FIITJEE
ALL INDIA TEST SERIES
JEE (Advanced)-2025
OPEN TEST – II
PAPER –2
TEST DATE: 13-04-2025

Time Allotted: 3 Hours **Maximum Marks: 180**

General Instructions:

- The test consists of total 54 questions.
- Each subject (PCM) has 18 questions.
- This question paper contains **Three Parts.**
- **Part-I** is Physics, **Part-II** is Chemistry and **Part-III** is Mathematics.
- Each **Part** is further divided into **Two Sections**: **Section-A & Section-B**.

Section – A *(01 – 04, 19 – 22, 37 – 40)*: This section contains **TWELVE (12)** questions. Each question has **FOUR** options. **ONLY ONE** of these four options is the correct answer.

Section – A *(05 –10, 23 – 28, 41 – 46)*: This section contains **EIGHTEEN (18)** questions. Each question has **FOUR** options. **ONE OR MORE THAN ONE** of these four option(s) is(are) correct answer(s).

Section – B *(11 – 18, 29 – 36, 47 – 54)*: This section contains **TWENTY FOUR (24)** numerical based questions. The answer to each question is a **Single Digit Integer, ranging from 0 to 9 both inclusive.**

MARKING SCHEME

Section – A (Single Correct): Answer to each question will be evaluated according to the following marking scheme:

Full Marks	:	+3	If ONLY the correct option is chosen.
Zero Marks	:	0	If none of the options is chosen (i.e. the question is unanswered);
Negative Marks	:	–1	In all other cases.

Section – A (One or More than One Correct): Answer to each question will be evaluated according to the following marking scheme:

Full Marks	:	+4	If only (all) the correct option(s) is (are) chosen;
Partial Marks	:	+3	If all the four options are correct but ONLY three options are chosen;
Partial marks	:	+2	if three or more options are correct but ONLY two options are chosen and both of which are correct;
Partial Marks	:	+1	If two or more options are correct but ONLY one option is chosen and it is a correct option;
Zero Marks	:	0	If none of the options is chosen (i.e. the question is unanswered);
Negative Marks	:	–2	In all other cases.

Section – B: Answer to each question will be evaluated according to the following marking scheme:

Full Marks	:	+3	If ONLY the correct integer is entered;
Zero Marks	:	0	Question is unanswered;
Negative Marks	:	–1	In all other cases.

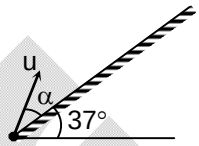
Physics

PART – I

Section – A (Maximum Marks: 12)

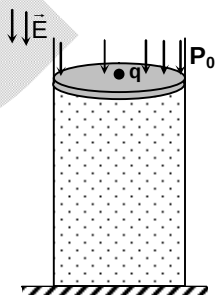
*This section contains **FOUR (04)** questions. Each question has **FOUR** options. **ONLY ONE** of these four options is the correct answer.*

1. A particle is projected from the foot of smooth, fixed inclined plane, which is at an angle of 37° from horizontal. After its elastic collision with the plane it moves in vertical direction. Its initial velocity is $u = \sqrt{388}$ m/s. (g = 10 m/s^2)



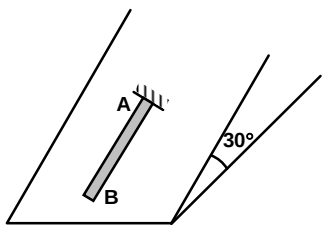
(A) The time after which particle returns to its initial position is 6s
(B) The time after which particle returns to its initial position is 4s
(C) The angle of initial velocity with incline plane is $\tan^{-1}\left(\frac{3}{4}\right)$
(D) The angle of initial velocity with incline plane is $\tan^{-1}\left(\frac{5}{9}\right)$

2. Below shown is heat insulating piston cylinder arrangement having ideal gas of adiabatic exponent γ enclosed. A point charge q having negligible mass is attached to centre of freely movable piston of mass M. The system is kept in uniform electric field $\vec{E}$ as shown. Atmospheric pressure is P_0 and when the piston is in equilibrium volume is V_0. On disturbing the piston from equilibrium position (Assume system to have cross-sectional area as A)



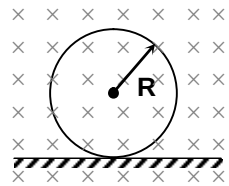
(A) The system executes S.H.M. with time period $T = 2\pi\sqrt{\frac{M\,V_0}{\left(\frac{qE+Mg}{A}+P_0\right)\gamma A^2}}$
(B) The system does not executes S.H.M.
(C) The system will not execute S.H.M. if magnitude of charge is increased.
(D) The system executes S.H.M. with time period $T = 2\pi\sqrt{\frac{M\,V_0}{P_0\gamma A^2}}$

