SRIGAYATRI EDUCATIONAL INSTITUTIONS

INDIA

JEE MAIN TOT GT-1

Time: 3 Hours **Max. Marks: 300 M**

SECTION – I

(SINGLE CORRECT ANSWER TYPE)

This section contains 20 multiple choice questions. Each question has 4 options (A), (B), (C) and (D) for its answer, out of which **ONLY ONE** option can be correct.

Marking scheme: +4 for correct answer, 0 if not attempted and -1 if not correct.

MATHEMATICS

1. **If** $i=\sqrt{-1}$ **then** $\sum_{k=0}^{200} i^k + \prod_{p=1}^{50} i^p = x+iy \Rightarrow \frac{x}{y} = ...$ (Π **is product symbol)**

A) 1 B) -1 C) 0 D) $\frac{1}{2}$

2. **Let** $\bar{a},\bar{b},\bar{c}$ **are three non-coplanar vectors such that** $\left[\bar{a}\,\bar{b}\,\bar{c}\right]=6.$ **Then the volume of the tetrahedron with three coterminous edges along** $\bar{a}\times\bar{b},\bar{b}\times\bar{c},\bar{c}\times\bar{a}$ **is equal to (in cubic units)**

A) 6 B) 36 C) 72 D) 216

3. **Let R be a relation over set** $N\times N$ **defined by (a, b) R(c, d) such that** $a+d=b+c$ **then R is …….. (Here N is the set of all natural numbers)**

A) Reflexive only B) Symmetric only C) Transitive only D) Equivalence relation

4. **If** $f:R\to R$ **satisfies** $f(x+y)=f(x)+f(y)$ **for all** $x,y\in R$ **and** $f(1)=7,$ **then** $\sum_{r=1}^{n} f(r)$ **is**

A) $\frac{7n}{2}$ B) $\frac{7(n+1)}{2}$ C) $7n(n+1)$ D) $\frac{7n(n+1)}{2}$

5. **If** p,q **are two propositions, then** $(p\vee \sim q)\wedge(\sim p\wedge q)$ **is**

A) a tautology B) a contradiction

C) neither a tautology nor a contradiction D) both a tautology and a contradiction

6. **The number of integral values of** α **for which the quadratic expression** $\alpha x^2+|2\alpha-3|x-6$ **is positive for exactly two integral values of** x **is equal to**

A) 3 B) 2 C) 1 D) 0

7. **The value of** $\tan^{-1}\frac{4}{7}+\tan^{-1}\frac{4}{19}+\tan^{-1}\frac{4}{39}+\tan^{-1}\frac{4}{67}+......\infty$ **equals**

A) $\tan^{-1}1+\tan^{-1}\frac{1}{2}+\tan^{-1}\frac{1}{3}$ B) $\tan^{-1}1+\cot^{-1}3$

C) $\cot^{-1}1+\cot^{-1}\frac{1}{2}+\cot^{-1}\frac{1}{3}$ D) $\cot^{-1}1+\tan^{-1}3$

8. **The number of positive integral solutions of the equation** $\begin{vmatrix} x^3+1 & x^2y & x^2z \\ xy^2 & y^3+1 & y^2z \\ xz^2 & yz^2 & z^3+1 \end{vmatrix}=11$ **is**

A) 0 B) 3 C) 6 D) 12

9. **Let** $\vec{u},\vec{v},\vec{w}$ **be such that** $|\vec{u}|=1,|\vec{v}|=2,|\vec{w}|=3.$ **If the projection of** $\vec{v}$ **along** $\vec{u}$ **is equal to that of** $\vec{w}$ **along** $\vec{u}$ **and vectors** $\vec{v},\ \vec{w}$ **are perpendicular to each other then** $|\vec{u}-\vec{v}+\vec{w}|$ **equals**

A) 2 B) $\sqrt{7}$ C) $\sqrt{14}$ D) 14

10. Two cubes have their faces painted either red or blue. The first cube has five red faces and one blue face. When the two cubes are rolled simultaneously, the probability that the two top faces show the same colour is $\frac{1}{2}$. Number of red faces on the second cube, is

A) 1 B) 2 C) 3 D) 4

11. $P(x, y)$ **is called a good point if x, y $\in$ N. Total number of good points lying inside the quadrilateral formed by the lines** $2x+y=2,\ x=0,\ y=0$ **and** $x+y=5$ **is equal to**

