FIITJEE
ALL INDIA TEST SERIES
JEE (Advanced)-2025
FULL TEST – VII
PAPER –2
TEST DATE: 20-04-2025

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.**

<table>
<tr><td colspan="4" align="center">MARKING SCHEME</td></tr>
<tr><td colspan="4">Section – A (Single Correct): Answer to each question will be evaluated according to the following marking scheme:</td></tr>
<tr><td><i>Full Marks</i></td><td>:</td><td>+3</td><td>If ONLY the correct option is chosen.</td></tr>
<tr><td>Zero Marks</td><td>:</td><td>0</td><td>If none of the options is chosen (i.e. the question is unanswered);</td></tr>
<tr><td><i>Negative Marks</i></td><td>:</td><td>–1</td><td>In all other cases.</td></tr>
<tr><td colspan="4">Section – A (One or More than One Correct): Answer to each question will be evaluated according to the following marking scheme:</td></tr>
<tr><td>Full Marks</td><td>:</td><td>+4</td><td>If only (all) the correct option(s) is (are) chosen;</td></tr>
<tr><td>Partial Marks</td><td>:</td><td>+3</td><td>If all the four options are correct but ONLY three options are chosen;</td></tr>
<tr><td>Partial marks</td><td>:</td><td>+2</td><td>if three or more options are correct but ONLY two options are chosen and both of which are correct;</td></tr>
<tr><td>Partial Marks</td><td>:</td><td>+1</td><td>If two or more options are correct but ONLY one option is chosen and it is a correct option;</td></tr>
<tr><td>Zero Marks</td><td>:</td><td>0</td><td>If none of the options is chosen (i.e. the question is unanswered);</td></tr>
<tr><td>Negative Marks</td><td>:</td><td>–2</td><td>In all other cases.</td></tr>
<tr><td colspan="4">Section – B: Answer to each question will be evaluated according to the following marking scheme:</td></tr>
<tr><td>Full Marks</td><td>:</td><td>+3</td><td>If ONLY the correct integer is entered;</td></tr>
<tr><td>Zero Marks</td><td>:</td><td>0</td><td>Question is unanswered;</td></tr>
<tr><td>Negative Marks</td><td>:</td><td>–1</td><td>In all other cases.</td></tr>
</table>

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 thin lens of refractive index 1.5, and focal length in air 20 cm is placed inside, a large container containing two immiscible liquids as shown. If an object is placed at an infinite distance close to principle axis (common intersection line of the layers), the distance between images
    (A) 25 cm   (B) 45 cm
    (C) 65 cm   (D) 85 cm
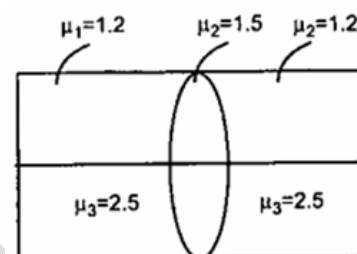
2. There is a uniform magnetic field B in circular region of radius R as shown in figure, whose magnitude changes at the rate of dB/dt. The e.m.f. induced across the ends of a circular concentric conducting arc of radius R_1 having an angle θ as shown ($\angle OAO'$) is:

    (A) $\dfrac{\theta}{2\pi} R_1^2 \dfrac{dB}{dt}$

    (B) $\dfrac{\theta}{2} R^2 \dfrac{dB}{dt}$

    (C) $\dfrac{\theta}{2\pi} R^2 \dfrac{dB}{dt}$

    (D) none of these
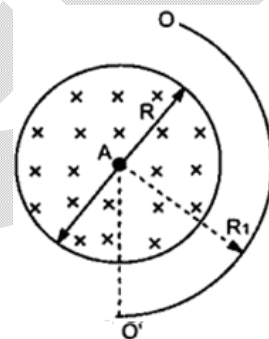
3.
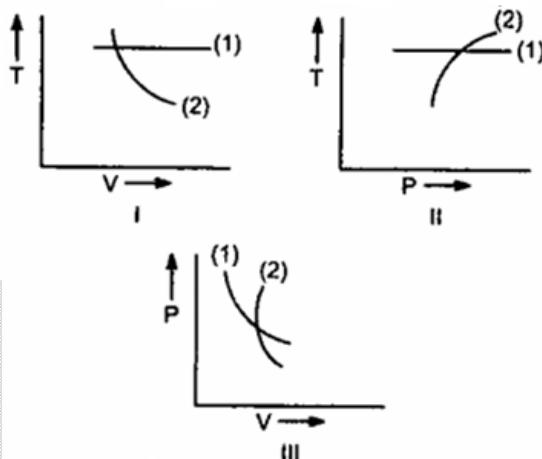
    If (I) represents isothermal and (II) represents adiabatic, which of the graphs given above in respect of an ideal gas are correct?
    (A) I and II   (B) II and III
    (C) I and III   (D) I, II and III

---

4.   A travelling wave is given by

$$y = \frac{0.8}{3x^2 + 12xt + 12t^2 + 4}$$

Where x and y are in m and t is in sec, then velocity and amplitude of wave will be

(A) 2 m/s, 0.2 m   (B) 4 m/s, 0.2 m
(C) 2 m/s, 0.4 m   (D) none of these

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.   Three unlike point charges are arranged as shown in given figure, where AOB is the right angle formed by two conducting half-planes. The magnitude of each of the charges is | q | and the distances between them are shown in the figure. Total charge induced on the conducting half-planes and the force acting on the charge –q is

(A) charge = –q
(B) charge = –3q
(C) Force $= \left(\dfrac{2\sqrt{2}-1}{4\pi\varepsilon_0} \right) \dfrac{q^2}{2a^2}$

(D) Force $= \left(\dfrac{4\sqrt{2}+1}{4\pi\varepsilon_0} \right) \dfrac{q^2}{2a^2}$
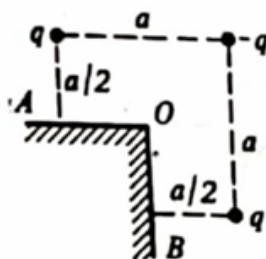
6.   Consider an arrangement of cells shown in the figure. There are m-branches and in each branch there are n-cells. Suppose this combination of cells can be replaced by a single battery of emf V and internal resistance R, then V and R.

(A) $V = \dfrac{n(m+1)E}{2}$

(B) $V = \dfrac{m(n+1)E}{2}$

(C) $R = \dfrac{n(n+1)r}{2m}$

(D) $R = \dfrac{m(m+1)r}{2n}$
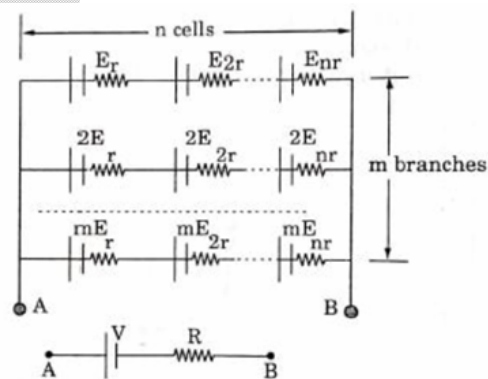
7.   Consider the shown case of a freezing lake due to negative environmental temperature $(-\theta^0 C)$. Thickness (x) of ice layer is small in comparison to depth of lake. Rate of increase in x will be greater:
(A) if environmental temperature increases.
(B) for larger thickness of ice layer.
(C) if environmental temperature decreases.
(D) for smaller thickness of ice layer.
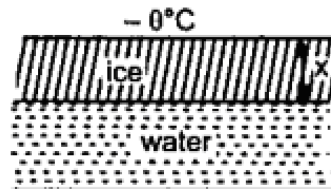
8. For a certain transverse standing wave on a long string, an antinode is formed at x = 0 and next to it, a node is formed at x = 0.10 meter, the displacement y(t) of the sting particle at x = 0 is shown in figure.
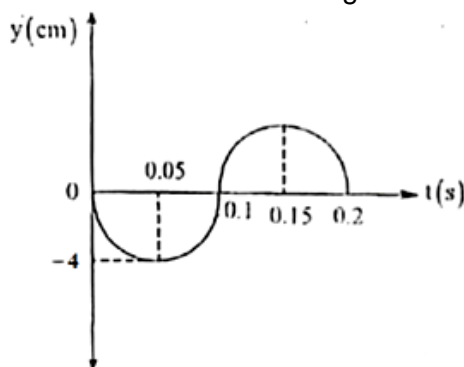
(A) Transverse displacement of the particle at x = 0.05 m and t = 0.05 sec is $-2\sqrt{2}$ cm