3. In the shown figure, A thin rod AB of length ℓ is placed on smooth inclined plane having angle 30° with horizontal. It is hinged at end A such that it is free to move parallel to the plane. Its linear mass density increases linearly as $\frac{dm}{dx} \propto x$, where x is distance from end A. It is slightly displaced from its equilibrium position then it oscillates about an axis passing through A and perpendicular to inclined plane. The time period of oscillations is



(A) $2\pi\sqrt{\frac{3\ell}{2g}}$
(B) $2\pi\sqrt{\frac{3\ell}{4g}}$
(C) $2\pi\sqrt{\frac{2\ell}{3g}}$
(D) $2\pi\sqrt{\frac{\ell}{2g}}$

4. A uniform non-conducting sphere of mass m, radius R is placed on rough horizontal surface. Uniform horizontal magnetic field is present in circular region co-centric with centre of the sphere. Sphere is uniformly charged with total charge Q on its surface. Magnetic field is suddenly switched off. The sphere starts moving on the surface and finally it starts pure rolling with velocity.



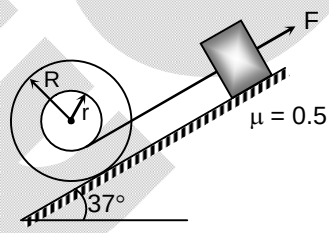
(A) $\frac{QBR}{m}$ (B) $\frac{QBR}{6m}$

(C) $\frac{5QBR}{21m}$ (D) $\frac{QBR}{2m}$

Section – A (Maximum Marks: 24)

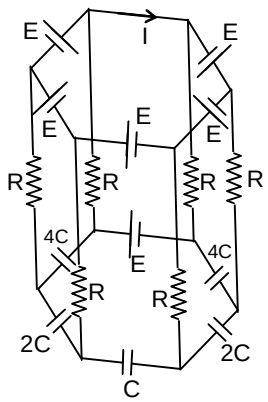
*This section contains **SIX (06)** questions. Each question has **FOUR** options (A), (B), (C) and (D). **ONE OR MORE THAN ONE** of these four option(s) is (are) correct answer(s).*

5. In the shown figure a spool of mass 10 kg of outer and inner radius R=2m and r=1m respectively , moment of inertia about its axis 10 kg-m^2 is placed on rough inclined surface where coefficient of friction is $\mu = 0.5$. A block of mass 4 kg is attached with a string which is wrapped on the spool. Force F = 106 N is applied up the inclined plane as shown in the figure. The correct statements are (no slipping between spool and string) [take g = 10 m/s^2]



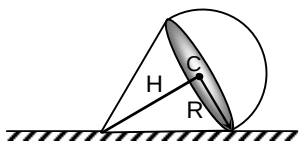
(A) Acceleration spool is 2 m/s^2 down the plane
(B) Acceleration spool is 2 m/s^2 up the plane
(C) Acceleration of the block is 1 m/s^2 up the plane
(D) Acceleration of the block is 1 m/s^2 down the plane

6. Hexagonal prism wire frame is made in which 6 sources of equal emf ε = 5V with equal internal resistance r = 1Ω. Six equal resistance each equal to R = 2Ω and four capacitors of capacitance as shown in the figure. Value of capacitance C = 2μF then the correct statement(s) is/are



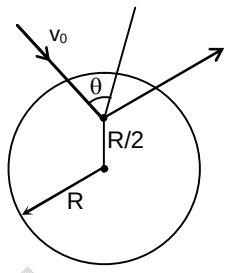
(A) Value of current I = 6A
(B) Value of current I = 5A
(C) Value of charge on capacitor 4C = 16μc
(D) The value of charge on capacitor C = 0

7. A right circular cone of height $H = R\sqrt{3}$ is glued with hemisphere of radius R. Both are made from same material of uniform density. The object made is rolled on rough horizontal surface such that speed of centre of hemisphere is v_0. The correct statements are



(A) The ratio of time period of top about cones axis to the vertical axis is 2 : 3
(B) The ratio of time period of top about cones axis to the vertical axis is 1 : 2
(C) The frictional force acting on this top is $\frac{5}{2}\frac{mv_0^2}{R}$ where m is mass of the top.
(D) The frictional force acting on this top is $\frac{2}{3}\frac{mv_0^2}{R}$, where m is mass of the top.

