

JEE Main 2018 Paper 1 (B.E./B.Tech) 15 April 2018 Slot 2 (afternoon) Question Paper



Conducted by the Central Board of Secondary Education (CBSE)

Time Allowed: 3 Hours

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

Maximum Marks: 360

General Instructions

- (i) This paper is **Paper 1 (B.E./B.Tech.)** of **JEE (Main) 2018 - Annual**, conducted by the Central Board of Secondary Education (CBSE) in Computer Based Test (CBT) mode on 15 April 2018, Shift 2. The total duration is **3 hours**.
- (ii) The paper has **90 questions** and a maximum of **360 marks**: Mathematics, Physics and Chemistry carry 30 questions (120 marks) each, in that order.
- (iii) Each subject has **30 multiple choice questions** (MCQs), with four options each. Select the most appropriate answer.
- (iv) **All questions are compulsory**. Use only the constants given in the question while calculating.
- (v) **Marking scheme**: **+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.

Mathematics - Multiple Choice Questions

1. If the system of linear equations

$$x + ay + z = 3$$

$$x + 2y + 2z = 6$$

$$x + 5y + 3z = b$$

has no solution, then :

(A) $a = -1, \quad b = 9$ (B) $a = -1, \quad b \neq 9$

(C) $a \neq -1, \quad b = 9$ (D) $a = 1, \quad b \neq 9$

2. Let $f(x) =$

$$\begin{cases} (x-1)^{\frac{1}{2-x}}, & x > 1, x \neq 2 \\ k, & x = 2 \end{cases}$$

The value of k for which f is continuous at $x = 2$ is :

(A) 1 (B) e

(C) e^{-1} (D) e^{-2}

3. If $|z - 3 + 2i| \leq 4$ then the difference between the greatest value and the least value of $|z|$ is :

(A) $2\sqrt{13}$

(B) 8

(C) $4 + \sqrt{13}$

(D) $\sqrt{13}$

4. Suppose A is any 3×3 non-singular matrix and $(A - 3I)(A - 5I) = O$ where $I = I_3$ and $O = O_3$. If $\alpha A + \beta A^{-1} = 4I$, then $\alpha + \beta$ is equal to :

(A) 8 (B) 7

(C) 13 (D) 12

5. Tangents drawn from the point $(-8, 0)$ to the parabola $y^2 = 8x$ touch the parabola at P and Q . If F is the focus of the parabola, then the area of the triangle PFQ (in sq. units) is equal to :

(A) 24 (B) 32

(C) 48 (D) 64

6. The sides of a rhombus $ABCD$ are parallel to the lines, $x - y + 2 = 0$ and $7x - y + 3 = 0$. If the diagonals of the rhombus intersect $P(1, 2)$ and the vertex A (different from the origin) is on the y -axis, then the coordinate of A is :

(A) $\frac{5}{2}$

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

(C) 2

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

7. If a, b, c are in A.P. and a^2, b^2, c^2 are in G.P. such that

$$a < b < c \text{ and } a + b + c = \frac{3}{4},$$

then the value of a is :

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

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

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

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

8. The number of four letter words that can be formed using the letters of the word **BARRACK** is :

(A) 120 (B) 144

(C) 264 (D) 270

9. If $f(x) = \sin^{-1} \left(\frac{2 \times 3^x}{1 + 9^x} \right)$,

then f

$$\left(-\frac{1}{2} \right)$$

equals :

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

10. A player X has a biased coin whose probability of showing heads is p and a player Y has a fair coin. They start playing a game with their own coins and play alternately. The player who throws a head first is a winner. If X starts the game, and the probability of winning the game by both the players is equal, then the value of ' p ' is :

- (A) $\frac{1}{5}$
 (B) $\frac{1}{3}$
 (C) $\frac{2}{5}$
 (D) $\frac{1}{4}$

11. Let $f: A \rightarrow B$ be a function defined as $f(x) = \frac{x-1}{x-2}$,

Where $A = \mathbf{R} - \{2\}$ and $B = \mathbf{R} - \{1\}$. Then f is :

(A) invertible and

$$f^{-1}(y) = \frac{3y-1}{y-1}$$

(B) invertible and

$$f^{-1}(y) = \frac{2y-1}{y-1}$$

(C) invertible and

$$f^{-1}(y) = \frac{2y+1}{y-1}$$

(D) not invertible

12. An angle between the lines whose direction cosines are given by the equations,

$$l + 3m + 5n = 0 \text{ and } 5l - 2m + 6n = 0, \text{ is :}$$

- (A) $\cos^{-1} \left(\frac{1}{3} \right)$
 (B) $\cos^{-1} \left(\frac{1}{4} \right)$
 (C) $\cos^{-1} \left(\frac{1}{6} \right)$
 (D) $\cos^{-1} \left(\frac{1}{8} \right)$

13. The curve satisfying the differential equation, $(x^2 - y^2) dx + 2xy dy = 0$ and passing through the point $(1, 1)$ is :

- (A) a circle of radius one. (B) a hyperbola.
 (C) an ellipse. (D) a circle of radius two.

14. If

$$\int \frac{2x+5}{\sqrt{7-6x-x^2}} dx = A\sqrt{7-6x-x^2} + B\sin^{-1} \left(\frac{x+3}{4} \right) + C$$

(where C is a constant of integration), then the ordered pair (A, B) is equal to :

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

15. The foot of the perpendicular drawn from the origin, on the line, $3x + y = \lambda$ ($\lambda \neq 0$) is P . If the line meets x -axis at A and y -axis at B , then the ratio $BP : PA$ is :