(B) Transverse displacement of the particle at x = 0.04 m and t = 0.025 sec is $-2\sqrt{2}$ cm

(C) Speed of travelling wave that interfere to produce this standing wave is 2 m/s.

(D) The transverse velocity of the string particle at $x = \dfrac{1}{15}$ m and t = 0.1 sec is 20π cm/sec.

9. A particle performing simple harmonic motion undergoes initial displacement of A/2 (where A is the amplitude of simple harmonic motion) in 1s At t = 0, the particle may be at the extreme position or mean position. The time period of the simple harmonic motion can be

(A) 6 s   (B) 2.4 s

(C) 12 s   (D) 1.2 s

10. A sky lab of mass m is first launched from the surface of earth (radius R) in a circular orbit of radius 2R (from centre of earth) and then it is shifted from this circular orbit to another circular orbit of radius 3R.

(A) Minimum energy required to place the lab in first orbit is equal to $\dfrac{3}{4}$mgR.

(B) Minimum energy required to shift lab from first orbit to second orbit is $\dfrac{mgR}{12}$.

(C) Energy of sky lab in second orbit is greater than its energy in firsts orbit.

(D) Energy of sky lab in second orbit is less than its energy in first orbit.

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 glass of refractive index 1.5 is coated with a thin layer of thickness t, of refractive index 1.8. Light of wavelength λ travelling in air is incident normally on the layer. It is partly reflected at the upper and at the lower surfaces of the layer. The two reflected rays interfere. If λ = 648 nm, obtain the least value of t (in 10^{-8} m) for which the rays interfere constructively.

12. A Bohr hydrogen atom undergoes a transition n = 5 to n = 4 and emits a photon of frequency f. Frequency of circular motion of electron in n = 4 orbit is f_4. The ratio $\dfrac{f}{f_4}$ is found to be $\dfrac{18}{5\,m}$. State the value of m.

13. Two uniform spheres shown in given figure rotate separately on two parallel horizontal axis passing though their centres. The upper sphere has an angular speed ω_0 and the lower sphere is at rest. Now the two spheres are moved together so that their surfaces touch. After a short time the two spheres, now in contact, are rotating without slipping. Find the final rate of rotation of upper sphere in rad/s [given moment of inertia of the upper sphere $I_1 = 4$ kg m^2, moment of inertia of lower sphere $I_2 = 2$ kg m^2, radius of upper sphere a = 2 m, radius of lower sphere b = 1 m, $\omega_0 = 12$ rad/s].
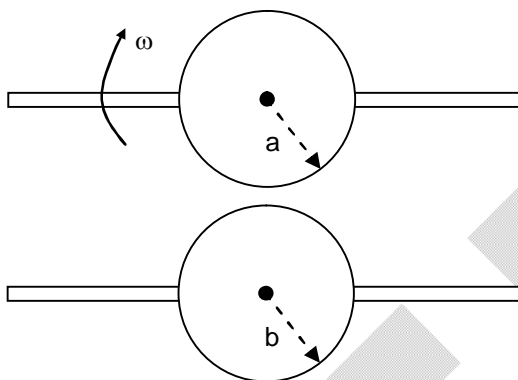