8. A disc of radius R = 20 cm and mass m is lying (in X-Y plane) on smooth horizontal surface. A particle of mass m moving with velocity $\vec{v}_0 = (5\hat{i} - 10\hat{j})$ m/s collides with the disc at a distance $\frac{R}{2}$ from centre of the disc. The coefficient of restitution e = 1 and coefficient of friction between particle and disc is μ = 0.2. Assume slipping during collision and the vertical plane in which particle is moving is at distance R/2 from centre of disc. The correct statements are (g = 10 m/s^2)



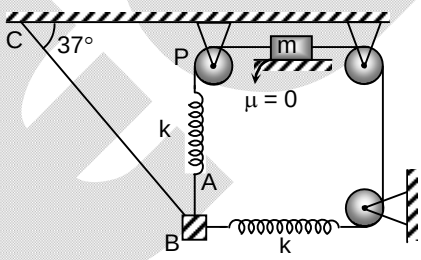
(A) Angular velocity of disc after collision is 20 rad/s

(B) Linear velocity of the centre of disc is 4 m/s

(C) The ratio of time of flight of particle after collision and time period of disc is $\frac{20}{\pi}$

(D) The ratio of time of flight of particle after collision to time period of disc is $\frac{\pi}{20}$

9. In the shown figure a block of mass m = $\frac{1}{2}$kg is suspended in equilibrium with the help of ideal string and two ideal spring of force constant k = 100 N/m. Now string AP is cut. Pullies are massless, frictionless, AP is vertical and other spring is horizontal. Just after cutting the string (g = 10 m/s^2)



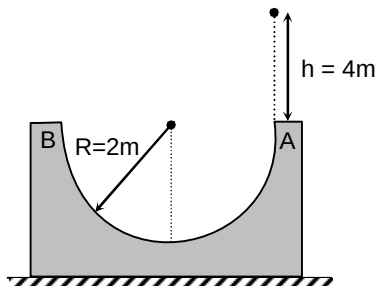
(A) Tension in string BC is 3N

(B) Tension in string BC is $\frac{37}{7}$N

(C) Acceleration of the suspended block is $\frac{32}{7}$ m/s^2.

(D) Acceleration of the suspended block is 8 m/s^2.

10. In the shown figure a block of mass 10 kg is placed on smooth horizontal surface. It has smooth hemispherical surface of radius R = 2m. A particle of mass 5 kg is released from rest from height of 4m above point A, such that it smoothly lands on spherical surface at point A. Neglect air drag .The correct option(s) are (g = 10 m/s^2)



(A) Particle will move up from end B upto height 4m

(B) Particle will move up from end B upto height less then 4m

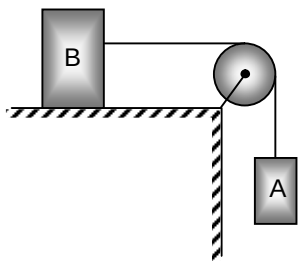
(C) maximum vertical acceleration of the particle is 90 m/s^2

(D) maximum vertical acceleration of particle is 40 m/s^2

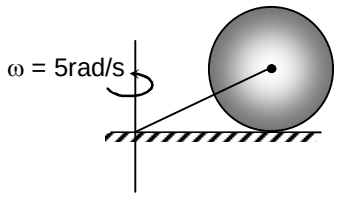
Section – B (Maximum Marks: 24)

*This section contains **EIGHT (08)** numerical based questions. The answer to each question is a **Single Digit Integer, ranging from 0 to 9 both inclusive.***

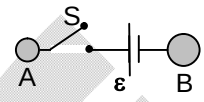
11. A block B of mass $M_B = \frac{\pi}{e}$kg placed on rough horizontal surface is connected with block A with the help of string (ideal). The string passes over fixed horizontal cylinder. The coefficient of friction between block B and ground as well as between string and cylinder is $\mu = \frac{7}{11}$. Find the minimum mass of block A in kg so that block B starts sliding. (Take value of $\pi = \frac{22}{7}$ and e = 2.72)



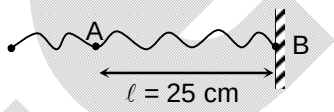
12. A sphere of mass 1.8 kg and radius 40 cm is radially pierced by a massless stick up to its centre. Length of stick is 2m. The free end of stick is pivoted on smooth ground and sphere is given velocity so that it slides on the ground such that its centre moves in a circle around pivot with angular velocity ω = 5 rad/s. The normal force acting on sphere due to ground in newton is 9P. Find the value of P. (g = 10 m/s^2)