A) 4 B) 2 C) 10 D) 6

12. The point on the line $\frac{x-2}{1}=\frac{y+3}{-2}=\frac{z+5}{-2}$ **at a distance of 6 from the point** $(2,-3,-5)$ **is**

A) $(2,-5,-3)$ B) $(4,-7,-9)$ C) $(0,2,-1)$ D) $(-3,5,3)$

13. The value of $\lim_{x\to 0}\left\{\tan\left(\frac{\pi}{4}+x\right)\right\}^{1/x}$ **is**

A) $e^{-1/2}$ B) e^{2} C) $e^{1/2}$ D) 1

14. If $f(x+y)=f(x)f(y)$ **for all** $x, y \in R,\ f(5)=2,\ f^{1}(0)=3.$ **Then,** $f^{1}(5)$ **equals**

A) 6 B) 3 C) 5 D) 7

15. If $f(x)=\min\{|x|,|x-2|,2-|x-1|\},$ **then** $f(x)$ **is**

A) Discontinuous at exactly three points

B) Maximum value of $f(x)$ is 2

C) $f(x)$ is non-differentiable at $x=\frac{1}{2},0,1\frac{1}{2},2,\frac{5}{2}$

D) $f(x)$ is non-differentiable at $x=-\frac{1}{2},0,1,2,\frac{5}{2}$

16. If $\int\frac{dx}{x^2\left(x^n+1\right)^{(n-1)/n}}=-\left[f(x)\right]^{1/n}+C$ **then** $f(x)$ **is**

A) $(1+x^n)$ B) $1+x^{-n}$ C) x^n+x^{-n} D) x^n-x^{-n}

17. If [x] denotes the greatest integer less than or equal to x**, then the value of the integral** $\int_0^2 x^2[x]\,dx$ **equals**

A) $\frac{5}{3}$ B) $\frac{7}{3}$ C) $\frac{8}{3}$ D) $\frac{4}{3}$

18. The area inside the parabola $5x^2-y=0$ **but outside the parabola** $2x^2-y+9=0$ **is**

A) $12\sqrt{3}$ B) $6\sqrt{3}$ C) $8\sqrt{3}$ D) $4\sqrt{3}$

19. The solution of differential equation $\frac{dy}{dx}+x\sin 2y=x^3\cos^2 y$ **is**

A) $\cot y=\frac{1}{2}\left(x^2+1\right)+ce^{-x^2}$ B) $\tan y=\frac{1}{3}\left(x^2+2\right)+ce^{-2x^2}$

C) $\tan y=\frac{1}{2}\left(x^2-1\right)+ce^{-x^2}$ D) $\tan y=\frac{1}{3}\left(x^2-2\right)+ce^{-2x^2}$

20. The solution of differential equation $ydx+\left(x+x^2y\right)dy=0$ **is**

A) $-\frac{1}{xy}+\log x=c$ B) $-\frac{x}{y}+\log y=c$ C) $-\frac{y}{x}+\log xy=c$ D) $-\frac{1}{xy}+\log y=c$

SECTION-II

(Numerical Value Answer Type)

This section contains 5 questions. The answer to each question is a Numerical values comprising of positive or negative decimal numbers. Marking scheme: +4 for correct answer, 0 in all other cases.

21. **Given an acute triangle ABC such that** $\sin C = \frac{4}{5}$, **then** $\tan A = \frac{24}{7}$ **and** $c = 50$. **The area of the triangle ABC**

22. **If** $1, \alpha_1, \alpha_2, ...\alpha_{2008}$ **are** $(2009)^{th}$ **roots of unity, then the value of** $\sum_{r=1}^{2008} r\left(\alpha_r + \alpha_{2009-r}\right)$ **equals**

23. **The area of the triangle formed by two rays whose combined equation is** $y = |x|$ **and the line** $x + 2y = 2$ **is**

24. **The area of the triangle formed by the tangents from the point (4, 3) to the circle** $x^2 + y^2 = 9$ **and the line joining their points of contact is**

25. **The ratio of the area of a triangle inscribed in the ellipse** $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$ **and that of a triangle formed by the corresponding points on the auxiliary circle is 0.5, then the eccentricity of the ellipse is**