14. A solid cylinder of height h and mass m is floating in a liquid of density ρ as shown in the figure. Find the acceleration of the vessel (in m/s^2) containing liquid for which the relative downward acceleration of the completely immersed cylinder w.r.t. vessel becomes equal to one-third of that of the vessel acceleration in magnitude. (Take g = 10 m/s^2)
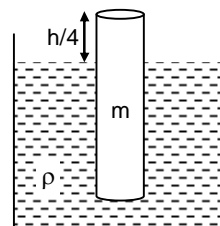

15. A barometer contains two uniform capillaries of radii 1.44×10^{-3} m and 7.2×10^{-4} m. If the height of liquid in narrow tube is 0.2 m more than that in wide tube. The true pressure difference is $310 \times N$. Then the value of 'N' is _____.
Density of liquid = 10^3 kg/m^3, surface tension = 72×10^{-3} N/m and g = 9.8 m/s^2. (Angle of contact = 0)

16. Two electrode each of radius $a = \dfrac{1}{\pi}$ are embedded a large distance apart in a homogeneous conducting medium of resistivity $\rho = 1$. Resistance between the electrodes is $\dfrac{4}{n}$. Then the value of 'n' is _____ .

17. Time constant in given network. $\tau = 2.1 \times n$. Then the value of 'n' is _____ .
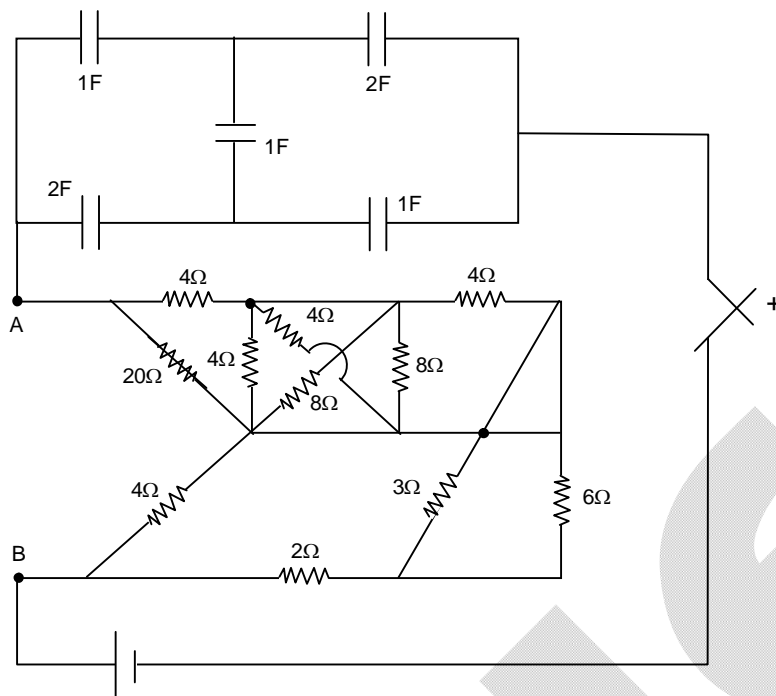
18. Plane of height h = 1.6 meter and inclination $\alpha = 30°$ to the horizontal has a smooth groove cut in it inclined at an angle $\beta = 45°$ to the line of greatest slope as shown in figure. Time that a particle would take to move top point A to bottom point O in groove, starting from rest at the top is $\frac{3.2}{k}$. Then value of 'k' is (g = 10 m/sec^2)
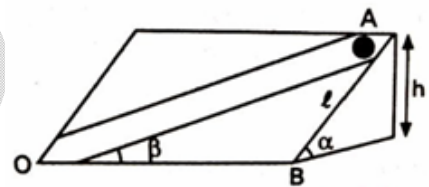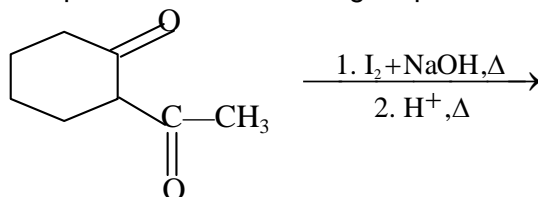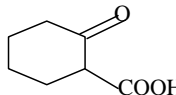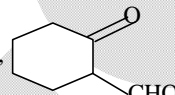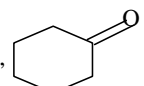
Chemistry   PART – II