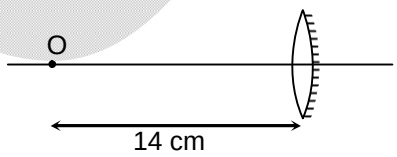
13. Two spherical conductors A and B of radius 9m and 18m respectively are placed at large distance. They are connected to each other through a cell of emf ε = 300 volt as shown in the figure. Initially they are chargeless. The loss of electric energy when switch is ON is 10P μJ. The value of P is



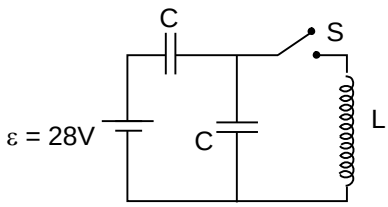
14. A wave $y = 10\sin\left(200\pi t - \frac{4\pi}{100}x\right)$ (where x and y are in cm and t is in second) is travelling in string in which tension is 100 N. The wave is reflected from a fixed support and stationary wave is produced. Assuming no loss of energy due to reflection and air drag, the energy in 25 cm length of string is kπ^2 Joules. Find the value of k.



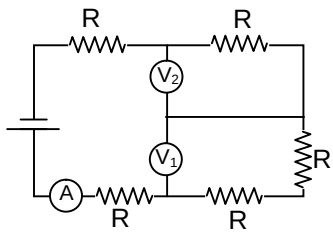
15. Object O is placed at a distance of 14 cm from an equi-convex lens of refractive index $\mu = \frac{3}{2}$ and radius of curvature of lens surface is 32 cm. One of its surface is silvered another convex lens of focal length 24 cm is placed between object and silvered lens such that the final image coincides with the object. The distance between object and the lens in cm is ……..



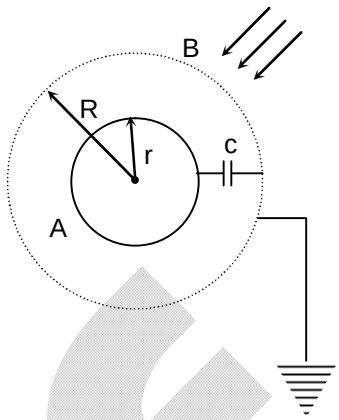
16. In the shown figure two uncharged capacitors each of equal capacitance C = 2mF are connect to cell of emf 28V. The circuit was in this state from long time. Now switch S is closed with inductor with inductance L = 16mH. The maximum current in inductor in ampere will be



17. In the figure two identical voltmeter having their reading V_1 = 15 V and V_2 = 10V. The reading of ideal ammeter is I = 3A. All the five resistance have equal resistance R. The value of R is Ω is



18. A conducting solid sphere of radius r = 2 cm is surrounding by a conducting shell which is made up of fine wire mesh with radius R = 4 cm are shown in the figure. The shell and sphere are joined by a capacitor of capacitance C = 2μF. Work function of the material of shell A and B is 1eV and 4eV respectively. Light falls on this system have frequency $\nu = 7.27 \times 10^{14}$ Hz. The energy stored in the capacitor C in steady condition (in μJ) is



Chemistry

PART – II

Section – A (Maximum Marks: 12)

*This section contains **FOUR (04)** questions. Each question has **FOUR** options. **ONLY ONE** of these four options is the correct answer.*

19. In a AB_xL_y $\left(sp^3d \text{ hybridisation of } 'A'\right)$ have linear shape. What will be the shape of molecule if 'A' forms AB_yL_x type molecule?

(B = Bond pair of electron, L = Lone pair of electrons and A = Central atom).

(A) T-shape
(B) See – saw
(C) Trigonal bipyramidal
(D) Linear

20. If only gases remain after 12 g carbon is treated with 49.26 litre of air at 300 K and 2 atm pressure (Assume 20% by volume of O_2, 79% by volume of N_2 and 1% by volume of CO_2 is present in air). Total amount of heat released in this reaction is…….

$\left(\Delta H_f \text{ for CO and } CO_2 \text{ are } -26 \text{ kcal mol}^{-1} \text{ and } -94 \text{ kcal mol}^{-1}\right)$

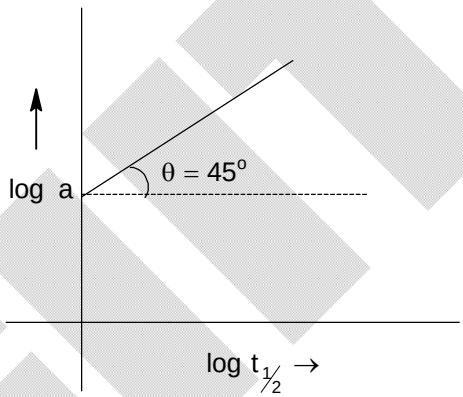
(No reactants are left unreacted after the reaction)

