FIITJEE

ALL INDIA TEST SERIES

FULL TEST – V

JEE (Main)-2025

TEST DATE: 15-01-2025

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**
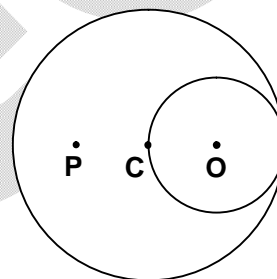
SECTION – A
(One Options Correct Type)

*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. Given potential difference $V = (8 \pm 0.5)V$ and current $I = (2 \pm 0.2)A$. The value of resistance R in Ω is
   (A) $4 \pm 16.25\%$ (B) $4 \pm 6.25\%$
   (C) $4 \pm 10\%$ (D) $4 \pm 3.75\%$

2. Light of frequency 7.21×10^{14} Hz is incident on metal surface. Electrons with maximum speed of 6×10^5 m/s are ejected from the surface. The threshold frequency of incident light in experiment is $N \times 10^{14}$ Hz. Find out N.
   (A) 2.74   (B) 4.49
   (C) 3.74   (D) 5.74

3. Consider a point P at a distance equal to one third of the fringe width from centre of screen in a Young's double slit experiment. Find out ratio of maximum intensity on screen and intensity at P.
   (A) 3   (B) $\sqrt{2}$
   (C) 6   (D) 4

4. Four electromagnetic wave is given. γ rays, microwaves, infrared rays and ultraviolet rays. Which option give correct representation of given electromagnetic wave according to decreasing order of wavelength.
   (A) γ rays, micro waves, infrared rays, ultraviolet rays
   (B) ultraviolet rays, γ rays, micro wave, infrared
   (C) infrared, microwave, ultraviolet, γ rays
   (D) microwave, infrared, ultraviolet, γ rays

5. A small town gets power of 1200 kW at 220 V, is situated 20 km away from on electric plant generating electrical power at 440 V. The resistance of two wire lines carrying power is 0.5 Ω/km. The town gets the power from line through a 4000 – 220 V step down transformer at a substation in the town. Calculate line power loss.
   (A) 1800 W   (B) 80 W
   (C) 200 W   (D) 500 W

6. A circular coil expands radially in a region of magnetic field and no electromotive force is produced in the coil. This can be because
   (a) The magnetic field is constant
   (b) Direction of magnetic field is in the same plane as of the circular coil and it may or may not vary
   (c) The magnetic field is perpendicular to plane of coil and its magnitude is decreasing.
   Find correct option.
   (A) a, b, c   (B) b, c
   (C) a, c   (D) a, c

7. Three lens and position of object 'O' is shown in the figure. Focal length of lens A, B, C are +10cm, −10cm and 30 cm respectively. Final image is real and at distance 30 cm from lens C. Separation between lens A and B is
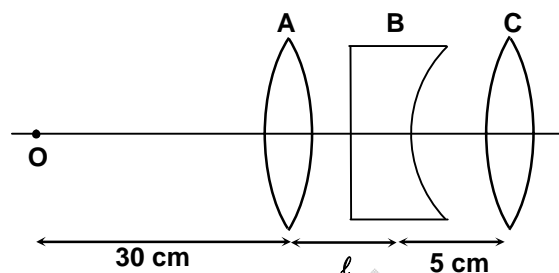
(A) 10 cm
(B) 20 cm
(C) 5 cm
(D) can't be calculated from given information

8. An air bubble of radius 2 mm is in liquid of surface tension 0.075 N/m and density 10^3kg/m^3. The bubble is at a depth of 10.0 cm below the free surface. By what amount is the pressure inside the bubble is greater than that of atmospheric pressure (take g =9.8 m/s^2)
(A) 1055 Nm^{-2}
(B) 1130 Nm^{-2}
(C) 1025.5 Nm^{-2}
(D) 1600 Nm^{-2}

9. From sphere of mass 8M and radius R a sphere of radius $\frac{R}{2}$ is removed. Separation between centre of sphere and centre of cavity is $\frac{R}{2}$. What is gravitational field at distance $\frac{R}{2}$ from centre of sphere opposite to centre of cavity?

