

JEE - Main

Chapter wise Model Paper - III

Time: 3 hrs

Max. Marks: 360

IMPORTANT INSTRUCTIONS :

Physics : Question No. 1 to 30 consists FOUR (4) marks. Negative (-1)

Chemistry : Question No. 31 to 60 consists FOUR (4) marks. Negative (-1)

Maths : Question No. 61 to 90 consists FOUR (4) marks. Negative (-1)

Syllabus:

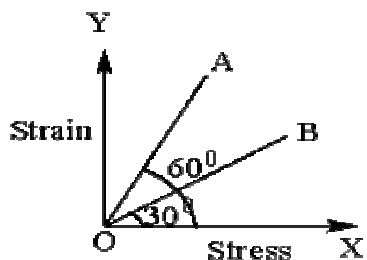
Mathematics : Trigonometry

Physics : Properties of matter and heat

Chemistry : Groups 1,2, 13,14,15, 16, 17 and 18, Hydrogen and its compounds

PHYSICS

- 1 The stress versus strain graphs for wires of two materials A and B are as shown in the fig. If Y_A and Y_B are the young's moduli of the materials, then



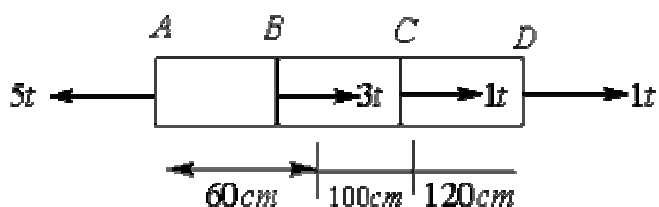
1. $Y_B = 2Y_A$ 2. $Y_A = Y_B$ 3. $Y_B = 3Y_A$ 4. $Y_A = 3Y_B$
- 2 An ideal gas is taken through a cyclic thermodynamic process through four steps. The amounts of heat exchanges involved in these steps are $Q_1 = 5960 J, Q_2 = -5585 J, Q_3 = 2980 J$ and $Q_4 = 3645 J$ respectively. The corresponding works involved are $W_1 = 2200 J, W_2 = -825 J$ and $W_3 = 1100 J$. Then the work done in the fourth step W_4 is
1. 1315 J 2. 1040 J 3. 765 J 4. -756 J
- 3 Two moles of helium gas are taken over the cycle ABCDA, as shown in the P.T diagram. Assuming the gas to be ideal the workdone on the gas in taking it from A to B is:
1. 300R 2. 400R 3. 500R 4. 200R
- 4 One kg of a diatomic gas is at a pressure of $8 \times 10^4 N/m^2$. The density of the gas is $4 kg/m^3$. Energy of the gas due to its thermal motion is

1. $5 \times 10^4 J$ 2. $6 \times 10^4 J$ 3. $7 \times 10^4 J$ 4. $3 \times 10^4 J$

5 An ideal black-body at room temperature is thrown into a furnace. It is observed that

1. initially it is the darkest body and at later times the brightest
2. it is the darkest body at all times
3. it cannot be distinguished at all times
4. initially it is the darkest body and at later times it cannot be distinguished

6 A brass bar, having cross sectional area 10 cm^2 is subjected to axial forces as shown in the fig. Total elongation of the bar (Take $Y = 8 \times 10^{10} \text{ t/cm}^2$)



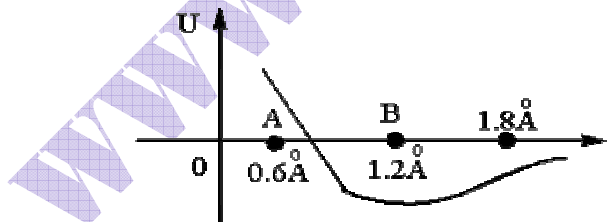
1. 0.0775 cm
2. 7.5 cm
3. 0.75 cm
4. 75 cm

7 Ideal monoatomic gas is taken through a process $dQ = 2dU$. The molar heat capacity for the process is : (where dQ is heat supplied and dU is change in internal energy)

1. $5R$
2. $3R$
3. R
4. None of these

8 The potential energy 'U' between two molecules as a function of 'r' of the distance between them is shown in fig. A, B and C are points for which

$r = 0.6 \text{ \AA}, 1.2 \text{ \AA}$ and 1.8 \AA respectively. At A, B and C the force between two molecules respectively is



1. zero, attractive, repulsive
2. zero, repulsive, attractive
3. attractive, zero, repulsive
4. repulsive, zero, attractive

9 A and B are two points on a uniform metal ring whose centre is C. The angle $ACB = \theta$. A and B are maintained at two different constant temperatures. When $\theta = 120^\circ$, the rate of

total heat flow from A to B is 90 W. When $\theta = 180^\circ$, this rate will be.....