- (A) $1 : 3$ (B) $3 : 1$
 (C) $1 : 9$ (D) $9 : 1$

16. If

$$I_1 = \int_0^1 e^{-x} \cos^2 x dx;$$

$$I_2 = \int_0^1 e^{-x^2} \cos^2 x dx$$

and

$$I_3 = \int_0^1 e^{-x^3} dx;$$

then

$$(A) I_2 > I_3 > I_1 \quad (B) I_2 > I_1 > I_3$$

$$(C) I_3 > I_2 > I_1 \quad (D) I_3 > I_1 > I_2$$

17. If $f(x)$ is a quadratic expression such that $f(1) + f(2) = 0$, and -1 is a root of $f(x) = 0$, then the other root of $f(x) = 0$ is :

$$(A) \quad \frac{5}{8}$$

$$(B) \quad \frac{8}{5}$$

$$(C) \quad \frac{5}{8}$$

$$(D) \quad \frac{8}{5}$$

18. The value of integral

$$\int_{\frac{\pi}{4}}^{\frac{3\pi}{4}} \frac{x}{1 + \sin x} dx$$

is :

$$(A) \quad \pi\sqrt{2}$$

$$(B) \quad \pi(\sqrt{2} - 1)$$

$$(C) \quad \frac{\pi}{2}(\sqrt{2} + 1)$$

$$(D) \quad 2\pi(\sqrt{2} - 1)$$

19. If the mean of the data : 7, 8, 9, 7, 8, 7, λ , 8 is 8, then the variance of this data is :

$$(A) \quad \frac{7}{8}$$

$$(B) \quad 1$$

$$(C) \quad \frac{9}{8}$$

$$(D) \quad 2$$

20. If the position vectors of the vertices A, B and C of a ΔABC are respectively $4\hat{i} + 7\hat{j} + 8\hat{k}$, $2\hat{i} + 3\hat{j} + 4\hat{k}$, and $2\hat{i} + 5\hat{j} + 7\hat{k}$, then the position vectors of the point, where the bisector of $\angle A$ meets BC is :

$$(A) \quad \frac{1}{2}(4\hat{i} + 8\hat{j} + 11\hat{k})$$

$$(B) \quad \frac{1}{3}(6\hat{i} + 11\hat{j} + 15\hat{k})$$

$$(C) \quad \frac{1}{3}(6\hat{i} + 13\hat{j} + 18\hat{k})$$

$$(D) \quad \frac{1}{4}(8\hat{i} + 14\hat{j} + 19\hat{k})$$

21.

$$\lim_{x \rightarrow 0} \frac{x \tan 2x - 2x \tan x}{(1 - \cos 2x)^2}$$

equals :

$$(A) \quad \frac{1}{4}$$

$$(B) \quad 1$$

$$(C) \quad \frac{1}{2}$$

$$(D) \quad \frac{1}{2}$$

22. Let $f(x)$ be a polynomial of degree 4 having extreme values at $x = 1$ and $x = 2$.

If

$$\lim_{x \rightarrow 0} \left(\frac{f(x)}{x^2} + 1 \right) = 3$$

then $f(-1)$ is equal to :

$$(A) \quad \frac{9}{2}$$

$$(B) \quad \frac{5}{2}$$

$$(C) \quad \frac{3}{2}$$

$$(D) \quad \frac{1}{2}$$

23. A normal to the hyperbola, $4x^2 - 9y^2 = 36$ meets the co-ordinate axes x and y at A and B, respectively. If the parallelogram OABP (O being the origin) is formed, then the locus of P is :

- (A) $4x^2 + 9y^2 = 121$ (B) $9x^2 + 4y^2 = 169$
(C) $4x^2 - 9y^2 = 121$ (D) $9x^2 - 4y^2 = 169$

24. The tangent to the circle $C_1 : x^2 + y^2 - 2x - 1 = 0$ at the point (2, 1) cuts off a chord of length 4 from a circle C_2 whose center is (3, -2). The radius of C_2 is :

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

25. The coefficient of x^{10} in the expansion of $(1 + x)^2(1 + x^2)^3(1 + x^3)^4$ is equal to :

- (A) 52 (B) 56
(C) 50 (D) 44

26. Let $A_n = \left(\frac{3}{4}\right) - \left(\frac{3}{4}\right)^2 + \left(\frac{3}{4}\right)^3 - \dots + (-1)^{n-1} \left(\frac{3}{4}\right)^n$

and $B_n = 1 - A_n$.

Then, the least natural number p , so that $B_n > A_n$, for all $n \geq p$, is :

- (A) 9 (B) 7
(C) 11 (D) 5

27. A plane bisects the line segment joining the points (1, 2, 3) and (-3, 4, 5) at right angles. Then this plane also passes through the point :

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

28. The number of solutions of $\sin 3x = \cos 2x$, in the interval

$$\left(\frac{\pi}{2}, \pi\right)$$

is :

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

29. A tower T_1 of height 60 m is located exactly opposite to a tower T_2 of height 80 m on a straight road. From the top of T_1 , if the angle of depression of the foot of T_2 is twice the angle of elevation of the top of T_2 , then the width (in m) of the road between the feet of the towers T_1 and T_2 is :

- (A) $10\sqrt{2}$
(B) $10\sqrt{3}$
(C) $20\sqrt{3}$
(D) $20\sqrt{2}$

30. Consider the following two statements :

Statement p :

The value of $\sin 120^\circ$ can be derived by taking $\theta = 240^\circ$ in the equation $2\sin$

$$\frac{\theta}{2} = \sqrt{1 + \sin \theta} - \sqrt{1 - \sin \theta}$$

Statement q :

The angles A, B, C and D of any quadrilateral ABCD satisfy the equation $\cos$

$$\left(\frac{1}{2}(A + C)\right) + \cos\left(\frac{1}{2}(B + D)\right) = 0$$

Then the truth values of p and q are respectively :

- (A) F, T (B) T, F
(C) T, T (D) F, F

Physics - Multiple Choice Questions

31. Muon (μ^-) is a negatively charged ($|q| = |e|$) particle with a mass $m_\mu = 200 m_e$, where m_e is the mass of the electron and e is the electronic charge. If μ^- is bonded to a proton to form a hydrogen like atom, identify the correct statements.

(A) Radius of the muonic orbit is 200 times smaller than that of the electron.

(B) The speed of the μ^- in the n^{th} orbit is $\frac{1}{200}$ times that of the electron in the n^{th} orbit.

(C) The ionization energy of muonic atom is 200 times more than of a hydrogen atom.

(D) The momentum of the muon in the n^{th} orbit is 200 times more than that of the electron.