(A) $\frac{27}{2}\frac{GM}{R^2}$
(B) $\frac{3GM}{R^2}$
(C) $\frac{11}{3}\frac{GM}{R^2}$
(D) $\frac{4GM}{R^2}$

10. An object is floating in a liquid with its $\frac{1}{10}$th volume inside liquid. Now whole system is accelerated upward with acceleration $\frac{g}{3}$. The fraction of volume of object inside liquid will be (in steady state)
(A) More than $\frac{1}{10}$th of its volume
(B) Less than $\frac{1}{10}$th of its volume
(C) Equal to $\frac{1}{10}$th of its volume
(D) Buoyancy on object will remain unchanged

11. A circular disc of radius B has hole of radius A, which coincides with its centre. If mass per unit area of the disc varies as $\frac{\sigma_0}{r}$, where r is distance from centre of disc. Then moment of inertia of disc about its diameter is
(A) $\frac{\pi\sigma_0}{3}\left[B^3 - A^3\right]$
(B) $\frac{3\pi\sigma_0}{4}\left[B^2 - A^2\right]$
(C) $\frac{\pi\sigma_0}{6}\left[B^3 - A^3\right]$
(D) $\frac{2\pi\sigma_0}{3}\left[B^3 - A^3\right]$

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12. Six stars are present at corner of regular hexagon having side length ℓ. If mass of each star is M. Find gravitational force on each star

    (A) $\dfrac{GM}{4\ell^2}$

    (B) $\dfrac{(\sqrt{3}-2)}{4}\dfrac{GM}{\ell^2}$

    (C) $\dfrac{(\sqrt{3}-4)}{4}\dfrac{GM}{\ell^2}$

    (D) $\dfrac{3GM}{4\ell^2}$

13. A steel has Young's modulus $Y = 2 \times 10^{11}$ Nm^{-2} and coefficient of linear expansion $\alpha = 10^{-5}$ C^{-1}. Length of steel rod and its area of cross sectional is 2m and 1 cm^2. Rod is heated from 0°C to 200°C without being allowed to extend. The tension produced in rod, and thermal strain is given by

    (A) 2×10^4N, zero

    (B) 4×10^4N, 2×10^{-3}N

    (C) 4×10^4N, zero

    (D) 2×10^4N, 2×10^{-3}N

14. A block is attached to a horizontal spring. The block is pulled to a distance x = 10 cm from equilibrium position (at x = 0) on a frictionless horizontal surface. Block is released from rest. The energy of block at x = 5 cm is 0.25 J. The spring constant of spring is …..
    (A) 25 N/m
    (B) 50 N/m
    (C) 10 N/m
    (D) 30 N/m

15. An object is projected with a velocity of 20 m/s making on angle of 45° with vertical. The equation of trajectory is $Y = \alpha x - \beta x^2$ where y is in vertical and x is in horizontal. α and β are positive constant. The ratio of $\alpha : \beta$ is
    (A) 1 : 15
    (B) 15 : 1
    (C) 40 : 1
    (D) 20 : 1

16. A block of mass 10 kg lies on rough inclined plane, making angle $\theta = 37°$ horizontal. Force of 60 N is applied on block parallel to inclined plane in upward direction as shown is diagram. The reaction force on block is in which direction

    (A) OA
    (B) OB
    (C) OC
    (D) OD

17. A particle is in simple harmonic motion with amplitude 6 cm. Its speed is tripled at the instant when particle is at a distance of 4 cm from equilibrium position. The new amplitude of motion will be
    (A) 12 cm
    (B) 7 cm
    (C) 14 cm
    (D) $\sqrt{13}$ cm

