FIITJEE
ALL INDIA TEST SERIES
JEE (Advanced)-2024
FULL TEST – IV
PAPER –2
TEST DATE: 08-02-2024

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

General Instructions:

- The test consists of total 51 questions.
- Each subject (PCM) has 17 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 **Three Sections**: **Section-A, Section-B & Section-C**.
  Section – A *(01 – 04, 18 – 21, 35 – 38)*: This section contains **TWELVE (12)** questions. Each question has **FOUR** options. **ONLY ONE** of these four options is the correct answer.
  Section – A *(05 –07, 22 – 24, 39 – 41)*: This section contains **NINE (09)** questions. Each question has **FOUR** options. **ONE OR MORE THAN ONE** of these four option(s) is(are) correct answer(s).
  Section – B *(08 – 13, 25 – 30, 42 – 47)*: This section contains **EIGHTEEN (18)** numerical based questions. The answer to each question is a **NON-NEGATIVE INTEGER VALUE**.
  Section – C *(14 –17, 31 – 34, 48 – 51)*: This section contains **SIX (06) paragraphs.** Based on each paragraph, there are **TWO (02)** questions of numerical answer type. The answer to each question is a **NUMERICAL VALUE (XXXXX.XX).** If the numerical value has more than two decimal places, truncate/round-off the value to **TWO** decimal places.

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	:	+4	If ONLY the correct integer is entered;
Zero Marks	:	0	Question is unanswered;
Negative Marks	:	0	In all other cases.

Section – C: 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	:	0	In all other cases.

Physics

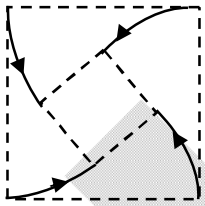
PART – I

SECTION – A
(One Options Correct Type)

*This section contains **FOUR (04)** questions. Each question has **FOUR** options (A), (B), (C) and (D). **ONLY ONE** of these four options is the correct answer.*

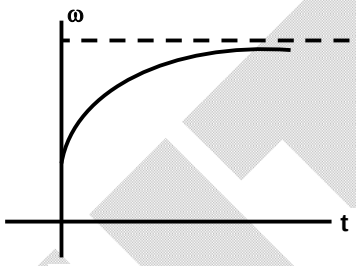
1. The length of the arms of a faulty physical balance are 45 cm and 55 cm and salesman weighs out twice to a customer articles of mass 20 kg by putting weights first in one pan and then in the other. Choose the correct option.
(A) Customer got 404 g more (B) Customer got 404 g less
(C) Customer got 808 g more (D) Customer got 808 g less

2. Consider four insects on a horizontal table, at rest, forming a hypothetical square of side L. Each insect starts approaching the adjacent insect (following a cyclic order) with constant speed u each:

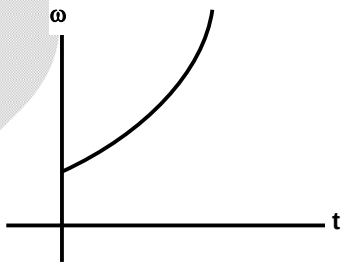


The hypothetical square is rotating with angular velocity $\omega(t)$. Where t is time. Take t = 0 to be the initial situation. Choose the correct graph for ω vs t, until the insects meet.

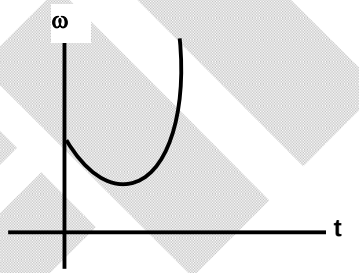
(A)



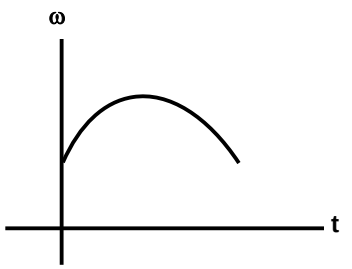
(B)



(C)



(D)



