  $\frac{\alpha}{5}$  A. The value of  $\alpha$  is \_\_\_\_\_.
50. A concave mirror of focal length 10 cm forms an image which is double the size of object when the object is placed at two different positions. The distance between the two positions of the object is \_\_\_\_\_ cm.

**SUBJECT III: CHEMISTRY****MARKS: 100****SECTION-1**

This section contains 20 Multiple Choice Questions. Each question has 4 choices (1), (2), (3) and (4), out of which **ONLY ONE CHOICE** is correct.

51. Which of the following contain the same number of atoms?

(Given : Molar mass in  $\text{g mol}^{-1}$  of H, He, O and S are 1, 4, 16 and 32 respectively)

- A. 2g of  $\text{O}_2$  gas                      B. 4g of  $\text{SO}_2$  gas                      C. 1400 mL of  $\text{O}_2$  at STP  
D. 0.05 L of He at STP                      E. 0.0625 mol of  $\text{H}_2$  gas

Choose the correct answer from the options given below :

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

52. The Bohr radius of a hydrogen like species is 70.53 pm. The species and the stationary state (n) are respectively.

(Given : Hydrogen atom Bohr radius is 52.9 pm)

- (1)  $\text{Li}^{2+}, 3$                       (2)  $\text{He}^+, 3$                       (3)  $\text{He}^+, 2$                       (4)  $\text{Li}^{2+}, 2$

53. Given below are two statements :

**Statement I :** The number of compounds among  $\text{SO}_2, \text{SO}_3, \text{SF}_4, \text{SF}_6$  and  $\text{H}_2\text{S}$  in which Sulphur does not obey the Octet rule is 3.

**Statement II :** Among  $[\text{H}_2\text{O}, \text{ClF}_3, \text{SF}_4]$ ,  $[\text{NH}_3, \text{BrF}_5, \text{SF}_4]$ ,  $[\text{BrF}_5, \text{ClF}_3, \text{XeF}_4]$  and  $[\text{XeF}_4, \text{ClF}_3, \text{H}_2\text{O}]$ , the number of sets in which all the molecules have one lone pair of electrons on the central atom is 1.

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

- (1) Both **Statement I** and **Statement II** are true  
(2) Both **Statement I** and **Statement II** are false  
(3) **Statement I** is true but **Statement II** is false  
(4) **Statement I** is false but **Statement II** is true

54. Math List - I with List II

Given  $V_1$  and  $V_2$  are initial and final volumes respectively.

| List - I<br>(Isothermal process) |                          | List - II<br>(Expression) |                              |
|----------------------------------|--------------------------|---------------------------|------------------------------|
| A                                | Reversible expansion     | I                         | $q=0$                        |
| B                                | Free expansion           | II                        | $q=nRT \ln \frac{V_2}{V_1}$  |
| C                                | Irreversible Compression | III                       | $w=-P_{\text{ext}}(V_1-V_2)$ |
| D                                | Cyclic reversible        | IV                        | $\frac{q_{\text{rev}}}{T}=0$ |

Choose the correct answer from the options given below :

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

55. Given below are two statements :

| Chamber 1                               |                         | Chamber 2                               |
|-----------------------------------------|-------------------------|-----------------------------------------|
| 18 g glucose in 100 mL aqueous solution | Semi-permeable membrane | 30 g glucose in 250 mL aqueous solution |

**Statement I :**  $\text{H}_2\text{O}$  molecules move from the chamber 1 to chamber 2.

**Statement II :** The osmotic pressure of a solution prepared by dissolving 50 mg of potassium sulphate (molar mass = 174 g/mol) in 2 L of water (at  $27^\circ\text{C}$ ) is 0.0107 bar. (Given :  $R = 0.083 \text{ dm}^3 \text{ bar K}^{-1} \text{ mol}^{-1}$  and assume complete dissociation of electrolyte)

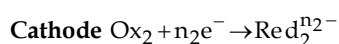
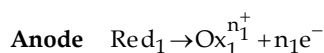
In the light of the above statements, choose the **correct** answer from the options given below :

- (1) Both **Statement I** and **Statement II** are true
- (2) Both **Statement I** and **Statement II** are false
- (3) **Statement I** is true but **Statement II** is false
- (4) **Statement I** is false but **Statement II** is true

56. Given is a concentrated solution of a weak electrolyte  $\text{A}_x\text{B}_y$  of concentration 'c' and dissociation constant 'K'. The degree of dissociation is given by :

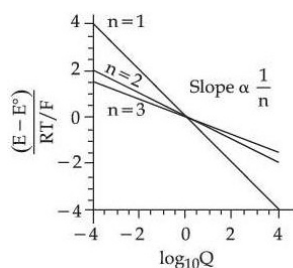
- (1)  $[K \times c^{x+y-1} x^x y^y]^{x+y}$
- (2)  $\left( \frac{K}{c^{x+y-1} x^x y^y} \right)^{\frac{1}{x+y}}$
- (3)  $\left( \frac{c^{x+y-1} x^x y^y}{K} \right)^{x+y}$
- (4)  $\left( \frac{c^{x+y-1} x^x y^y}{K} \right)^{\frac{1}{x+y}}$

57. For a general redox reaction



Which of the following statement is **incorrect**?