(A) –96.8 kcal
(B) –66.8 kcal
(C) –23.4 kcal
(D) –33.4 kcal

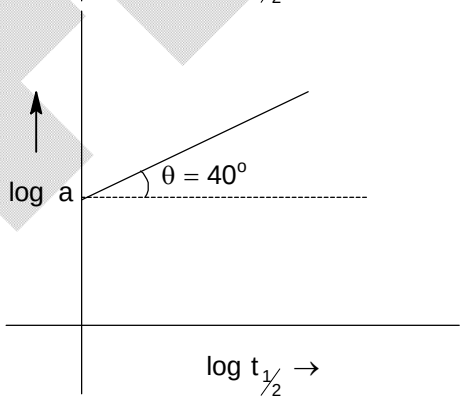
21. Which of the following is correct graph for the reaction given below (where 'a' represents initial conc. of reactant and $t_{1/2}$ represents its half-life time) [Assume the rate constant of the reaction to be greater than unity]

$$N_2O(g) \xrightarrow[\Delta]{Pt} N_2(g) + \frac{1}{2}O_2(g)$$

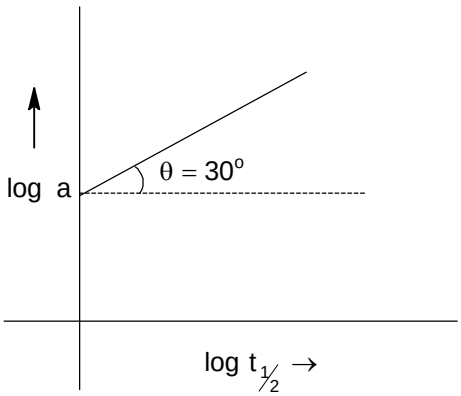
(A)



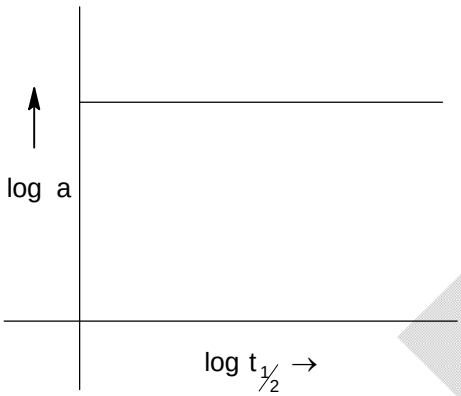
(B)



(C)



(D)



22. Fructose has a specific rotation of $\left(-92.4^{o}\right)$. An aqueous solution of fructose has an observed angle of rotation of $\left(-27.7^{o}\right)$ when placed in a polarimeter tube 10 cm long. How much amount of fructose is dissolved in 100 ml of aqueous solution?
(A) 0.299 g (B) 3.33 g
(C) 2.99 g (D) 29.97 g

Section – A (Maximum Marks: 24)

*This section contains **SIX (06)** questions. Each question has **FOUR** options (A), (B), (C) and (D). **ONE OR MOER THAN ONE** of these four option(s) is (are) correct answer(s).*

23. A metal sulphide crystallizes with cubic close packed array of S^{2-} ions. Cations are Zn^{2+} and Al^{3+} ions. Only half of the octahedral voids and $\left(\frac{1}{8}\right)^{th}$ of the tetrahedral voids are occupied by cations. The correct conclusion regarding this solid is/are:
(A) Empirical formula of the solid is $ZnAl_2S_4$.
(B) Empirical formula of the solid is $Zn_5Al_2S_8$.
(C) Co-ordination number of Zn^{2+} ions is 4.
(D) Co-ordination number of Al^{3+} ions is 6.

24. A solution is 0.01 M in $(NH_4)_2SO_4$ and 0.02 M in $NH_4OH\left(K_b = 2\times10^{-5}\right)$. Which of the following is/are true about this solution?
(A) The solution has buffer property.
(B) pH of this solution is (9 + 2 log2)
(C) pH of this solution is (9 + log2)
(D) Adding water to this solution increases pH.

25. Which of the following option(s) is/are correct regarding XeF_6 ?

(A) It acts as Lewis acid when it reacts with RbF.

(B) It undergoes complete hydrolysis to give XeO_3 .

(C) It fluorinates silica (SiO_2) to give $XeOF_4$.