3. In a meter bridge, if we use 100 Ω and 200 Ω resistances in left and right gap respectively we get null deflection at l_1 = 33 cm from left end. If we interchange the resistances, the null deflection was found to be at l_2 = 67 cm from left end. The end corrections at left and right ends are α and β respectively. Then
(A) $\alpha = 1\,\text{cm}, \beta = 1\,\text{cm}$ (B) $\alpha = 2\,\text{cm}, \beta = 1\,\text{cm}$
(C) $\alpha = 1\,\text{cm}, \beta = 2\,\text{cm}$ (D) $\alpha = 0\,\text{cm}, \beta = 1\,\text{cm}$

4. A point isotropic sound source is located on the perpendicular to the plane of ring drawn through the centre O of the ring. The distance between point O and the source is L = 1.00 m, the radius of the ring is R = 0.50 m. The value of mean energy flows across the area enclosed by the ring. Given that the intensity of sound at point O is equal to I_o= 30 $\mu W/m^2$ is.

(A) 5 μW (B) 15 μW
(C) 20 μW (D) 25 μW

SECTION – A
(One or More than one correct type)

*This section contains **THREE (03)** 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. Sound wave travel from a point A at absolute temp T_1 to a point B at absolute temperature T_2 in a time t. The air temperature increases linearly from T_1 and T_2. The speed of sound varies with absolute temperature T as $v = K\sqrt{T}$ where K is positive constant. Then

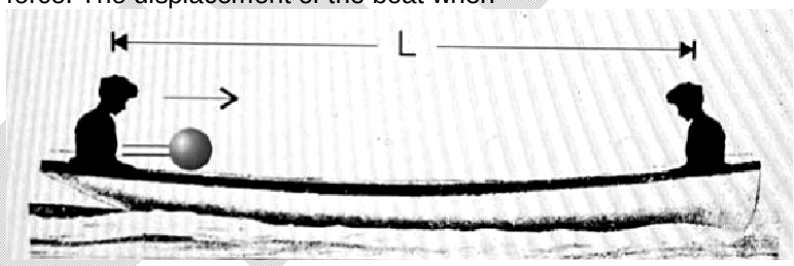
(A) Distance between A and B is $Kt\left(\sqrt{T_1}+\sqrt{T_2}\right)$

(B) The distance average velocity over the distance AB is $\frac{2K}{3}\frac{\left(T_2^{3/2}-T_1^{3/2}\right)}{\left(T_2-T_1\right)}$

(C) The distance average velocity over the distance AB is $\frac{K\left(\sqrt{T_1}+\sqrt{T_2}\right)}{2}$

(D) The time average velocity over the distance AB is $\frac{K\left(\sqrt{T_1}+\sqrt{T_2}\right)}{2}$

6. Laila and Majnu are on a boat for a picnic. The boat is initially at rest. Laila has a big watermelon which she throws towards Majnu. The man catches the melon and eats half of it. He throws back the remaining half to Laila. She eats the half of the melon that she receives and throws the remaining part to Majnu. Majnu again eats half of what he receives and return the remaining part back to Laila. This continues till the melon lasts. The two are sitting at the two ends of the boat which has a length L. Combined mass of the boat and the two lovers is Mo and the mass of the water melon is M. Assume that the boat can move horizontally on water without any resistive force. The displacement of the boat when



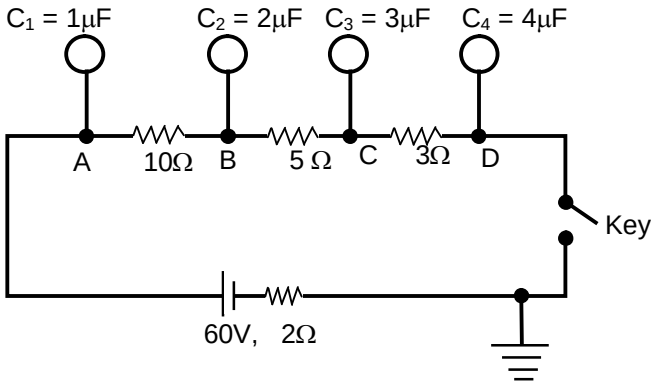
(A) Watermelon gets finished is $\frac{L}{6}$ if $M_o = 3M$