(A) (A), (B), (D) (B) (A), (C), (D)

(C) (B), (D) (D) (C), (D)

32. An unstable heavy nucleus at rest breaks into two nuclei which move away with velocities in the ratio of 8 : 27. The ratio of the radii of the nuclei (assumed to be spherical) is :

(A) 8 : 27 (B) 4 : 9

(C) 3 : 2 (D) 2 : 3

33. A convergent doublet of separated lenses, corrected for spherical aberration, has resultant focal length of 10 cm. The separation between the two lenses is 2 cm. The focal lengths of the component lenses are :

(A) 10 cm, 12 cm (B) 12 cm, 14 cm

(C) 16 cm, 18 cm (D) 18 cm, 20 cm

34. A constant voltage is applied between two ends of a metallic wire. If the length is halved and the radius of the wire is doubled, the rate of heat developed in the wire will be :

(A) Doubled

(B) Halved

(C) Unchanged

(D) Increased 8 times

35. A plane polarized monochromatic EM wave is traveling in vacuum along z direction such that at $t = t_1$ it is found that the electric field is zero at a spatial point z_1 . The next zero that occurs in its neighbourhood is at z_2 . The frequency of the electromagnetic wave is :

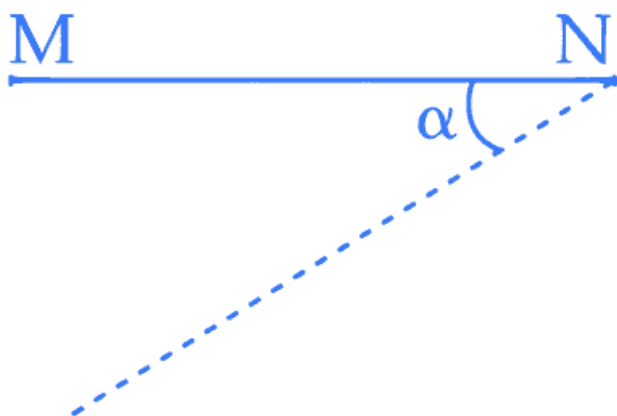
(A) $\frac{3 \times 10^8}{|z_2 - z_1|}$

(B) $\frac{1.5 \times 10^8}{|z_2 - z_1|}$

(C) $\frac{6 \times 10^8}{|z_2 - z_1|}$

(D) $\frac{1}{t_1 + \frac{|z_2 - z_1|}{3 \times 10^8}}$

36. A thin rod MN, free to rotate in the vertical plane about the fixed end N, is held horizontal. When the end M is released the speed of this end, when the rod makes an angle α with the horizontal, will be proportional to : (see figure)



- (A) $\sqrt{\sin \alpha}$
 (B) $\sin \alpha$
 (C) $\sqrt{\cos \alpha}$
 (D) $\cos \alpha$

37. A solid ball of radius R has a charge density ρ given by $\rho = \rho_0 (1 - r/R)$ for $0 \leq r \leq R$. The electric field outside the ball is :

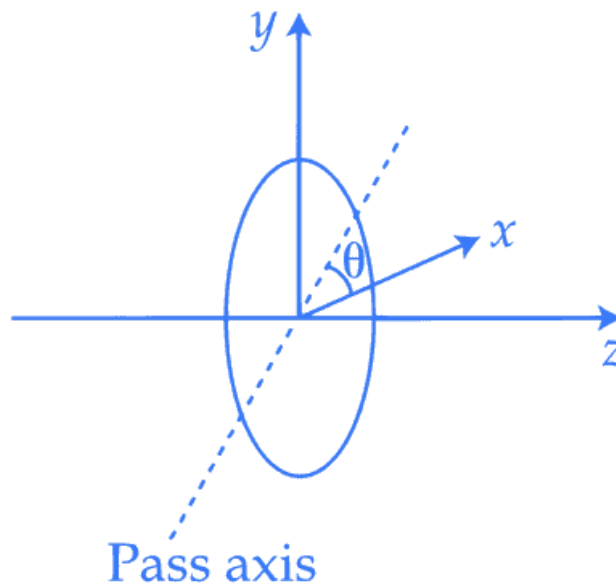
- (A) $\frac{\rho_0 R^3}{\epsilon_0 r^2}$
 (B) $\frac{\rho_0 R^3}{12 \epsilon_0 r^2}$
 (C) $\frac{4\rho_0 R^3}{3 \epsilon_0 r^2}$
 (D) $\frac{3\rho_0 R^3}{4 \epsilon_0 r^2}$

38. A body of mass 2 kg slides down with an acceleration of 3 m/s^2 on a rough inclined plane having a slope of 30° . The external force required to take the same body up the plane with the same acceleration will be : ($g = 10 \text{ m/s}^2$)

- (A) 14 N (B) 20 N
 (C) 6 N (D) 4 N

39. A plane polarized light is incident on a polariser with its pass axis making angle θ with x-axis, as shown in the figure. At four different values of θ , $\theta = 8^\circ, 38^\circ, 188^\circ$ and 218° , the observed intensities are same.

What is the angle between the direction of polarization and x-axis ?

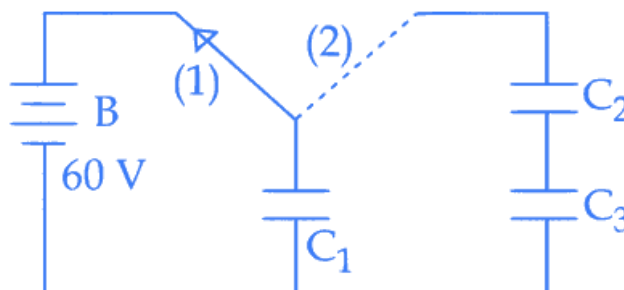


- (A) 98° (B) 128°
 (C) 203° (D) 45°

40. A capacitor $C_1 = 1.0 \mu\text{F}$ is charged up to a voltage $V = 60 \text{ V}$ by connecting it to battery B through switch (1). Now C_1 is disconnected from battery and connected to a circuit consisting of two uncharged capacitors

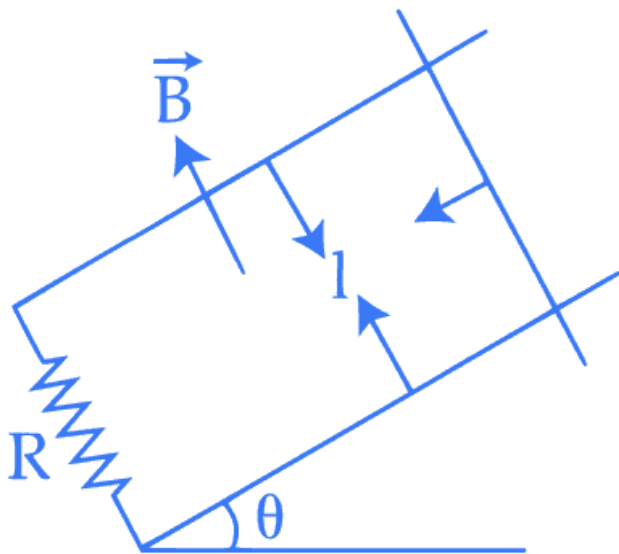
$$C_2 = 3.0 \mu\text{F}$$

and $C_3 = 6.0 \mu\text{F}$ through switch (2), as shown in the figure. The sum of final charges on C_2 and C_3 is :



