

JEE Main 2023 8 April Shift 1 Question Paper

Time Allowed :180 minutes	Maximum Marks :300	Total questions :90
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General Instructions

Read the following instructions very carefully and strictly follow them:

- (A) The test is of 3 hours duration.
- (B) The question paper consists of 90 questions. The maximum marks are 300.
- (C) There are three parts in the question paper consisting of Physics, Chemistry and Mathematics having 30 questions in each part of equal weightage.
- (D) Each part (subject) has two sections.
 - (i) Section-A: This section contains 20 multiple choice questions which have only one correct answer. Each question carries 4 marks for correct answer and –1 mark for wrong answer.
 - (ii) Section-B: This section contains 10 questions. In Section-B, attempt any five questions out of 10. The answer to each of the questions is a numerical value. Each question carries 4 marks for correct answer and –1 mark for wrong answer. For Section-B, the answer should be rounded off to the nearest integer.

Mathematics

1. The area of the region $\{(x, y) : x^2 \leq y \leq 8 - x^2, y \leq 7\}$ is:

- (1) 24
 - (2) 21
 - (3) 20
 - (4) 18
-

2. Let $P = \begin{bmatrix} \frac{\sqrt{3}}{2} & \frac{1}{2} \\ -\frac{1}{2} & \frac{\sqrt{3}}{2} \end{bmatrix}$, $A = \begin{bmatrix} 1 & 1 \\ 0 & 1 \end{bmatrix}$, and $Q = PAP^T$. If $P^T Q^{2007} P = \begin{bmatrix} a & b \\ c & d \end{bmatrix}$, then $2a + b - 3c - 4d$ equals:

- (1) 2004
 - (2) 2007
 - (3) 2005
 - (4) 2006
-

3. Negation of $(p \rightarrow q) \rightarrow (q \rightarrow p)$ is:

- (1) $(-q) \wedge p$
 - (2) $p \vee (\sim q)$
 - (3) $(\sim p) \vee q$
 - (4) $q \wedge (\sim p)$
-

4. Let $C(\alpha, \beta)$ be the circumcenter of the triangle formed by the lines $4x + 3y = 69$, $4y - 3x = 17$, and $x + 7y = 61$. Then $(\alpha - \beta)^2 + \alpha + \beta$ is equal to:

- (1) 18
- (2) 15

(3) 16

(4) 17

5. Let α, β, γ be the three roots of the equation $x^3 + bx + c = 0$. If $\beta\gamma = 1 = -\alpha$, then $b^3 + 2c^3 - 3\alpha^3 - 6\beta^3 - 8\gamma^3$ is equal to:

(1) $\frac{155}{8}$

(2) 21

(3) 19

(4) $\frac{169}{8}$

6. Let the number of elements in sets A and B be five and two respectively. Then the number of subsets of $A \times B$ each having at least 3 and at most 6 elements is:

(1) 752

(2) 772

(3) 782

(4) 792

7. If the coefficients of three consecutive terms in the expansion of $(1 + x)^n$ are in the ratio 1 : 5 : 20, then the coefficient of the fourth term is:

(1) 5481

(2) 3654

(3) 2436

(4) 1817

8. Let R be the focus of the parabola $y^2 = 20x$ and the line $y = mx + c$ intersect the parabola at two points P and Q . Let the point $G(10, 10)$ be the centroid of the triangle PQR . If $c - m = 6$, then $(PQ)^2$ is:

- (1) 325
 - (2) 346
 - (3) 296
 - (4) 317
-

9. Let $S_K = \frac{1+2+\dots+K}{K}$ and $\sum_{j=1}^n S_j^2$ where $A, B, C, D \in \mathbb{N}$ and A has the least value.

Then:

- (1) $A + B$ is divisible by D
 - (2) $A + B$ is divisible by 5
 - (3) $A + C + D$ is not divisible by B
 - (4) $A + B + D$ is divisible by 5
-

10. The shortest distance between the lines $\frac{x-4}{4} = \frac{y+2}{5} = \frac{z+3}{3}$ and $\frac{x-1}{3} = \frac{y-3}{4} = \frac{z-4}{2}$ is:

- (1) $2\sqrt{6}$
 - (2) $3\sqrt{6}$
 - (3) $6\sqrt{3}$
 - (4) $6\sqrt{2}$
-

11. The number of arrangements of the letters of the word "INDEPENDENCE" in which all the vowels always occur together is:

- (1) 16800
- (2) 14800

(3) 18000

(4) 33600

12. If the points with position vectors $\alpha\hat{i} + 10\hat{j} + 13\hat{k}$, $6\hat{i} + 11\hat{j} + 11\hat{k}$, and $\frac{9}{2}\hat{i} + \beta\hat{j} - 8\hat{k}$ are collinear, then $(19\alpha - 6\beta)^2$ is equal to:

(1) 49

(2) 36

(3) 25

(4) 16

13. In a bolt factory, machines A, B, and C manufacture respectively 20%, 30%, and 50% of the total bolts. Of their output, 3%, 4%, and 2% are defective bolts. A bolt is drawn at random from the product. If the bolt drawn is found to be defective, then the probability that it is manufactured by machine C is:

(1) $\frac{5}{14}$

(2) $\frac{3}{7}$

(3) $\frac{9}{28}$

(4) $\frac{2}{7}$

14. If for $z = \alpha + i\beta$, $|z + 2| = z + 4(1 + i)$, then $\alpha + \beta$ and $\alpha\beta$ are the roots of the equation:

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

(2) $x^2 + 7x + 12 = 0$

(3) $x^2 - 7x + 12 = 0$

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

15.