(B) Watermelon gets finished is $\frac{L}{9}$ if $M_o = 5M$

(C) Immediately after Laila eat for the first time is $\frac{L}{6}$ if $M_o = 3M$

(D) Immediately after Laila eat for the first time is $\frac{L}{12}$ if $M_o = 5M$

7. The given circuit is consisting of a battery (60V, 2Ω), three resisters of given resistance and four conducting spheres of given capacitance. Distance between spheres is much larger than their radius. Choose the correct options:



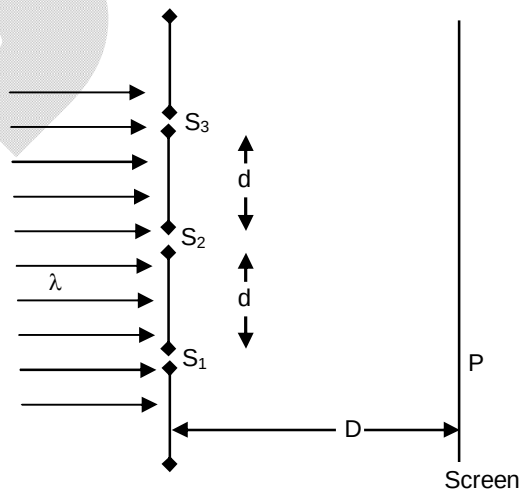
(A) Total charge accumulated on all spheres is 117 μF.
(B) Charge on sphere connected to point B is 48 μC.
(C) Current passing through battery is 12A. After shortening 5 Ω resister.
(D) Total charge accumulated on all spheres is 112 μC. After shortening 5 Ω resister.

SECTION – B

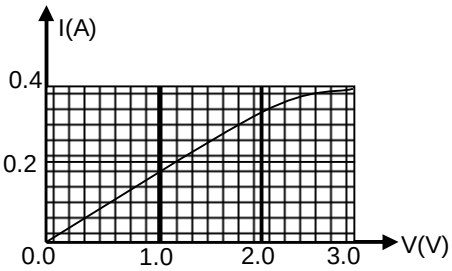
(Numerical Answer Type)

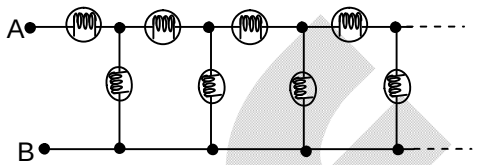
*This section contains **SIX (06)** Numerical based questions. The answer to each question is a **NON-NEGATIVE INTEGER VALUE**.*

8. Three slits S_1, S_2 and S_3 of intensities I_0, $2I_0$ and $4I_0$ respectively as shown. Point P and S_1 are at same level. If $\lambda << d << D$ and $S_2P - S_1P = \frac{\lambda}{4}$, then net intensity at point P is n I_0. Find value of n.

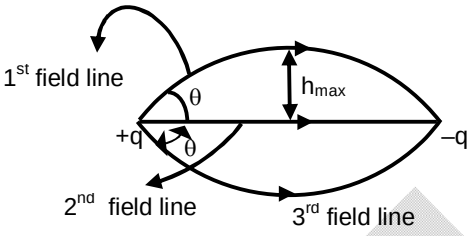


9. In the first figure is shown the current-voltage characteristics of an incandescent lamp. This lamp can withstand a maximum voltage 3.0 V and maximum current of 0.4A. In the second figure is shown an infinite network consisting of identical lamps of this kind. If maximum voltage can be applied between the terminals A and B is X volt. Find value of [X] where [ ] is greatest integer function. Considering no lamp gets damaged. (Use $\sqrt{5} \approx 2.2$)



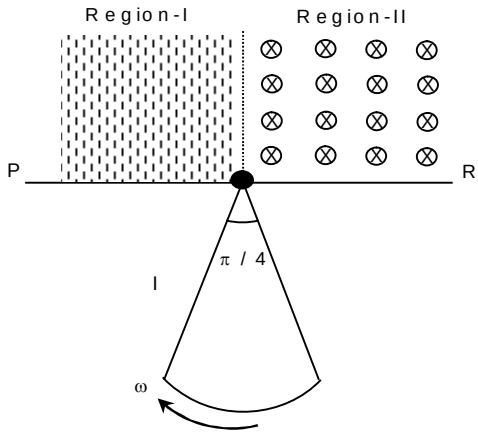


10. Two charges +q and –q are placed at some distance and separated by distance d as shown in figure. 1st field line which makes angle $\theta = 60^o$ with the 2nd field line has the maximum separation of h_{max} from the 2nd field line. The length of 2nd field line joining +q and –q is 6 m. If the value of h_{max} is $\sqrt{n}$ metre. Then find n.