1. 80 W 2. 90 W 3. 135 W 4. 180 W

10 A slab of ice is one half covered with black cloth and the other half with white cloth. This is then placed in sunlight. After some time the pieces of cloth are removed. Which of the following statements is correct.

1. Ice has melted equally under both the pieces.
2. More ice has melted under white cloth.
3. More ice has melted under black cloth.
4. It will depend on the medium in which ice is placed.

11 A Scientist says that the efficiency of heat engine which operates at source temperature 127°C and sink temperature 27° is 26%. Then

1. It is impossible 2. It is possible but less probable
3. It is quite probable 4. Data is incomplete

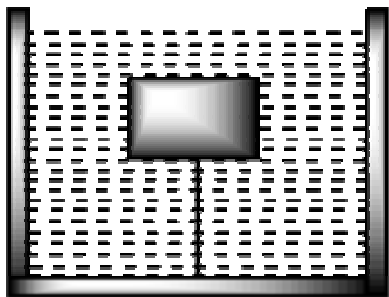
12 When two bodies A and B are in thermal equilibrium

1. The internal energies of the two bodies will be equal.
2. The average kinetic energy of the molecules of the two bodies will be equal.
3. The kinetic energy of all the molecules of A and B will be equal.
4. The potential energies of all the molecules of A and B will be equal.

13 A piece of copper having an internal cavity weighs 264 gm in air and 221 gm in water. The volume of the cavity is. [Density of copper is 8.8 gm/cc]

1. 11 cc 2. 12 cc 3. 13 cc 4. 14 cc

14 Find the tension in the string holding a solid block of volume 1000 cm^3 and density 0.8 gm/cm^3 dipped in liquid and tied to the bottom of a container filled with liquid of density 1.2 gm/cm^3 as shown in figure, when container is stationary.



1. 3.92 N 2. 39.2 N 3. 5.88 N 4. 0 N

15 A sample of an ideal gas ($\gamma = 1.5$) is compressed adiabatically from a volume of 150cm^3 to 50cm^3 . The initial pressure and the initial temperature are 150 kPa and 300 K. Find the change in internal energy of the gas and the work done by the gas in this process.

1. 33 J, -33 J 2. -33J, 33 J
3. 33 J, 33 J 4. 33 cal, -33 cal

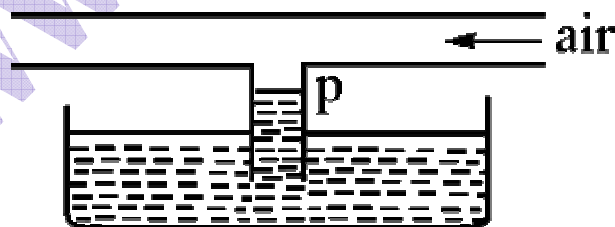
16 A capillary tube of radius ' r ' and length ' l ' is connected in series with another capillary tube of radius $2r$ and length $\frac{l}{2}$. If the pressure across the two tubes taken together is ' P ' and a liquid flows through it, then the ratio of pressures across the first and second tubes is

1. 1 : 4 2. 4 : 1 3. 16 : 1 4. 32 : 1

17 Water from a tap at the end of horizontal pipe emerges vertically downwards with an initial speed of 1ms^{-1} . The cross section of the pipe is 10^{-4}m^2 at the top. If the pressure of the stream is constant throughout, the area of the stream 0.15 m below the tap is

1. $5 \times 10^{-4}\text{m}^2$ 2. 10^{-5}m^2
3. $5 \times 10^{-5}\text{m}^2$ 4. $2 \times 10^{-5}\text{m}^2$

18 A capillary tube is dipped in a liquid which wets it. The liquid rises to a point P. If we blow air through the horizontal tube, what will happen to the liquid column in the capillary tube?