18. A body cools in 7 hr from 60° to 40° by obeying Newton's law of cooling. The temperature of body after next 7 hour will be (temperature of surrounding is 10°C)
    (A) 32°C
    (B) 36°C
    (C) 30°C
    (D) 28°C
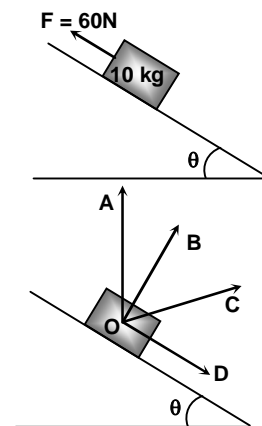
19. Find out the value of mean free path (λ) for oxygen molecules at temperature 27°C and pressure 1.01×10^5 Pa. Assume the molecule diameter is 0.3 nm. Gas is ideal ($k = 1.38 \times 10^{-23}$ J/k)
   (A) 86 nm
   (B) 32 nm
   (C) 58 nm
   (D) 102 nm

20. A beam of light consisting of two wavelength 6500Å and 5200Å is used to obtain interference fringes in Young's double slit experiment. m^{th} bright fringe due to wavelength 6500Å coincides with P^{th} bright fringe due to 5200Å at minimum distance from central maxima then
   (A) m = 4, P = 5
   (B) m = 10, P = 8
   (C) m = 8, P = 10
   (D) m = 5, P = 4

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. The displacement equation of two interfering waves given by

$$y_1 = 2\sin\left(400\pi + \frac{\pi}{3}\right) \text{cm}$$

$$y_2 = 3\left[\sin 400\pi t + \sqrt{3}\cos 400\pi t\right] \text{cm}$$

The amplitude of resultant wave is N cm. Find the value of N.

22. The velocity (in m/s) of a particle executing SHM varies with displacement x(in m), which is given by equation $16v^2 = 100 - x^2$. Find out ratio of amplitude of oscillation and maximum velocity.

23. Force is applied as shown in the figure. Find minimum coefficient of friction between block and ground so that system remains at rest is $\dfrac{N}{10}$. Find out N.
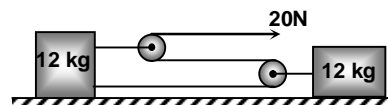
24. Velocity of particle moving in a curvilinear path in horizontal xy plane varies with time as $\vec{v} = 2t\hat{i} + t^2\hat{j}$ m/s (t is time in sec). At t = 1 sec radius of curvature of the path is $\dfrac{a\sqrt{b}}{2}$ m. Find $\dfrac{a+4}{b}$.

25. A vernier callipers has 20 division on the vernier scale which coincide with 19 division on main scale. The least count of the instrument is 0.1 mm. The main scale division in mm is N. Find the value of N.
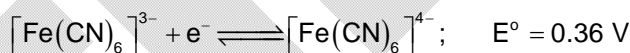
Chemistry   **PART – B**

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. o-Aminobenzoic acid is treated with $NaNO_2$ and dil. H_2SO_4 in cold condition and the resulting solution is then reacted with N, N-dimethylaniline to give a red coloured dye called methyl red. The structure of methyl red is,

    (A)

    (B)

    (C)

    (D)
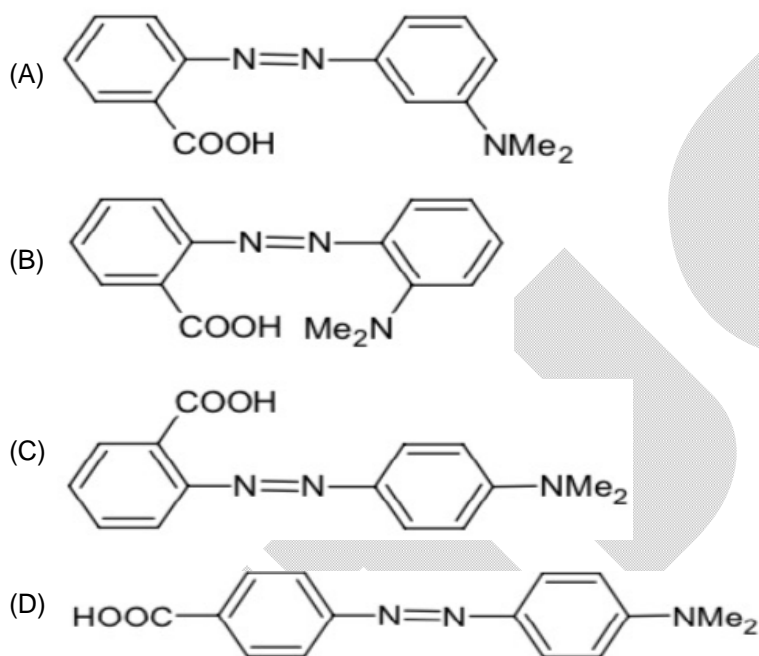
27. Given the overall formation constant of the $\left[Fe(CN)_6\right]^{4-}$ ion from Fe^{2+} ion as 10^{35} and the standard potential for the half reactions,

