SRIGAYATRI EDUCATIONAL INSTITUTIONS

INDIA

JEE MAIN TOT GT-4

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

SYLLABUS:

1. **Let** $a,b,c \in R$**. If** $f(x) = ax^2 + bx + c$ **is such that** $a+b+c=3$ **and** $f(x+y) = f(x) + f(y) + xy \forall\ x,y \in R$. **Then** $\sum_{n=1}^{10} f(n)$ **is equal to**

A) 190 B) 255 C) 330 D) 165

2. **If** $\bar{a}, \bar{b}, \bar{c}$ **are unit vectors such that** $\bar{a}+\bar{b}+\bar{c}=\bar{0}$ **then** $\bar{a}.\bar{b}+\bar{b}.\bar{c}+\bar{c}.\bar{a}=$

A) $\frac{3}{2}$ B) $\frac{-3}{2}$ C) $\frac{1}{2}$ D) $-\frac{1}{2}$

3. **If** $81^{\sin^2 x} + 81^{\cos^2 x} = 30$ **and** $0 \le x \le \frac{\pi}{2}$ **then** $x=$

A) $\frac{\pi}{6}, \frac{\pi}{3}$ B) $\frac{\pi}{4}, \frac{\pi}{2}$ C) $\frac{3\pi}{4}, \frac{2\pi}{4}$ D) $\frac{\pi}{2}, \frac{4\pi}{3}$

4. **If the angles of elevation of the top of a tower from three collinear points A,B and C on a line leading to the foot of the tower are 30^0,45^0 and 60^0 respectively, then the ratio AB : BC is**

A) $\sqrt{3}:1$ B) $\sqrt{3}:\sqrt{2}$ C) $1:\sqrt{3}$ D) 2 : 3

5. $\sqrt{-1-\sqrt{-1-\sqrt{-1....\infty}}} =$

A) 1 B) -1 C) ω D) $-\omega^2$

6. **A ratio of the 5^{th} term from the beginning to the 5^{th} term from the end in the binomial expansion of** $\left(2^{\frac{1}{3}} + \frac{1}{2(3)^{\frac{1}{3}}}\right)^{10}$ **is**

A) $1:4(16)^{\frac{1}{3}}$ B) $2(36)^{\frac{1}{3}}:1$ C) $1:2(6)^{\frac{1}{3}}$ D) $4(36)^{\frac{1}{3}}:1$

7. **The H.M of the numbers** $\frac{1}{5}, \frac{1}{10}, \frac{1}{15}, \frac{1}{20}, \frac{1}{25}, \frac{1}{30}, \frac{1}{35}$ **is**

A) $\frac{1}{20}$ B) $\frac{1}{16}$ C) $\frac{1}{15}$ D) $\frac{1}{13}$

8. **A point is selected at random from the interior of a circle. The probability that the point is closer to the center than to the boundary of the circle is**

A) $\frac{3}{4}$ B) $\frac{1}{2}$ C) $\frac{1}{4}$ D) $\frac{1}{3}$

9. **The value of** $\sum_{r=16}^{30} (r+2)(r-3)$ **is equal to**

A) 7785 B) 7780 C) 7775 D) 7770

10. **The negation of** $\sim s \vee (\sim r \wedge s)$ **is equivalent to :**

A) $s \wedge \sim r$ B) $s \wedge (r \wedge \sim s)$ C) $s \vee (r \vee \sim s)$ D) $s \wedge r$

11. **let** $\int \frac{x^2-1}{x^3\sqrt{3x^4+2x^2-1}}dx = f(x)+C$ **where** $f(1)=-1$ **and C is constant of integration then** $\lim_{x\to\infty} f(x)$ **is equal to**

A) $\frac{2}{\sqrt{3}}$ B) $-\frac{2}{\sqrt{3}}$ C) $\frac{\sqrt{3}}{2}$ D) $-\frac{\sqrt{3}}{2}$

12. $\int_0^{7\frac{1}{2}} [x-1]dx =$ **--------------, where** $[x]$ **denotes the greatest integer less than or equal to x**

A) $\frac{5}{2}$ B) 1 C) $\frac{5}{4}$ D) 17

13. **If** $e^y + xy = e$**, then ordered pair** $\left(\frac{dy}{dx}, \frac{d^2y}{dx^2}\right)$ **at x=0 is equal to**