- (A) $40 \mu\text{C}$ (B) $36 \mu\text{C}$
 (C) $20 \mu\text{C}$ (D) $54 \mu\text{C}$

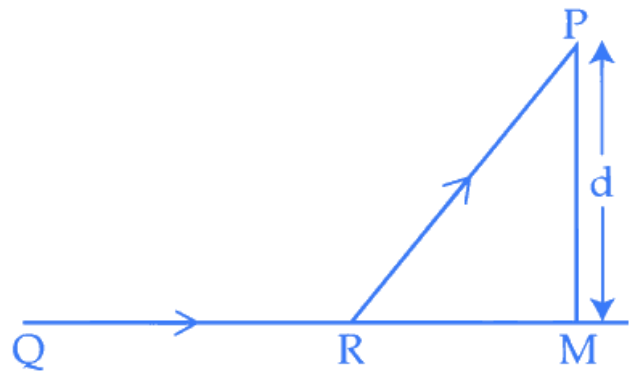
41.



A copper rod of mass m slides under gravity on two smooth parallel rails, with separation l and set at an angle of θ with the horizontal. At the bottom rails are joined by a resistance R . There is a uniform magnetic field B normal to the plane of the rails, as shown in the figure. The terminal speed of the copper rod is :

- (A) $\frac{mgR \tan \theta}{B^2 l^2}$
 (B) $\frac{mgR \cot \theta}{B^2 l^2}$
 (C) $\frac{mgR \sin \theta}{B^2 l^2}$
 (D) $\frac{mgR \cos \theta}{B^2 l^2}$

42. A man in a car at location Q on a straight highway is moving with speed v . He decides to reach a point P in a field at a distance d from the highway (point M) as shown in the figure. Speed of the car in the field is half to that on the highway. What should be the distance RM, so that the time taken to reach P is minimum ?



(A) d

(B) $\frac{d}{\sqrt{2}}$

(C) $\frac{d}{2}$

(D) $\frac{d}{\sqrt{3}}$

43. A copper rod of cross-sectional area A carries a uniform current I through it. At temperature T , if the volume charge density of the rod is ρ , how long will the charges take to travel a distance d ?

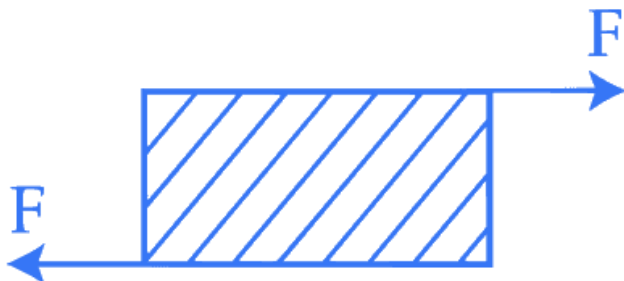
(A) $\frac{2\rho d A}{I}$

(B) $\frac{2\rho d A}{IT}$

(C) $\frac{\rho d A}{I}$

(D) $\frac{\rho d A}{IT}$

44. As shown in the figure, forces of 10^5 N each are applied in opposite directions, on the upper and lower faces of a cube of side 10 cm, shifting the upper face parallel to itself by 0.5 cm. If the side of another cube of the same material is 20 cm, then under similar conditions as above, the displacement will be :



- (A) 0.25 cm (B) 0.37 cm
(C) 0.75 cm (D) 1.00 cm

45. A disc rotates about its axis of symmetry in a horizontal plane at a steady rate of 3.5 revolutions per second. A coin placed at a distance of 1.25 cm from the axis of rotation remains at rest on the disc. The coefficient of friction between the coin and the disc is : ($g = 10 \text{ m/s}^2$)

- (A) 0.5 (B) 0.3
(C) 0.7 (D) 0.6

46. At the center of a fixed large circular coil of radius R , a much smaller circular coil of radius r is placed. The two coils are concentric and are in the same plane. The larger coil carries a current I . The smaller coil is set to rotate with a constant angular velocity ω about an axis along their common diameter. Calculate the emf induced in their smaller coil after a time t of its start of rotation.

- (A) $\frac{\mu_o I}{2R}$
 $\omega \pi r^2 \sin \omega t$
(B) $\frac{\mu_o I}{4R}$
 $\omega \pi r^2 \sin \omega t$
(C) $\frac{\mu_o I}{4R}$
 $\omega r^2 \sin \omega t$
(D) $\frac{\mu_o I}{2R}$
 $\omega r^2 \sin \omega t$

47. When an air bubble of radius r rises from the bottom to the surface of a lake its radius becomes $\frac{5r}{4}$. Taking the atmospheric pressure to be equal to 10 m height of water column, the depth of the lake would approximately be (ignore the surface tension and the effect of temperature) :

- (A) 11.2 m (B) 8.7 m
(C) 9.5 m (D) 10.5 m

48. The characteristic distance at which quantum gravitational effects are significant, the Planck length, can be determined from a suitable combination of the fundamental physical constants G , h and c .

Which of the following correctly gives the Planck length ?

- (A) $G \hbar^2 c^3$
(B) $G^2 \hbar c$
(C) $G^{1/2} \hbar^2 c$
(D) $\left(\frac{G \hbar}{c^3} \right)^{1/2}$

49. Two simple harmonic motions, as shown below, are at right angles. They are combined to form Lissajous figures.

$$x(t) = A \sin(at + \delta)$$

$$y(t) = B \sin(bt)$$

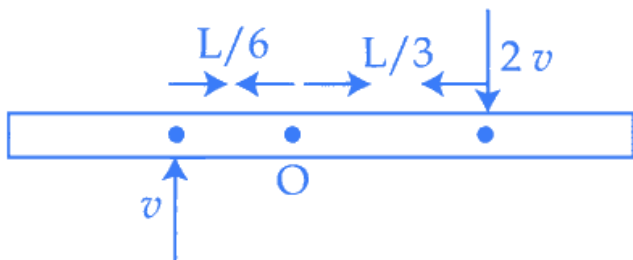
Identify the **correct** match below.