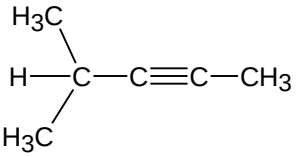
(D) When it reacts with HCl, gives HF, $XeCl_2$ and F_2.

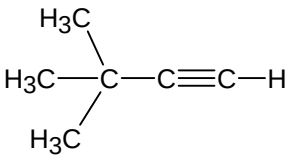
26. $\underset{(P)}{C_6H_{10}} \xrightarrow[\text{(iii) dil. HCl}]{\text{(i) dil. } H_2SO_4/HgSO_4 \text{ (ii) } NaBH_4/\text{ethanol}} (Q) \xrightarrow[\text{(iii) } Zn/H_2O]{\text{(i) conc. } H_2SO_4 \text{ (ii) } O_3} 2(R) \xrightarrow[\Delta]{\text{(i) dil. KOH}} H_3C-\underset{\underset{CH_3}{|}}{C}=CH-\overset{\overset{O}{||}}{C}-CH_3$

Which of the following is/are NOT the possible structure of (P)?

(A) $CH_3CH_2CH_2CH_2 - C \equiv C - H$

(B) $CH_3CH_2 - C \equiv C - CH_2CH_3$

(C) 

(D) 

27. For the reaction:

$A \longrightarrow B$

The rate expression is given below:

$$\text{rate} = \frac{2[A]}{3+[A]}$$

Where [A] is the concentration (mol/L) of reactant left at any time 't (in minutes)' and $[A]_0$ represents initial concentration of the reactant 'A' $(\ell n2 = 0.7)$

Now, identify the correct statement(s) regarding the above reaction:

(A) Plot of half-life time (Y-axis) versus $[A]_0$ (X-axis) is a straight line with slope 0.25 and intercept 1.05 on Y-axis.

(B) If initial concentration of A is 8 M, then it takes 5.1 minutes to reduce its concentration to 2 M.

(C) The reaction follows first order kinetics if concentration of 'A' is very small as compared to 3.

(D) If concentration of A is much greater than 3, then the plot of $t_{1/2}$ (Y-axis) versus $[A]_0$ (X-axis) is a straight line passing through origin.

28. Cyclohexene on heating with conc. H_2SO_4 gives a major product (A) and a minor product (B) having greater number of α – hydrogen atoms as compared to the other minor product (B'). (A) on reductive ozonolysis gives (C) while (B) on reductive ozonolysis gives (D). (C) on heating with dil. KOH gives (E) while (D) on heating with dil. Alkali gives (F).

Now, choose the correct option(s) from the following:

(A) (E) on reductive ozonolysis gives (C) and new product which on heating with conc. NaOH followed by acidification gives hydroxy cyclopentanecarboxylic acid.

(B) Degree of unsaturation of (F) is 4.

(C) Ratio of degree of unsaturation of (D) to that of (C) is 1.5.

(D) (F) consists of two rings and both rings are of same size.

Section – B (Maximum Marks: 24)

*This section contains **EIGHT (08)** numerical based questions. The answer to each question is a **Single Digit Integer, ranging from 0 to 9 both inclusive.***

29. If total number of plane of symmetry in a molecule of TEREPHTHALIC ACID be 'x' and total number of elements of symmetry (excluding axis of symmetry) in a molecule of MESO-2,3-dichlorocyclobutane be 'y' and total number of stereocentres in pent-3-en-2-ol be 'z', then the value of (x + y + z) will be…….

30. Consider the following set of reactions:

(i) $Ag_2S + NaCN \longrightarrow \left[Ag(CN)_x\right]^{-n}$

(ii) $Au + NaCN + O_2 \xrightarrow{H_2O} \left[Au(CN)_y\right]^{-n}$

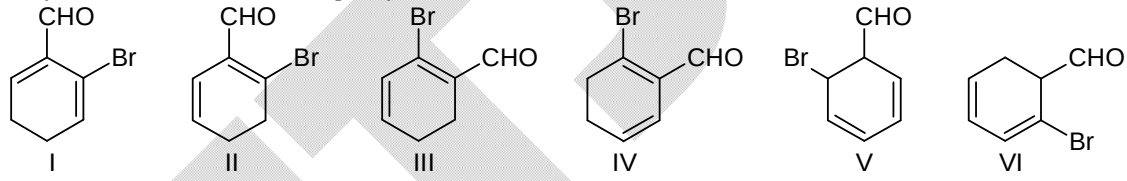
(iii) $\left[Ag(CN)_x\right]^{\pm n} \xrightarrow{Zn} Ag\downarrow + \left[Zn(CN)_z\right]^{-m}$

(iv) $\left[Au(CN)_y\right]^{\pm n} \xrightarrow{Zn} Au\downarrow + \left[Zn(CN)_z\right]^{-m}$

(Where m, n, x, y and z, all are positive integers.)
What is the value of (x + y + z – 2n + m)?