A) $\frac{1}{e}, -\frac{1}{e^2}$ B) $\left(-\frac{1}{e}, \frac{1}{e^2}\right)$ C) $\left(\frac{1}{e}, \frac{1}{e^2}\right)$ D) $\left(-\frac{1}{e}, -\frac{1}{e^2}\right)$

14. **The solution of the differential equation** $x\frac{dy}{dx} + 2y = x^2 \; (x \neq 0)$ **with** $y(1) = 1$ **is**

A) $y = \frac{4}{5}x^3 + \frac{1}{5x^2}$ B) $y = \frac{x^3}{5} + \frac{1}{5x^2}$ C) $y = \frac{x^2}{4} + \frac{3}{4x^2}$ D) $y = \frac{3}{4}x^2 + \frac{1}{4}x^2$

15. **An apache helicopter of enemy is flying along the curve given by** $y = x^2 + 7$ **. A soldier, placed at (3, 7) wants to shoot down the helicopter when it is nearest to him then the nearest distance is**

A) $\sqrt{2}$ B) $\sqrt{5}$ C) $\sqrt{7}$ D) $\sqrt{11}$

16. **The equation of the line passing through (-4, 3, 1) parallel to the plane** $x+2y-z=5$ **and intersecting the line** $\frac{x+1}{-3} = \frac{y-3}{2} = \frac{z-2}{-1}$

A) $\frac{x-4}{2} = \frac{y+3}{1} = \frac{z+1}{4}$ B) $\frac{x+4}{1} = \frac{y-3}{1} = \frac{z-1}{3}$

C) $\frac{x+4}{3} = \frac{y-3}{-1} = \frac{z-1}{1}$ D) $\frac{x+4}{-1} = \frac{y-3}{1} = \frac{z-1}{1}$

17. **Two vertices of a triangle are (5,-1) and (-2, 3) if the orthocenter is at the origin, then its third vertex is**

A) (4, 7) B) (4,-7) C) (-4, 7) D) (-4,-7)

18. **The point diametrically opposite to the P (1, 0) on the circle** $x^2 + y^2 + 2x + 4y - 3 = 0$ is

A) (3,-4) B) (-3, 4) C) (-3,-4) D) (3,4)

19. **If** $f(x) = \begin{cases} ax^2 + b & if\ 0 \le x < 1 \\ 4 & if\ x = 1 \\ x+3 & if\ x > 1 \end{cases}$ **then the value of (a, b) for which f(x) is cannot be continuous at x=1 is**

A) (2, 2) B) (3, 1) C) (4, 0) D) (5, 2)

20. **If the angle between the line** $x = \frac{y-1}{2} = \frac{z-3}{\lambda}$ **and the plane** $x+2y+3z=4$**, is** $Cos^{-1}\left(\sqrt{\frac{5}{14}}\right)$

A) $\frac{2}{5}$ B) $\frac{5}{3}$ C) $\frac{2}{3}$ D) $\frac{3}{2}$

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. **If a, b, c are non zero complex number satisfying** $a^2+b^2+c^2=0$ **and**
$$\begin{vmatrix} b^2+c^2 & ab & ac \\ ab & c^2+a^2 & bc \\ ac & bc & a^2+b^2 \end{vmatrix} = Ka^2b^2c^2,$$ **then K is equal to**

22. **If** $\left|Z+\frac{6}{Z}\right|=5$ **then the greatest value of** $|Z|=$

23. **If** $n_{C_{r-1}}=330,\ n_{C_r}=462, n_{C_{r+1}}=462$ **then r = _____**

24. **If the area enclosed by the curves** $y^2=4\lambda x$ **and** $y=\lambda x$ **is** $\frac{1}{9}$ **square units then value of** λ **is equal to**

25. **If the curves** $y=x^2+px+q$ **and** $y=rx-x^2$ **teach each other at (1,0) then the value of** $p^2+q^2+r^2$ **equals**

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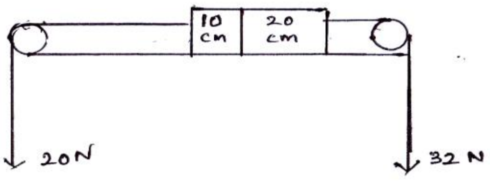
PHYSICS