- (A) **Parameters** $A \neq B, a = b; \delta = 0;$
Curve Parabola
(B) **Parameters** $A = B, a = b; \delta = \pi/2$
Curve Line
(C) **Parameters** $A \neq B, a = b; \delta = \pi/2$
Curve Ellipse
(D) **Parameters** $A = B, a = 2b; \delta = \pi/2$
Curve Circle

50. A current of 1 A is flowing on the sides of an equilateral triangle of side 4.5×10^{-2} m. The magnetic field at the center of the triangle will be :

- (A) 2×10^{-5} Wb/m² (B) Zero
(C) 8×10^{-5} Wb/m² (D) 4×10^{-5} Wb/m²

51. A thin uniform bar of length L and mass 8 m lies on a smooth horizontal table. Two point masses m and $2m$ are moving in the same horizontal plane from opposite sides of the bar with speeds $2v$ and v respectively. The masses stick to the bar after collision at a distance $\frac{L}{3}$ and $\frac{L}{6}$ respectively from the center of the bar. If the bar starts rotating about its center of mass as a result of collision, the angular speed of the bar will be :



- (A) $\frac{v}{5L}$
(B) $\frac{6v}{5L}$
(C) $\frac{3v}{5L}$
(D) $\frac{v}{6L}$

52. A parallel plate capacitor with area 200 cm² and separation between the plates 1.5 cm, is connected across a battery of emf V . If the force of attraction between the plates is 25×10^{-6} N, the value of V is approximately :

$$\left(\epsilon_0 = 8.85 \times 10^{-12} \frac{C^2}{N.m^2} \right)$$

- (A) 250 V (B) 100 V
(C) 300 V (D) 150 V

53. The value closest to the thermal velocity of a Helium atom at room temperature (300 K) in ms⁻¹ is :

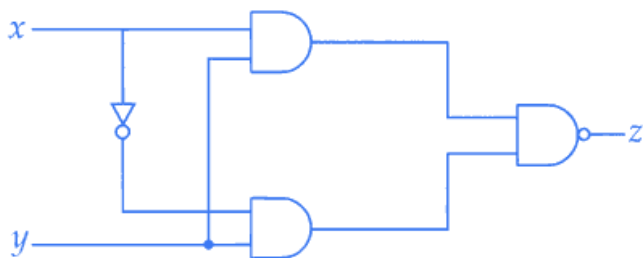
$$[k_B = 1.4 \times 10^{-23} \text{ J/K; } m_{\text{He}} = 7 \times 10^{-27} \text{ kg}]$$

- (A) 1.3×10^4 (B) 1.3×10^3
(C) 1.3×10^5 (D) 1.3×10^2

54. A proton of mass m collides elastically with a particle of unknown mass at rest. After the collision, the proton and the unknown particle are seen moving at an angle of 90° with respect to each other. The mass of unknown particle is :

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

55. Truth table for the following digital circuit will be :



(A)

x	y	z
0	0	0
0	1	0
1	0	0
1	1	1

(B)

x	y	z
0	0	1
0	1	1
1	0	1
1	1	0

(C)

x	y	z
0	0	1
0	1	1
1	0	1
1	1	1

(D)

x	y	z
0	0	0
0	1	1
1	0	1
1	1	1

56. If the de Broglie wavelengths associated with a proton and an α -particle are equal, then the ratio of velocities of the proton and the α -particle will be :

(A) 4 : 1

(B) 2 : 1

(C) 1 : 2

(D) 1 : 4

57. 5 beats / econd are heard when a tuning fork is sounded with a sonometer wire under tension, when the length of the sonometer wire is either 0.95 m or 1 m. The frequency of the fork will be :

(A) 195 Hz

(B) 150 Hz

(C) 300 Hz

(D) 251 Hz

58. Two Carnot engines A and B are operated in series. Engine A receives heat from a reservoir at 600 K and rejects heat to a reservoir at temperature T. Engine B receives heat rejected by engine A and in turn rejects it to a reservoir at 100 K. If the efficiencies of the two energies A and B are represented by η_A and η_B , respectively, then what is the value of

? $\frac{\eta_B}{\eta_A}$

(A) $\frac{12}{7}$

(B) $\frac{7}{12}$

(C) $\frac{12}{5}$

(D) $\frac{5}{12}$

59. The carrier frequency of a transmitter is provided by a tank circuit of a coil of inductance 49μ H and a capacitance of 2.5 nF. It is modulated by an audio signal of 12 kHz. The frequency range occupied by the side bands is :

(A) 13482 kHz – 13494 kHz

(B) 442 kHz – 466 kHz

(C) 63 kHz – 75 kHz

(D) 18 kHz – 30 kHz

60. A body takes 10 minutes to cool from 60°C to 50°C . The temperature of surroundings is constant at 25°C . Then, the temperature of the body after next 10 minutes will be approximately :

(A) 47°C

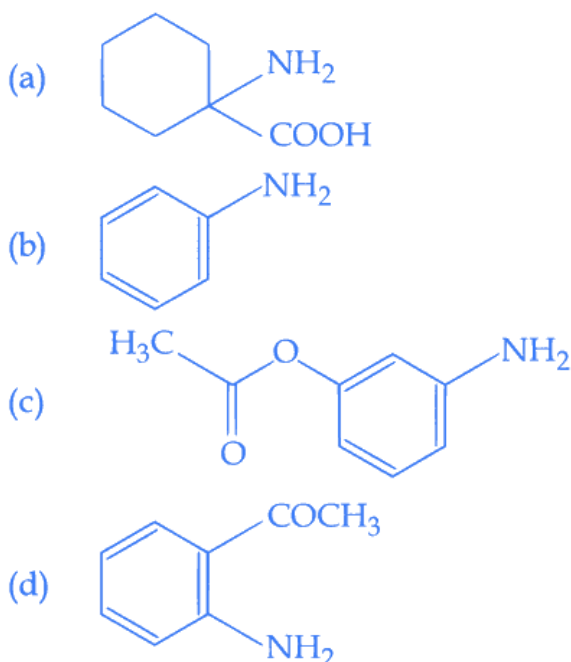
(B) 41°C

(C) 45°C

(D) 43°C

Chemistry - Multiple Choice Questions

61. The increasing order of diazotisation of the following compounds is :



- (A) (a) < (b) < (c) < (d) (B) (a) < (d) < (b) < (c)
 (C) (a) < (d) < (c) < (b) (D) (d) < (c) < (b) < (a)