31. 'P' gram of urea is dissolved in 500 g of water. If the difference in boiling point and freezing point of the solution is 100.46 K, then what is the value of (P)?
[For water, $K_b = 0.5\ K\ kg\ mol^{-1}$ and $K_f = 1.8\ K\ kg\ mol^{-1}$]

32. How many of the following molecules have locant-2 for bromine atom [Locant = Figure to indicate the position of bromine atom] as per IUPAC nomenclature?



33. How many of the following statement(s) is/are correct?
(i) Sodium amalgam is better reducing agent than hydrogen.
(ii) Sodium carbonate can be decomposed to its oxides on gentle heating.
(iii) On adding excess of NaOH to salt solution of $ZnCl_2$, soluble product is formed.
(iv) Copper sulphate on treatment aq. Na_2CO_3 solution gives basic copper carbonate.
(v) In case of alkali metals, for performing flame test, chlorides are preferred over carbonates.

34. Volume strength of H_2O_2 solution is 22.4. 5 mL of this H_2O_2 solution is just sufficient to react with 0.40 gm impure sample of H_2S. If the mass % of pure H_2S in the impure sample is 17x, then find the value of 'x'. [Assume impurities are inert]

35. in how many of the following reactions 'BORON' is formed?

(i) $NH_4Cl + Na_2B_4O_7 \xrightarrow{\text{red hot}} ?$

(ii) $BCl_3 + NH_4Cl \xrightarrow{140^oC} ? \xrightarrow{NaBH_4} ?$

(iii) $KBF_4 + K \xrightarrow{\Delta} ?$

(iv) $B_2O_3 + Cr_2(SO_4)_3 \xrightarrow{\Delta} ?$

(v) $B_2H_6 \xrightarrow[\Delta]{CH_3NH_2} ?$

(vi) $B_2H_6 \xrightarrow[\Delta]{(CH_3)_3N} ?$

36. 6.0 g of He^4 having average velocity 4×10^2 m/s is mixed with 12 g of Ne^{20} having same average velocity. If the average kinetic energy per mole of the mixture is 'x' kJ, then find the value of 10x?

Mathematics

PART – III

Section – A (Maximum Marks: 12)

*This section contains **FOUR (04)** questions. Each question has **FOUR** options. **ONLY ONE** of these four options is the correct answer.*

37. Consider the 12 face diagonals of a cube. If two diagonals are selected at random, then the probability that they are skew lines is

(A) $\frac{3}{11}$ (B) $\frac{6}{11}$

(C) $\frac{1}{2}$ (D) $\frac{5}{11}$

38. A new sequence is obtained from the sequence of the positive integers 1, 2, 3, ... by deleting all the perfect squares. Then the 2023rd term of the new sequence is

(A) 2066 (B) 2067

(C) 2068 (D) 2069

39. Let $x \in \left[-\frac{5\pi}{12}, -\frac{\pi}{3}\right]$. Then the maximum value of $y = \tan\left(x+\frac{2\pi}{3}\right) - \tan\left(x+\frac{\pi}{6}\right) + \cos\left(x+\frac{\pi}{6}\right)$ is

(A) $\frac{12\sqrt{2}}{5}$ (B) $\frac{11\sqrt{2}}{6}$

(C) $\frac{11\sqrt{3}}{6}$ (D) $\frac{11\sqrt{3}}{5}$

40. If $x^a = y^b = z^c$, where a, b, c are unequal positive numbers and x, y, z are in Geometric Progression, then $a^3 + c^3$ is

(A) $> 2b^3$ (B) $> 2c^3$

(C) $< 2b^3$ (D) $< 2c^3$

Section – A (Maximum Marks: 24)

*This section contains **SIX (06)** questions. Each question has **FOUR** options (A), (B), (C) and (D). **ONE OR MORE THAN ONE** of these four option(s) is (are) correct answer(s).*

41. Let A, B and C be the points (4, 1), (–1, –6) and (–3, 2) respectively. The point (x, y) in inside triangle ABC or on its perimeter, then

(A) maximum value of 4x – 3y is 14 (B) maximum value of 4x – 3y is 18

(C) minimum value of 4x – 3y is –14 (D) minimum value of 4x – 3y is –18

42. A variable point z_1 in the complex plane moves according to the equation $|z_1 - z_0| = |z_1|$, where z_0 is a fixed point ($z_0 \neq 0$). A second variable point z moves according to the equation $z_1 z = -1$. Then the locus of point z is