    $Fe^{3+} + e^- \rightleftharpoons Fe^{2+}$;　　　　　　　$E° = 0.77$ V

    $\left[Fe(CN)_6\right]^{3-} + e^- \rightleftharpoons \left[Fe(CN)_6\right]^{4-}$;　$E° = 0.36$ V

    Calculate the overall formation constant of the $\left[Fe(CN)_6\right]^{3-}$ ion from Fe^{3+} ion.
    (A) 8.59×10^{41} (B)　　　　　　　7.59×10^{41}
    (C) 5.59×10^{41} (D)　　　　　　　9.59×10^{41}

28. If 20 mL of ethanol (density = 0.7893 g/mL) is mixed with 40 mL water (density = 0.9971 g/mL) at 25^oC, the final solution has density of 0.9571 g/mL. Calculate the percentage change in total volume of mixing.
    (A) 3.1　　　　　　　　　　　(B) 2.5
    (C) 6.2　　　　　　　　　　　(D) 3.9

29. What is the shape of the cationic part of solid Cl_2O_6?
    (A) Distorted octahedral　　　　　(B) Square pyramidal
    (C) Square planar　　　　　　　　(D) Bend shape

30. Which compound does not dissolve in hot dil. HNO_3?
    (A) HgS (B) PbS
    (C) CuS (D) CdS

31. Which of the following ionic radius ratio will have highest value?

    (A) $\dfrac{H^-}{F^-}$ (B) $\dfrac{H^-}{Cl^-}$

    (C) $\dfrac{H^-}{Br^-}$ (D) $\dfrac{H^-}{I^-}$

32. What is the free energy change (ΔG) when 1.0 mole water at 100^oC and 1 atm pressure is converted into steam at 100^oC and 1 atm pressure?
    (A) 80 cal (B) 540 cal
    (C) 620 cal (D) zero

33. A gas mixture 3.67 L in volume contain C_2H_4 and CH_4 is proportion of 2 : 1 by moles and is at 25°C and 1 atm. If the $\Delta H_c\left(C_2H_4\right)$ and $\Delta H_c\left(CH_4\right)$ are – 1400 and – 900 kJ/mol find heat evolved on burning this mixture:
    (A) 20.91 Kj (B) 50.88 kJ
    (C) 185 kJ (D) 160 kJ

34. Which of the following biomolecules is insoluble in water?
    (A) $\alpha-$keratin (B) Haemoglobin
    (C) Ribonuclease (D) Adenine

35. In which of the following reactions, alcohol is formed as product gives positive iodoform test?

    (A) $\xrightarrow[\text{(ii) HOH/H}^+]{\text{(i) PhMgBr}}$
    (B) $H_3C-CH_2-CH=O$ $\xrightarrow[\text{(ii) HOH/H}^+]{\text{(i) MeMgBr}}$

    (C) $\xrightarrow[\text{(ii) HOH/H}^+]{\text{(i) PhMgBr(excess)}}$
    (D) $\xrightarrow[\text{(ii) HOH/H}^+]{\text{(i) PhMgBr(excess)}}$

36. Among the following, the chiral compound is

    (A) P (B) Q
    (C) R (D) S

37.   The correct structures and names of 'Z' in the following:
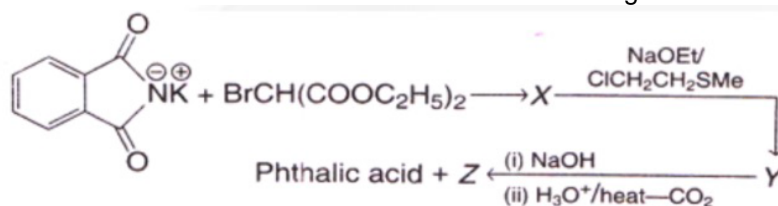
(A)
$$Z = HOOC-\underset{\underset{NH_2}{|}}{CH}-CH_2CH_2SMe$$