SYLLABUS:

26. **The resistance of a metallic wire is R = V/I. In a circuit the potential difference across the resistance is given by V = (8 ± 0.5) V and current in the circuit is given by I = (4 ± 0.2) A, then the value of resistance with its percentage error.**
A) (4 ± 2%) Ω B) (2 ± 11.25%) Ω C) (9 ± 2%) Ω D) (12 ± 15%) Ω

27. **A ball is dropped from the top of a building. The ball takes 0.5s to fall past the 3m length of window some distance from the top of the building. If the speed of the ball at the top and at the bottom of the window are V_1 and V_2 then ($g = 9.8m/s^{2}$)**
A) $V_1 + V_2 = 12ms^{-1}$ B) $V_1+V_2 = 4.9ms^{-1}$ C) $V_1+V_2=1ms^{-1}$ D) $\frac{V_2}{V_1}=2ms^{-1}$

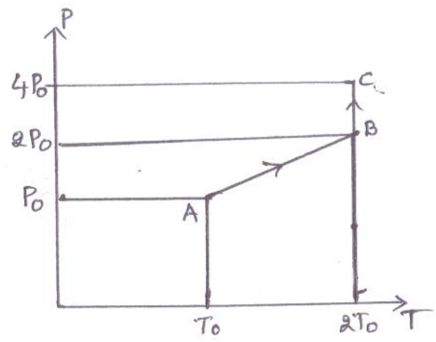
28. **A uniform rod of length 30cm and mass 3kg is arranged as shown in the figure . The strings are pulled with forces 20N and 32N. Find the force exerted by 20cm part of the rod on 10cm part**



A) 4N B) 20N C) 24N D) 32N

29. **A force acts on a 3g body. The position of the body as a function of time 't' is given by** $x=t^3-4t^2+3t$. **The work done in first four seconds is**
A) 578mJ B) 528mJ C) 498mJ D) 458mJ

30. **'n' moles of an ideal gas is taken through the process 'ABC'. The total work done**

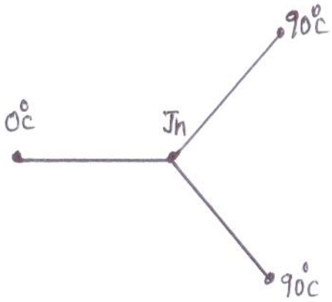


A) $4nRT_0ln2$ B) $2nRT_0ln2$ C) $-2nRT_0ln2$ D) Zero

31. The length of the wire is 'l' when the tension in it is 'F' and 'xl' when the tension in it is 'yF'. The natural length of the wire is

A) $\frac{(x-y)l}{x-1}$ B) $\frac{(y-x)l}{y-1}$ C) $\frac{(x-y)l}{x+1}$ D) $\frac{(y-x)l}{y+1}$

32. Three rods one arranged as shown in the figure the temperature at the junction is



A) 45^0C B) 60^0C C) 30^0C D) 20^0C

33. A large tank filled with water to a height 'h' is to be emptied through a small hole at the bottom. The ratio of times taken for the level of water to fall from h to $\frac{h}{2}$ and $\frac{h}{2}$ to zero.

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

34. A pendulum of length l =1m is released from θ=60^0. The rate of change of speed of the bob at θ = 30^0 (g = 10ms$^{-B)}$

A) $5\sqrt{3}ms^{-2}$ B) $5ms^{-2}$ C) $10ms^{-2}$ D) $2.5ms^{-2}$

35. The x and y- co-ordinates of a particle are x = A sin ωt and $y = A\sin\left(\omega t+\frac{\pi}{2}\right)$. The motion of the particle is

A) Circular anti clockwise B) Circular clockwise
C) Elliptical clockwise D) Rectilinear from left to right

36. The lowest frequency standing wave that can be setup in a string has a frequency of 512Hz. The length of the string is 80cm. The speed of the wave in the string is