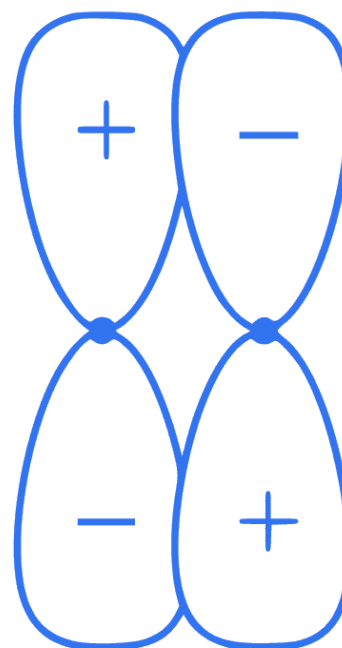
62. For a first order reaction, $A \rightarrow P$, $t_{1/2}$ (half-life) is 10 days. The time required for $\frac{1}{4}$ th conversion of A (in days) is : ($\ln 2 = 0.693$, $\ln 3 = 1.1$)

- (A) 5 (B) 3.2
 (C) 4.1 (D) 2.5

63. The correct order of electron affinity is :

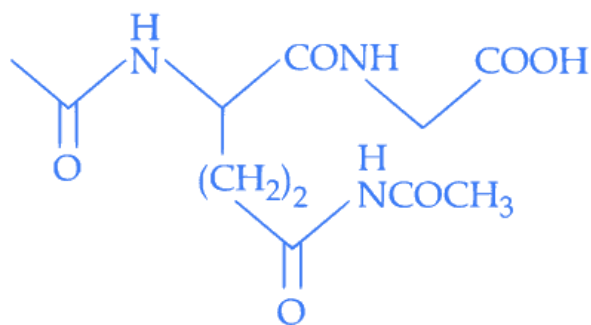
- (A) $F > Cl > O$ (B) $F > O > Cl$
 (C) $Cl > F > O$ (D) $O > F > Cl$

64. Which of the following best describes the diagram below of a molecular orbital ?

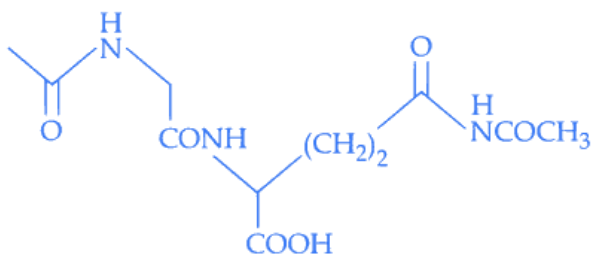


- (A) A non-bonding orbital (B) An antibonding σ orbital
 (C) A bonding π orbital (D) An antibonding π orbital

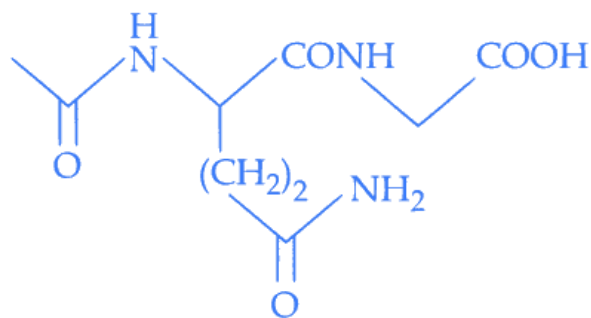
65. The dipeptide, Gln-Gly, on treatment with CH_3COCl followed by aqueous work up gives :



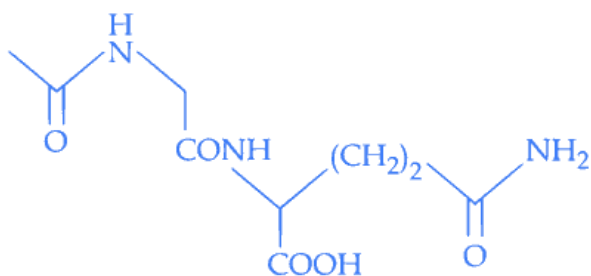
(A)



(B)

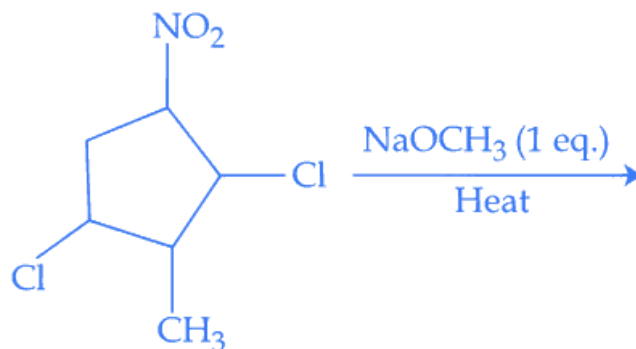


(C)

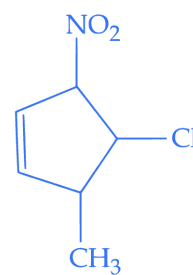


(D)

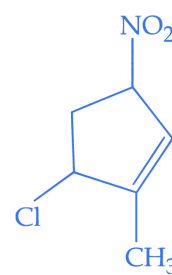
66. The major product formed in the following reaction is :



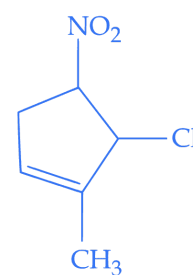
(A)



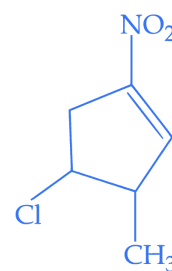
(B)



(C)



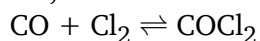
(D)



67. Two 5 molal solutions are prepared by dissolving a non-electrolyte non-volatile solute separately in the solvents X and Y. The molecular weights of the solvents are M_X and M_Y , respectively where $M_X = \frac{3}{4} M_Y$. The relative lowering of vapor pressure of the solution in X is "m" times that of the solution in Y. Given that the number of moles of solute is very small in comparison to that of the solvent, the value of "m" is :

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

68. At a certain temperature in a 5 L vessel, 2 moles of carbon monoxide and 3 moles of chlorine were allowed to reach equilibrium according to the reaction,



At equilibrium, if one mole of CO is present then equilibrium constant (K_c) for the reaction is :

- (A) 2 (B) 2.5
 (C) 3 (D) 4

69. Two compounds I and II are eluted by column chromatography (adsorption of I > II). Which one of following is a correct statement ?

