FIITJEE

ALL INDIA TEST SERIES

PART TEST – I

JEE (Main)-2025

TEST DATE: 16-11-2024

Time Allotted: 3 Hours **Maximum Marks: 300**

General Instructions:

- The test consists of total 75 questions.
- Each subject (PCM) has 25 questions.
- This question paper contains **Three Parts.**
- **Part-A** is Physics, **Part-B** is Chemistry and **Part-C** is Mathematics.
- Each part has only two sections: **Section-A and Section-B**.

  Section-A (01 – 20, 26 – 45, 51 – 70) *contains 60 multiple choice questions which have* ***only one correct answer****. Each question carries* ***+4 marks*** *for correct answer and* ***–1 mark*** *for wrong answer.*

  Section-B (21 – 25, 46 – 50, 71 – 75) *contains 15 Numerical based questions. The answer to each question is rounded off to the nearest integer value. Each question carries* ***+4 marks*** *for correct answer and* ***–1 mark*** *for wrong answer.*

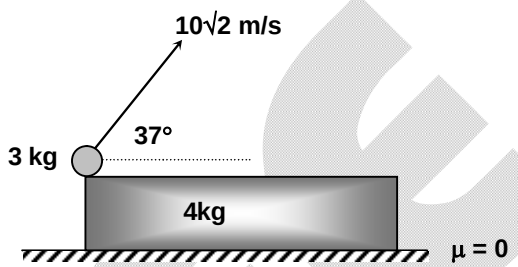
Physics

PART – A

SECTION – A
(One Options Correct Type)

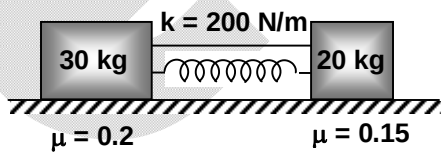
This section contains **20 multiple choice questions**. Each question has **four choices** (A), (B), (C) and (D), out of which **ONLY ONE** option is correct.

1. A particle of mass 3 kg is projected with an angle of 37° with a velocity $10\sqrt{2}$ m/s relative to ground form a plank of mass 4 kg which is placed on smooth surface. Initially plank was at rest. Find the minimum length of the plank required for which the ball will fall on the plank (Take g = 10 m/s^2)



(A) 16.8 m
(B) 33.6 m
(C) 50.4 m
(D) 67.2 m

2. Two blocks are connected by a spring and thread as shown in the figure are at rest. Now the thread is burnt and system is allowed to move. Find the kinetic energy of 20 kg block when spring attains its natural length. Initially spring (k = 200 N/m) is compressed by 30 cm.

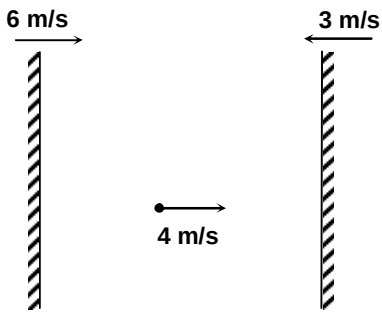


(A) zero
(B) 6 J
(C) 9 J
(D) spring will never attain its natural length

3. The moment of inertia of a cube of mass M and side 'ℓ' about any of its face diagonal is

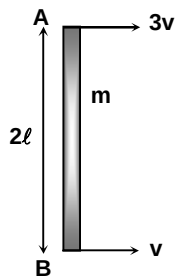
(A) $\frac{M\ell^2}{12}$
(B) $\frac{2M\ell^2}{12}$
(C) $\frac{5M\ell^2}{12}$
(D) $\frac{8M\ell^2}{12}$

4. A particle collides elastically with two moving walls one by one as shown on a horizontal plane. Find the final speed of the particle after two collisions.



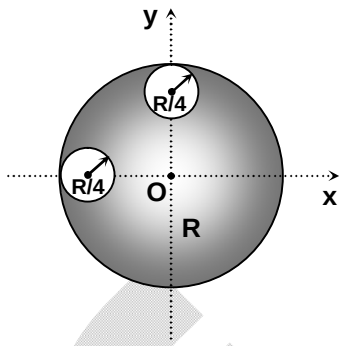
(A) 11 m/s
(B) 13 m/s
(C) 22 m/s
(D) 16 m/s

5. A uniform rod of mass m and length 2ℓ is moving on a smooth horizontal surface as shown in the figure. What is the kinetic energy of rod?