(A) a circle with centre $\frac{-1}{z_0}$ (B) a circle with centre $\frac{1}{z_0}$

(C) a circle with radius $\frac{1}{|z_0|}$ (D) a circle with radius $\frac{2}{|z_0|}$

43. Let 4x – y = 0 and y = 0 be two lines and C(6, 4) be a point in the xy plane. A variable line through C intersect the given lines at A and B respectively. P be the point of intersection of the given lines, then

(A) if area of ΔPAB is minimum, then A is $\left(\frac{3}{2}, 6\right)$

(B) if area of ΔPAB is minimum, then A is (2, 8)

(C) if PA + PB is minimum, then B is $\left(\frac{15}{2}, 0\right)$

(D) if PA + PB is minimum, then B is (10, 0)

44. The solution set of the inequality $\sqrt{\log_2 x - 1} + \frac{1}{2}\log_{\frac{1}{2}} x^3 + 2 > 0$ may be

(A) [2, 3) (B) (2, 3]
(C) [2, 4) (D) (2, 4]

45. Let f : z $\rightarrow$ R be defined as f(x + 2) = f(x) + 2(x + 1) if x is even and f(x + 2) = f(x) + 1 if x is odd and f(1) = 1, f(2) = 5, then

(A) f(6) = f(41) (B) f(7) < f(8)
(C) f(x) is increasing (D) f(10) + f(11) = 59

46. Consider the equation $3\cot^2 x + \lambda \cot x + 3 = 0$, $x \in (0, 2\pi) - \{\pi\}$. Which of the following options is/are CORRECT?

(A) Sum of the solutions of the equation = 3π if $\lambda = 7$
(B) Sum of the solutions of the equation = 3π if $\lambda = -8$
(C) Sum of the solutions of the equation = 5π if $\lambda = 9$
(D) Sum of the solutions of the equation = 5π if $\lambda = -10$

Section – B (Maximum Marks: 24)

*This section contains **EIGHT (08)** numerical based questions. The answer to each question is a **Single Digit Integer, ranging from 0 to 9 both inclusive.***

47. The number of real solution of the equation $(x^{2024} + 1)(1 + x^2 + x^4 + ... + x^{2022}) = 2024x^{2023}$ is

48. The complex numbers z_1 and z_2 satisfy $|z_1| = |z_1 + z_2| = 3$ and $|z_1 - z_2| = 3\sqrt{3}$. If the value of $\log_3\left|(z_1\bar{z}_2)^{2023} + (\bar{z}_1 z_2)^{2023}\right|$ is 578k, then the value of k is

49. The maximum value of $f(x) = \sqrt{x^4 - 3x^2 - 6x + 13} - \sqrt{x^4 - x^2 + 1}$ is k, then [k] is (where [.] represents greatest integer function)

50. Let P be any point on the hyperbola $\frac{x^2}{9} - \frac{y^2}{4} = 1$. If F_1 and F_2 be the foci of the hyperbola and I be the in-centre of the ΔPF_1F_2. If locus of I is $\lambda y^2 + 2x + \mu = 0$, then the value of $|\lambda + \mu|$ is equal to

51. Let $\vec{a}, \vec{b}, \vec{c}$ be three vectors such that $|\vec{a}| = 1, |\vec{b}| = 2,$ and $|\vec{c}| = 4$. If $|\vec{a} - \vec{b}|^2 + |\vec{b} - \vec{c}|^2 + |\vec{c} - \vec{a}|^2 = 62$, then the value of $|2\vec{a} + 3\vec{b} + 4\vec{c}|$ is equal to

52. Let $f(x) = \int_x^1 \ln(1 - t^2)dt$, $x \in (0, 1)$ and $\alpha = \int_0^1 f(x)dx$, then the value of $4\alpha + 5$ is equal to

53. Let tangent at (α_1, β_1) on the curve $y = x^4 - 2x^2 - x$ touch the curve again at (α_2, β_2), then the value of $|\alpha_1| + |\alpha_2| + |\beta_1| + |\beta_2|$ is equal to

54. Let A and C be two points on the line $\frac{x-1}{3} = \frac{y-2}{2} = \frac{z-3}{1}$ and B & D be two point on the line $\frac{x-2}{5} = \frac{y-1}{2} = \frac{z-2}{3}$ such that AB is perpendicular to both the given lines and the length of CD is $3\sqrt{3}$. If V is the maximum volume of the tetrahedron ABCD, then [V] is equal to
(where [.] represents greatest integer function)