(B) Z = Methionine

(C) Z = Alanine

(D) Z = Cysteine

38.   The photon emitted due to electronic transition from 5th excited state to 2nd excited state in Li^{2+}, is used to excite He^+ already in first excited state. He^+ ion after absorbing the photon reaches in an orbit having total energy equal to:
(A) −3.4 eV   (B) −13.6 eV
(C) −6.8 eV   (D) −27.2 eV

39.   23 g of $N_2O_4(g)$ was placed in a 1 L container at 400 K and allowed to attain equilibrium $N_2O_4(g) \rightleftharpoons 2NO_2(g)$. The total pressure at equilibrium was found to be 11.6 bar, then what will be the partial pressure of NO_2 at equilibrium? $\left(R = 0.083 \text{ L bar k}^{-1} \text{ mol}^{-1}\right)$
(A) 9.15 bar   (B) 4.98 bar
(C) 6.6 bar   (D) 8.3 bar

40.   What could be the major product from the following reactions?

(A)

(B)

(C)

(D)
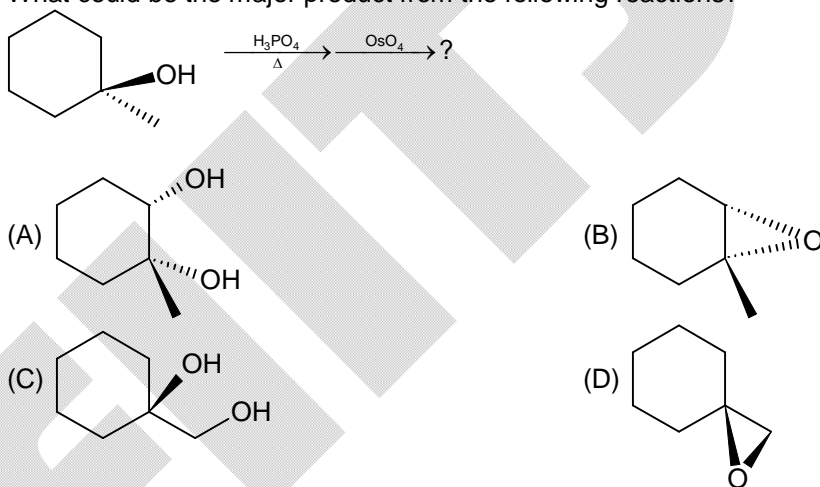
41.   The mole% of Cl_2 at equilibrium for the reaction $PCl_5 \rightleftharpoons PCl_3 + Cl_2$ $K_P = 0.2$ under a total pressure of 2 atm is_____
(A) 23%   (B) 15%
(C) 29%   (D) 35%

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42. Hydrolysis of mustard gas give HCl and a diol. Which of the following intermediate will form during the hydrolysis

(A)

(B)

(C)

(D)
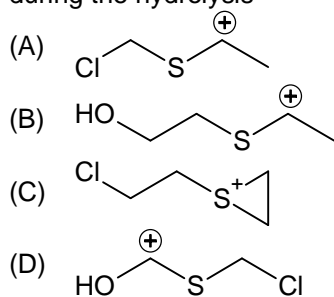
43. Predict the major product formed when the following reaction occurs in dilute base:

(A)

(B)

(C)

(D)
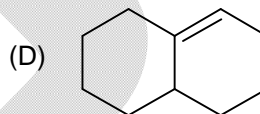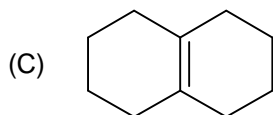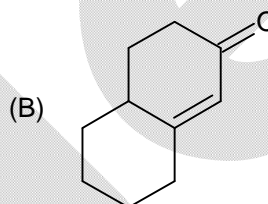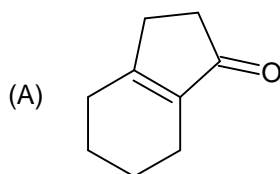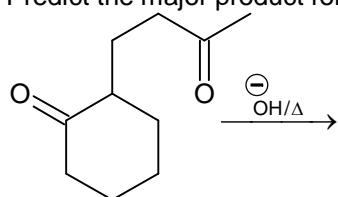
44. Which of the following physical and chemical characteristics of interstitial compounds formed by d-block elements (TiC, Fe_3H etc.) is correct?
    (A) They have low melting point than those of pure metals.
    (B) They are very soft.
    (C) They retain metallic conductivity.
    (D) They are chemically very reactive.