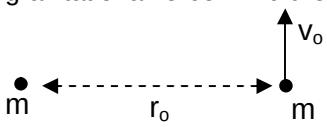


11. A very long solid conducting cylinder (radius R) carries a current/along its length which is distributed uniformly across its cross-section. Consider, P(r) represents pressure due to magnetic force at axial distance r. If $\frac{P(r=0)}{P\left(r=\frac{2R}{3}\right)} = \frac{9}{n}$. Find n.

12. A wire frame in the form of a part of circle (sector) of radius ℓ & resistance R is free to rotate about an axis passing through O and perpendicular to plane of paper as shown in figure. The angle of the sector is $\pi/4$ and it is rotating with constant angular velocity ω as shown. Above line PR uniform magnetic field of magnitude B exist in the direction perpendicular to plane of paper. In region I field is outward while in region II field is inward. If total thermal energy dissipated in one cycle is $\frac{3}{p}\pi\omega^q R^r B^s L^t$. Then value of $p+q+r+s+t$ is



13. Two equal masses are situated at a separation r_o. One of them is imparted a velocity $v_o = \sqrt{\frac{Gm}{r_o}}$ perpendicular to the line joining them both are free to move. treating motion only under mutual gravitational force. Find the ratio of maximum and minimum separation between them.

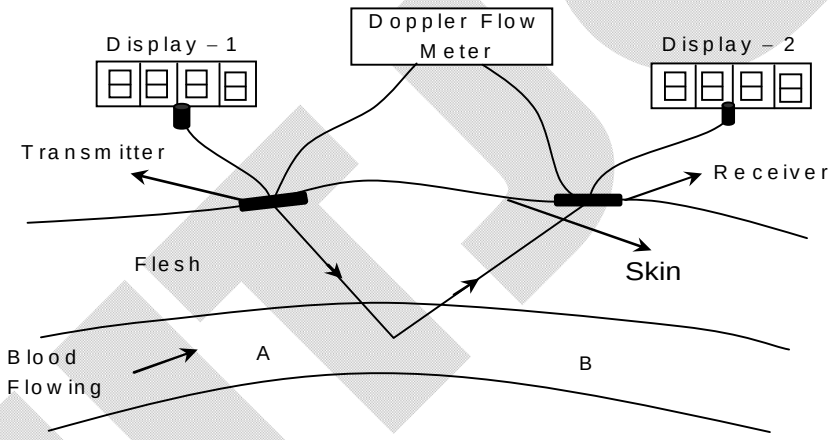


SECTION – C
(Numerical Answer Type)

*This section contains **TWO (02) paragraphs.** Based on each paragraph, there are **TWO (02)** questions of numerical answer type. The answer to each question is a **NUMERICAL VALUE (XXXXX.XX).** If the numerical value has more than two decimal places, truncate/round-off the value to **TWO** decimal places.*

Paragraph for Question Nos. 14 and 15

Doppler flow meter is a medical device whose working is based on doppler effect.
This device measures the speed of blood flow, using transmitting and receiving elements that are placed directly on the skin as shown in figure.



The transmitter sends the signal (sound wave), which when comes into the interaction with the red blood cells a part of these waves has been reflected, these reflected sound waves has different frequency as compared to frequency of original sound wave, this is due to the fact that blood cells are moving with certain velocity and due to doppler effect frequency of reflected wave changes.

