SRIGAYATRI EDUCATIONAL INSTITUTIONS
INDIA

JEE MAIN TOT GT-6

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:* Total Syllabus.**

1. **If the system of linear equations**
$x_1 + 2x_2 + 3x_3 = 6$, $x_1 + 3x_2 + 5x_3 = 9$, $2x_1 + 5x_2 + ax_3 = b$
is consistent and has infinite number of solutions, then:
A) a= 8, b can be any real number B) b = 15, a can be any real number
C) $a \in R - \{8\}$ and $b \in R - \{15\}$ D) $a = 8, b = 15$

2. $(p \wedge \sim q) \wedge (\sim p \vee q)$ is
A) tautology B) contradiction C) duality D) double implication

3. **In a set of 2n observations, half of them are equal to 'a' and the remaining half are equal to $'-a'$. If the standard deviation of all the observations is 2; then the value of $|a|$ is**
A) 2 B) $\sqrt{2}$ C) 4 D) $2\sqrt{2}$

4. **One ticket is selected at random from 50 tickets numbered 00,01,02,……,49. Then the probability that the sum of the digits on the selected ticket is 8, given that the product of these digits is zero, equals to**
A) $\frac{1}{7}$ B) $\frac{5}{14}$ C) $\frac{1}{50}$ D) $\frac{1}{14}$

5. **The sum $\sum_{i=0}^{m} \binom{10}{i}\binom{20}{m-i}$, where $\binom{p}{q} = 0$ if $p > q$, is maximum when m is equal to**
A) 5 B) 10 C) 15 D) 20

6. **Sum of infinite number of terms of GP is 20 and sum of their square is 100. The common ratio of GP is**
A) 5 B) 3/5 C) 8/5 D) 1/5

7. **In a triangle, the sum of lengths of two sides is x and the product of the lengths of the same two sides is y. If $x^2 - c^2 = y$, where c is the length of the third side of the triangle, then the circumradius of the triangle is**
A) $\frac{3}{2}y$ B) $\frac{c}{\sqrt{3}}$ C) $\frac{c}{3}$ D) $\frac{y}{\sqrt{3}}$

8. **The value of 'a' for which one root of the quadratic equation** $(a^2 - 5a + 3)x^2 + (3a - 1)x + 2 = 0$ is twice as large as the other is
A) $-\frac{1}{3}$ B) $\frac{2}{3}$ C) $-\frac{2}{3}$ D) $\frac{1}{3}$

9. **If** $f(x) = 2\tan^{-1}x + \sin^{-1}\left(\frac{2x}{1+x^2}\right), x > 1$ then $f(2020) =$ ________
A) $-\pi$ B) π C) 0 D) $4\tan^{-1}(2020)$

10. The sum of 4-digit even numbers formed by the digits 0, 3, 5, 4 repetition of the digits is not allowed is _________

A) 40506 B) 53436 C) 43536 D) 65433

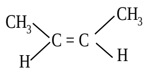
11. A square is inscribed in the circle $x^2+y^2-6x+8y-103=0$ with its sides parallel to the coordinate axes. Then the distance of the vertex of this square which is farthest to the origin is

A) $\sqrt{137}$ B) $\sqrt{265}$ C) $\sqrt{365}$ D) $\sqrt{41}$

12. The plane containing the line $\frac{x-3}{2}=\frac{y+2}{-1}=\frac{z-1}{3}$ and also containing its projection on the plane $2x+3y-z=5$, contains which one of the following points?

A) $(2,2,0)$ B) $(-2,2,2)$ C) $(0,-2,2)$ D) $(2,0,-2)$

13. A tangent to the hyperbola $\frac{x^2}{4}-\frac{y^2}{2}=1$ meets x-axis at P and y-axis at Q. Lines PR and QR are drawn such that OPRQ is a rectangle (Where O is the origin). Then R lies on:

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

C) $\frac{2}{x^2}+\frac{4}{y^2}=1$ D) $\frac{4}{x^2}-\frac{2}{y^2}=1$

14. Let $f(x)$ be defined in the interval [-2, 2] such that $f(x)=\begin{cases}-1, & -2\le x\le 0\\ x-1, & 0<x\le 2\end{cases}$ and $g(x)=f(|x|)+|f(x)|$. Test the differentiability of $g(x)$ in $(-2,2)$.