(A) $\frac{mv^2}{6}$
(B) $\frac{11mv^2}{6}$
(C) $\frac{12mv^2}{6}$
(D) $\frac{13\,mv^2}{6}$

6. From a circular uniform disc of radius R two small disc of radius $\frac{R}{4}$ are cut off locate the centre of mass of the new structure.



(A) $R(-\hat{i}-\hat{j})$ (B) $\frac{3R}{56}(-\hat{i}-\hat{j})$

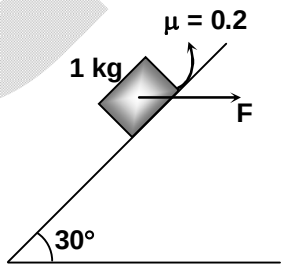
(C) $\frac{3R}{56}(\hat{i}+\hat{j})$ (D) $\frac{3R}{56}(\hat{i}-\hat{j})$

7. A bird can fly in still air at 15 km/h, wind is blowing at 5 km/h due east. What is the time it takes to reach a point 5 km due to north east of its starting point?

(A) $\left(\frac{\sqrt{17}-\sqrt{2}}{16}\right)$hr (B) $\left(\frac{\sqrt{17}+\sqrt{2}}{16}\right)$hr

(C) $\left(\frac{\sqrt{34}-\sqrt{2}}{16}\right)$hr (D) $\left(\frac{\sqrt{34}+\sqrt{2}}{16}\right)$hr

8. A force $F=\frac{10}{\sqrt{3}}$ N is applied horizontally on a block of mass 1 kg as shown in figure. Find the friction force acting on the block.

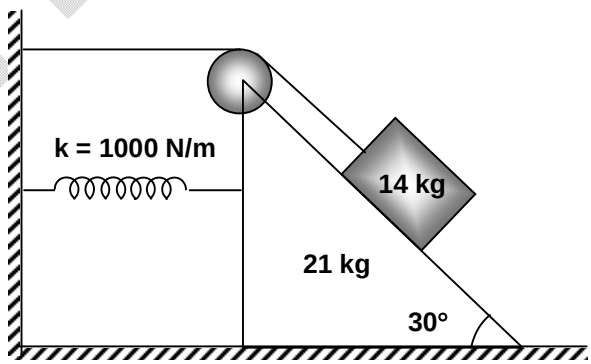


(A) zero (B) $\frac{5}{\sqrt{3}}$N

(C) $\frac{10}{\sqrt{3}}$N (D) $\frac{20}{\sqrt{3}}$N

9. In the system shown in the figure, there is no friction and it is in equilibrium. Springs, string and pulley are massless. Find compression in spring in equilibrium. (g = 10 m/s^2, k = 1000 N/m)

(A) 3.5 cm
(B) 7 cm
(C) 10.5 cm
(D) 14 cm



10. A particle starts from rest with constant acceleration covers a distance x in first (n –1) seconds and a distance y in first n seconds. Find the time in which it will cover (x + y) distance.

(A) (2n –1) s (B) (2n +1) s

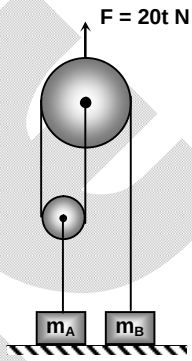
(C) $\left(\sqrt{2n^2-2n+1}\right)$s (D) $(2n^2-2n+1)$s

11. From the top of a tower, two particles are thrown horizontally with velocities u and v in opposite directions. If their velocities are perpendicular just before they strike the ground, then find the height of the tower.

(A) $\frac{uv}{4g}$ (B) $\frac{uv}{2g}$

(C) $\frac{2uv}{g}$ (D) $\frac{4uv}{g}$

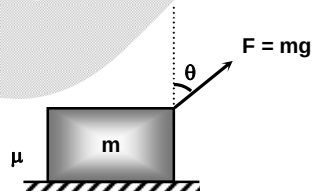
12. A force F = 20t where t is in second and F is in newton, is applied on upper pulley. Find the time when m_A loses contact with the surface. (m_A = 4 kg, m_B= 1 kg) (g = 10 m/s^2)



(A) 1 sec (B) 2 sec

(C) 3 sec (D) 4 sec

13. A block of mass m rests on a rough horizontal surface as shown in the figure. A force F = mg acts at an angle θ with the vertical on the block to pull it. Coefficient of friction between the block and the surface is 'μ'. In which of the following cases the block can be pulled along the surface?