The receiver detects the reflected wave and measure its frequency using electronic counter. The transmitted wave frequency is displayed on display 1 while reflected wave frequency is displayed on display 2. From the change in frequency the speed of blood flow can be determined. Doppler flow meter can be used to locate regions where blood vessels have narrowed, since greater flow speeds occur in the narrowed regions due to continuity equation. Depending on various factors like absorption of wave by flesh, location of transmitter and receiver, how they have been placed on skin, heart beat etc., a simple formula for the speed of blood flow can be derived. Here we are writing approximate expression.

$$v = \frac{v_{wave} \times \Delta f}{v_{wave} - 400} \times 10^{-4} \text{ m/s}$$

where $v \rightarrow$ speed of blood flow

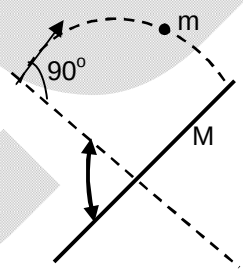
$v_{wave} \rightarrow$ speed of sound wave in flesh
$\Delta f \rightarrow$ difference in reading of two displays.

14. For reflection approximately at A, if the difference in transmitter and receiver frequency is 800 Hz, while the frequency emitted by transmitter is 6.02 MHz. The reading of display -2 is _____ KHz?

15. If the blood is flowing at 1.2 cc/s and cross section area of blood vessel at B is 2×10^{-5} m^2, the ratio of velocity of blood at B to A is _____. (Take speed of blood flow at A = 0.12 m/s)

Paragraph for Question Nos. 16 and 17

A homogeneous bar of mass M rotates uniformly in alternating directions to and fro around the horizontal axis going through its center, while a ball of mass ma bounces between the ends of the bar in vertical plane as shown in the figure. The angular velocity of the bar is $\pm\frac{2\pi}{3}$ rad sec^{-1} and the time period of the motion of the ball is 2 second. (The mechanical loss and the duration of the collisions are negligible)



Use: $\left(\sqrt{3}=1.73,\ \pi=3.14\right)$

16. The velocity of the ball at the highest point of its path is _____m/s.

17. The ratio of $\frac{m}{M}$ is _____.

Chemistry

PART – II

SECTION – A
(One Options Correct Type)

*This section contains **FOUR (04)** questions. Each question has **FOUR** options (A), (B), (C) and (D). **ONLY ONE** of these four options is the correct answer.*

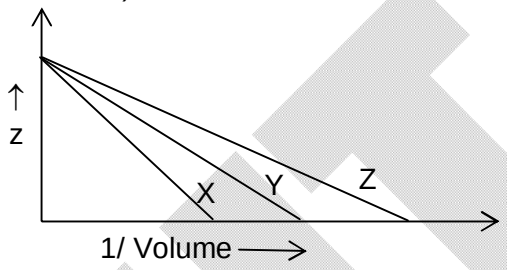
18. Which of the given statement is/are correct for the given reaction knowing the fact that higher the number of hyperconjugative structures higher the stability of carbocation

$$(CD_3)_3C^+ + (CH_3)_3CH \rightleftharpoons (CH_3)_3C^+ + (CD_3)_3CH$$

(A) The equilibrium constant should be higher than one for the above reaction
(B) The equilibrium constant should be lower than one for the above reaction
(C) $(CD_3)_3C^+$ will be more stable than $(CH_3)_3C^+$ due to higher electron releasing nature of deuterium than hydrogen
(D) $(CD_3)_3C^+$ will be more stable than $(CH_3)_3C^+$ due to presence of stronger C–D bond than C–H bond

19. Which of the following statements is true?
(A) Alkali metal hydride in aqueous medium is alkaline.
(B) BeH_2 has less reducing tendency than MgH_2.
(C) The melting point of LiCl, LiI, KF, CsCl and NaCl can be arranged as
$LiI < LiCl < NaCl < KF < CsCl$
(D) All of the above

20. In the low pressure region, the following graph was observed for different gases X, Y and Z. (1 mole each)



Which of the following is incorrect?
(A) Liquefaction order of the gases is X > Y > Z.
(B) As the temperature increases, the change in slope of the gases is of the order X = Y = Z.
(C) If molar volume tends to zero, all gases behave ideally.
(D) Force of attraction is dominating in X, Y and Z.