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PHYSICS

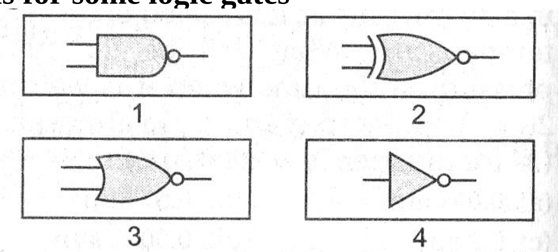
26. **A lens has a convex surface of radius of radius 20cm and a concave surface of radius 40cm and is made of glass of refractive index 1.54. Compute the focal length of the lens**

A) 74cm B) 23cm C) 15cm D) 29cm

27. **Red light falls normally on a diffraction grating ruled 4000 lines / cm and the second order image is diffracted** 34.0^0 **from the normal. Compute the wavelength of the light** $\left(\sin 34^0 = 0.559\right)$

A) 229 nm B) 137 nm C) 699 nm D) 250 nm

28. **Given below are symbols for some logic gates**



The XOR gate and NOR gate respectively are

A) 1 and 2 B) 2 and 3 C) 3 and 4 D) 1 and 4

29. **A body slides down a plane inclined at an angle** θ **to the horizontal. The coefficient of friction** μ **down the plane varies in direct proportion to the distance moved down the plane. The body will move down the plane with a**

A) Constant acceleration $g\sin\theta$

B) Constant acceleration $\left(g\sin\theta - \mu g\cos\theta\right)$

C) Constant acceleration $\left(\mu g\cos\theta - g\sin\theta\right)$

D) Variable acceleration that first decreases, then becomes negative

30. Unit of LCR is

A) $ohm \times sec$ B) $ohm s^{-1}$ C) $ohm \times sec^2$ D) No unit

31. Two factories are sounding their sirens at 800 Hz each. A man goes from one factory to the other at a speed of 2 ms^{-1}. The speed of sound is 320 ms^{-1}. Therefore, the number of beats heard by the person in one second will be

A) 2 B) 4 C) 8 D) 10

32. A container open to atmosphere contains air (assumed to be an ideal gas) at temperature 27^0C. The temperature is now raised to 227^0C. The ratio of number of atoms in the container now and at the beginning is

A) $\frac{3}{5}$ B) $\frac{5}{3}$ C) $\frac{3}{4}$ D) $\frac{4}{5}$

33. Four charges Q each are located at four vertices of a regular tetrahedron of side L. The potential energy of the system is

A) $\frac{4Q^2}{\pi\varepsilon_0 L^2}$ B) $\frac{6Q^2}{4\pi\varepsilon_0 L}$ C) $\frac{Q^2}{\pi\varepsilon_0 L}$ D) $\frac{8Q^2}{4\pi\varepsilon_0 L}$

34. The moment of inertia of a body about a given axis is 1.2 kg-m^2. Initially, the body is at rest. In order to produce a rotational kinetic energy of 1500 J, an angular acceleration of 25 rad-s^{-2} must be applied about that axis for a duration of

A) 4s B) 2s C) 8s D) 10s

35. Light passes from a denser medium 1 to a rarer medium 2. When the angle of incidence is θ, the reflected and refracted rays are mutually perpendicular. The critical angle will be

A) $\sin^{-1}(\cot\theta)$ B) $\sin^{-1}(\tan\theta)$ C) $\sin^{-1}(\cos\theta)$ D) $\sin^{-1}(\sec\theta)$

36. A particle A has charge +q and particle B has charge $+4q$ with each of them having same mass m. When allowed to fall from rest through the same electric potential difference, the ratio of their speeds $\frac{v_A}{v_B}$ will become

A) 2:1 B) 1:2 C) 1:4 D) 4:1

37. A radio transmitter operates at 880 kHz and its power is 10 kW. The number of photons emitted per second is

A) 1.72×10^{31} B) 1.72×10^{32} C) 3.44×10^{31} D) None of these

38. The whistle of a railway engine is heard in winter at much longer distances. This is due to

A) Decrease in the velocity of sound in winter

B) Decrease in the density of air with respect to height from the surface of the earth

C) Cold air absorbs much small energy form sound waves

D) Increase in the density of air with respect to height from the surface of the earth

39. The position vector of an electron is $r = 5i + 4j - 3k$. To an observer moving along x direction with speed 0.6c, the magnitude of position vector is

A) $5\sqrt{2}$ B) $\sqrt{34}$ C) $\sqrt{41}$ D) 5

40. The displacement of a particle is given by $y = 2\sin(\omega t) + 2\sin\left(\omega t + \frac{\pi}{3}\right)$ then, the incorrect statement is