1. It rises above P 2. It falls below P
3. It remains at P 4. None

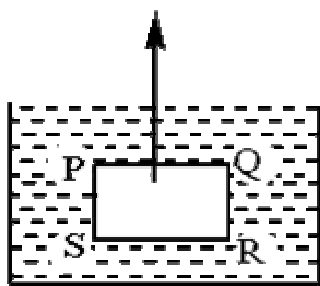
19 A large tank filled with water to a height 'h' is to be emptied through a small hole at the bottom. The ratio of the time taken for the level to fall from 'h' to h/2 and that taken for the level to fall from h/2 to 0 is

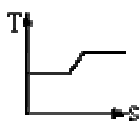
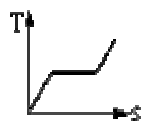
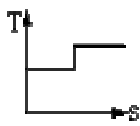
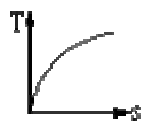
1. $\sqrt{2}$ 2. $\frac{1}{\sqrt{2}}$ 3. $\sqrt{2}-1$ 4. $\frac{1}{\sqrt{2}-1}$

20 30g of water at 300°C is in a copper beaker. This of the following when added to water will have greatest cooling effect. (Specific heat of copper = $0.1 \text{ cal/g}^\circ\text{C}$)

1. 100g of water at 10°C 2. 15g of water at 0°C
3. 3g of ice at 0°C 4. 18g of copper at 0°C

21 A metallic square plate attached with a massless inextensible string is immersed in a liquid contained in a beaker as shown figure. If the point of support is slowly raised vertically upwards with a constant velocity v , the graph showing the variation of tension T in the string against displacement of support is best represented by:



1. 
2. 
3. 
4. 

22 The velocity of air over the upper surface of airplane wing is 40 ms^{-1} and that on the lower surface is 30 ms^{-1} . The area of the wing is 4 m^2 . If the mass of the wing is 200 Kg, the net force acting on it is (density of air 1.3 kg m^{-3})

1. 140 N up 2. 140 N down
3. 280 N up 4. 280 N down

23 The initial pressure and volume of a given mass of a gas $\left(\frac{C_p}{C_q} = \gamma\right)$ are P_0 and V_0 . The gas

can exchange heat with its surroundings. It is slowly compressed to a volume $\frac{V_0}{2}$ and then suddenly compressed to $\frac{V_0}{4}$. Find the final pressure.

1. $2^\gamma P_0$ 2. $2^{\gamma+1} P_0$ 3. $2P_0$ 4. $4P_0$

24 The mean density of sea water is ρ , and bulk modulus is B. The change in density of sea water in going from the surface of water to a depth of h is :

1. $\frac{B\rho^2}{gh}$ 2. $B\rho gh$ 3. $\frac{\rho^2 gh}{B}$ 4. $\frac{\rho gh}{B}$

25 A glass rod of diameter $d_1 = 1.5$ mm is inserted symmetrically into a glass capillary with inside diameter $d_2 = 2.0$ mm. Then the whole arrangement is vertically oriented and brought in contact with the surface of water. To what height will the liquid rise in the capillary. Surface tension of water is $70 \times 10^{-3} \text{ Nm}^{-1}$, $g = 10 \text{ m.s}^{-2}$

1. 6 m 2. 7 m 3. 5.6 cm 4. 0.6 mm

26 The specific heat of many solids at low temperatures varies with absolute temperature T according to the relation $S = AT^3$, where A is a constant. The heat energy required to raise the temperature of a mass m of such a solid from $T = 0\text{k}$ to $T = 20\text{k}$ is:

1. $4 \times 10^4 mA$ 2. $2 \times 10^3 mA$
3. $8 \times 10^6 mA$ 4. $2 \times 10^6 mA$

27 A light rod of length 200 cm is suspended from the ceiling horizontally by means of two vertical wires of equal length tied to its ends. One of the wires is made of steel and is of cross section 0.1 sq. cm. and the other is of brass of cross section 0.2 sq. cm. Find the position along the rod at which a weight may be hung to produce equal strains in both wires. (from the steel wire) ($Y_{brass} = 10 \times 10^{11} \text{ dynes / cm}^2$, $Y_{steel} = 20 \times 10^{11} \text{ dynes / cm}^2$)