21. An important mineral of chromium is "Chromite ($FeCr_2O_4$)," chromium metal is extracted from chromite or by the following process:

$$FeCr_2O_4 + NaOH + air \longrightarrow (A) + Fe_2O_3$$

$$(A) + (B) \longrightarrow Na_2Cr_2O_7$$

$$Na_2Cr_2O_7 + [X] \longrightarrow Cr_2O_3$$

$$Cr_2O_3 + [Y] \xrightarrow{\Delta} Cr$$

Choose the correct option for the compounds A, B, X and Y:

	[A]	[B]	[X]	[Y]
(A)	Na_2CrO_4	HCl	H_2	C
(B)	Na_2CrO_4	H_2SO_4	Al	C
(C)	Na_2CrO_4	H_2SO_4	C	Al
(D)	$HCrO_4$	Na_2SO_4	C	Al

SECTION – A

(One or More than one correct type)

*This section contains **THREE (03)** 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).*

22. Identify the correct statements of the following:
    (A) the general formula of chain and cylic silicates is $(SiO_3)_n^{2n-}$
    (B) correct order of acid strength of the following oxides is:
    $Cl_2O_7 > SO_2 > P_4O_{10}$
    (C) hypophosphorus acid < phosphorus acid < phosphoric acid (increasing acid strength)
    (D) BF_3 is thermodynamically more stable than BCl_3

23. In the electrolysis of a 27.372 lit $CuSO_4$ solution, there are two possible reactions at anode
    (i) $Cu \longrightarrow Cu^+ + 2e^-$ and (ii) $2H_2O \longrightarrow O_2 + 4H^+ + 4e^-$
    A current of 1.0 A is passed for 2.0 hrs. The loss in mass of the Cu anode was 1.50 g. Now, select the correct statement (s) of the following (At. wt. of Cu = 63.5 g mol^{-1}).
    (A) 0.07461 mol of electrons are passed through the solution during entire electrolysis
    (B) 153.4 ml of O_2(g) is liberated at STP at anode
    (C) Fraction of current used in the production of Cu^{2+} ions = 0.633
    (D) pH around anode drops to 3

24. Which of the following is mismatched:
    (A) H_3BO_3 → Central atom is sp^2 hybridized
    (B) H_3PO_4 → At least two atoms are sp^3 hybridized
    (C) H_2SO_4 → Total lone pairs in the molecule exceeds 6
    (D) $Cr_2O_7^{2-}$ → All Cr – O bond lengths are equal

SECTION – B

(Numerical Answer Type)

*This section contains **SIX (06)** Numerical based questions. The answer to each question is a **NON-NEGATIVE INTEGER VALUE**.*

25. A 150 ml solution of I_2 is divided into two unequal parts. I part reacts with hypo solution in acidic medium. 15 ml of 0.4 M hypo was consumed. II part was added with 100 ml of 0.3 M NaOH solution. Residual base required 10 ml of 0.3 M H_2SO_4 solution for complete neutralization. Calculate the value of "10 times" the initial concentration of I_2?

26. A glow-worm of mass 5.0 g emits red-light (650 nm) with power of 0.10 W entirely in the backward direction. What velocity (v) in m/sec, will it have accelerated to after 10 years, if released in free space (and assumed to live). Report the answer as (v/7).

27. In the monochlorination of 3- methylpentane, let x be the number of pairs of isomers, which exist as enantiomers, y be the number of pairs of isomers, which exist as diastereomers, z be the number of isomers, which are achiral. Calculate the value of (x + y + z).

28. To 250 ml of water, x g of acetic acid is added. If 11.5% of acetic acid is dissociated, the depression in freezing point comes out 0.416. What will be the value of x if K_f (water) = 1.86 K kg^{-1} mol^{-1} and density of water is 0.997 g ml^{-1}.

29. An unsaturated hydrocarbon X($C_{14}H_{18}$) on complete hydrogenation give Y($C_{14}H_{26}$). X on reductive ozonolysis gives only two different products. None of the product contains more than two oxygen atoms per molecule. What will be the sum of statements which may be applicable to compound X?

(i)	Double bond equivalent is six	1
(ii)	Only one ring is present in the compound (X)	2
(iii)	Two rings are present in the compound (X)	3
(iv)	Triple bond may be present in the compound (X)	4

30. CH_3COCl is used to detect the number of amino groups in the organic compounds. When a compound of molecular mass 175 is acetylated, gives a compound of molecular mass 385. The number of amino groups in the compound is _____.