A) differentiable at all points B) not continuous
C) not differentiable at two points D) not differentiable at one point

15. The integral $\int\frac{dx}{(1+\sqrt{x})\sqrt{x-x^2}}$ is equal to : (Where C is a constant of integration)

A) $\pm2\sqrt{\frac{1+\sqrt{x}}{1-\sqrt{x}}}+C$ B) $-\sqrt{\frac{1-\sqrt{x}}{1+\sqrt{x}}}+C$ C) $-2\sqrt{\frac{1-\sqrt{x}}{1+\sqrt{x}}}+C$ D) $-2\sqrt{\frac{1+\sqrt{x}}{1-\sqrt{x}}}+C$

16. Let [x] denote the greatest integer less than or equal to x. Then:

$$\lim_{x\to0}\frac{\tan(\pi\sin^2x)+(|x|-\sin(x[x]))^2}{x^2}$$

A) does not exist B) equals π C) equals $\pi+1$ D) equals 0

17. The straight line $3x+y=1$ meets the coordinate axes at A and B. A circle is drawn through A, B and the origin. Then the sum of perpendicular distances from A and B on the tangent to the circle at the origin is

A) $\sqrt{10}$ B) $\frac{\sqrt{10}}{2}$ C) $\frac{\sqrt{10}}{3}$ D) $3\sqrt{10}$

18. Equation of common tangent of $y=x^2, y=-x^2+4x-4$ is

A) $y=4(x-1)$ B) $x=0$ C) $y=-4(x-1)$ D) $y=-30x-50$

19. Consider the differential equation $y^2dx+\left(x-\frac{1}{y}\right)dy=0$. If $y(1)=1$, then x is given by

A) $4-\frac{2}{y}-\frac{e^{\frac{1}{y}}}{e}$ B) $3-\frac{2}{y}+\frac{e^{\frac{1}{y}}}{e}$ C) $1+\frac{1}{y}-\frac{e^{\frac{1}{y}}}{e}$ D) $1-\frac{1}{y}+\frac{e^{\frac{1}{y}}}{e}$

20. The d.r's of normal to the plane through (1,0,0), (0,1,0) which makes an angle $\frac{\pi}{4}$ with plane $x+y=3$ are

A) $1,\sqrt{2}.1$ B) $1,1,\sqrt{2}$ C) $1,1,2$ D) $\sqrt{2},1,1$

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. **Let** $\vec{a}=\hat{i}+2\hat{j}+4\hat{k}, \vec{b}=\hat{i}+\lambda\hat{j}+4\hat{k}$ **and** $\vec{c}=2\hat{i}+4\hat{j}+\left(\lambda^2-1\right)\hat{k}$ **be coplanar vectors** $\lambda\neq\pm3$**. Then** $\vec{a}.\vec{c}$ **is_______**

22. **Let** $\left(-2-\frac{1}{3}i\right)^3=\frac{x+iy}{27}\left(i=\sqrt{-1}\right)$**, where x and y are real numbers, then** $x+y=$**_____**

23. **The value of integral** $\int_{-2}^{2}\frac{\sin^2 x}{\left[\frac{x}{\pi}\right]+\frac{1}{2}}dx$ **(where [x] denotes the greatest integer less than or equal to x) is_______**

24. **Two circles with equal radii are intersecting at the points (0, 1) and** $(0,-1)$**. The tangent at the point (0,1)) to one of the circles passes through the centre of the other circle. Then the distance between the centres of these circles is______**

25. **The maximum value of the function** $f\left(x\right)=2x^3-15x^2+36x-48$ **on the set** $A=\left\{x\left|x^2+20\leq 9x\right|\right\}$ **is _________**

SECTION–I
(SINGLE CORRECT ANSWER TYPE)

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PHYSICS

SYLLABUS: Total Syllabus

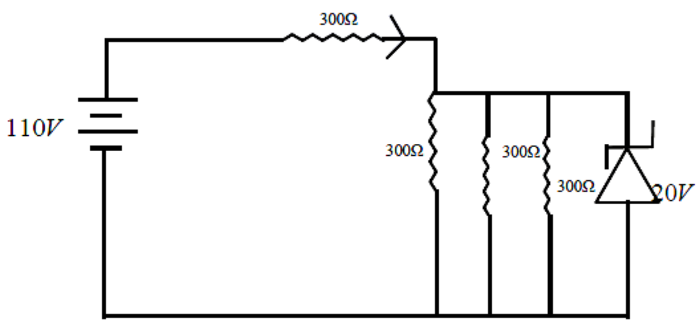
26. **The trajectory of a projectile is** $y=\sqrt{3}x-\frac{x^2}{80}$**. Here x and y are in metres. The radius of curvature of its trajectory when this particle making an angle 45^0 with the horizontal is R. Neglecting air resistance and taking acceleration due to gravity** $g=10m/s^2$**, the value of R is**