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.   End product of the following sequence of reaction is

$$\xrightarrow[\text{2. } H^+, \Delta]{\text{1. } I_2 + NaOH, \Delta}$$

(A)   Yellow ppt. of CHI_3,

(B)   Yellow ppt. of CHI_3,

(C)   Yellow ppt. of CHI_3,

(D)   Yellow ppt. of CHI_3,

20.   The following reactions takes place in stratosphere

$$O_2 \xrightarrow{\text{U.V radiation}} O + O$$

$$O + O_2 + M \longrightarrow O_3 + M\,(\text{exothermic})$$
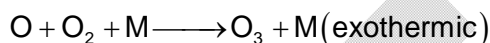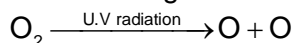
What is the role of 'M' in above reaction?
(A) It is used as a catalyst
(B) It absorbs some heat energy and prevents decomposition of O_3
(C) It converts ground state O_2 to excited O_2^*
(D) It reduces the reactivity of nascent oxygen

21.   The temperature of a definite amount of an ideal monoatomic gas becomes four times in an isoentropic process. Which of the following is correct relation between the final and initial parameters of gas?
(A) $V_f = 8V_i$ (B) $V_f = 16\,V_i$
(C) $P_f = 32\,P_i$ (D) $P_f = P_i$

22.   0.1 M acetic acid solution is titrated against 0.1 M NaOH solution. What would be the difference in pH between ¼ and ¾ stages of neutralization of acid.
(A) 2 log 3/4   (B) 2 log ¼
(C) log 1/3   (D) 2 log 3

For More Join: @FIITJEE_AITS_for_JEE

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).*

23.
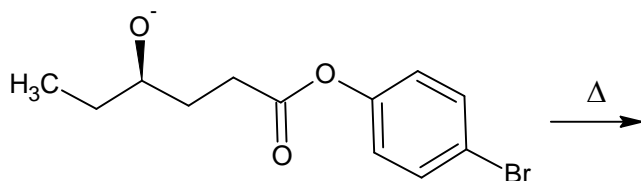
Which of the statements regarding the product formed in the above reaction is correct?
(A) If Br is replaced with NO_2 rate of reaction increases
(B) Inversion of configuration takes place.
(C) Nucleophillic acyl substitution takes place.
(D) Configuration at chiral carbon does not change

24. Which of the following statements is/are true about an azeotropic mixture?
(A) An azeotropic mixture boils at constant temperature
(B) The composition of an azeotropic mixture changes on distillation
(C) An azeotropic solution of two liquids has a boiling point lower than that of either of them when it shows positive deviation from the Raoult's law
(D) An azeotropic solution of two liquids has a boiling point higher than that of either of them if it shows positive deviation from Raoult's law

25. The following data are given for the reaction
$X(g) + Y(g) \longrightarrow$ Product
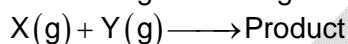
No. of expt.	Initial concentration of 'X' in 'M'	Initial concentration of 'Y' in 'M'	Rate of reaction in M s^{-1} unit
1.	0.1	0.1	2×10^{-8}
2.	0.2	0.2	4×10^{-8}
3.	0.4	0.2	8×10^{-8}