1. 100 cm 2. 200 cm 3. 300 cm 4. 400 cm

28 2 kg of ice at -20°C is mixed with 5 kg of water at 20°C in an insulating vessel having a negligible heat capacity. Calculate the final mass of water and ice remaining in the container. It is given that the specific heats of water and ice are $1 \text{ kcal / kg } / ^\circ \text{C}$ and $0.5 \text{ kcal / kg } / ^\circ \text{C}$ while the latent heat of fusion of ice is 80 kcal/kg :

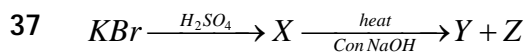
1. 7 kg, 0kg 2. 6 kg, 1kg
3. 4 kg, 3kg 4. 2 kg, 5 kg

- 29 A cubical box of side 1 meter contains helium gas (atomic weight 4) at a pressure of 100 N/m^2 . During an observation time of 1 second, an atom travelling with the root-mean-square speed parallel to one of the edges of the cube was found to make 500 hits with a particular wall, without any collision with other atoms. Take $R = \frac{25}{3} \text{ J/mol-K}$ and $K = 1.38 \times 10^{-23} \text{ J/K}$ Evaluate the temperature of the gas
1. 160 K 2. 160°C 3. 100 K 4. 60 K
- 30 If a bar is made of copper whose coefficient of linear expansion is one and half times that of iron, then the ratio of force developed in the copper bar to the iron bar of identical lengths and cross-sections, when heated through the same temperature range is (Young's modulus of copper may be taken equal to Young's modulus of iron) is
1. 3/2 2. 2/3 3. 9/4 4. 4/9

CHEMISTRY

- 31 Four alkali metals A,B,C and D having standard electrodes potentials as - 3.05, -1.66, -0.40 and 0.80 V respectively, which one will be the most reducing agent
1. D 2. B 3. C 4. A
- 32 Thermal stability of alkaline earth metal carbonates decreases in the order
1. $\text{BaCO}_3 > \text{SrCO}_3 > \text{CaCO}_3 > \text{MgCO}_3$ 2. $\text{BaCO}_3 > \text{SrCO}_3 > \text{MgCO}_3 > \text{CaCO}_3$
 3. $\text{CaCO}_3 > \text{SrCO}_3 > \text{MgCO}_3 > \text{BaCO}_3$ 4. $\text{MgCO}_3 > \text{CaCO}_3 > \text{SrCO}_3 > \text{BaCO}_3$
- 33 XeF_2 on hydrolysis gives
1. XeO_3 2. XeO 3. Xe 4. XeO_2
- 34 The empirical formula of sheet silicates is
1. $(\text{Si}_2\text{O}_5)_n^{2n-}$ 2. $(\text{SiO}_3)_n^{2n-}$ 3. $(\text{Si}_2\text{O}_5)_n^{4n-}$ 4. $(\text{Si}_2\text{O}_5)_n^{2n+}$
- 35 'X' is a colourless oxide of nitrogen which on exposure to air gives brown coloured 'Y'. If 'X' and 'Y' are both gases at room temperature, their nature
1. X is paramagnetic and Y is diamagnetic 2. Y is paramagnetic and X is diamagnetic
 3. Both X and Y are diamagnetic 4. Both X and Y are paramagnetic
- 36 Oxyacid of sulphur that has a persulphide linkage is

1. H_2SO_3 2. H_2SO_4 3. $H_2S_2O_7$ 4. $H_2S_3O_6$



Oxidation numbers of halogen in the products Y and Z are

1. -1, +1 2. -1, +3 3. -1, +5 4. +1, +5

38 The structure of XeO_2F_2 is

1. Square pyramidal 2. Trigonal pyramidal 3. Octahedral 4. Tetrahedral

39 H_2O_2 turns blackened lead paintings to white colour. In this reaction it oxidizes PbS to $PbSO_4$. The number of moles of H_2O_2 needed to oxidize 0.1 moles of PbS is

1. 1 mole 2. 0.1 mole 3. 0.5 mole 4. 0.4 mole

40 Assertion(A): Alkali metals dissolve in liquid ammonia to give blue solutions

Reason(R): Alkali metal in liquid ammonia give solvated species of the type $[M(NH_3)_n]^+$ (M = alkali metal)