A) $40\sqrt{2}m$ B) 80 m C) $160\sqrt{2}m$ D) $80\sqrt{2}$ m

27. **A hydrogen atom, initially in the ground state is excited by absorbing a photon of energy 12.75 eV. The radius of the orbit in the excited state, in terms of Bohr's first orbit radius** r_0**, willbe**

A) $9r_0$ B) $36r_0$ C) $16r_0$ D) $4r_0$

28. **In the given circuit the current through zener Diode is close to**



A) 0.5 A B) 0.1 A C) 0.01 A D) 0.2 A

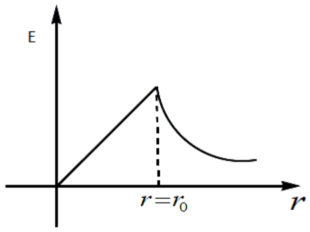
29. Two solenoids of equal number of turns have their lengths and radii in the same ratio 1:2. The ratio of their self inductances will be

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

30. A particle undergoing simple harmonic motion has time dependent displacement given by $y(t) = y_0 \sin\frac{\pi t}{300}$. The ratio of kinetic to the total energy of this particle at $t = 100s$ will be:

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

31. The given graph shows variations (with distance *r* from centre) of

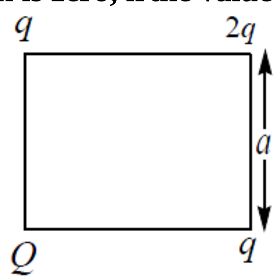


A) Electric field of uniformly charged non – conducting sphere
B) Potential of a uniformly charged spherical shell
C) Potential of a uniformly charged non – conducting sphere
D) Electric field of a uniformly charged spherical shell

32. If *E*,*m*,*l* and G denote energy, mass, angular momentum and gravitational constant respectively, the quantity $\left(\frac{El^2}{m^5G^2}\right)$ has the dimensions of

A) mass B) length C) time D) angle

33. Four charges *Q*,+*q*,+2*q* and +*q* are placed at the vertices of a square as shown below. The net electric energy of the configuration is zero, if the value of Q is



A) $\frac{-q(4\sqrt{2}+1)}{\sqrt{2}(2+\sqrt{2})}$ B) $\frac{-q(4\sqrt{2}+1)}{2+\sqrt{2}}$ C) $\frac{q(4\sqrt{2}+1)}{2(2+\sqrt{2})}$ D) $\frac{q(4\sqrt{2}+1)}{(2+\sqrt{2})}$

34. Spherical aberration in a thin lens can be reduced by

A) Using a monochromatic light B) using a doublet combination
C) Using a circular annular mark over the lens D) Increasing the size of the lens.

35. A uniform rod of length 1 m and mass 4 kg is supported on two knife – edges placed 10 cm from each end. A 60 N weight is suspended at 30 cm from one end. The reactions at the knife edges is

A) 60 N, 40 N B) 75 N, 25 N C) 65 N, 35 N D) 55N, 45 N

36. 100 g ice at – 20^0C is added to 100 g of water at 50^0C. The mixture contents are : (specific heat of water = 4.2 J/g/^{0}C, specific heat of ice =2.1 J /g/^{0}C. Heat of fusion of water at 0^0C=334 J/g)

A) 50 g ice and 150 g water at $0^0\ C$ *B)* 50 g ice and 150 g water of $10^0\ C$
C) 40 g ice and 160 g water at $0^0\ C$ *D)* 40 g ice and 160 g water at $10^0\ C$

37. A particle is moving along a circular path with a tangential acceleration $2m/s^2$. What is the magnitude of the change in angular momentum during 10s, after starting from rest. (mass of the particle m=1 kg, radius of the path r=0.2m)