$\lim_{x \rightarrow 0} \left(\frac{(1 - \cos^2(3x)) \sin^3(4x)}{\cos^3(4x) \log(2x + 15)} \right)$ is equal to:

- (1) 24
 - (2) 9
 - (3) 18
 - (4) 15
-

16. The number of ways in which 5 girls and 7 boys can be seated at a round table so that no two girls sit together is:

- (1) $7(720)^2$
 - (2) 720
 - (3) $7(360)^2$
 - (4) $126(5!)^2$
-

17. Let $f(x) = \frac{\sin x + \cos x - \sqrt{2}}{\sin x - \cos x}$, where $x \in [0, \pi]$, and $x \in [0, \frac{\pi}{4}]$. Then $f\left(\frac{7\pi}{12}\right)$ is equal to:

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

18. If the equation of the plane containing the line $x + 2y + 3z - 4 = 0$, $2x + y - z + 5 = 0$, and perpendicular to the plane $\vec{r} = (\hat{i} - \hat{j}) + \lambda(\hat{i} + \hat{j} + \hat{k}) + \mu(\hat{i} - 2\hat{j} + 3\hat{k})$ is $ax + by + cz = 4$, then $a - b + c$ is equal to:

- (1) 22
- (2) 24
- (3) 20
- (4) 18

19. Let

$$A = \begin{bmatrix} 2 & 1 & 0 \\ 1 & 2 & -1 \\ 0 & -1 & 2 \end{bmatrix}.$$

If $|\text{adj}(\text{adj}(\text{adj}(2A)))| = (16)^n$, then n is equal to:

- (1) 8
- (2) 9
- (3) 12
- (4) 10

20. Let $I(x) = \int_0^x \frac{x+1}{x(1+xe^x)^2} dx$, $x > 0$. If $\lim_{x \rightarrow \infty} I(x) = 0$, then $I(1)$ is equal to:

- (1) $\frac{e+2}{e+1} - \log(e+1)$
- (2) $\frac{e+1}{e+2} + \log(e+1)$
- (3) $\frac{e+2}{e+1} - \log(e+1)$
- (4) $\frac{e+1}{e+2} + \log(e+1)$

21. Let $A = \{0, 3, 4, 6, 7, 8, 9, 10\}$ and R be the relation defined on A such that $R = \{(x, y) \in A \times A : x - y \text{ is an odd positive integer or } x - y = 2\}$. The minimum number of elements

that must be added to R so that it is a symmetric relation is:

22. Let $[t]$ denote the greatest integer $\leq t$. If the constant term in the expansion of $(3x^2 - \frac{1}{2x})^7$ is α , then $[\alpha]$ is equal to:

23. Let λ_1, λ_2 be the values of λ for which the points $(1, \lambda, \frac{1}{2})$ and $(-2, 0, 1)$ are at equal distance from the plane $2x + 3y - 6z + 7 = 0$. If $\lambda_1 > \lambda_2$, then the distance of the point $(1 - \lambda_2, \lambda_2, \lambda_1)$ from the line $\frac{x-5}{1} = \frac{y-1}{2} = \frac{z+7}{2}$ is:

24. If the solution curve of the differential equation $(y - 2 \log x)dx + (x \log x^2)dy = 0$ passes through the points $(e^{4/3}, \alpha)$ and (e^4, α) , then α is equal to:

25. Let $\vec{a} = 6\hat{i} + 9\hat{j} + 12\hat{k}$, $\vec{b} = a\hat{i} + 11\hat{j} - 2\hat{k}$, and $\vec{c}$ be vectors such that $\vec{a} \times \vec{c} = \vec{a} \times \vec{b}$. If $\vec{a} \cdot \vec{c} = -12$ and $\vec{c} \cdot (\hat{i} - 2\hat{j} + \hat{k}) = 5$, then $\vec{c} \cdot (\hat{i} + \hat{j} + \hat{k})$ is equal to:

26. The largest natural number n such that 3^n divides $66!$ is:

27. If $a_n = \frac{n^3}{n^4+147}$, $n = 1, 2, 3, \dots$, and a_n is the greatest term in the sequence, then a_n is equal to:

28. Let the mean and variance of 8 numbers $x, y, 10, 12, 6, 12, 4, 8$ be 9 and 9.25 respectively. If $x > y$, then $3x - 2y$ is equal to:

29. Consider a circle $C_1 : x^2 + y^2 - 4x - 2y = \alpha - 5$. Let its mirror image in the line $y = 2x + 1$ be another circle $C_2 : 5x^2 + 5y^2 - 10x - 10y + 36 = 0$. Let r be the radius of C_2 . Then $\alpha + r$ is equal to:

30. Let $[t]$ denote the greatest integer $\leq t$. The $\int_{\frac{\pi}{6}}^{\frac{5\pi}{6}} (8[\csc x] - 5[\cot x]) dx$ is equal to:

Physics

31. A cylindrical wire of mass $(0.4 \pm 0.01)\text{g}$ has length $(8 \pm 0.04)\text{ cm}$ and radius $(6 \pm 0.03)\text{ mm}$. The maximum error in its density will be:

Options:

- (1) 4%
 - (2) 1%
 - (3) 3.5%
 - (4) 5%
-

32. The engine of a train moving with speed 10 ms^{-1} towards a platform sounds a whistle at frequency 400 Hz. The frequency heard by a passenger inside the train is (neglect air speed, speed of sound in air = 330 ms^{-1}):

Options:

- (1) 400 Hz
 - (2) 388 Hz
 - (3) 200 Hz
 - (4) 412 Hz
-

33. The weight of a body on the earth is 400 N. Then weight of the body when taken to a depth half of the radius of the earth will be:

Options:

- (1) 300 N
 - (2) Zero
 - (3) 100 N
 - (4) 200 N
-

34. A TV transmitting antenna is 98 m high, and the receiving antenna is at ground level. If the radius of the earth is 6400 km, the surface area covered by the transmitting antenna is approximately:

Options:

- (1) 1240 km^2
 - (2) 1549 km^2
 - (3) 4868 km^2
 - (4) 3942 km^2
-

35. Certain galvanometers have a fixed core made of non-magnetic metallic material. The function of this metallic material is:

Options:

- (1) To produce large deflecting torque on the coil
 - (2) To bring the coil to rest quickly
 - (3) To oscillate the coil in magnetic field for longer period of time
 - (4) To make the magnetic field radial
-

36. Dimension of $\frac{1}{\mu_0 \epsilon_0}$ should be equal to:

Options:

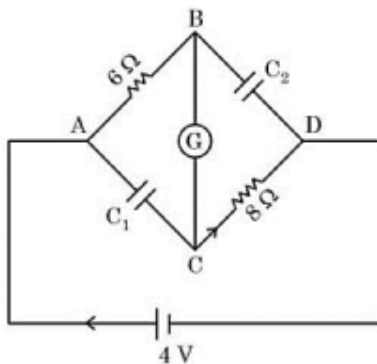
- (1) T/L
- (2) T^2/L^2
- (3) L/T
- (4) L^2/T^2

37. Two projectiles A and B are thrown with initial velocities of 40 m/s and 60 m/s at angles 30° and 60° with the horizontal respectively. The ratio of their ranges is ($g = 10 \text{ m/s}^2$):

Options:

- (1) $2 : \sqrt{3}$
 - (2) $\sqrt{3} : 2$
 - (3) $4 : 9$
 - (4) $1 : 1$
-

38. In this figure, the resistance of the coil of galvanometer G is 2Ω . The emf of the cell is 4 V. The ratio of potential difference across C_1 and C_2 is:



Options:

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

39. A charge particle moving in magnetic field B has components of velocity along B and perpendicular to B . The path of the charge particle will be:

Options:

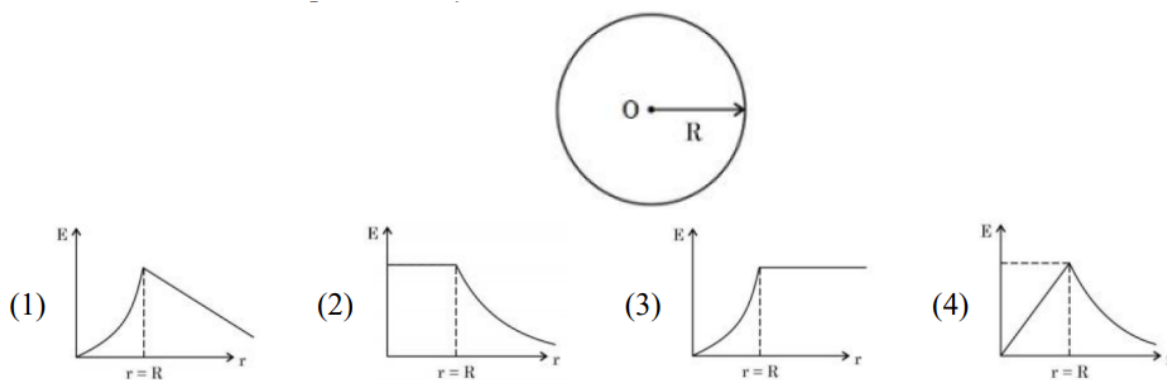
- (1) Helical path with the axis along magnetic field B
 - (2) Straight along the direction of magnetic field B
 - (3) Helical path with the axis perpendicular to the direction of magnetic field B
 - (4) Circular path
-

40. Proton (P) and electron (e) will have same de-Broglie wavelength when the ratio of their momentum is (assume $m_p = 1849 m_e$):

Options:

- (1) 1 : 43
 - (2) 43 : 1
 - (3) 1 : 1849
 - (4) 1 : 1
-

41. Graphical variation of electric field due to a uniformly charged insulating solid sphere of radius R , with distance r from the center O is represented by:



42. For a nucleus A_ZX having mass number A and atomic number Z:

Options:

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

43. At any instant the velocity of a particle of mass 500 g is $(2t\hat{i} + 3t^2\hat{j}) \text{ ms}^{-1}$. If the force acting on the particle at $t = 1 \text{ s}$ is $(\hat{i} + x\hat{j}) \text{ N}$, then the value of x will be:

Options:

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

44. Given below are two statements:

Statement I: If E be the total energy of a satellite moving around the Earth, then its potential energy will be $\frac{E}{2}$.