1. If both A and R are correct and R is the correct explanation of the A
 2. If both A and R are correct, but R is not the correct explanation of the A
 3. If A is correct but R is incorrect
 4. If A is incorrect but R is correct

41 $MgCl_2 \cdot 6H_2O$ on heating forms 'X' and on strong heating finally transforms to 'Y'. Substances 'X' and 'Y' are respectively

1. $Mg(OH)Cl, MgO$ 2. $MgO, Mg(OH)_2$ 3. $MgO, Mg(OH)Cl$ 4. $Mg(OH)_2, Mg(OH)Cl$

42 Total number of atoms of diborane involved in the formation of both the banana bonds in the molecule is

1. 3 2. 4 3. 6 4. 8

43 Carbon dioxide Silicon dioxide

- 1) Gas at room temperature 1) Solid at room temperature
 2) Has sp hybridization 2) Has sp^3 hybridization
 3) Has only double bond 3) Has only single bonds

4) Molecular formula is CO_2 4) Molecular formula is SiO_2

From the above table, incorrect one is

1. 1 2. 2 3. 3 4. 4

44 Correct order of volatility of hydrides of group 15 elements is

1. $NH_3 > PH_3 > AsH_3 > SbH_3$ 2. $PH_3 > AsH_3 > SbH_3 > NH_3$
 3. $PH_3 > AsH_3 > NH_3 > SbH_3$ 4. $PH_3 > NH_3 > AsH_3 > SbH_3$

45 The ring of cyclic trimer of sulphur trioxide contains

1. 3 atoms 2. 5 atoms 3. 6 atoms 4. 8 atoms

46 The correct order of acidic strength is

1. $HF < HCl < HBr < HI$ 2. $HCl < HBr < HF < HI$
 3. $HBr < HCl < HI < HF$ 4. $HI < HBr < HCl < HF$

47 XeF_4 is a square planar molecule. The hybridization of xenon atom in this molecule is

1. dsp^2 2. sp^3d 3. sp^3d^2 4. d^2sp^3

48 Regarding chromium peroxide CrO_5 , which of the following is false

1. Oxidation state of Cr is +10 2. It is blue coloured 3. It has two peroxy bonds 4. It is stable in ether

49 $Na_2CO_3 + SO_2 \xrightarrow{\Delta} A + CO_2$

Aqueous 'A' on boiling with flower of sulphur give 'B'. 'B' reduces iodine to give sodium iodide and

1. Na_2SO_4 2. Na_2SO_3 3. $Na_2S_2O_3$ 4. $Na_2S_4O_6$

50 The value of n in the molecular formula $Be_nAl_2Si_6O_{18}$ is

1. 4 2. 3 3. 2 4. 1

51 In the reaction $2X + B_2H_6 \rightarrow [BH_2(X_2)]^+ [BH_4]^-$ the amine(s) X is(are):

- a) NH_3 b) CH_3NH_2 c) $(CH_3)_2NH$ d) $(CH_3)_3N$
 1. Only a 2. Only a, b 3. Only a, b and c 4. a, b, c and d

52 The distance between two adjacent carbon atoms in a layer of graphite is 'x' pm and between two adjacent layers is 'y' pm. The ratio of 'x' and 'y' is about

1. 1:1 2. 2:5 3. 2:1 4. 4:5

53 A solution of colourless salt H on boiling with excess NaOH produces a non – flammable gas. The gas evolution ceases after sometime. Upon addition of Zn dust to the same solution, the gas evolution restarts. The colourless salt(s) H is/are

- a) NH_4NO_3 b) NH_4NO_2 c) NH_4Cl d) $(\text{NH}_4)\text{SO}_4$
 1. a,b,c and d 2. Only a, c 3. Only a, d 4. Only a, b

54 In which one of the following compounds, difference in oxidation states of two different types of sulphurs is two

1. $\text{H}_2\text{S}_2\text{O}_4$ 2. $\text{H}_2\text{S}_2\text{O}_5$ 3. $\text{H}_2\text{S}_2\text{O}_6$ 4. $\text{H}_2\text{S}_4\text{O}_6$

55 Gas 'A' is passed through water to form a saturated solution. This solution gives a white precipitate with silver nitrate. This solution dissolves magnesium, liberating a colourless gas 'B'. Gases 'A' and 'B' are respectively