SECTION – C
(Numerical Answer Type)

*This section contains **TWO (02) paragraphs.** Based on each paragraph, there are **TWO (02)** questions of numerical answer type. The answer to each question is a **NUMERICAL VALUE (XXXXX.XX).** If the numerical value has more than two decimal places, truncate/round-off the value to **TWO** decimal places.*

Paragraph for Question Nos. 31 and 32

A closed rigid bulb contains 0.01 mole of inert helium gas and a sample of solid white ammonium chloride, NH_4Cl. Assume that the volume of the solid NH_4Cl is negligible compared to the volume of the bulb. The pressure of He is measured at 300 K and is found to be 114 mm Hg. The bulb is then heated to 600 K. All the NH_4Cl decomposes to $NH_3(g)$ and HCl(g). The final total pressure in the bulb after complete decomposition of the solid is 908 mm Hg. Assume ideal behaviour for all gases.

31. The approximate mass (in gram) of NH_4Cl present initially in the bulb is

32. The capacity (volume in litre) of bulb is

Paragraph for Question Nos. 33 and 34

As a result of the isobaric heating by ΔT = 72 K, one mole of a certain ideal gas obtains an amount of heat Q = 1.60 kJ.

33. The work performed (in kJ) by the gas is

34. The increment of its internal energy (in kJ) is

Mathematics

PART – III

SECTION – A
(One Options Correct Type)

*This section contains **FOUR (04)** questions. Each question has **FOUR** options (A), (B), (C) and (D). **ONLY ONE** of these four options is the correct answer.*

35. Value of $\sum_{r=1}^{10} {}^{15}C_r \cdot {}^{35}C_{10-r}$ is

(A) ${}^{10}C_{10}$ (B) ${}^{50}C_{10} - {}^{35}C_{10}$

(C) ${}^{40}C_{10}$ (D) ${}^{40}C_{10} - 1$

36. Let $f(x) = \int x^{\sin x}\left(1 + x\cos x \ln x + \sin x\right)dx$ and $f\left(\frac{\pi}{2}\right) = \frac{\pi^2}{4}$. Find the value of $\cos\left(f(\pi)\right)$.

(A) $\frac{\pi}{2}$ (B) π

(C) 0 (D) 1

37. Find unit vector which is orthogonal to vector $3\hat{i} + 2\hat{j} + 6\hat{k}$ and is coplanar with vectors $2\hat{i} + \hat{j} + \hat{k}$ and $\hat{i} - \hat{j} + \hat{k}$ is

(A) $\frac{2\hat{i} - 6\hat{j} + \hat{k}}{\sqrt{41}}$ (B) $\frac{2\hat{i} - 3\hat{j}}{\sqrt{13}}$

(C) $\frac{3\hat{j} - \hat{k}}{10}$ (D) $\frac{4\hat{i} + 3\hat{j} - 3\hat{k}}{\sqrt{34}}$

38. If $S_n = \sum_{r=1}^{n} \frac{2r+1}{r^4 + 2r^3 + r^2}$, then S_{10} equals

(A) 1 (B) $\frac{121}{120}$

(C) $\frac{120}{121}$ (D) $\frac{99}{100}$

SECTION – A
(One or More than one correct type)

*This section contains **THREE (03)** 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).*

39. If $f(x) = \left||x-1| + |x-3| - |2x-1|\right| + \left||x-1| + |x-3| + |2x-1|\right|$, then

(A) f(x) is non-differentiable at x = 1 (B) f(x) is non-differentiable at $x = \frac{3}{2}$

(C) f(x) has minimum value is 2 (D) x = 1 is point local minima

40. If $\int \cos 2018x \sin^{2016} x\,dx = f(x) + c$, where f(0) = 0, then

(A) $\int_0^x f(x)dx = f(\pi)$ (B) $f\left(\frac{\pi}{4}\right) = \frac{1}{2^{1009}} \cdot \frac{1}{2017}$

(C) $f\left(\frac{\pi}{4}\right) = \frac{1}{(2018)2^{1009}}$ (D) f(x) is odd function