- (1) The overall reaction can be written as  $n_2 \text{Red}_1 + n_1 \text{Ox}_2 \rightleftharpoons n_2 \text{Ox}_1^{n_1+} + n_1 \text{Red}_2^{n_2-}$ .
- (2) The electrons do not appear in the overall reaction because electrons produced at the anode are consumed at the cathode.



- (3) Here n is the number of electrons transferred in redox reaction.
- (4) If the reaction is carried out reversibly, the electrical work done is equal to the ratio of charge and potential difference through which charge is moved.

58. In a period, the first ionisation enthalpy of the element at extreme left and the negative electron again enthalpy of the extreme right element, except noble gases, are respectively.
- (1) lowest and lowest (2) highest and lowest  
(3) lowest and highest (4) highest and highest
59. Given below are two statements :
- Statement I :**  $F_2O < H_2O < Cl_2O$  is the correct trends in terms of bond angle.  
**Statement II :**  $SiF_4, SnF_4$  and  $PbF_4$  are ionic in nature.  
In the light of the above statements, choose the **correct** answer from the options given below :
- (1) Both **Statement I** and **Statement II** are true  
(2) Both **Statement I** and **Statement II** are false  
(3) **Statement I** is true but **Statement II** is false  
(4) **Statement I** is false but **Statement II** is true
60. The **correct** order of first ( $\Delta_i H_1$ ) and second ( $\Delta_i H_2$ ) ionisation enthalpy values of Cr and Mn are :
- A.  $\Delta_i H_1 : Cr > Mn$   
B.  $\Delta_i H_2 : Cr > Mn$   
C.  $\Delta_i H_1 : Mn > Cr$   
D.  $\Delta_i H_2 : Mn > Cr$
- Choose the **correct** answer from the options given below :
- (1) A and B only (2) B and C only (3) A and D only (4) C and D only
61. Which of the following sequences of hybridization, geometry and magnetic nature are **correct** for the given coordination compounds?
- A.  $[NiCl_4]^{2-} - sp^3$ , tetrahedral, paramagnetic B.  $[Ni(NH_3)_6]^{2+} - sp^3d^2$ , octahedral, paramagnetic  
C.  $[Ni(CO)_4] - sp^3$ , tetrahedral, paramagnetic D.  $[Ni(CN)_4]^{2-} - dsp^2$ , square planar, diamagnetic
- Choose the correct answer from the options given below :
- (1) A, B, C and D (2) B, C and D only (3) A, C and D only (4) A, B and D only
62. **Statement I :** A mixture of  $C_{12}H_{22}O_{11}$  (sugar) and NaCl can be separated by dissolving sugar in alcohol, due to differential solubility.  
**Statement II :** Rose essence from rose petals is separated by steam distillation due to its high volatility and insolubility in  $H_2O$ .  
In the light of the above statements, choose the **correct** answer from the options given below :
- (1) Both **Statement I** and **Statement II** are true  
(2) Both **Statement I** and **Statement II** are false  
(3) **Statement I** is true but **Statement II** is false  
(4) **Statement I** is false but **Statement II** is true
63. Shown below is the structure of methyl acetate with three different  $\alpha, \beta$  and  $\gamma$  carbon - oxygen bonds
- $$\begin{array}{c}
 O \\
 || \\
 H_3C - C - O - CH_3 \\
 \alpha \quad \beta \quad \gamma
 \end{array}$$
- The correct order of bond lengths of these bonds is :
- (1)  $\alpha > \beta > \gamma$  (2)  $\alpha < \beta < \gamma$  (3)  $\alpha = \beta = \gamma$  (4)  $\alpha < \beta = \gamma$

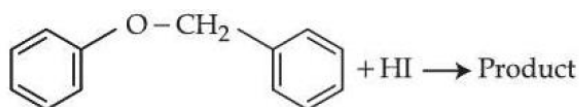
64. 'x' is the product which is obtained by the hydrolysis of prop-1-yne in the presence of mercuric sulphate under dilute acidic medium at 333 K. 'y' is the product which is obtained by the reaction of ethane nitrile with methyl magnesium bromide in dry ether followed by hydrolysis. IUPAC name of product obtained from 'x' and 'y' in the presence of barium hydroxide followed by heating is:

- (1) 2-Methylpent-4-en-3-one (2) 4-Methylpent-3-en-2-one  
(3) 4-Methylpent-1-ene (4) 2-Methylpent-3-one

65. An optically active alkyl bromide  $C_4H_9Br$  reacts with ethanolic KOH to form major compound [A] which reacts with bromine to give compound [B]. Compound [B] reacts with ethanolic KOH and sodamide to give compound [C]. One molecule of water adds to compound [C] on warming with mercuric sulphate and dilute sulphuric acid at 333 K to form compound [D]. The functional group in compound D will be confirmed by:

- (1) Haloform test (2) Lucas test  
(3) Silver mirror test (4) Benedict test

66. Consider the following reaction :

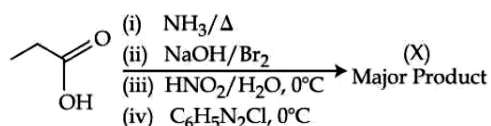


**Statement I :** In the above reaction, product formed will be a mixture of benzyl alcohol and iodobenzene.

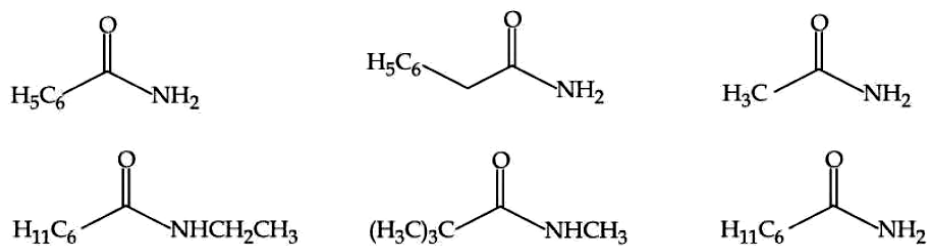
**Statement II :** In the above reaction, the  $-O-CH_2-$  bond is cleaved to give the product.

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

- (1) Both **Statement I** and **Statement II** are true  
(2) Both **Statement I** and **Statement II** are false  
(3) **Statement I** is true but **Statement II** is false  
(4) **Statement I** is false but **Statement II** is true
67. Consider the following organic reaction sequence. Choose the final product (X) from the following (consider the major product in all intermediate reactions)

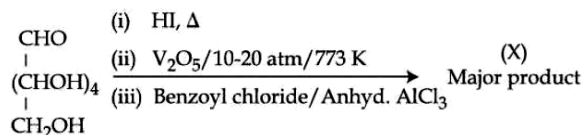


- (1) Benzene (2) Phenol (3) Propanol (4) Chlorobenzene
68. The number of compounds from the following which can undergo reaction with  $Br_2 / KOH$  (alcoholic) to give respective products and these respective products can also be obtained separately by Gabriel phthalimide reaction is:



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

69. Consider the following reactions. Total number of electrons in the  $\pi$  bonds and lone pair of electrons in the product (X) is:



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

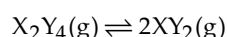
70. Treatment of a gas 'X' with a freshly prepared ferrous sulphate solution gives a compound 'Y' as a brown ring. The compounds X and Y are:

- (1) NO and  $[\text{Fe}(\text{NO})]\text{SO}_4$                       (2)  $\text{NO}_2$  and  $[\text{Fe}(\text{NO}_2)]\text{SO}_4$   
(3)  $\text{N}_2\text{O}$  and  $[\text{Fe}(\text{N}_2\text{O})]\text{SO}_4$                       (4)  $\text{N}_2\text{O}_4$  and  $[\text{Fe}(\text{N}_2\text{O}_4)]\text{SO}_4$

## SECTION-2

This section contains Five (05) Numerical Value Type Questions. The answer to each question is an integer ranging from 0 to 999.

71. An excess of  $\text{AgNO}_3$  is added to 100 mL of a 0.05 M solution of tetraaquadichloridochromium(III) chloride. The number of moles of  $\text{AgCl}$  precipitated will be  $\text{_____} \times 10^{-3}$ . (Nearest Integer)
72. An alkane (Y) requires 8 moles of oxygen for complete combustion and on chlorination with  $\text{Cl}_2 / h\nu$ , (y) gives only one monochlorinated product (Z). The total number of primary carbon atoms in (Y) is \_\_\_\_\_.
73. 500 mL of 0.2  $\text{MMnO}_4^-$  solution in basic medium when mixed with 500 mL of 1.5 M KI solution, oxidises iodide ions to liberate molecular iodine. This liberated iodine is then titrated with a standard x M thiosulphate solution in presence of starch till the end point. If 300 mL of thiosulphate was consumed, then the value of x is \_\_\_\_\_.
74. In a closed flask at 600 K, one mole of  $\text{X}_2\text{Y}_4(\text{g})$  attains equilibrium as given below :



At equilibrium, 75%  $\text{X}_2\text{Y}_4(\text{g})$  was dissociated and the total pressure is 1 atm. The magnitude of  $\Delta_r G^\ominus$  (in  $\text{kJ mol}^{-1}$ ) at this temperature is \_\_\_\_\_. (Nearest Integer)

(Given :  $R=8.3 \text{ J mol}^{-1}\text{K}^{-1}$  ;  $\ln 10 = 2.3$ ,  $\log 2 = 0.3$ ,  $\log 3 = 0.48$ ,  $\log 5 = 0.69$ ,  $\log 7 = 0.84$ )

75. Decomposition of a hydrocarbon follows the equation  $k = (5.5 \times 10^{11} \text{ s}^{-1}) e^{\frac{-28000\text{K}}{T}}$ . The activation energy of the reaction is \_\_\_\_\_  $\text{kJ mol}^{-1}$ . (Nearest Integer)

Given :  $R = 8.3 \text{ J K}^{-1} \text{ mol}^{-1}$