45. Equal volume of 2 M each of $KMnO_4$ and $K_2Cr_2O_7$ are used to oxidise Fe(II) solution in acidic medium. The amount of Fe oxidized will be
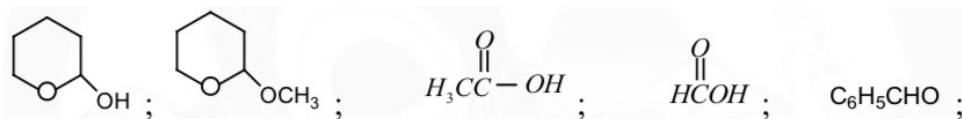   (A) equal with both oxidizing agents.
    (B) more with $KMnO_4$.
    (C) more with $K_2Cr_2O_7$.
    (D) cannot be determined.

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. How many of the following compounds can be oxidized by Tollen's reagent?

$\alpha - D - \text{glucopyranose}$; $\text{Methyl} - \beta - D - \text{fructo furanoside}$;
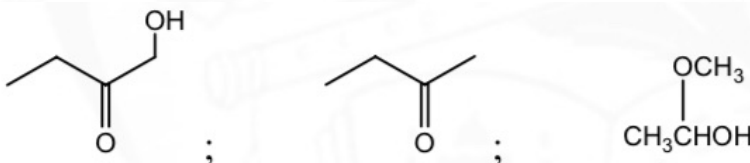
47. The number of substrates those can give rearrangement products during S_N1 reactions:
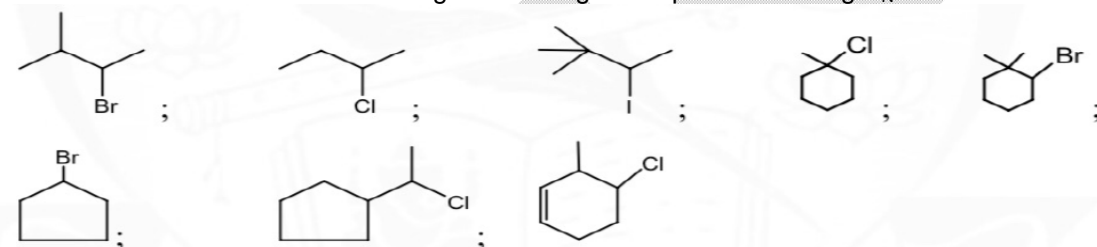
48. A weak base $\text{BOH}\left(K_b = 10^{-n}\right)$ is titrated with a strong acid HCl. At $\frac{3}{4}$ th of the equivalence point, pH of the solution is $9 - \log(3)$, then 'n' is_____

49. Number of geometrical isomers for the complex $\left[\text{CuCl}_2\text{Br}_2\right]^{2-}$ is:

50. A gas phase chemical reaction
$2A(g) \longrightarrow 2B(g) + 4C(g)$ in a closed vessel. The concentration of 'A' is decreased by 4×10^{-2} mol L^{-1} in 40 seconds. The rate of appearance of 'C' is $z \times 10^{-3}$ mol L^{-1} s^{-1}. Find the value of 'z'.