A) The amplitude of motion is $\sqrt{12}$ B) The angular frequency is ω

C) The velocity at $t = 0$ is 3ω D) The initial phase of motion is $\frac{\pi}{3}$

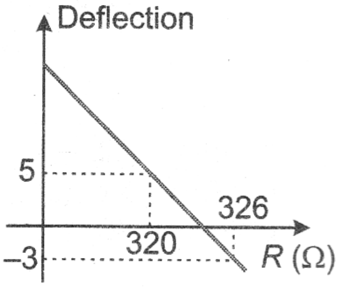
41. Substances for which permeability μ is slightly greater than 1, are called

A) Diamagnetic B) Paramagnetic C) Ferromagnetic D) Non-magnetic

42. An isolated sphere S of radius R carries an electric charge. S is momentarily connected to a distant uncharged sphere T which has a radius r. The ratio of surface charge density of S to that of T is

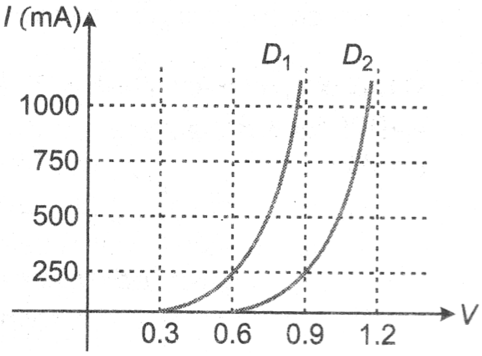
A) $\frac{R}{r}$ B) $\frac{r}{R}$ C) $\frac{r}{2R}$ D) $\frac{(r+R)}{R}$

43. In post office box, the graph of galvanometer deflection versus resistance R (pulled out of resistance box) for the ratio 100:1 is given as shown (due to unsuitable values of R, galvanometer shows deflection). The two consecutive values of R are shown in the figure. The value of unknown resistance would be



A) 3.2Ω B) 3.24Ω C) 3.206Ω D) 3.237Ω

44. The forward bias characteristics of two diodes D_1 and D_2 are shown, the knee voltages for D_1 and D_2 are respectively (approx.)



A) 0.4V and 0.7V B) 0.6V and 0.9V C) 0.6V and 0.8V D) 0.4V and 0.9V

45. The output current of a 60% modulated AM generator is 1.5A. To what value will the current rise, if the generator is additionally modulated by another audio wave of modulation index 0.7?

A) 0.64A B) 1.64A C) 2.34A D) 5.32A

SECTION- II

(Numerical Value Answer Type)

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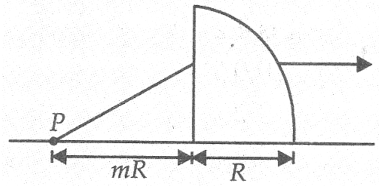
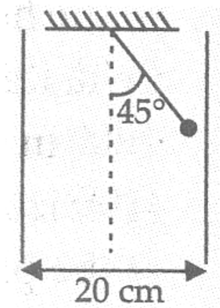
46. A quarter cylinder of radius R and refractive index 1.5 is placed on a table. A point object P is kept at a distance mR from it. Find the value of m for which a ray from P will emerge parallel to the table as shown in figure.



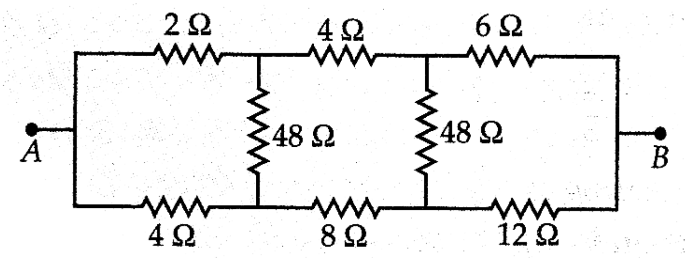
47. **A flat thin circular disc has a radius 4cm and a circular hole of radius $\frac{1}{2}cm$ is made in it with its centre at a distance of 1cm from the centre of disc. The mass of the disc is 10 kg. If the moment of inertia of the system about an axis passing through the centre of the hole is $N\times10^{-3}kg\ m^2$, Find the value of N.**