Statement II: The kinetic energy of a satellite revolving in an orbit is equal to the half the magnitude of total energy E .

Options:

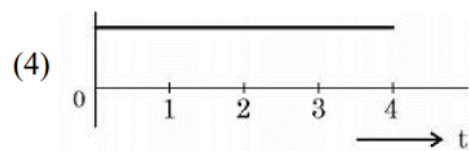
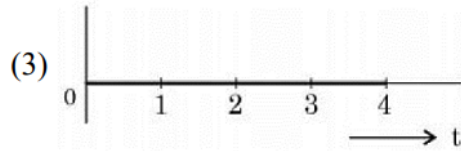
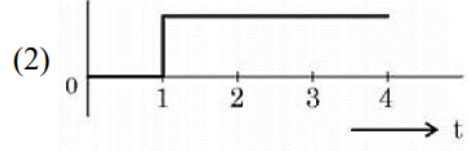
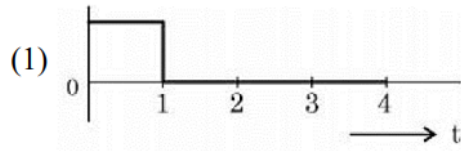
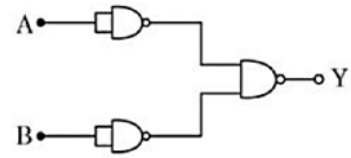
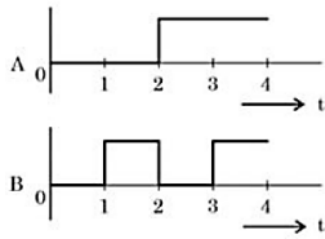
- (1) Both Statement I and Statement II are incorrect
 - (2) Statement I is incorrect but Statement II is correct
 - (3) Statement I is correct but Statement II is incorrect
 - (4) Both Statement I and Statement II are correct
-

45. Two forces having magnitude A and $\frac{A}{2}$ are perpendicular to each other. The magnitude of their resultant is:

Options:

- (1) $\frac{5A}{2}$
 - (2) $\frac{\sqrt{5A^2}}{2}$
 - (3) $\frac{\sqrt{5A}}{4}$
 - (4) $\frac{\sqrt{5A}}{2}$
-

46. For the logic circuit shown, the output waveform at Y is:



47. An aluminium rod with Young's modulus $Y = 7.0 \times 10^{10} \text{ N/m}^2$ undergoes elastic strain of 0.04%. The energy per unit volume stored in the rod in SI unit is:

Options:

- (1) 5600
- (2) 2800
- (3) 11200
- (4) 8400

48. Given below are two statements:

Statement I: If heat is added to a system, its temperature must increase.

Statement II: If positive work is done by a system in a thermodynamic process, its volume must increase.

Options:

- (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
-

49. An air bubble of volume 1 cm^3 rises from the bottom of a lake 40 m deep to the surface at a temperature of 12°C . The atmospheric pressure is $1 \times 10^5 \text{ Pa}$, the density of water is 1000 kg/m^3 , and $g = 10 \text{ m/s}^2$. The volume of the air bubble when it reaches the surface will be:

Options:

- (1) 3 cm^3
 - (2) 4 cm^3
 - (3) 2 cm^3
 - (4) 5 cm^3
-

50. In a reflecting telescope, a secondary mirror is used to:

Options:

- (1) Make chromatic aberration zero
 - (2) Reduce the problem of mechanical support
 - (3) Move the eyepiece outside the telescopic tube
 - (4) Remove spherical aberration
-

51. The momentum of a body is increased by 50%. The percentage increase in the kinetic energy of the body is:

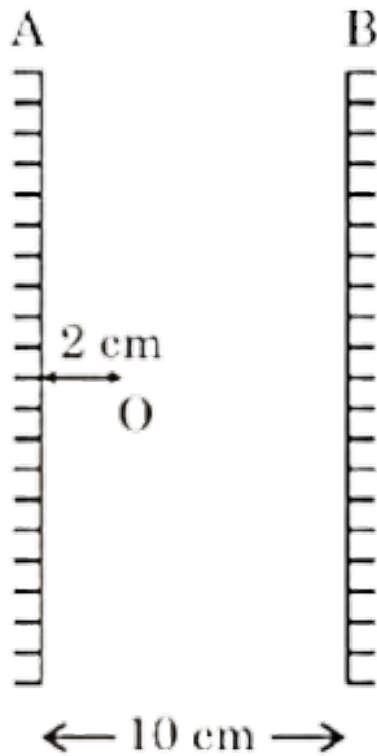
52. A nucleus with mass number 242 and binding energy per nucleon as 7.6 MeV breaks into two fragments each with mass number 121. If each fragment nucleus has binding energy per nucleon as 8.1 MeV, the total gain in binding energy is:

53. An electric dipole of dipole moment $6.0 \times 10^{-6} \text{ C} \cdot \text{m}$ is placed in a uniform electric field of $1.5 \times 10^3 \text{ N/C}$. The work done in rotating the dipole by 180° in this field will be:

54. An organ pipe 40 cm long is open at both ends. The speed of sound in air is 360 m/s. The frequency of the second harmonic is:

55. The moment of inertia of a semicircular ring about an axis, passing through the center and perpendicular to the plane of the ring, is $(1/x)MR^2$, where R is the radius and M is the mass of the semicircular ring. The value of x will be:

56. Two vertical parallel mirrors A and B are separated by 10 cm. A point object O is placed at a distance of 2 cm from mirror A. The distance of the second nearest image behind mirror A from the mirror A is:



57. The magnetic intensity at the center of a long current carrying solenoid is found to be 1.6×10^3 A/m. If the number of turns is 8 per cm, then the current flowing through the solenoid is:

58. A current of 2 A through a wire of cross-sectional area 25.0 mm^2 . The number of free electrons in a cubic meter is 2.0×10^{28} . The drift velocity of the electrons is $\text{---} \times 10^{-6} \text{ m/s}$

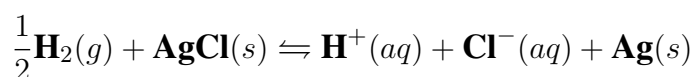
(given, charge on electron = 1.6×10^{-19} C):

59. An oscillating LC circuit consists of a 75 mH inductor and a $1.2 \mu\text{F}$ capacitor. If the maximum charge to the capacitor is $2.7 \mu\text{C}$. The maximum current in the circuit will be:

60. An air bubble of diameter 6 mm rises steadily through a solution of density 1750 kg/m^3 at the rate of 0.35 cm/s . The coefficient of viscosity of the solution (neglect density of air) is ____ Pas (given, $g = 10 \text{ m/s}^2$):

Chemistry

61. The reaction



occurs in which of the given galvanic cells?

- (A) $\text{Pt} \mid \text{H}_2(g) \mid \text{HCl}(\text{sol}^n) \mid \text{AgNO}_3(\text{sol}^n) \mid \text{Ag}$
 - (B) $\text{Pt} \mid \text{H}_2(g) \mid \text{HCl}(\text{sol}^n) \mid \text{AgCl}(s) \mid \text{Ag}$
 - (C) $\text{Pt} \mid \text{H}_2(g) \mid \text{KCl}(\text{sol}^n) \mid \text{AgCl}(s) \mid \text{Ag}$
 - (D) $\text{Ag} \mid \text{AgCl}(s) \mid \text{KCl}(\text{sol}^n) \mid \text{AgNO}_3 \mid \text{Ag}$
-

62. Sulphur (S)-containing amino acids from the following are:

- (A) Isoleucine
- (B) Cysteine
- (C) Lysine
- (D) Methionine
- (E) Glutamic acid

Choose the correct answer from the following:

- (A) b, c, e
 - (B) a, d
 - (C) a, b, c
 - (D) b, d
-

63. Which of the following complex is octahedral, diamagnetic and the most stable?

- (1) $\text{K}_3[\text{Co}(\text{CN})_6]$
 - (2) $[\text{Ni}(\text{NH}_3)_6]\text{Cl}_2$
 - (3) $[\text{Co}(\text{H}_2\text{O})_6]\text{Cl}_2$
 - (4) $\text{Na}_3[\text{CoCl}_6]$
-

64. Which of the following metals can be extracted through alkali leaching technique?

- (1) Cu
 - (2) Au
 - (3) Pb
 - (4) Sn
-

65. The correct order of spin-only magnetic moments for the following complex ions is:

- (1) $[\text{CoF}_6]^{3-} < [\text{MnBr}_4]^{2-} < [\text{Fe}(\text{CN})_6]^{3-} < [\text{Mn}(\text{CN})_6]^{3-}$
 - (2) $[\text{Fe}(\text{CN})_6]^{3-} < [\text{CoF}_6]^{3-} < [\text{MnBr}_4]^{2-} < [\text{Mn}(\text{CN})_6]^{3-}$
 - (3) $[\text{MnBr}_4]^{2-} < [\text{CoF}_6]^{3-} < [\text{Fe}(\text{CN})_6]^{3-} < [\text{Mn}(\text{CN})_6]^{3-}$
 - (4) $[\text{Fe}(\text{CN})_6]^{3-} < [\text{Mn}(\text{CN})_6]^{3-} < [\text{CoF}_6]^{3-} < [\text{MnBr}_4]^{2-}$
-

66. The water gas on reacting with cobalt as a catalyst forms:

- (1) Methanoic acid
 - (2) Methanal
 - (3) Ethanol
 - (4) Methanol
-

67. The reaction:



What is the value of x ?