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. The value of the expression $\dfrac{\sin 20^\circ \left(4\cos 20^\circ + 1\right)}{\cos 20^\circ . \cos 30^\circ}$ is

(A) 2

(B) $\dfrac{1}{3}$

(C) $\dfrac{1}{2}$

(D) 3

52. If $\begin{vmatrix} x-4 & 2x & 2x \\ 2x & x-4 & 2x \\ 2x & 2x & x-4 \end{vmatrix} = \left(A + Bx\right)\left(x - A\right)^2$, then the ordered pair (A, B) is equal to

(A) (4, 5)

(B) $(-4, -5)$

(C) $(-4, 3)$

(D) $(-4, 5)$

53. A shooter can hit a given target with probability $\dfrac{1}{4}$. She keeps firing a bullet at the target until she hits it successfully three times and then she stops firing. The probability that she fires exactly six bullets lies in the interval

(A) (0.32, 0.33)

(B) (0.16, 0.17)

(C) (0.08, 0.09)

(D) (0.06, 0.07)

54. The function $f\left(x\right) = 2|x| + |x+2| - \big||x+2| - 2|x|\big|$ has a local minima and a local maxima respectively at $x =$

(A) -2 and 0

(B) -2 and 2

(C) 0 and $-\dfrac{2}{3}$

(D) 0 and 2

55. The area enclosed by the curves $y = \sin x + \cos x$ and $y = |\cos x - \sin x|$ over the interval $\left[0, \dfrac{\pi}{2}\right]$ is

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

(B) $2\sqrt{2}\left(\sqrt{2} - 1\right)$

(C) $2\left(\sqrt{2} + 1\right)$

(D) $2\left(\sqrt{2} + 1\right)$

56. A curve passes through the point $\left(1, \dfrac{\pi}{6}\right)$. Let the slope of the curve at each point $\left(x, y\right)$ be $\dfrac{y}{x} + \sec\left(\dfrac{y}{x}\right)$, $x > 0$. Then the equation of the curve is

(A) $\sin\left(\dfrac{y}{x}\right) = \log x + \dfrac{1}{2}$

(B) $\operatorname{cosec}\left(\dfrac{y}{x}\right) = \log x + 2$

(C) $\sec\left(\dfrac{2y}{x}\right) = \log x + 2$

(D) $\cos\left(\dfrac{2y}{x}\right) = \log x + \dfrac{1}{2}$

57.   The coefficient of x^{1012} in the expansion of $\left(1 + x^n + x^{253}\right)^{10}$, (where $n \le 22$ is any positive integer), is

(A) $^{253}C_4$ (B) $4n$

(C) $^{10}C_4$ (D) 1

58.   A function $f : I \to I$ is defined as follows:

$$f(n) = \begin{cases} n + 3, & \text{if } n \text{ is odd} \\ \dfrac{n}{2}, & \text{if } n \text{ is even} \end{cases}$$

Suppose k is odd and $f\big(f\big(f(k)\big)\big) = 27.$ Then the sum of digits of k is

(A) 3   (B) 6

(C) 9   (D) 12

59.   If $a = 2,$ then the sum of infinite terms of the series

$\cot^{-1}\left(2a^{-1} + a\right) + \cot^{-1}\left(2a^{-1} + 3a\right) + \cot^{-1}\left(2a^{-1} + 6a\right) + \cot^{-1}\left(2a^{-1} + 10a\right) + \ldots\ldots$ is

(A) $\dfrac{\pi}{4}$ (B) $\dfrac{\pi}{2}$

(C) $\dfrac{\pi}{3}$ (D) $\dfrac{\pi}{6}$

60.   If $\displaystyle\int \frac{\sec^2 x - 2010}{\sin^{2010} x}\,dx = \frac{P(x)}{\left(\sin x\right)^{2010}} + C,$ then the value of $P\left(\dfrac{\pi}{3}\right)$ is

(A) 0   (B) $\dfrac{1}{\sqrt{3}}$

(C) $\sqrt{3}$ (D) $\dfrac{3\sqrt{3}}{2}$

61.   Let x, y, z be three natural numbers such that x + y + z = 10. The maximum possible value of xyz + xy + yz + zx is

(A) 52   (B) 64

(C) 69   (D) 73

62.   Two circles are given as $x^2 + y^2 + 14x - 6y + 40 = 0$ and $x^2 + y^2 - 2x + 6y + 7 = 0$ with their centres as C_1 and C_2. If equation of another circle whose centre C_3 lies on the line $3x + 4y - 16 = 0$ and touches the circle with centre C_1 externally and also $C_1C_2 + C_2C_3 + C_3C_1$ is minimum, is $x^2 + y^2 + ax + by + c = 0$ then the value of $(a + b + c)$ is

(A) 2   (B) 0

(C) 16   (D) 8

63.   There are several tea cups in the kitchen, some with handle and the others without handles. The number of ways of selecting two cups without a handle and three with a handle is exactly 1200. What is the maximum possible number of cups in the kitchen?