48. **A small sphere of mass 2.0 g and having charge 0.5 mC is suspended by a string between the plates of a parallel plate capacitor as shown in the figure. What potential difference (in volt) between the plates (separation 20 cm) should be applied so that the string makes an angle of 45^0 with the vertical? (Take $g=10ms^{-2}$)**



49. **A ball is allowed to fall freely from a height of 3 metres on to a fixed plate. The successive rebound heights are $h_1, h_2, h_3, ...$ If the distance covered by the ball before coming to rest is x metres, find the value of x. (Given that the coefficient of restitution is 0.5)**

50. **Find the resistance (in Ω) between the terminals A and B of the network shown below**



<u>SECTION – I</u>
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<u>CHEMISTRY</u>

51. **Which of the following has the maximum number of atoms?**
A) 24 g C B) 56 g of Fe C) 27 g of Al D) 108 g of Ag

52. **Which of the following will not be oxidized by O_3?**
A) KI B) $FeSO_4$ C) $KMnO_4$ D) K_2MnO_4

53. **The decreasing order of energy for the electrons represented by the following sets of quantum numbers is**
1) $n=4, l=0, m=0, s=\pm1/2$ **2)** $n=3, l=1, m=1, s=-1/2$
3) $n=3, l=2, m=0, s=+1/2$ **4)** $n=3, l=0, m=0, s=-1/2$
A) 1>2>3>4 B) 2>1>3>4 C) 3>1>2>4 D) 4>3>2>1

54. **The $\Delta_f H^\ominus$ for CO_2(g), CO(g), and H_2O(g) are -393.5,-110.5, and -214.8 KJmol^{-1}, respectively. The standard enthalpy change(in KJmol^{-1}) for the reaction**
$CO_2(g)+H_2(g)\rightarrow CO(g)+H_2O(g)$ **is**
A) 524.1 B) +41.2 C) -262.5 D) -41.2

55. $CsCl$ **crystallizes in body centred cubic lattice. If 'a' is its edge length then which of the following expressions is correct?**

A) $r_{Cs^{\oplus}} + r_{Cl^{\ominus}} = \frac{\sqrt{3}}{2}a$ B) $r_{Cs^{\oplus}} + r_{Cl^{\ominus}} = \sqrt{3}a$ C) $r_{Cs^{\oplus}} + r_{Cl^{\ominus}} = 3a$ D) $r_{Cs^{\oplus}} + r_{Cl^{\ominus}} = \frac{3}{2}a$

56. Silver is removed electrolytically from 200mL of a 0.1N solution of $AgNO_3$ by a current of 0.1A. How long will it take to remove half of the silver from the solution?

A) 0.1s B) 100s C) 965s D) 9650s

57. What is the nature of Al_2O_3 and B_2O_3?

A) Acidic, acidic B) Acidic, amphoteric
C) Amphoteric, amphoteric D) Amphoteric, acidic

58. In terms of polar character, the correct order is

A) $H_2S > HF > H_2O > NH_3$ B) $HF > H_2O > NH_3 > H_2S$
C) $HF > H_2S > NH_3 > H_2O$ D) $H_2S > NH_3 > H_2O > HF$

59. The correct order of stability for the following superoxides is

A) $KO_2 > RbO_2 > CsO_2$ B) $RbO_2 > CsO_2 > KO_2$
C) $CsO_2 > RbO_2 > KO_2$ D) $KO_2 > CsO_2 > RbO_2$

60. H_3BO_3 **is**

A) a monobasic acid and weak Lewis acid B) a monobasic acid and weak Bronsted acid
C) a monobasic acid and strong Lewis acid D) a tribasic and weak Bronsted acid

61. Acid strength is in the order

A) $HClO_4 > HIO_4 > HBrO_4$ B) $HClO_4 > HBrO_4 > HIO_4$
C) $HClO_4 < HBrO_4 > HIO_4$ D) None

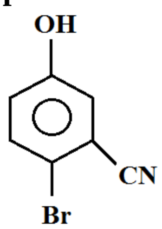
62. Both $\left[Ni(CO)_4\right]$ and $\left[Ni(CN)_4\right]^{2-}$ are diamagnetic. The hybridization of nickel in these complexes, respectively, are

A) sp^3, sp^3 B) sp^3, dsp^2 C) dsp^2, sp^3 D) dsp^2, dsp^2

63. Ellingham diagram represents

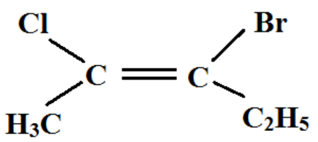
A) Change of ΔG with temperature B) Change of ΔH with temperature
C) Change of ΔG with pressure D) Change of $(\Delta G - T\Delta S)$ with temperature