41. Let f(x) be a continuous function which takes positive values for $x \geq 0$ and satisfy $\int_0^x f(t)dt = x\sqrt{f(x)}$ with $f(1) = \frac{1}{2}$. Then

(A) f(x) is increasing function in domain (B) f(x) is decreasing function in domain

(C) $f\left(\sqrt{2}+1\right) = \frac{1}{2\sqrt{2}}$ (D) $f\left(\sqrt{2}+1\right) = \frac{1}{4}$

SECTION – B

(Numerical Answer Type)

*This section contains **SIX (06)** Numerical based questions. The answer to each question is a **NON-NEGATIVE INTEGER VALUE**.*

42. The value of $\sum_{r=1}^{5}\left(x^r + \frac{1}{x^r}\right)$, where $x^2 + x + 1 = 0$, is

43. Number of points, where f(x) = maximum $\left\{\text{sgn}(x), -\sqrt{9-x^2}, x^3\right\}$ is continuous but not differentiable.

44. The distance of point $(1,-2,3)$ from plane x – y + z = 5 measured parallel to line $\frac{x}{2} = \frac{y}{3} = \frac{z-1}{-6}$ is

45. If $f(x) = \left[9^x - 3^x + 1\right] \forall x \in (-\infty, 1)$ ([.] denotes the greatest integer function) then number of elements in range of f(x) are

46. The minimum number of times a fair coin needs to be tossed, so that the probability of getting at least two heads is at least 0.96 is

47. The area bounded by curve y = x + sin x and its inverse function between the ordinates x = 0 and $x = 2\pi$ is 4α find α?

SECTION – C

(Numerical Answer Type)

*This section contains **TWO (02) paragraphs.** Based on each paragraph, there are **TWO (02)** questions of numerical answer type. The answer to each question is a **NUMERICAL VALUE (XXXXX.XX).** If the numerical value has more than two decimal places, truncate/round-off the value to **TWO** decimal places.*

Paragraph for Question Nos. 48 and 49

If $\left[\vec{a}\ \vec{b}\ \vec{c}\right] = \vec{a}.\left(\vec{b} \times \vec{c}\right)$ (scalar triple product) and linearly dependent vectors are coplanar vectors,

48. If $\vec{u}(x) = x\hat{i} + (\sin x)\hat{j} + (1+\sin x)\hat{k}$, $-\vec{v}(x) = \hat{i} + \cos x\left(\hat{j} + \hat{k}\right)$ and $\vec{w}(x) = \sin x\left(\hat{j} + \hat{k}\right)$, all are linearly dependent vectors for $x = \alpha$, then $\left(\frac{2\alpha}{\pi}\right)^2$ is divided by 8 leaves remainder ……

49. If $f(x) = (\cos x)\hat{i} + (\sin x)\hat{j} + (\cos 2x)\hat{k}$, $g(x) = (\tan x)\hat{i} + (\sin 3x)\hat{j} + (\cos 4x)\hat{k}$ and $h(x) = (\cos 3x)\hat{i} + (\sin 5x)\hat{j} + (\cos 6x)\hat{k}$ are three variable vectors given, then $\int_0^{\pi}[f(x).g(x),h(x)]dx$, where [.] denotes scalar triple product, is equal to

Paragraph for Question Nos. 50 and 51

Consider the curve $R = \{(x, y) \in R \times R : ax^2 + 2hxy + by^2 + 2gx + 2fy + c = 0\}$ represents 2D curve. Then,

50. If x + y = 3 is tangent at (2, 1) on hyperbola, intersects asymptotes at A and B such that AB = $8\sqrt{2}$ and if centre of hyperbola is $(-1,-1)$, then least possible value of sum of semi-transverse axis and semi-conjugate axis is $p\sqrt{q}$, where HCF (p, q) = 1 and $\sqrt{q}$ is irrational number. Then, $\left(\frac{p}{q}\right)$ is equal to

51. If $x^2 + y^2 = 16$ is director circle of locus of centre of a moving ellipse touches both the axes in first quadrant, then if major axis and minor axis are not fixed. Then maximum value of product of semi-major and semi-minor axis is