A) $820ms^{-1}$ B) $410ms^{-1}$ C) $1000ms^{-1}$ D) $330ms^{-1}$

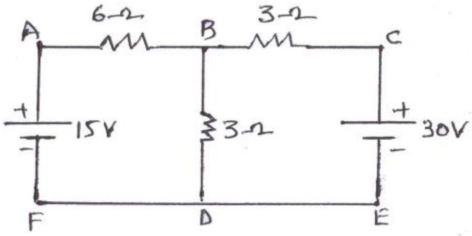
37. A plane mirror is moving with velocity $4\hat{i}+5\hat{j}+8\hat{k}$. A point object in front of the mirror moves with a velocity $3\hat{i}+4\hat{j}+5\hat{k}$. Here, $\hat{k}$ is the normal to the plane of the mirror facing towards the object. The velocity of the image is

A) $-3\hat{i}-4\hat{j}+5\hat{k}$ B) $3\hat{i}+4\hat{j}+11\hat{k}$ C) $-3\hat{i}-4\hat{j}+11\hat{k}$ D) $7\hat{i}+9\hat{j}+11\hat{k}$

38. YDSE experiment is carried out by green, red and blue light. The fringe width are $\beta_G, \beta_R, \beta_B$ then

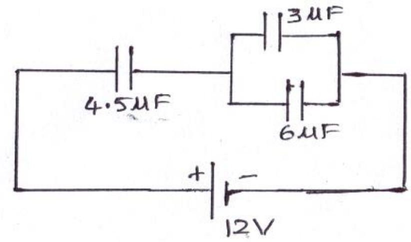
A) $\beta_G > \beta_B > \beta_R$ B) $\beta_B > \beta_R > \beta_G$ C) $\beta_R > \beta_B > \beta_G$ D) $\beta_R > \beta_G > \beta_B$

39. Find the current through the branch BD



A) 5A   B) 0A   C) 3A   D) 4A

40. Find potential difference across 4.5μF



A) 8V   B) 4V   C) 2V   D) 6V

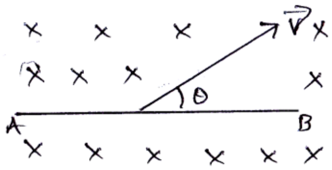
41. A rectangular ferro magnetic material of dimensions 10cm × 0.5cm × 2cm is placed in a magnetic field of intensity 2×10^5 A/m. The induced magnetic moment is 6A-m^2. The value of magnetic induction is

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

42. The electric field in a region $\vec{E} = 5\hat{i} + 2\hat{j}$ N/C. The electric flux due to this field through an area of 2m^2 lying is YZ plane is_____(SI Umt)

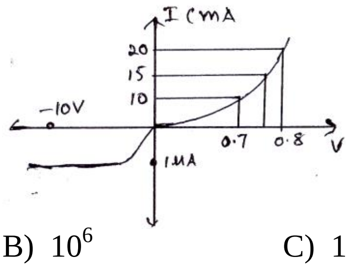
A) 10   B) 20   C) $10\sqrt{2}$ D) $2\sqrt{29}$

43. A conducting rod of length l = 1m is moving with a velocity V = 4m/s making an angle 30^0 with its length in a magnetic field B = 2T exists perpendicular to plane of motion, then potential difference across the ends of the rod



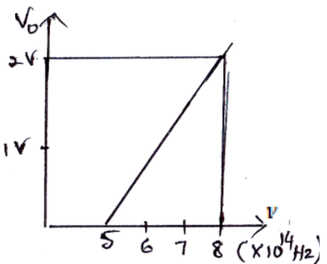
A) $V_A - V_B = 8V$ B) $V_A - V_B = 4V$ C) $V_B - V_A = 8V$ D) $V_B - V_A = 4V$

44. V-I characteristic curve of a diode is given. Find the ratio of forward to reverse bias resistance



A) 100   B) 10^6 C) 10   D) 10^{-6}

45. In a photoelectric experiment a graph is drawn between stopping potential and frequency of incident radiation. Find the threshold wavelength of photo sensitive metal



A) $4500A^0$ B) $6000A^0$ C) $5000A^0$ D) $3000A^0$

SECTION- II
(Numerical Value Answer Type)

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46. The power factor of a circuit is $\frac{1}{\sqrt{2}}$. The capacitance of the circuit is equal to____

47. On interchanging the resistance in left and right gaps in a meter bridge, balancing point shifts 60cm towards left. If the sum of the two resistors in 25Ω what is the left gap resistance ____

48. Nitrogen of mass 10g is enclosed in a vessel at 300K. What heat must be supplied to it to double the rms velocity of its molecules. ____