(A) $\cot\left(\frac{\theta}{2}\right) \geq \mu$ (B) $\tan\left(\frac{\theta}{2}\right) \geq \mu$

(C) $\cot\theta \geq \mu$ (D) $\tan\theta \geq \mu$

14. A car of mass m is accelerated on a horizontal frictionless road under a force changing its velocity from u and v in distance x. If a constant power P is given by the engine of the car, then v is

(A) $\left(u^3 + \frac{2Px}{m}\right)^{1/2}$ (B) $\left(u^3 + \frac{3Px}{m}\right)^{1/2}$

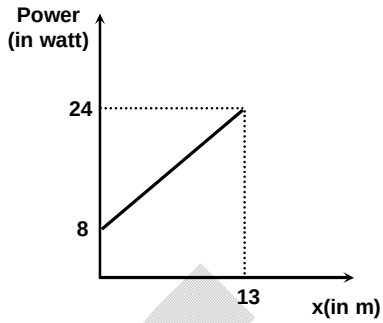
(C) $\left(u^3 + \frac{2Px}{m}\right)^{1/3}$ (D) $\left(u^3 + \frac{3Px}{m}\right)^{1/3}$

15. A small mass starts sliding down an inclined plane of inclination θ with the horizontal. The coefficient of friction is $\mu = \mu_0 x$, where x is the distance through which the mass slides down and μ_0 is constant. Find the distance covered by the mass before is stops.

(A) $\frac{\tan\theta}{2\mu_0}$ (B) $\frac{\tan\theta}{\mu_0}$

(C) $\frac{2\tan\theta}{\mu_0}$ (D) $\frac{4\tan\theta}{\mu_0}$

16. A block A of mass 24 kg is moving in the positive x-direction. Its initial velocity at x = 0 is 1 m/s. Graph of power versus position is drawn below. Find the velocity of block A at x = 13 m.



(A) 3 m/s
(B) $\sqrt{3}$ m/s
(C) $3\sqrt{3}$ m/s
(D) 9 m/s

17. A ball with a speed of 10 m/s collides horizontally with another identical ball at rest. After collision, the direction of each ball makes an angle of 30° with the horizontal direction. Find the ratio of velocities of balls after collision.

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

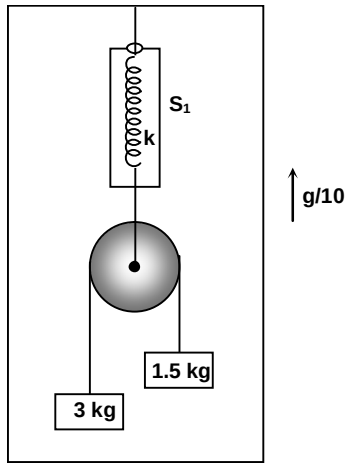
(C) 1 (D) $\frac{1}{2}$

18. A ball is dropped from a point 0.4 m above the top of a 0.5 long window. Find the time taken by the ball to cross the window. (Take g = 9.8 m/s^2)

(A) $\frac{1}{4}$s (B) $\frac{1}{5}$s

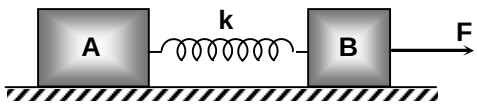
(C) $\frac{1}{6}$s (D) $\frac{1}{7}$s

19. If the elevator is moving up with an acceleration $\frac{g}{10}$, the pulley and the string are light and pulley is smooth. Find the reading of the spring balance.



(A) 3.6 kg (B) 1.8 kg
(C) 2.2 kg (D) 4.4 kg

20. Two identical blocks A and B each of mass 'M' are connected by a spring of stiffness 'k'. If a force 'F' is applied on block B as shown in the figure, and the elongation of spring is 'x_0'. Find the acceleration of block B with respect to A.



(A) zero (B) $\frac{F}{2M}$

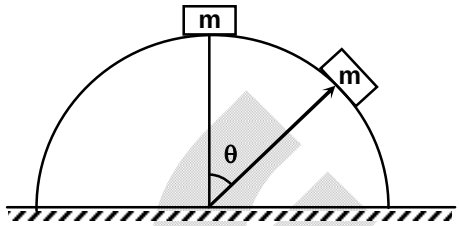
(C) $\frac{F-kx_0}{M}$ (D) $\frac{F-2kx_0}{M}$

SECTION – B

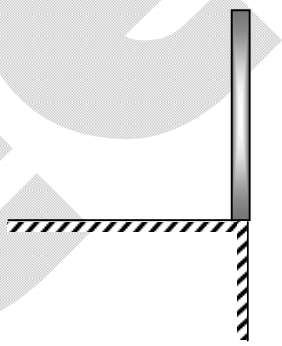
(Numerical Answer Type)

This section contains **05** Numerical based questions. The answer to each question is rounded off to the nearest integer value.