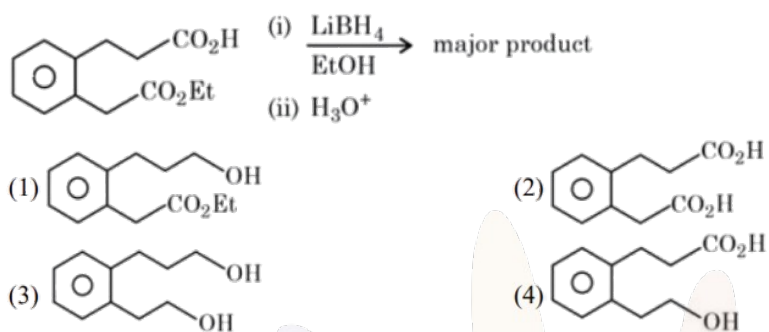
- (1) 12
 - (2) 10
 - (3) 2
 - (4) 6
-

68. What is the purpose of adding gypsum to cement?

- (1) To give a hard mass
- (2) To speed up the process of setting

- (3) To facilitate the hydration of cement
- (4) To slow down the process of setting
-

69. The major product formed in the following reaction is:



70. Match List I with List II:

List I (Species)	List II (Maximum Allowed Concentration in ppm in Drinking Water)
A. F^-	I. < 50 ppm
B. SO_4^{2-}	II. < 5 ppm
C. NO_3	III. < 2 ppm
D. Zn	IV. < 500 ppm

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

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

71. In chromyl chloride, the number of d-electrons present on chromium is the same as in:

(Given atomic numbers: Ti = 22, V = 23, Cr = 24, Mn = 25, Fe = 26)

- (1) Fe (III)
 - (2) V (IV)
 - (3) Ti (III)
 - (4) Mn (VII)
-

72. Assertion-Reason:

Assertion (A): Butan-1-ol has a higher boiling point than ethoxyethane.

Reason (R): Extensive hydrogen bonding leads to stronger association of molecules.

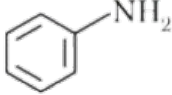
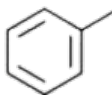
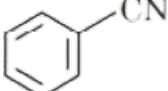
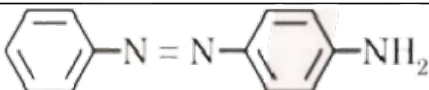
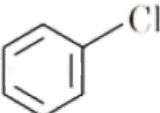
- (A) Both A and R are true, but R is not the correct explanation of A.
 - (B) Both A and R are true, and R is the correct explanation of A.
 - (C) A is false, but R is true.
 - (D) A is true, but R is false.
-

73. Match List I with List II:

List I (Reagents Used)	List II (Compound with Functional Group Detected)
A. Alkaline solution of copper sulphate and sodium citrate	I. 
B. Neutral FeCl ₃ solution	II. 
C. Alkaline chloroform solution	III. 
D. Potassium iodide and sodium hypochlorite	IV. 

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

74. Match List I with List II:

List I (Reagent)	List II (Product)
A. 	I. 
B. HBF_4, Δ	II. 
C. Cu, HCl	III. 
D. CuCN/KCN	IV. 

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

75. Match List I with List II:

List I	List II
A. Saccharin	I. High potency sweetener
B. Aspartame	II. First artificial sweetening agent
C. Alitame	III. Stable at cooking temperature
D. Sucralose	IV. Unstable at cooking temperature

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

76. The correct order of electronegativity for given elements is:

- (A) $P > Br > C > At$
 - (B) $C > P > At > Br$
 - (C) $Br > P > At > C$
 - (D) $Br > C > At > P$
-

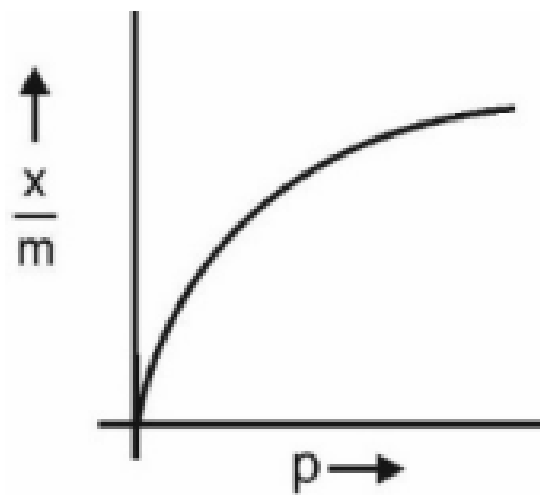
77. Given below are two statements:

Statement I: Lithium and Magnesium do not form superoxide.

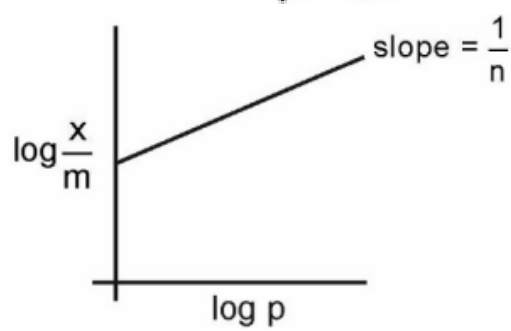
Statement II: The ionic radius of Li^+ is larger than the ionic radius of Mg^{2+} .

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

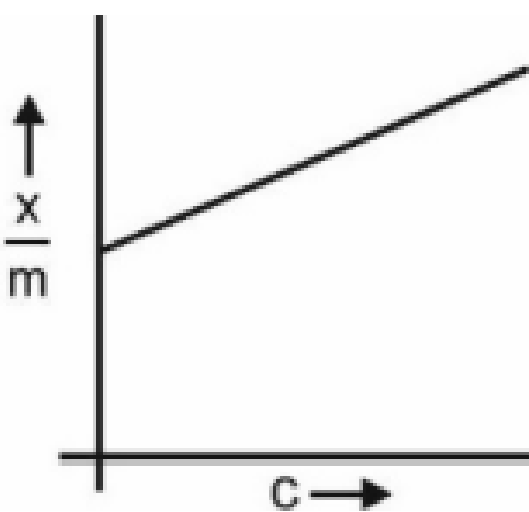
78. Which of the following represent the Freundlich adsorption isotherms?