1. Cl_2, CO_2 2. Cl_2, H_2 3. CO_2, Cl_2 4. H_2, Cl_2

56 Bond angle is large in

1. XeF_2 2. XeF_4 3. XeF_6 4. XeO_4

57 Which of the following is same for H_2 and D_2

1. Bond length 2. Bond energy 3. Rate of diffusion 4. Rate of reaction

Paragraph: There are some deposits of nitrates and phosphates in earth's crust. Nitrates are more soluble in water. Nitrates are difficult to reduce under the laboratory conditions but microbes do it easily. Ammonia forms large number of complexes with transition metal ions. Hybridization easily explains the ease of sigma donation capability of NH_3 and PH_3 . Phosphine is a flammable gas and is prepared from white phosphorus.

58 Among the following, the correct statement is

1. Phosphates have no biological significance in humans
 2. Between nitrates and phosphates, phosphates are less abundant in earth's crust
 3. Between nitrates and phosphates, nitrates are less abundant in earth's crust
 4. Oxidation of nitrates is possible in soil

59 Among the following the correct statement is

1. Between NH_3 and PH_3 , NH_3 is a better electron donor because the lone pair of electron occupies spherical s - orbital and is less directional
2. Between NH_3 and PH_3 , PH_3 is better electron donor because the lone pair of electrons occupies sp^3 orbital and is more directional
3. Between NH_3 and PH_3 , NH_3 is a better electron donor because the lone pair of electrons occupies sp^3 orbital and is more directional
4. Between NH_3 and PH_3 , PH_3 is a better electron donor because the lone pair of electrons occupies spherical s - orbital and is less directional

60 White phosphorus on reaction with NaOH gives PH_3 as one of the products, this is a

- | | | | |
|--------------------------|--------------------------------|--------------------------|---------------------------|
| 1. Dimerization reaction | 2. Disproportionation reaction | 3. Condensation reaction | 4. Precipitation reaction |
|--------------------------|--------------------------------|--------------------------|---------------------------|

MATHEMATICS

61 The equation $\cos 2x + a \sin x = 2a - 7$ possesses a solution if

- | | |
|------------|-----------------------|
| 1. $a < 2$ | 2. $2 \leq a \leq 6$ |
| 3. $a > 6$ | 4. a is any integer |

62 If $\sin x + \sin^2 x + \sin^3 x = 1$, then $\cos^6 x - 4\cos^4 x + 8\cos^2 x$ is equal to

- | | | | |
|------|------|------|------|
| 1. 0 | 2. 2 | 3. 4 | 4. 8 |
|------|------|------|------|

63 $A = \begin{bmatrix} \cos^2 \alpha & \cos \alpha \sin \alpha \\ \cos \alpha \sin \alpha & \sin^2 \alpha \end{bmatrix}$ and $B = \begin{bmatrix} \cos^2 \beta & \cos \beta \sin \beta \\ \cos \beta \sin \beta & \sin^2 \beta \end{bmatrix}$ are two matrices such that AB is the null matrix, then

- | | |
|-------------------------------|-------------------------------|
| 1. $\alpha = \beta$ | 2. $\cos(\alpha - \beta) = 0$ |
| 3. $\sin(\alpha - \beta) = 0$ | 4. None of these |

64 If $\alpha + \beta = \pi/2$ and $\beta + \gamma = \alpha$, then $\tan \alpha$ equals

- | | |
|----------------------------------|---------------------------------|
| 1. $2(\tan \beta + \tan \gamma)$ | 2. $\tan \beta + \tan \gamma$ |
| 3. $\tan \beta + 2 \tan \gamma$ | 4. $2 \tan \beta + \tan \gamma$ |

65 If α, β are positive acute angles and $\cos 2\alpha = \frac{3\cos 2\beta - 1}{3 - \cos 2\beta}$, then $\tan \alpha = k \tan \beta$ such that

1. $k = -\sqrt{2}$ 2. $k = \sqrt{2}$ 3. $k = 1$ 4. $k = \sqrt{3}$

66 If $|\sqrt{\sin^2 x + 2a^2} - \sqrt{2a^2 - 1 - \cos^2 x}| \leq A \quad \forall a, x \in R$, then A is :

1. $\sqrt{5}$ 2. $\sqrt{3}$ 3. $\sqrt{2}$ 4. 1

67 If $\cos \frac{2\pi}{7}, \cos \frac{4\pi}{7}, \cos \frac{6\pi}{7}$ are the roots of the equation $8x^3 + 4x^2 - 4x - 1 = 0$ then the equation whose roots are $\tan^2 \frac{5\pi}{7}, \tan^2 \frac{3\pi}{7}, \tan^2 \frac{\pi}{7}$ is