49. A particle of mass 3kg is moving under the action of a central force whose potential energy is given by U = 10 r^3J. For what angular momentum will the orbit be a circle of radius 10 m

50. A particle is moving in X -Y plane. At a certain instant the components of its velocity and acceleration are $V_x = 3ms^{-1}$, $V_y = 4ms^{-1}$, $a_x = 2ms^{-2}$,$a_y = 1ms^{-2}$. The rate of change of speed at this moment is ____

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CHEMISTRY

SYLLABUS:

51. The kinetic energy of an electron in the second Bohr orbit of a hydrogen atom is [a_0 is Bohr radius]:

A) $\frac{h^2}{4\pi^2 ma_0^2}$ B) $\frac{h^2}{16\pi^2 ma_0^2}$ C) $\frac{h^2}{32\pi^2 ma_0^2}$ D) $\frac{h^2}{64\pi^2 ma_0^2}$

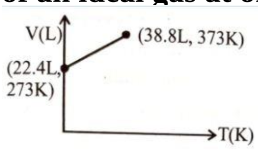
52. Among Al_2O_3, SiO_2, P_2O_3 and SO_2 the correct order of acid strength is

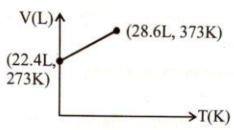
A) $Al_2O_3 < SiO_2 < SO_2 < P_2O_3$ B) $SiO_2 < SO_2 < Al_2O_3 < P_2O_3$
C) $SO_2 < P_2O_3 < SiO_2 < Al_2O_3$ D) $Al_2O_3 < SiO_2 < P_2O_3 < SO_2$

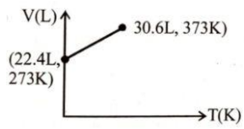
53. The molecule which has zero dipole moment is :

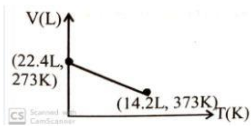
A) CH_2Cl_2 B) BF_3 C) NF_3 D) ClO_2

54. Which of the following volume (V) – temperature (T) plots represents the behavior of one mole of an ideal gas at one atmospheric pressure ?

A) 

B) 

C) 

D) 

55. Amongst the following identify the species with an atom in +6 oxidation state

A) MnO^-_4 B) $[Cr(CN)_6]^{3-}$ C) $[NiF_6]^{2-}$ D) CrO_2Cl_2

56. The direct conversion of A to B is difficult, hence it is carried out by the following shown path:

$$\begin{tikzcd} C \arrow[r] & D \arrow[d] \\ A \arrow[u] & B \end{tikzcd}$$

Given

$\Delta S_{(A\to C)} = 50 e.u., \Delta S_{(C\to D)} = 30 e.u., \Delta S_{(B\to D)} = 20 e.u.,$

Where e.u is the entropy unit, then $\Delta S_{(A\to B)}$ is

A) +60e.u B) +100e.u C) -60e.u D) -100e.u

57. Which one is more acidic in aqueous solution.

A) $NiCl_2$ B) $FeCl_3$ C) $AlCl_3$ D) $BeCl_2$

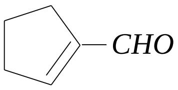
58. Which one of the following alkaline earth metal sulphates has its hydration enthalpy greater than its lattice enthalpy ?

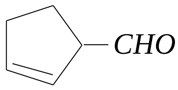
A) $BaSO_4$ B) $SrSO_4$ C) $CaSO_4$ D) $BeSO_4$

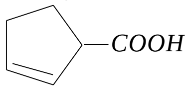
59. Which of the following has the highest nucleophilicity?