Choose the correct statement(s) from the following
(A) The order of reaction with respect to X is one
(B) The overall order of reaction is one
(C) The rate constant of the reaction is 2×10^{-7} s^{-1}
(D) The half-life of 'Y' does not depend on its concentration

26. Which of the following substance(s) produce(s) gases when treated with water?
(A) CaC_2 (B) Mg_3N_2
(C) Na_2S (D) KNO_3

27. What is/are the product of reaction?

For More Join: @FIITJEE_AITS_for_JEE

(C)

(D)
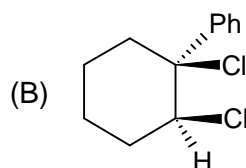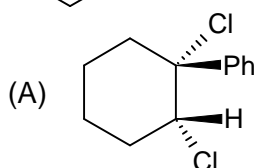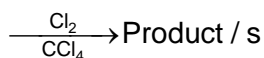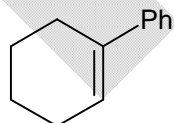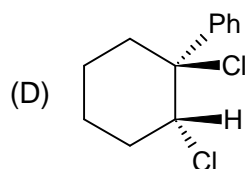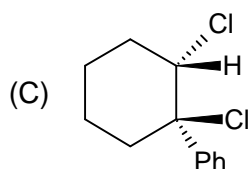
28.   Which of the following complex(es) show(s) geometrical isomerism?
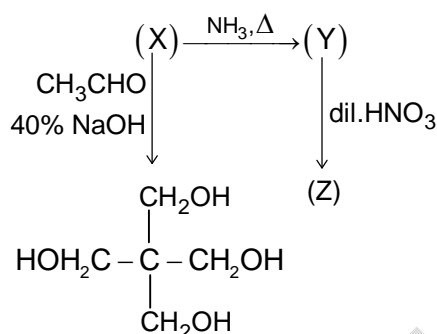(A) $[Cr(H_2O)_5Cl]Cl_2.H_2O$ (B) $[Pt(NH_2CH_2COO)_2]$
(C) $[PtCl_2P(C_2H_5)_3]_2$ (D) $K_2[Fe(CN)_4(NH_3)_2]$

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.*

29.

Total how many sp^2 hybridised N are present in (Z)

30.   Among the following
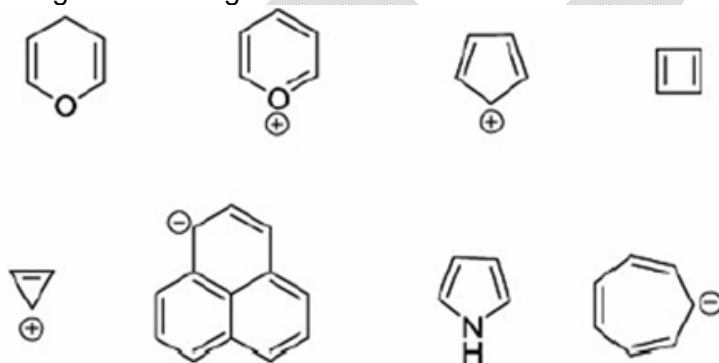
The total number of aromatic species is

31.   The Mo–Mo bond order in $[(\eta^5\text{-}C_5H_5)Mo(CO)_2]_2$ which obeys the 18-electron rule is__.

32. $X(s) \xrightarrow{HCl} Y \uparrow \xrightarrow[NaOH]{Na_2[Fe(CN)_5NO]} $ Purple solution gas

Y has been allowed to react with following species in neutral/acidic medium

(a) $FeCl_3$ (b) $CuSO_4$ (c) $BaCl_2$ (d) SO_2 (e) $Cr_2O_7^{2-}$ (f) CH_3COONa (g) Hg^{2+}

The calculate the value of P + Q – R
P : Number of species which undergoes redox reaction with gas Y
Q: Number of species with which gas Y undergoes precipitation
R: Number of species with which gas Y produce no observable change