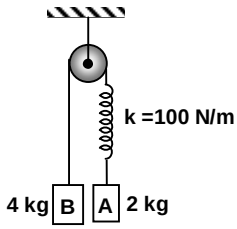
21. A block of mass 'm' released from the top of a fixed hemisphere of radius 'R'. The friction between block and hemisphere is zero. At the moment when block breaks off the surface the torque about the centre of hemisphere on the block of mass 'm' is $\frac{\sqrt{x}}{3}$mgR. Find the value of x.



22. A uniform rod is placed with one end on the edge of a table which is rough and very sharp. The rod is in a nearly vertical position and is then released from rest as shown in the figure. When rod leaves the surface, the angle it makes with the vertical is $\sin^{-1}\left(\frac{N}{5}\right)$. Find N.



23. Two block A and B of mass 2 kg and 4 kg, respectively are held at rest such that spring is in its natural length. Find the ratio of acceleration of B and A just after system in released from rest.



24. A particle can move along the x-axis under the influence of a singe conservative force. The potential energy of the particle is given by $U = (5x^2 - 20x + 2)$ J. Where x is the co-ordinate of the particle expressed in meter. If the particle is released from rest at x = –3m. Find the maximum x-coordinate of the particle.

25. A ring of mass 1 kg can slide on a smooth horizontal wire. The ring is attached to a particle of mass 3 kg by a string of length $\frac{81}{40}$ m. A horizontal velocity 9m/s is given to the ring. Find the maximum angle (in degree) the string will make with the vertical in subsequent motion. (Take g = 10 m/s^2)

Chemistry

PART – B

SECTION – A
(One Options Correct Type)

This section contains **20 multiple choice questions**. Each question has **four choices** (A), (B), (C) and (D), out of which **ONLY ONE** option is correct.

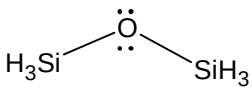
26. The magnitude of electron gain enthalpy $\left(\Delta_{eg}H^{o}\right)$ of noble gases (He, Ne, Xe, Rn) is in **decreasing** order….

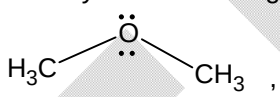
(A) He > Ne > Xe > Rn
(B) Ne > Xe > Rn > He
(C) Xe > Ne > Rn > He
(D) He > Xe > Ne > Rn

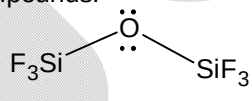
27. Which of the following statement is **CORRECT?**

(A) Backbonding in $\ddot{C}Cl_3$ and $:CCl_2$ takes place from carbon to chlorine in both the species.
(B) Backbonding in $\ddot{C}Cl_3$ and $:CCl_2$ takes place from chlorine to carbon in both the species.
(C) Backbonding in $\ddot{C}Cl_3$ and $:CCl_2$ takes place in opposite directions.
(D) Both $\ddot{C}Cl_3$ and $:CCl_2$ undergoes similar type of reactions.

28. The **CORRECT** order of basicity of the following compounds:

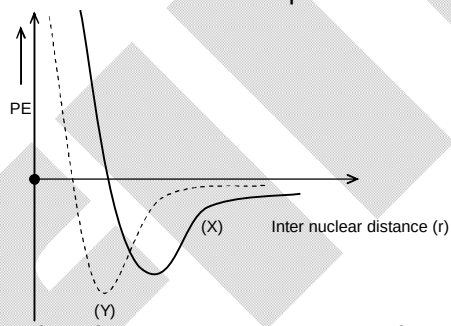

(X)


(Y)


(Z)

(A) (Y) > (X) > (Z)
(B) (X) > (Y) > (Z)
(C) (Z) > (X) > (Y)
(D) (Y) > (Z) > (X)

29. Consider two diatomic species CN and CN^- and their potential energy diagrams:



Select the **CORRECT** statement from the following:
(A) Bond order of CN is 2.5 and curve (Y) represents CN.
(B) Bond order of CN is 3 and curve (X) represents CN.
(C) Bond order of CN^- is 3 and curve (Y) represents CN^-.
(D) Bond order of CN^- is 2.5 and curve (X) represents CN^-.