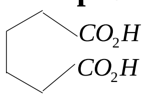
A) F^- B) OH^- C) CH_3^- D) NH_2^-

60. Cyclohexene on ozonolysis followed by reaction with zinc dust and water gives compound E. Compound E on further treatment with aqueous KOH yields compound F. Compound F is

A) 

B) 

C) 

D) 

61. CsBr has bcc structure with edge length 4.3pm. The shortest inter ionic distance in between Cs^+ and Br^- is :

A) 3.72 B) 1.86 C) 7.44 D) 4.3

62. The Henry's law constant for the solubility of N_2 gas in water at 298K is 1.0×10^5 atm. The mole of N_2 in air is 0.8. The number of moles of N_2 from air dissolved in 10 moles of water at 298 K and 5atm pressure is

A) 4.0×10^{-4} B) 4.0×10^{-5} C) 5.0×10^{-4} D) 4.0×10^{-6}

63. The equivalent conductance of NaCl at concentration C and at infinite dilution are λ_C and λ_∞ respectively. The correct relationship between λ_C and λ_∞ is given as : (where the constant B is positive)

A) $\lambda_C=\lambda_\infty+(B)C$ B) $\lambda_C=\lambda_\infty-(B)C$ C) $\lambda_C=\lambda_\infty-(B)\sqrt{C}$ D) $\lambda_C=\lambda_\infty+(B)\sqrt{C}$

64. The half-life period of a radioactive elements is 140 days. After 560 days, one gram of the element will reduced to :

A) $\frac{1}{2}g$ B) $\frac{1}{4}g$ C) $\frac{1}{8}g$ D) $\frac{1}{16}g$

65. In the context of the Hall- Heroult process for the extraction of Al, which of the following statements is false ?

A) Al^{3+} is reduced at the cathode to form Al

B) Na_3AlF_6 serves as the electrolyte only

C) CO and CO_2 are produced in this process

D) Al_2O_3 is mixed with CaF_2 which lowers the melting point of the mixture and brings conductivity

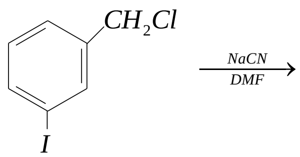
66. Extra pure N_2 can be obtained heating

A) NH_3 with CuO B) NH_4NO_3 C) $(NH_4)_2\ Cr_2O_7$ D) $Ba(N_3)_2$

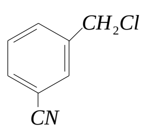
67. The spin only magnetic moment value (in Bohr megneton units) of $Cr(CO)_6$ is

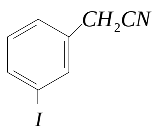
A) 0 B) 2.84 C) 4.90 D) 5.92

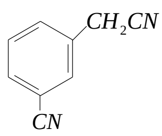
68. The structure of the major product formed in the following reaction

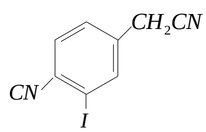


is

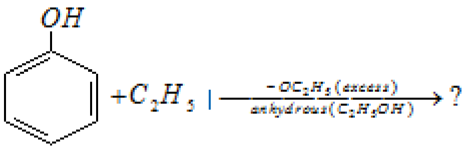
A) 

B) 

C) 

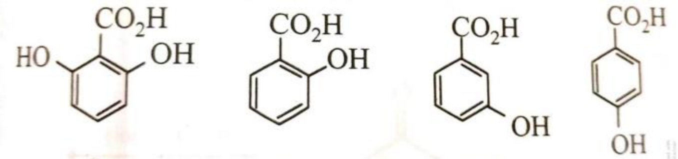
D) 

69.



A) $C_6H_5OC_2H_5$ B) $C_2H_5OC_2H_5$ C) $C_6H_5OC_6H_5$ D) C_6H_5I

70. The correct order of acidity for the following compounds is



I II III IV

A) I > II > III > IV B) III > I > II > IV C) III > IV > II > I D) I > III > IV > I

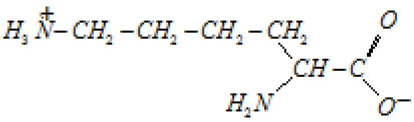
SECTION-II
(Numerical Value Answer Type)

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. The dissociation constant of a substituted benzoic acid at 25^0C is 1.0×10^{-4}. The pH of a 0.01 M solution of its sodium salt is

72. The total number of cyclic isomers possible for a hydrocarbon with the molecular formula C_4H_6 is

73. The total number of basic group in the following form of lysine is



74. In neutral or faintly alkaline solution, 8 moles of permanganate anion quantitatively oxidize thiosulphate anions to produce X moles of a sulphur containing product. The magnitude of X is.

75. Among the following , the number of compounds those can react with PCl_5 to give $POCl_3$ is

$O_2, CO_2, SO_2, H_2O, H_2SO_4, P_4O_{10}$