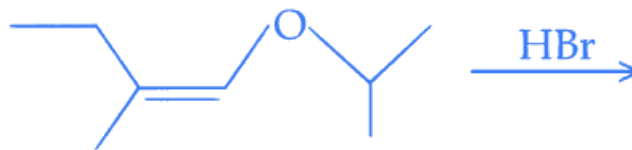
- (A) I moves faster and has higher R_f value than II
 (B) II moves faster and has higher R_f value than I
 (C) I moves slower and has higher R_f value than II
 (D) II moves slower and has higher R_f value than I

70. For per gram of reactant, the maximum quantity of N_2 gas is produced in which of the following thermal decomposition reactions ?

(Given : Atomic wt. - Cr = 52 u, Ba = 137 u)

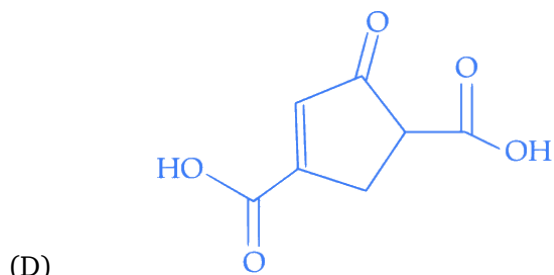
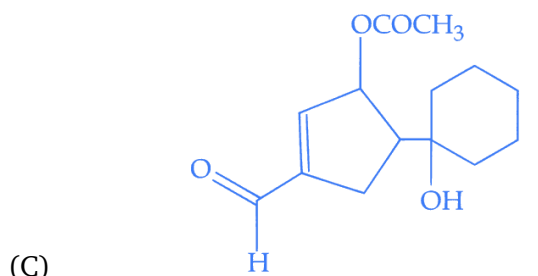
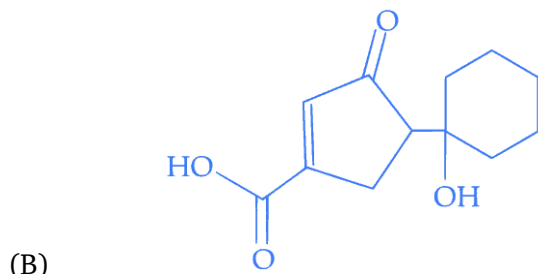
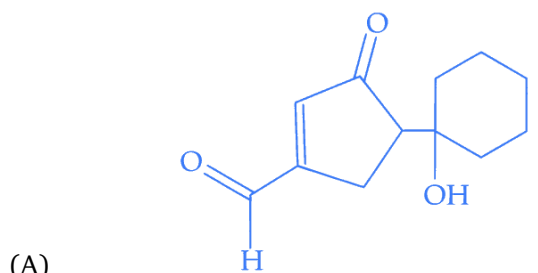
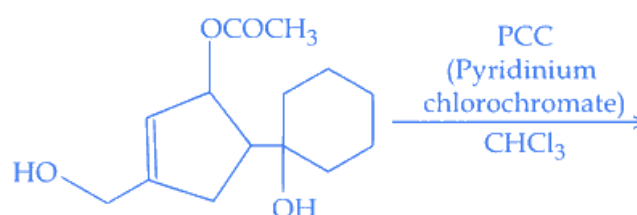
- (A) $(\text{NH}_4)_2\text{Cr}_2\text{O}_7(\text{s}) \rightarrow \text{N}_2(\text{g}) + 4\text{H}_2\text{O}(\text{g}) + \text{Cr}_2\text{O}_3(\text{s})$
 (B) $2\text{NH}_4\text{NO}_3(\text{s}) \rightarrow 2\text{N}_2(\text{g}) + 4\text{H}_2\text{O}(\text{g}) + \text{O}_2(\text{g})$
 (C) $\text{Ba}(\text{N}_3)_2(\text{s}) \rightarrow \text{Ba}(\text{s}) + 3\text{N}_2(\text{g})$
 (D) $2\text{NH}_3(\text{g}) \rightarrow \text{N}_2(\text{g}) + 3\text{H}_2(\text{g})$

71. The total number of optically active compounds formed in the following reaction is :



- (A) Two (B) Four
 (C) Six (D) Zero

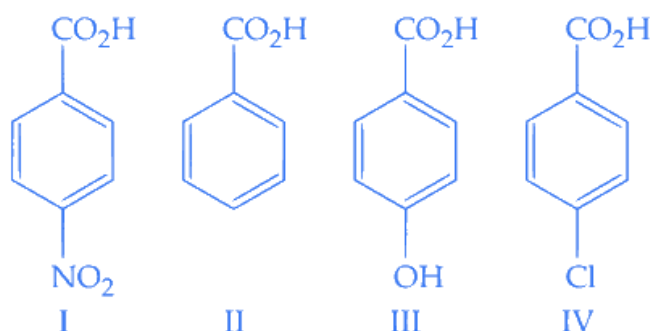
72. The major product formed in the following reaction is :



73. When 2-butyne is treated with H_2 /Lindlar's catalyst, compound X is produced as the major product and when treated with $Na/liq. NH_3$ it produces Y as the major product. Which of the following statements is correct?

- (A) X will have higher dipole moment and higher boiling point than Y. (B) Y will have higher dipole moment and higher boiling point than X.
(C) X will have lower dipole moment and lower boiling point than Y. (D) Y will have higher dipole moment and lower boiling point than X.