30. Consider the following reactions:

$O(g) + e^- \longrightarrow O^-(g) \quad \Delta H^o = -141\,kJ\,mol^{-1}$

$O^-(g) + e^- \longrightarrow O^{--}(g) \quad \Delta H^o = +780\,kJ\,mol^{-1}$

The formation of $O^{--}(g)$ is not favoured from $O^-(g)$ although $O^{--}(g)$ attains the noble gas configuration of neon. It is due to

(A) Oxygen is more electronegative

(B) Addition of electron in O(g) results in the large size of ion.

(C) Inter electronic repulsions dominates the stability of gaining noble gas configuration

(D) $O^-(g)$ is having smaller size as compared to O(g)

31. The number of mols of $KMnO_4$ that will be needed to react completely with 3 mols of ferrous oxalate in acidic medium

(A) 2.8 (B) 1.8

(C) 3.8 (D) 2.0

32. An ideal gas 'X' polymerizes to a very small extent at a given temperature T as $nX(g) \rightleftharpoons X_n(g)$. The polymerization starts from 1 mol of 'X' in a container of volume V. The value of $\frac{PV}{RT}$ at equilibrium is if K_C is the equilibrium constant

(A) $1-\frac{(n-1)K_C}{V^{n-1}}$ (B) $\frac{(n-1)K_C}{V^n}$

(C) $1-nK_CV^{1-n}$ (D) $1-nK_CV^{-n}$

33. When photons of energy 4.25 eV strikes the metal surface 'X', the ejected photoelectrons have maximum kinetic energy 'T_X (in eV) and de-Broglie wavelength λ_x. For another metal surface 'Y' the photons strikes it by energy of 4.20 eV and maximum kinetic energy of photoelectrons ejected is 'T_Y' (in eV) and de-Broglie wavelength λ_y such that

$\lambda_y = 2\lambda_x$ and $T_X - T_Y = 1.50$ eV. Then select the **INCORRECT** statement of the following

$\left(h = 6.6\times10^{-34}\ J\,s,\ m_e = 9\times10^{-31}\ kg,\ 1\,eV = 1.6\times10^{-19}\ J\right)$

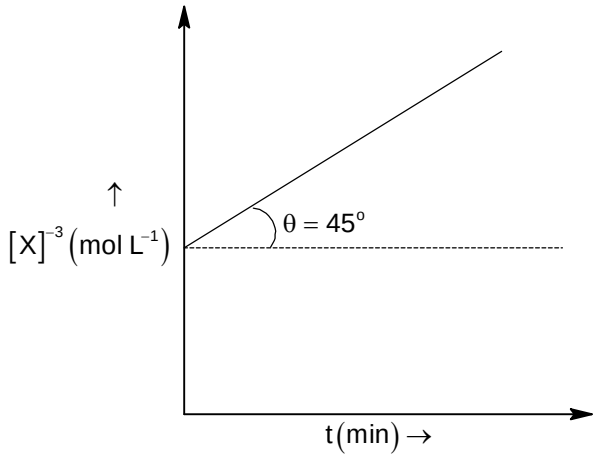
(A) Work function $(\phi_x) = 2.25$ eV

(B) Work function $(\phi_Y) = 3.70$ eV

(C) $T_x = 2.00$ eV

(D) λ_y is 1500 pm

34. For the reaction $3X \rightarrow 2Y$, the following graph is obtained through experiments



The rate of the reaction when [X] = 0.2 M is

(A) 4×10^{-4} M min^{-1} (B) $\frac{16}{9}\times10^{-4}$ M min^{-1}

(C) 1.6×10^{-3} M min^{-1} (D) $\frac{16}{3}\times10^{-3}$ M min^{-1}

35. The weight of NaOH that should be added in 600 mL of 2M – CH_3COOH solution to get a buffer solution of maximum buffer capacity

(A) 32g (B) 40g
(C) 24g (D) 80g

36. Consider the following molecules
Carbondioxide (X), Tetracyanomethane (Y), Benzene (Z), Buta-1,3-diene (W)
The **CORRECT** order of ratio of $\sigma-\text{bond(s)}$ to $\pi-\text{bond(s)}$ is:

(A) X = Y < Z < W (B) X = Y < W < Z
(C) X = Y = Z = W (D) Z < W < X < Y

37. Select the **CORRECT** statement of the following:

(A) Stability order : $N_2^+ < N_2^-$

(B) Bond length order : $N_2^- < N_2^+$

(C) Bond order : $N_2^+ = N_2^-$

(D) Both N_2^+ and N_2^- are diamagnetic

38. Consider the following gas phase reactions achieve equilibrium simultaneously at a given temperature

$X \rightleftharpoons Y(K_1)$, $X \rightleftharpoons Z(K_2)$ and $Y \rightleftharpoons Z(K_3)$