33. On heating a sample of 25 mg hydrated compound(molecular weight = 250 g/mol) in thermogravimetric analysis, 16 mg of dehydrated compound remains. The number of water molecules lost per molecule of hydrated compound is _____
(Molecular weight of water = 18 g/mol)

34. Number of carbonyl groups present in the final product of the following reaction sequence is

$$\text{1. } O_3, H_2O_2$$
$$\text{2. } H_3O^+, \Delta$$
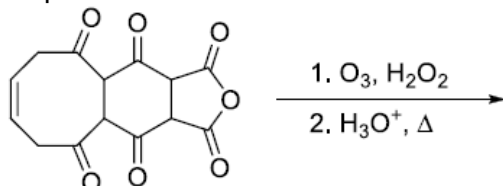
35. A tetrapeptide, made up of natural amino acids, has alanine as the N-terminal residue which is coupled to a chiral amino acid. Upon complete hydrolysis, the tetrapeptide gives glycine, alanine, phenylalanine and leucine. The number of possible sequences of the tetrapeptide is

36. The number of possible stereoisomers for cyclononene is _____

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. Let A and B be 2 × 2 matrices with real entries satisfying $(AB - BA)^n = I_2$ for some positive integer n, then n is
(A) even   (B) odd
(C) prime   (D) any integer

38. Let A & B be two n × n matrices that do not commute and for which there exist non zero real numbers p, q, r such that $pAB + qBA = I_n$ and $A^2 = rB^2$ then
(A) $p + q = 0$ (B) $p - q = 0$
(C) $p^2 + q = 0$ (D) $p = 2q$

39. The solution of the differential equation $\dfrac{d^2y}{dx^2} = \sin 3x + e^x + x^2$ when $y_1(0) = 1$ and $y(0) = 0$ is

(A) $\dfrac{-\sin 3x}{9} + e^x + \dfrac{x^4}{12} + \dfrac{1}{3}x - 1$ (B) $\dfrac{-\sin 3x}{9} + e^x + \dfrac{x^4}{12} + \dfrac{1}{3}x$

(C) $\dfrac{-\cos 3x}{3} + e^x + \dfrac{x^4}{12} + \dfrac{1}{3}x + 1$ (D) none of these

40. Consider a circle of diameter AB and center O, and the tangent t at B. A variable tangent to the circle with contact point M intersects t at P. The locus of the point Q where the line OM intersects the parallel through P to the line AB is
(A) straight line   (B) parabola
(C) ellipse   (D) hyperbola

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. Variable circle is described to pass through point (1, 0) and tangent to the curve $y = \tan(\tan^{-1} x)$. The locus of the centre of the circle is a parabola whose:

(A) length of the latus rectum is $2\sqrt{2}$

(B) axis of symmetry has the equation $x + y = 1$

(C) vertex has the co – ordinates $\left(\dfrac{3}{4}, \dfrac{1}{4}\right)$

(D) none of these

For More Join: @FIITJEE_AITS_for_JEE

42. Line through P(a, 2) meets the ellipse $\dfrac{x^2}{9} + \dfrac{y^2}{4} = 1$ at A and D and meets the coordinate axes at B and C so that PA, PB, PC, PD are in G.P., then possible values of a can be:
   (A) 5   (B) 8
   (C) 10   (D) −7

43. Let α be a real number, then the integral, $(n \in I)$

$$I(\alpha) = \int_{-1}^{1} \frac{\sin \alpha \, dx}{1 - 2x \cos \alpha + x^2} =$$

   (A) $\dfrac{\pi}{2}$ if $\alpha \in \left[2n\pi, (2n+1)\pi\right]$ (B) $\dfrac{\pi}{2}$ if $\alpha \in \left((2n+1)\pi, (2n+2)\pi\right)$

   (C) $\dfrac{-\pi}{2}$ if $\alpha \in \left((2n+1)\pi, (2n+2)\pi\right)$ (D) $\dfrac{\pi}{2}$ if $\alpha \in \left(2n\pi, (2n+1)\pi\right)$