A) 4 kg m^2/s B) 1 kg m^2/s C) 2 kg m^2/s D) 8 kg m^2/s

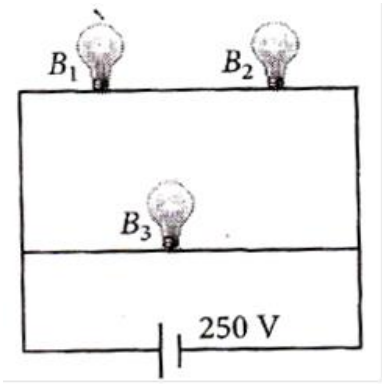
38. **A message signal** $C_m(t) = 0.4\sin\left(4.4\times10^4\right)t$ **is modulating with a carrier wave** $C_c(t) = 20\sin\left(9.9\times10^5\right)t$**. The side band frequencies in (kHz) are,** $\left[Given\ \pi = \frac{22}{7}\right]$**.**

A) 160.5 and 150.5 B) 164.5 and 160.5 C) 164.5 and 150.5 D) 160.5 and 150.5

39. **3 moles of oxygen at temperature 2T and 5 moles of helium at temperature T are mixed, the total internal energy of the system is**

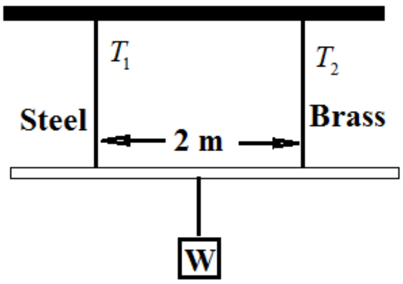
A) $\frac{45RT}{2}$ B) 45RT C) $\frac{33RT}{2}$ d0 33RT

40. **A 100 W bulb B_1 and two 60 W bulbs B_2 and B_3, are connected to a 250 V source, as shown in figure. Now W_1, W_2 and W_3 are the output powers of the bulbs B_1, B_2 and B_3, respectively. Then**



A) $W_1 > W_2 = W_3$ B) $W_1 > W_2 > W_3$ C) $W_1 < W_2 = W_3$ D) $W_1 < W_2 < W_3$

41. **A light rod of length 2 m suspended from the ceiling horizontally by means of two vertical wires of equal length. A weight W is hung form a light rod as shown in figure. The rod hung by means of a steel wire of cross- sectional area** $A_1 = 0.1cm^2$ **and brass wire of cross- sectional area** $A_2 = 0.2cm^2$**. To have equal stress in both wires,** T_1/T_2 **is equal to**

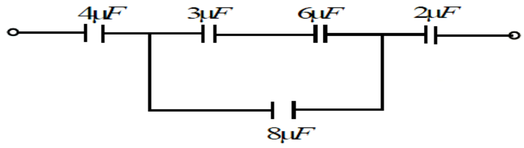


A) 1/3 B) 1/4 C) 4/3 D) 1/2

42. **An electromagnetic wave** $E_1 = 100\left(\sin 3\times10^6 t - 2\times10^{-2}x\right)\frac{v}{m}$ **is propagating in the medium -1. The same electromagnetic wave propagating in the another medium -2, represented by** $E_2 = 100\sin\left(4\times10^6 t - 3\times10^{-2}x\right)V/m$**. The relative refractive index of medium – 1 wrt to the medium - 2 is**

A) $\frac{8}{3}$ B) $\frac{3}{8}$ C) $\frac{6}{4}$ D) $\frac{8}{9}$

43. In the figure shown below, the charge on the left plate of the 6μF is 180μC . The charge on the right plate of the 2μF capacitor is

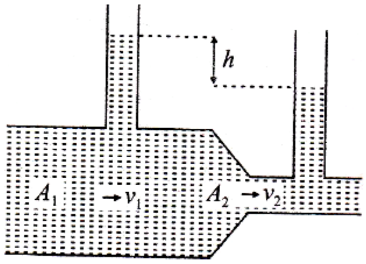


A) 450 μC B) – 450 μC C) - 900 μC D) 800 μC

44. A rigid monoatomic ideal gas undergoes an adiabatic process at room temperature. The relation between temperature and volume for this process is TV^x =constant, then x is

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

45. A liquid flows through a horizontal tube as shown in figure. The velocities of the liquid in the two sections, which have areas of cross – section A_1 and A_2, are v_1 and v_2, respectively. The difference in the levels of the liquid in the two vertical tubes is h . Then



A) $v_2^2 - v_1^2 = 2gh$ B) $v_2^2 + v_1^2 = 2gh$ C) $v_2^2 - v_1^2 = gh$ D) $v_2^2 + v_1^2 = gh$

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.
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46. The speed of electron is $7.25\times10^6 m/s$. If the debroglie wave length of an electron is equal to the wavelength of a photon, then the energy of the photon is: (near value of photon energy) (Speed of light $=3\times10^8 m/s$ planks constant $=6.63\times10^{-34} J.s.$ Mass of electron $=9.1\times10^{-31}$ kg)_______ eV.