The mole fraction of 'X' at equilibrium in terms of equilibrium constants, K_1, K_2 and K_3 respectively

(A) $\frac{K_1}{K_1+K_2+K_3}$ (B) $\frac{1}{1+K_2+K_3}$

(C) $\frac{1}{1+K_1+K_2}$ (D) $\frac{1}{K_1-K_2+K_3}$

39. Consider the reaction

$2XY(g) \rightleftharpoons 2X(g) + Y_2(g)$

The ratio $\frac{K_P}{P}$, where P is the total pressure of gases at equilibrium and $P_{Y_2(g)} = \frac{P}{9}$ at a given temperature is

(A) $\frac{1}{9}$ (B) $\frac{1}{81}$

(C) $\frac{1}{27}$ (D) $\frac{1}{3}$

40. The time period of revolution in the third orbit of Li^{++} ion is t second. The time period of revolution in the second orbit of He^{+} ion should be:

(A) t s (B) 1.5t s

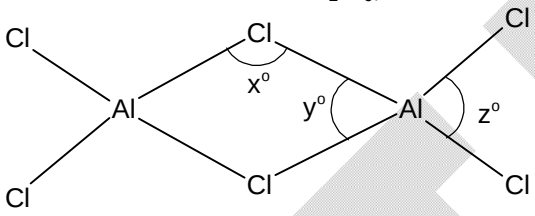
(C) 0.66t s (D) 0.30t s

41. Ionization enthalpy $\left(\Delta_{ion}H_1^o\right)$ for the **Group (13)** elements follows the order

(A) B > Al > Ga > In > Tℓ (B) B > In > Ga > Al > Tℓ

(C) B > Tℓ > Ga > Al > In (D) B > Al > Tℓ > In > Ga

42. Consider the structure of Al_2Cl_6, i.e. dimer of $AlCl_3$



The correct order of x^o, y^o and z^o is

(A) $y^o < x^o < z^o$ (B) $x^o < y^o < z^o$

(C) $x^o < z^o < y^o$ (D) $z^o < x^o < y^o$

43. $xNO_3^-(aq) + yAs_2S_3(s) + zH_2O(\ell) \longrightarrow aAsO_4^{3-}(aq) + bNO(g) + cSO_4^{--}(aq) + dH^+(aq)$

The sum total of x, y, z, i.e. x + y + z in balanced equation is:

(A) 28 (B) 36

(C) 31 (D) 35

44. The molarity of $\left[Fe(CN)_6\right]^{4-}$ ions in a saturated solution of $Ag_4\left[Fe(CN)_6\right]$ if its solubility product constant is K_{sp} .....

(A) $\sqrt[5]{\frac{K_{SP}}{256}}$ (B) $\sqrt[5]{\frac{256}{K_{SP}}}$

(C) $\sqrt[5]{\frac{K_{SP}}{3125}}$ (D) $\sqrt[5]{\frac{3125}{K_{SP}}}$

45. For a certain reaction

$\ell nk = x + y\ell nT - \frac{z}{T}$

Where, k = Rate constant
T = Temperature in Kelvin
x, y, z = Constants.

Then the activation energy (E_a) of the reaction is

(A) $yRT + zR$ (B) zR

(C) y + zR (D) yRT – zR

SECTION – B

(Numerical Answer Type)

This section contains **05** Numerical based questions. The answer to each question is rounded off to the nearest integer value.

46. The magnitude of orbital angular momentum of an electron is $\sqrt{5}\frac{h}{\pi}$. If there are 'x' orbitals of this kind possible for a sub-shell then the value of 11x is.....

47. Consider the following reaction of first order

$X(\ell) \longrightarrow Y(\ell) + Z(g)$

A solution of $X(\ell)$ initially gives 80 mL of Z (g) on complete decomposition. It is found that at 30^oC, 40 mL of Z (g) was evolved in 40 min. The time (in min) after the start of decomposition 70 mL of Z(g) evolves is.....