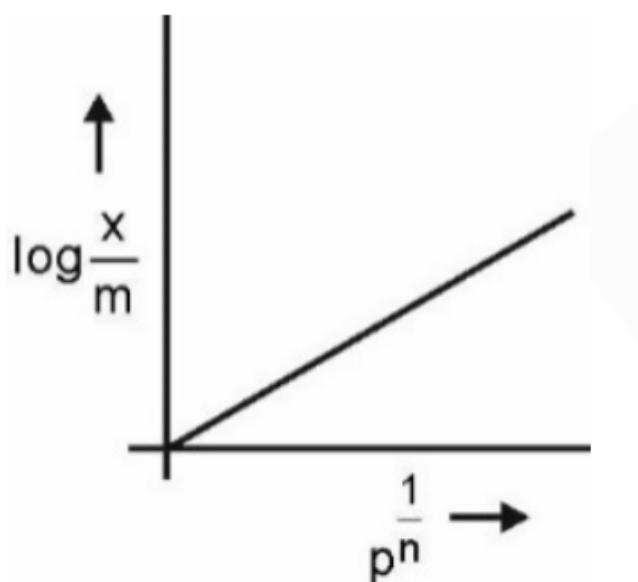
(A)



(B)

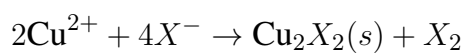


(C)



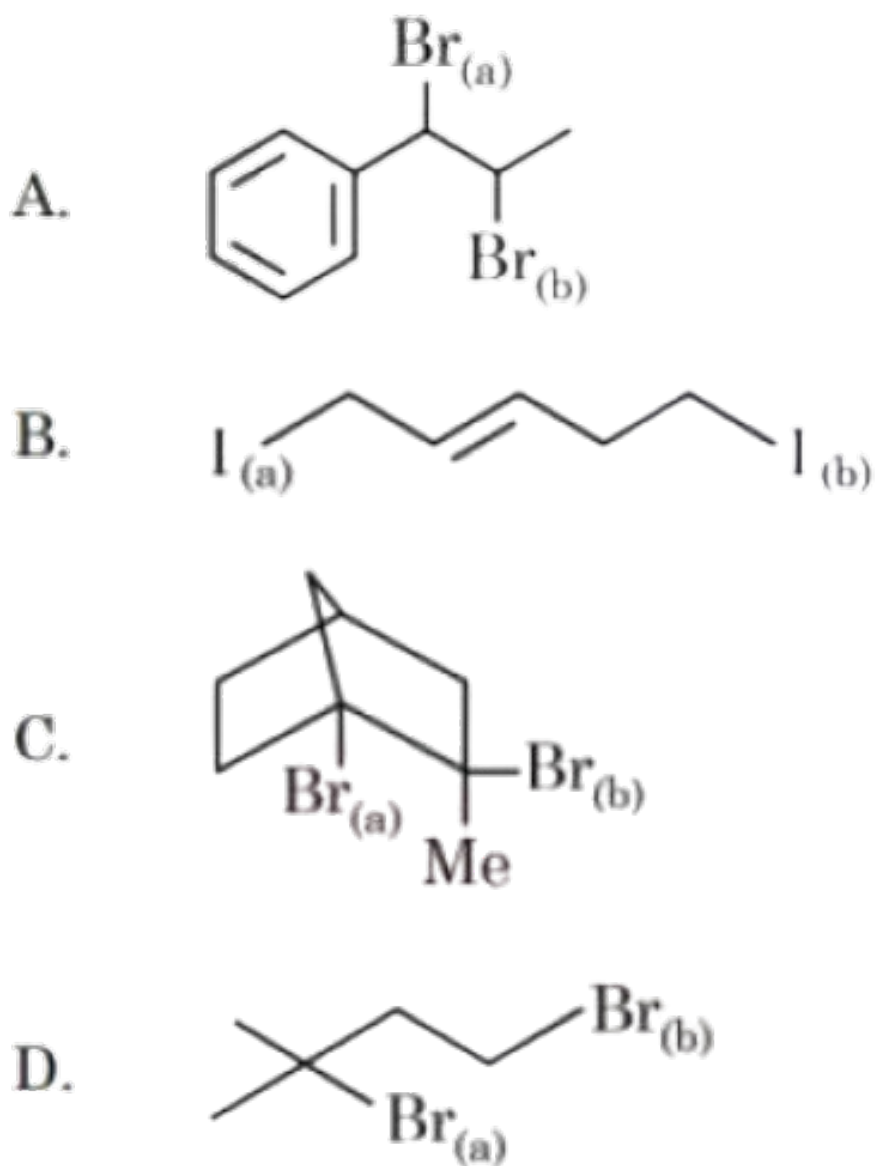
- (D)
 (A) A, C, D only
 (B) A, B only
 (C) A, B, D only
 (D) B, C, D only
-