47. A satellite is revolving in a circular orbit at a height h from the earth surface, such that h << R where R is the radius of the earth. Assuming that the effect of earth's atmosphere can be neglected the minimum percentage of the velocity to be increased, so that the satellite could escape from the gravitational field of the earth is______

48. Equation of travelling wave on a stretched string of linear density 5g/m is $Y=10\sin(450t-kx)$ where distance and time are measured in SI units. The tension in this string is 50 N. The value of k is _______ m^{-1}.

49. Refractive index of glass for red and violet colours are1.50 and 1.60 respectively. Then the dispersive power of the medium is_______

50. In a potentiometer a cell of emf 1.5 V in the secondary circuit gives a balance point at 32 cm length of the wire. If the cell is replaced by another cell then the balance point shifts to 65.0 cm then the emf of second cell in the secondary circuit is______V.

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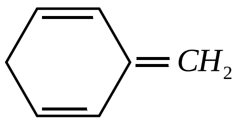
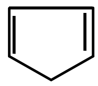
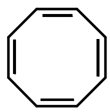
CHEMISTRY

SYLLABUS: **Total Syllabus**

51. Methemoglobinemia is due to

A) > 50 PPM of SO_4^{2-} B) > 50 PPM of CO_3^{2-}
C) >50 PPM of NO_3^- D) >50 PPM of Cl^-

52. The non aromatic compound among these:

A) 
B) 
C) 
D) All of these

53. $CH_3-C\equiv CH+H_2O\xrightarrow[\substack{20-40\% \\ H_2SO_4}]{HgSO_4 1\%} X$ □ Z .

Which of the following statements are true regarding the sequence of reactions?

A) It is a nucleophilic addition reaction B) It forms an unstable enol
C) Enol tautomerizes to give a carbonyl compound
D) All of these

54. The number of oxygen atoms in ammonium phosphomolybdate are

A) 0 B) 40 C) 20 D) 30

55. Oxygenated water is treated with finely divided metal. The product obtained subjected to U.V treatment to give another product. This product has angular structure. The correct statements about it are

I) It oxidizes 3 moles of SO_2 **II) It turns Benzidine paper brown**
III) It's reaction with oxygenated water is a typical reduction reaction
IV) It can not do dry bleaching.

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

56. Aluminium nitride on treatment with hot water gave a gas "X". "X" in excess is passed into horn Silver to give a compound "Y". The correct statements regarding X and Y are

I) "X" is a lewis base and monodentate ligand
II) "Y" has coordination number two and central atom undergoes SP- hybridization.
III) Y is diamagnetic complex
IV) Horn silver $AgNO_3$

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

57. The minimum amount of dioxygen consumed per gram of reactant is in the case of

A) Propane combustion B) Tetraphosphorous combustion
C) Ferrum combustion D)Z= 12 Combustion

58. Let us assume that according to Bohr's theory

$E_t =$ Total energy $K_t =$ Kinetic energy
$V_t =$ Potential energy $r_n =$ radius of nth orbit

Match the following

Column – I	**Column – II**
A) $V_t/K_t=?$	**P =0**
B) If radius of nth orbit $\alpha\, E_{t_1}^{x}\, x=?$	**Q= - 1**
C) angular momentum of lowest orbital	**R= -2**
D) $\frac{1}{r^n}<2^y\ y=?$	**S= 1**

A) A – R , B– Q, C – P, D – S B) A – S, B – Q, C – P, D – R
C) A – D, B – Q, C – R, D – S D) A – Q, B – S, C – R, D – P

59. Arrange the following compounds in the order of increasing dipole moment toluene (I) m-dichloro benzene(II), o-dichloro benzene(III), P-dichloro benzene(IV)

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

60. Linear molecules among these:

A) I_3^-, XeF_2 B) CO_2, ICl_2^- C) $BeCl_2, N_3^-$ D) All of these

61. Consider the Vander Waal's constants a and b for the following gases:

Gas	**Ar**	**Ne**	**Kr**	**Xe**
a) atm dm^6 mole^{-2}	**1.3**	**0.2**	**5.1**	**4.1**
b) 10^{-2} dm^3 mol^{-1}	**3.2**	**1.7**	**1.0**	**5.0**

Which gas is expected to have the highest critical temperature?