48. At 300 K, the rate of forward reaction at time t is e^4 times greater than of reverse reaction for the reaction $X + Y \rightleftharpoons Z$. The magnitude of free energy change at that time t is x cal. The value of $\frac{x}{600}$ is..... $\left[R = 2 \text{ cal } K^{-1} \text{ mol}^{-1}\right]$

49. The molar concentration of a weak acid (HX) should be added to 1 L of 0.6 M of another weak acid (HY) so that percentage dissociation of the weak acid (HY) remains unchanged is ..... M.
$\left[K_a \text{ of HX} = 1.8 \times 10^{-5}, K_a \text{ of HY} = 2.4 \times 10^{-4}\right]$

50. MO_2 undergoes disproportion reaction due to MO_4^- and M^{x+} ions in acidic medium. If the mole ratio of MO_2 undergoes oxidation and reduction is 2 : 3 the value of 'x' is.....

Mathematics

PART – C

SECTION – A
(One Options Correct Type)

This section contains **20 multiple choice questions**. Each question has **four choices** (A), (B), (C) and (D), out of which **ONLY ONE** option is correct.

51. If A = {6, 7, 8, 9}, B = {1, 2, 3, 4, 5} and f : A $\rightarrow$ B, then total number of many-one function from A to B is equal to
(A) 625 (B) 505
(C) 120 (D) 1024

52. If $n((C - A) \cap (C - B)) = 30$, $n(C) = 40$, $n(A \cap C) = 5$, $n(B \cap C) = 6$, then the value of $n(C - B) + n(C - A) + n(A \cap B \cap C)$ is equal to
(A) 70 (B) 85
(C) 55 (D) 81

53. Let A = {1, 2, 3}, B = {4, 5, 6}, C = {7, 8, 9} and D = {1, 2, 3, 4, 5, ……. 10}, then total number of subsets of D having exactly one element from each of sets A, B and C is equal to
(A) 27 (B) 120
(C) 147 (D) 54

54. Let A = {1, 2, 3} then the relation R = {(1, 1), (1, 2), (2, 1)} on A is
(A) reflexive (B) transitive
(C) symmmetric (D) none of these

55. If $f(x) = \dfrac{x^4 - 8}{(x+1)^4}$ $\forall$ R – {–1} and g(x) = 6. $\forall$ x $\in$ R, then total number of real and distinct solutions of the equation f(x) = g(x) is
(A) 0 (B) 1
(C) 4 (D) 2

56. The value of $\lim\limits_{x \to a}\left(2 - \dfrac{a}{x}\right)^{\tan\left(\frac{\pi x}{2a}\right)}$ is $(a \neq 0)$
(A) $e^{\frac{2}{\pi}}$ (B) $e^{\frac{\pi}{2}}$
(C) $e^{-\frac{\pi}{2}}$ (D) $e^{-\frac{2}{\pi}}$

57. If $f(x) = |x|^2 - 4|x|$ and $h(x) = \begin{cases} \min\{f(t) : -6 \le t \le x & \forall x \in [-6, 0] \\ \max\{f(t) : 0 \le t \le x & \forall x \in (0, 6] \end{cases}$, then h(x) has
(A) exactly one point of local minima
(B) exactly one point of local maxima
(C) no point of local maxima but exactly one point of local minima
(D) neither a point of local maxima nor minima

58. Consider $g(x) = x^{51} + \log_7\left(x + \sqrt{x^2 + 1}\right)$, then for $\alpha, \beta \in R$, such that $\alpha + \beta > 0$. Now which one is correct ?
(A) $g(\alpha) + g(\beta) < 0$ (B) $g(\alpha) + g(\beta) > 0$
(C) $g(\alpha + 7) + g(\beta) < 0$ (D) $g(\alpha) + g(\beta + 1) = 0$

59. The solution of differential equation $2x^3ydy + (1 - y^2)(x^2y^2 + y^2 - 1)dx = 0$ is

(A) $x^2y^2 = (cx + 1)(1 - y^2)$ (B) $x^2y^2 = (cx + 1)(1 + y^2)$

(C) $x^2y^2 = (cx - 1)(1 - y^2)$ (D) none of these

60. The value of $\lim\limits_{n\to\infty}\sum\limits_{r=1}^{n}\left(\frac{r}{n^2+n+2r}\right)$ is

(A) 0 (B) $\frac{1}{3}$

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

61. Let $f(x) = x^3 + x + 1$ and h(x) be it's inverse function then equation of the normal to $y = h(x)$ at $x = 3$ is

(A) $x - 4y + 1 = 0$ (B) $4x + y - 13 = 0$

(C) $4x + y + 13 = 0$ (D) $x + 4y - 1 = 0$

62. Let $g : R \to R$ be x differentiable function at $x = 0$, satisfying $g(0) = 0$ and $g'(0) = 1$, then the value of $\lim\limits_{x\to0}\frac{1}{x}\sum\limits_{n=1}^{\infty}(-1)^n g\left(\frac{x}{n}\right)$ is equal to