74. The increasing order of the acidity of the following carboxylic acids is:

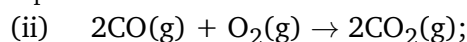
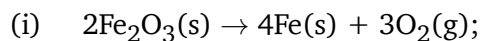


- (A) $I < III < II < IV$ (B) $IV < II < III < I$
(C) $II < IV < III < I$ (D) $III < II < IV < I$

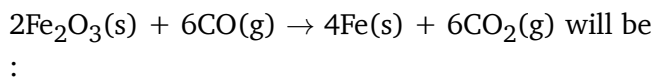
75. The correct order of spin-only magnetic moments among the following is:
(Atomic number: Mn = 25, Co = 27, Ni = 28, Zn = 30)

- (A) $[ZnCl_4]^{2-} > [NiCl_4]^{2-} > [CoCl_4]^{2-} > [MnCl_4]^{2-}$ (B) $[CoCl_4]^{2-} > [MnCl_4]^{2-} > [NiCl_4]^{2-} > [ZnCl_4]^{2-}$
(C) $[NiCl_4]^{2-} > [CoCl_4]^{2-} > [MnCl_4]^{2-} > [ZnCl_4]^{2-}$ (D) $[MnCl_4]^{2-} > [CoCl_4]^{2-} > [NiCl_4]^{2-} > [ZnCl_4]^{2-}$

76. Given



Free energy change, $\Delta_r G^\circ$ for the reaction



- (A) $-112.4 \text{ kJ mol}^{-1}$ (B) $-56.2 \text{ kJ mol}^{-1}$
(C) $-168.2 \text{ kJ mol}^{-1}$ (D) $-208.0 \text{ kJ mol}^{-1}$

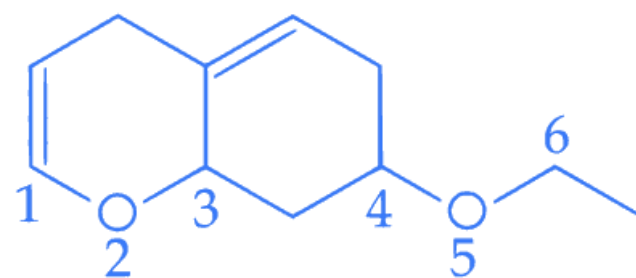
77. In KO_2 , the nature of oxygen species and the oxidation state of oxygen atom are, respectively:

- (A) Oxide and -2 (B) Superoxide and $-1/2$
(C) Peroxide and $-1/2$ (D) Superoxide and -1

78. Following four solutions are prepared by mixing different volumes of NaOH and HCl of different concentrations, pH of which one of them will be equal to 1?

- (A) 100 mL $\frac{M}{10}$ HCl + 100 mL $\frac{M}{10}$ NaOH (B) 75 mL $\frac{M}{5}$ HCl + 25 mL $\frac{M}{5}$ NaOH
(C) 60 mL $\frac{M}{10}$ HCl + 40 mL $\frac{M}{10}$ NaOH (D) 55 mL $\frac{M}{10}$ HCl + 45 mL $\frac{M}{10}$ NaOH

79. On treatment of the following compound with a strong acid, the most susceptible site for bond cleavage is:



- (A) C1 - O2 (B) O2 - C3
(C) C4 - O5 (D) O5 - C6

80. The total number of possible isomers for square-planar $[Pt(Cl)(NO_2)(NO_3)(SCN)]^{2-}$ is:

- (A) 8 (B) 12
(C) 16 (D) 24

81. $\Delta_f G^\circ$ at 500 K for substance 'S' in liquid state and gaseous state are $+100.7 \text{ kJ mol}^{-1}$ and $+103 \text{ kcal mol}^{-1}$, respectively. Vapour pressure of liquid 'S' at 500 K is approximately equal to : ($R = 2 \text{ cal K}^{-1} \text{ mol}^{-1}$)

- (A) 0.1 atm (B) 1 atm
(C) 10 atm (D) 100 atm

82. The de-Broglie's wavelength of electron present in first Bohr orbit of 'H' atom is :

- (A) 0.529 $\text{\AA}$
(B) $2\pi \times 0.529$ $\text{\AA}$
(C) $\frac{0.529}{2\pi}$ $\text{\AA}$
(D) 4×0.529 $\text{\AA}$

83. In the leaching method, bauxite ore is digested with a concentrated solution of NaOH that produces 'X'. When CO_2 gas is passed through the aqueous solution of 'X', a hydrated compound 'Y' is precipitated. 'X' and 'Y' respectively are :

- (A) NaAlO_2 and $\text{Al}_2(\text{CO}_3)_3 \cdot x \text{H}_2\text{O}$ (B) $\text{A}(\text{OH})_3$ and $\text{Al}_2\text{O}_3 \cdot x \text{H}_2\text{O}$
(C) $\text{Na}[\text{Al}(\text{OH})_4]$ and $\text{Al}_2\text{O}_3 \cdot x \text{H}_2\text{O}$ (D) $\text{Na}[\text{Al}(\text{OH})_4]$ and $\text{Al}_2(\text{CO}_3)_3 \cdot x \text{H}_2\text{O}$

84. The number of P – O bonds in P_4O_6 is :

- (A) 6 (B) 9
(C) 12 (D) 18

85. All of the following share the same crystal structure except :

- (A) LiCl (B) NaCl
(C) RbCl (D) CsCl

86. If x gram of gas is adsorbed by m gram of adsorbent at pressure P, the plot of $\log \frac{x}{m}$ versus $\log P$ is linear. The slope of the plot is : (n and k are constants and $n > 1$)

- (A) 2k
(B) $\log k$
(C) n
(D) $\frac{1}{n}$

87. Which of the following statements is **not** true ?

- (A) Step growth polymerisation requires a bifunctional monomer.
(B) Nylon 6 is an example of step-growth polymerisation.
(C) Chain growth polymerisation includes both homopolymerisation and copolymerisation.
(D) Chain growth polymerisation involves homopolymerisation only.

88. Biochemical Oxygen Demand (BOD) value can be a measure of water pollution caused by the organic matter. Which of the following statements is correct ?

- (A) Aerobic bacteria decrease the BOD value. (B) Anaerobic bacteria increase the BOD value.
(C) Clean water has BOD value higher than 10 ppm. (D) Polluted water has BOD value higher than 10 ppm.

89. In XeO_3F_2 , the number of bond pair(s), π -bond(s) and lone pair(s) on Xe atom respectively are :

- (A) 5, 2, 0 (B) 4, 2, 2
(C) 5, 3, 0 (D) 4, 4, 0

90. Lithium aluminium hydride reacts with silicon tetrachloride to form :

- (A) LiCl, AlH_3 and SiH_4 (B) LiCl, AlCl_3 and SiH_4
(C) LiH, AlCl_3 and SiCl_2 (D) LiH, AlH_3 and SiH_4

- End of Question Paper -