(A) 29   (B) 49

(C) 31   (D) 44

64. $\dfrac{2^3-1^3}{1\times 7}+\dfrac{4^3-3^3+2^3-1^3}{2\times 11}+\dfrac{6^3-5^3+4^3-3^3+2^3-1^3}{3\times 15}+.....+\dfrac{30^3-29^3+28^3-27^3+....+2^3-1^3}{15\times 63}$ is equal to

   (A) 90   (B) 100
   (C) 110   (D) 120

65. Neha lists all the positive divisors of $(2010)^2$. She then randomly selects two distinct divisors from the list. Then the probability that exactly one of the selected divisors is a perfect square is

   (A) $\dfrac{32}{81}$ (B) $\dfrac{26}{81}$

   (C) $\dfrac{16}{81}$ (D) $\dfrac{34}{81}$

66. The set of all real values of x where the function $f(x)=\sin|x|-|x|+2(x-\pi)\cos|x|$ is not differentiable is equal to
   (A) Null set   (B) $\{\pi\}$
   (C) $\{0\}$ (D) $\{0,\ \pi\}$

67. The intercepts on X-axis made by tangents to the curve, $y=\displaystyle\int_0^x |t|\,dt,\ x\in R$, which are parallel to the line y = 2x, are equal to
   (A) ± 3 (B) ± 4
   (C) ± 1 (D) ± 2

68. Let z be a complex number such that the imaginary part of z is nonzero and $a=z^2+z+1$ is real. Then 'a' **cannot** take the value

   (A) -1 (B) $\dfrac{1}{3}$

   (C) $\dfrac{1}{2}$ (D) $\dfrac{3}{4}$

69. Let $\vec{p},\vec{q}$ and $\vec{r}$ be three unit vectors satisfying $|\vec{p}-\vec{q}|^2+|\vec{q}-\vec{r}|^2+|\vec{r}-\vec{p}|^2=9$, then $|2\vec{p}+5\vec{q}+5\vec{r}|$ is equal to
   (A) 0   (B) 3

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

70. If $x=\cos 1^\circ\cos 2^\circ\cos 3^\circ........\cos 89^\circ$ and $y=\cos 2^\circ\cos 6^\circ\cos 10^\circ........\cos 86^\circ$, then $\dfrac{2}{7}\log_2\left(\dfrac{y}{x}\right)$ is equal to
   (A) 19   (B) 15
   (C) 27   (D) 31

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. Number of distinct quadratic equations with real roots such that the equation remains unchanged if their roots are cubed is equal to

72. If the minimum value of the expression $\dfrac{x^2y^2 - 2xy^2 + 2y^2 + 4xy - 4y + 4}{xy^2 + 2y}$ is 'k' $\forall\, x, y \in R^+$, then [10k] equals (where [.] represents greatest integer function)

73. Two sides of a triangle have the combined equation $x^2 - 3y^2 - 2xy + 8y - 4 = 0$. The third side, which is variable always passes through the point $(-5, 1)$. If the range of values of the slope of the third line so that the origin is an interior point of triangle is the interval (a, b), then the value of

    $\dfrac{a + \dfrac{1}{b^2}}{4}$ is

74. Volume of parallelopiped determined by vectors $\vec{a}, \vec{b}$ and $\vec{c}$ is 5. Then the volume of the parallelopiped determined by the vectors $3(\vec{a} + \vec{b}), (\vec{b} + \vec{c})$ and $2(\vec{c} + \vec{a})$ is

75. Consider the set of eight vectors $V = \left\{ a\hat{i} + b\hat{j} + c\hat{k};\ a, b, c \in \{-1, 1\} \right\}$. Then the number of ways in which three non-coplanar vectors can be chosen from V equals