A) Kr B) Xe C) Ar D) Ne

62. Consider the reaction $N_{2(g)} + 3H_{2(g)} \rightleftharpoons 2NH_{3(g)}$.The equilibrium constant of the above reaction is k_p . If pure ammonia is left to dissociate, the partial pressure of ammonia at equilibrium is given by (assume that $P_{NH_3} << P_{total}$ at equilibrium.

A) $\dfrac{3^{3/2}K_P^{1/2}P^2}{4}$ B) $\dfrac{3^{3/2}K_P^{1/2}P^2}{16}$ C) $\dfrac{K_P^{1/2}P^2}{16}$ D) $\dfrac{K_P^{1/2}P^2}{4}$

63. The initial rate of hydrolysis of methyl acetate (1 M) by a weak acid (HA, 1M) is 1/100th of that of a strong acid (HX 1M) at 25^{0}C. The Ka of (HA) is

A) 1×10^{-4} B) 1×10^{-5} C) 1×10^{-6} D) 1×10^{-3}

64. For gold $C_P\left(JK^{-1}\ mol^{-1}\right) = 20 + 0.01T$. If the temperature T of 3 moles of gold is raised from 300K to 1000 K at 1 atm. The value of ΔH will be close to

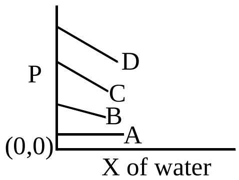
A) 55.6 KJ B) 66.6 KJ C) 76.6 KJ D) 45.6 KJ

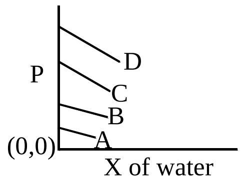
65. A compound of formula A_2B_3 has hexagonal close packing. Which atom forms hcp lattice and what fraction of tetrahedral void is occupied by the other atoms?

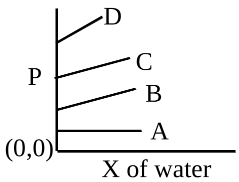
A) hcp lattice – A 4/3 tetrahedral voids –B B) hcp lattice – A 4/3 tetrahedral voids – B

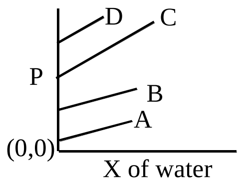
C) hcp lattice – B 4/3 tetrahedral voids – A D) hcp lattice –B 1/3 tetrahedral voids – A

66. For the solution of gases A, B, C and D in water at 298K the Henry's constant are 1, 4 70 and 80 K bar respectively. The correct plot for the given data

A) 

B) 

C) 

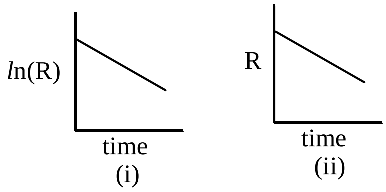
D) 

67. The decreasing order of electrical conductivity of the following aqueous solutions is

I) $1M\ HCOOH$ II) $1M\ H_2C_2O_4$ III) $1M\ CH_3COOH$ IV) $1M\ C_6H_5COOH$

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

68. The given plots represent the variation of the concentration of a reaction "R" with time for two different reactions(i) with(ii). The respective orders of the reaction are



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

69. Haemoglobin and gold_____ sols are

A) +Ve, –Ve B) –Ve, + Ve C) + Ve, +Ve D) – Ve, –Ve

70. Which of the following reaction requires spongy platinum catalyst and heating?

A) $H_2 + F_2$ B) $H_2 + Cl_2$ C) $H_2 + Br_2$ D) $H_2 + I_2$

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. Each question has 4 options (1), (2), (3) and (4) for its answer, out of which **ONLY ONE** option can be correct.
Marking scheme: +4 for correct answer, 0 in all other cases.

71. The highest oxidation state shown by Np and Pt is______

72. In EDTA the maximum denticity is _____

73. When lithium tetrahydrido aluminate (III) is treated with methyl propenyl ester the number hydrogen's involved is______

74. An organic compound neither reacts with neutral ferric chloride solution nor with fehilings solution. It however reacts with Grignard's reagent and gives positive iodoform test. The compound has a particular functional group. The number of atoms in the functional group____

75. The number of peptide bonds in aspartame an artificial sweetner is_____