44. Let $u = ax + by + a\sqrt[3]{b} = 0$, $v = bx - ay + b\sqrt[3]{a} = 0$, where $a, b \in R$ be two straight lines. The equations of the bisectors of the angles formed by $k_1 u - k_2 v = 0$ and $k_1 u + k_2 v = 0$ for non zero real k_1 and k_2 are:
   (A) $u = 0$ (B) $k_2 u + k_1 v = 0$
   (C) $k_2 u - k_1 v = 0$ (D) $v = 0$

45. If $f : \mathbb{R} \to \mathbb{R}$, such that $f(x) = \dfrac{\left(x^2 - x + 1\right)^3}{x^6 - x^3 + 1}$, then

   (A) minimum value of $f(x)$ is 1   (B) minimum value of $f(x)$ is $\dfrac{\sqrt{3}}{1+\sqrt{3}}$

   (C) maximum value of $f(x)$ is 1   (D) maximum value of $f(x)$ is 9

46. Let z, iz and z + iz represent three vertices of a triangle then,
   (A) area of Δ is given by, Area $= \dfrac{1}{2}|z|^2$ (B) area of Δ is given by, Area $= |z|^2$
   (C) orthocentre of Δ is given by $z + iz$ (D) None of these

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. Tangent are drawn from any point on the hyperbola $\dfrac{x^2}{9} - \dfrac{y^2}{4} = 1$ to the circle $x^2 + y^2 = 9$.

   If the locus of the mid – point of the chord of contact is $a\left(x^2 + y^2\right)^2 = bx^2 - cy^2$, then the value of $a^2 + b^2 + c^2 - 7870$ is equal to

For More Join: @FIITJEE_AITS_for_JEE

48. Let $\vec{b} = 4i + 3j$ and $\vec{c}$ be two vectors perpendicular to each other in the xy – plane. If $\vec{r}_i, i = 1, 2, ...n$ are the vectors in the same plane having projection 1 and 2 along $\vec{b}$ and $\vec{c}$ respectively $\sum_{i=1}^{n} \left| \vec{r}_i \right|^2$ is equal to k then $\dfrac{k}{4}$ equals to

49. If the value of greater of $\sin x + \tan x$ and $2x \left(0 < x < \dfrac{\pi}{2} \right)$ at $\dfrac{\pi}{4}$ is $g\left(\dfrac{\pi}{4} \right)$ then $g\left(\dfrac{\pi}{4} \right) - \dfrac{1}{\sqrt{2}}$ is equal to

50. Let A & B be 2 × 2 matrices with integer entries such that A, A + B, A + 2B, A + 3B and A + 4B are all invertible matrices whose inverse have integer entries, then find I det (A + 5B) I

51. Let $< a_n >$ be an arithmetic sequence such that arithmetic mean of $a_1, a_3, a_5, ...a_{97}, a_{99}$ is 1. Find the value of $\left| \sum_{r=1}^{50} (-1)^{\frac{r(r+1)}{2}} . a_{2r-1} \right|$

52. Let $f(x) = ax^2 + bx + c,$ where $a \neq 0, a, b, c$ are integers and $f(1) = 1, 6 < f(3) < 8$ and $18 < f(5) < 22$. Then the number of solutions of equation $f(x) = e^x$ is _____

53. If z_1, z_2 are complex numbers, then the maximum value of $\dfrac{z_1 \overline{z_2} + \overline{z_1} z_2 + \overline{z_1} \overline{z_2} + \overline{z_1} \overline{z_2}}{\left| z_1 z_2 \right|}$ is equal to _____.

54. Let $f(x) = ax^2 + bx + c, (a < b)$ and $f(x) \geq 0 \, \forall \, x \in R$. If the minimum value of $\dfrac{a+b+c}{b-a}$ is k then value of k is