(A) ln2 (B) – ln2

(C) e (D) – e

63. If $\int\frac{(x-1)}{(x+1)}\frac{dx}{\sqrt{x^3+x^2+x}} = \alpha\cot^{-1}\sqrt{\frac{x^2+1+x}{x}} + c$, then $|\alpha|$ is equal to

(A) 1 (B) 4

(C) 2 (D) 3

64. $\int\limits_0^1\left(\int\limits_z^1 e^{x^2}dx\right)dz$ is equal to

(A) $\frac{e}{2}$ (B) $\frac{e-1}{2}$

(C) $\frac{e-2}{2}$ (D) $\frac{e-3}{2}$

65. The value of $\int\limits_0^{\infty}\frac{\tan^{-1}\beta x - \tan^{-1}x}{x}$ (where β is a parameter, greater than equal to 1) is equal to

(A) $\frac{\pi}{2}\ln\beta$ (B) $\frac{\pi}{4}\ln\beta$

(C) $\frac{\pi}{3}\ln\beta$ (D) $\frac{\pi}{6}\ln\beta$

66. The value of $\lim\limits_{n\to\infty}\left[\frac{(n-\alpha)^{1/3}}{n} + \frac{(2^2n-\alpha)^{1/3}}{2n} + \frac{(3^2n-\alpha)^{1/3}}{3n} + ... + \frac{(n^3-\alpha)^{1/3}}{n^2}\right]$ (where α is a constant) is equal to

(A) $\frac{2}{3}$ (B) $\frac{1}{3}$

(C) $\frac{3}{2}$ (D) $\frac{5}{2}$

67. If $\int_0^1 \left(2y^3 - f(y)\right) f(y)\,dy = \frac{1}{7}$, then the measure of the area bounded by y = f(x), x-axis and the line x = 2 and x = 3 is

(A) 8 (B) $\frac{15}{2}$

(C) $\frac{65}{4}$ (D) $\frac{63}{8}$

68. $g : R^+ \to R^+$ is an invertible function such that $g'(x) > 0$ and $g''(x) > 0 \ \forall\, x \in [2, 6]$. If g(2) = 2 and g(6) = 6 and area bounded by y = g(x), x-axis, x = 2 and x = 6 is 12 sq. units, then the area bounded by $y = g^{-1}(x)$, x-axis, x = 2 and x = 6 is

(A) 10 (B) 20

(C) 30 (D) 40

69. The order of the differential equation representing the family of hyperbolas, having fixed directrix and eccentricity is

(A) 2 (B) 3

(C) 4 (D) 5

70. If g be a continuous function on [0, 1], differentiable in (0, 1) such that g(1) = 0, then their exists some $\alpha \in (0, 1)$ such that

(A) $\alpha g'(\alpha) - g(\alpha) = 0$ (B) $g'(\alpha) + \alpha g(\alpha) = 0$

(C) $g'(\alpha) - \alpha g(\alpha) = 0$ (D) $\alpha g'(\alpha) + g(\alpha) = 0$

SECTION – B

(Numerical Answer Type)

This section contains **05** Numerical based questions. The answer to each question is rounded off to the nearest integer value.

71. If $\int_0^{4\pi} \ln\left|\left(13\sin y + 3\sqrt{3}\cos y\right)\right| dy = \alpha\pi \ln 7$, then the value of α is ____

72. If $|c| < \frac{1}{2}$ and f(x) is a differentiable function at x = 0, given by $f(x) = \begin{cases} b\sin^{-1}\left(\frac{c+x}{2}\right) \forall x \in \left(-\frac{1}{2}, 0\right) \\ \frac{1}{2} \forall x = 0 \\ \frac{e^{ax/2} - 1}{x} \forall x \in \left(0, \frac{1}{2}\right) \end{cases}$

then the value of $64b^2 + c^2 + a^2$ is equal to ____

73. If the tangent to the curve $xy + \alpha x + \beta y = 0$ at (1, 1) makes an angle $\tan^{-1}(2)$ with x-axis, then $\frac{40(\alpha+\beta)}{\alpha\beta}$ is equal to ____

74. Area bounded by the parabola $(y - 2)^2 = x - 1$, the tangent to it at the point P(2, 3) and the x-axis is equal to ____

75. If $\lim_{x\to 0}\left(\frac{1}{x^2} - \frac{1}{\sin^2 x}\right)$ is L, then the value of |3000L| is equal to ____