79. Which halogen is known to cause the reaction given below:



- (A) All halogens
 (B) Only chlorine
 (C) Only bromine
 (D) Only iodine
-

80. Choose the halogen which is most reactive towards $\text{S}_{\text{N}}1$ reaction in the given compounds (A, B, C, & D):



(A) A-Br(a); B-I(a); C-Br(b); D-Br(a)

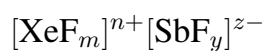
(B) A-Br(a); B-I(a); C-Br(a); D-Br(a)

(C) A-Br(b); B-I(b); C-Br(b); D-Br(b)

(D) A-Br(a); B-Br(a); C-Br(a); D-I(a)

81. Molar mass of the hydrocarbon (X) which on ozonolysis consumes one mole of O_3 per mole of (X) and gives one mole each of ethanol and propanone is:

82. XeF_4 reacts with SbF_5 to form:



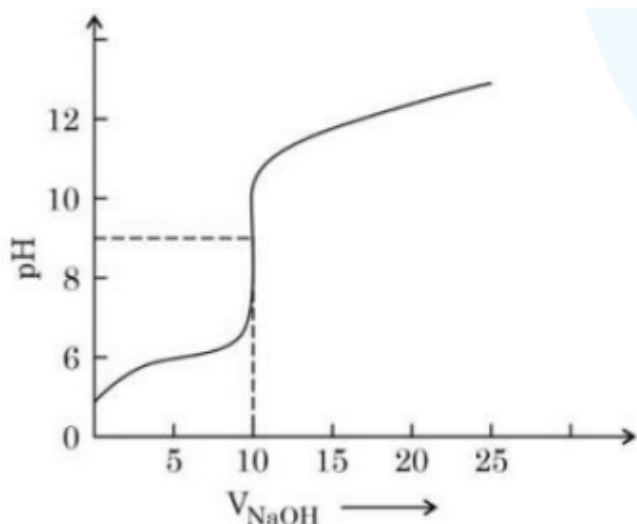
What is $m + n + y + z$?

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

83. The number of following statements which is/are incorrect is:

- (A) Line emission spectra are used to study the electronic structure.
 - (B) The emission spectra of atoms in the gas phase show a continuous spread of wavelength from red to violet.
 - (C) An absorption spectrum is like the photographic negative of an emission spectrum.
 - (D) The element helium was discovered in the sun by spectroscopic method.
-

84. The titration curve of weak acid vs. strong base with phenolphthalein as indicator is shown below:

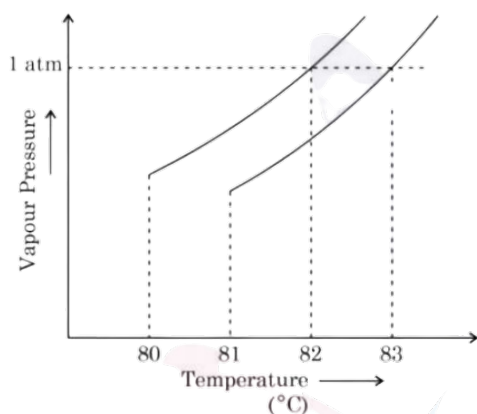


The $K_{\text{phenolphthalein}} = 4 \times 10^{-10}$ and $\log 2 = 0.3$. The number of correct statements about phenolphthalein is:

- (A) It can be used as an indicator for the titration of weak acid with weak base.
 - (B) It begins to change color at $\text{pH} = 8.4$.
 - (C) It is a weak organic base.
 - (D) It is colorless in acidic medium.
-

85. When a 60 W electric heater is immersed in a gas for 100 s in a constant volume container with adiabatic walls, the temperature of the gas rises by 5°C . The heat capacity of the given gas is:

86. The vapor pressure vs. temperature curve for a solution-solvent system is shown below. The boiling point of the solvent is:



- (A) 81°C
 - (B) 82°C
 - (C) 83°C
 - (D) 84°C
-

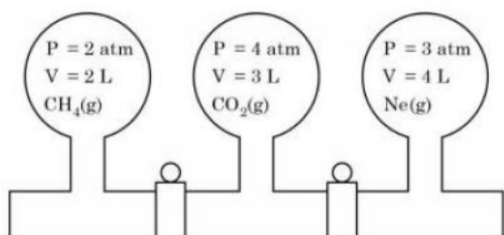
87. 0.5 g of an organic compound (X) with 60% carbon will produce $\text{---} \times 10^{-1}$ g of CO_2 on complete combustion.

88. The number of following factors which affect the percent covalent character of the ionic bond is --- .

- (A) Polarising power of cation
 - (B) Extent of distortion of anion
 - (C) Polarisability of the anion
 - (D) Polarising power of anion
-

89. Three bulbs are filled with CH_4 , CO_2 , and Ne as shown in the picture. The bulbs are connected through pipes of zero volume. When the stopcocks are opened and the

temperature is kept constant throughout, the pressure of the system is found to be ____ atm. (Nearest integer)



90. The number of given statements/s which is/are correct is ____:

- (A) The stronger the temperature dependence of the rate constant, the higher is the activation energy.
 - (B) If a reaction has zero activation energy, its rate is independent of temperature.
 - (C) The stronger the temperature dependence of the rate constant, the smaller is the activation energy.
 - (D) If there is no correlation between the temperature and the rate constant, then it means that the reaction has negative activation energy.
-