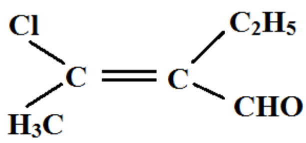
64. The IUPAC name of the following compound is

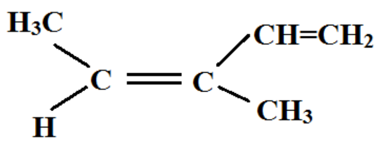


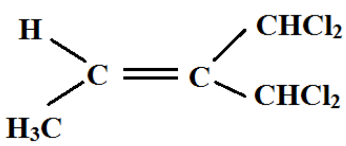
A) 4-Bromo-3-cynophenol B) 2-Bromo-5-hydroxy benzene carbonitrile
C) 2-Cyno-4-hydroxy bromo benzene D) 6-Bromo-3- hydroxy benzonitrile

65. The E-isomer among the following is

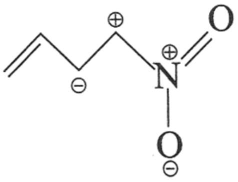
A) 

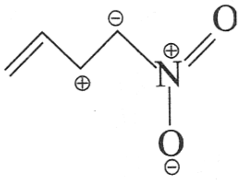
B) 

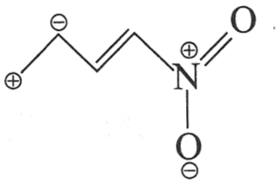
C) 

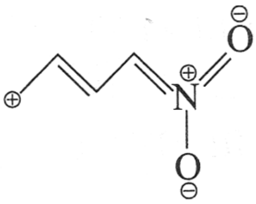
D) 

66. Among the following, the least stable resonance structure is

A) 

B) 

C) 

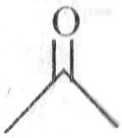
D) 

67. 

A) 

B) 

C) 

D) 

68. $(X)\xrightarrow[H_2SO_4]{K_2Cr_2O_7}(Y)\xrightarrow{LiAlH_4}(X)$; **X, Y are**

A) CH_3COOH, CH_3CH_2OH

B) $CH_3CH(OH)CH_3, CH_3COOH$

C) CH_3CH_2OH, CH_3COOH

D) CH_3CHO, CH_3CH_2OH

69. Acetone $(C_3H_6O)\xrightarrow{\text{Aldol condensation}}(X)C_6H_{10}O\xrightarrow[NaOH+Cl_2]{NaOCl}(Y)C_5H_7ONa$; **Y is:**

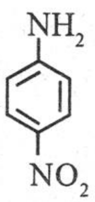
A) $CH_3-CH=\underset{}{\overset{CH_3}{\overset{|}{C}}}H-COONa$

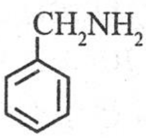
B) $(H_3C)(H_3C)C=C(CH_3)(COONa)$

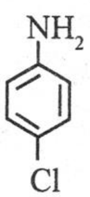
C) $(CH_3)(H)C=C(CH_3)(COONa)$

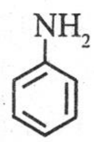
D) $(H_3C)(H_3C)C=C(H)(COONa)$

70. Which of the following is the most basic

A) 

B) 

C) 

D) 

SECTION-II
(Numerical Value Answer Type)

This section contains 5 questions. The answer to each question is a Numerical values comprising of positive or negative decimal numbers.
Marking scheme: +4 for correct answer, 0 in all other cases.

71. **10 mL of a solution of H_2O_2 of 10 volume strength decolourises 100mL of $KMnO_4$ solution acidified with dil. H_2SO_4. The amount of $KMnO_4$ in the given solution is (K=39, Mn=55)**

72. **A certain buffer solution contains equal concentration of X^- and HX. The K_b for X^- is 10^{-10}. The pH of the buffer is**

73. **Among** PbS, CuS, HgS, MnS, Ag_2S, NiS, CoS, Bi_2S_3 and SnS_2, **the total number of BLACK coloured sulphides is:**

74. **An organic compound contains 66% C and 13.3% H. Its vapour density is 37. The possible number of isomers of all types for the compound is:**

75. **How many chirality centers are there in an aldohexose?**

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