1. $x^3 - 21x^2 + 35x - 7 = 0$ 2. $x^3 - 35x^2 + 21x - 7 = 0$
3. $x^3 - 35x^2 + 7x - 21 = 0$ 4. $x^3 - 21x^2 + 7x - 35 = 0$

68 If maximum and minimum values of $|\sin^{-1} x| + |\cos^{-1} x|$ are M and m then $M+m$ is

1. $\pi/2$ 2. π 3. 2π 4. 3π

69 Tangents are parallel to the 3 sides drawn to incircle of the triangle ABC . If α, β, γ are the lengths of the tangents within the triangle then $\frac{\alpha}{a} + \frac{\beta}{b} + \frac{\gamma}{c}$ is (a, b, c , are the sides)

1. 1 2. 2 3. 3 4. 4

70 If P is the least positive solution of the equation $\sin^{10} x + \cos^{10} x = \frac{29}{16} \cos^4 2x$ then $[P]$ where $[.]$ is G.I.F is

1. 0 2. 1 3. 2 4. 3

71 If $f(x) = 1 + \cos^2 \left(\frac{\pi}{6} + x \right) - \cos x \cos \left(x + \frac{\pi}{3} \right)$ then $f(2012) =$

1. 0 2. 2012 3. 1 4. $\frac{5}{4}$

72 In $\triangle ABC$, usual notation if $r_1 + r = r_2 + r_3$. If the measure of $\angle A = 60^\circ$ then the ratio $\frac{s}{a}$ is $m : n$ then $m + n$ is (m, n are least numbers)

1. 9 2. 18 3. 27 4. None

73 The value of $\tan^6 40^\circ - 33 \tan^4 40^\circ + 27 \tan^2 40^\circ$ is

1. 12 2. 9 3. 6 4. 3

- 74 If $f : [0,1] \rightarrow R$ is a real valued function such that $2f(\sin x) + \sqrt{2}f(\cos x) = \tan x$ then $f\left(\frac{1}{2}\right) =$
1. $\frac{3+\sqrt{2}}{\sqrt{6}}$ 2. $\frac{\sqrt{3}-\sqrt{2}}{\sqrt{6}}$ 3. $\frac{\sqrt{2}+\sqrt{3}}{\sqrt{6}}$ 4. $\frac{\sqrt{2}-3}{\sqrt{6}}$
- 75 If (α, β) is the point of intersection of the curves $y = \sin \frac{\pi x}{2}$, and $y = \left[\sin \frac{\pi}{10} + \cos \frac{\pi}{10} \right]$ where $[.]$ denotes greatest integer function and α is least positive then $\alpha + \beta$ is
1. 1 2. 2 3. 3 4. 4
- 76 The number of positive integral solutions of the equation $\tan^{-1} x + \cos^{-1} \frac{y}{\sqrt{1-y^2}} = \sin^{-1} \frac{3}{\sqrt{10}}$ is
1. 4 2. 2 3. 1 4. 0
- 77 If H is the orthocentre of a acute angled triangle ABC , whose circum circle is $x^2 + y^2 = 16$ then circumdiameter of the ΔHBC is
1. 8 2. 16 3. 32 4. 64
- 78 If the median AD of a ΔABC makes an angle $\pi/4$ with the side BC , then the value of $|\cot B - \cot C|$ is
1. 1 2. 2 3. 4 4. 8
- 79 In any triangle ABC , the minimum value of $\frac{r_1 r_2 r_3}{r^3}$ is N then sum of digits in N is
1. 3 2. 6 3. 9 4. 12
- 80 In ΔABC , if $\cos^2 \frac{A}{2} + \cos^2 \frac{B}{2} + \cos^2 \frac{C}{2} = y \left(x^2 + \frac{1}{x^2} \right)$ then maximum value of y is
1. $\frac{3}{2}$ 2. $\frac{9}{8}$ 3. $\frac{9}{4}$ 4. $\frac{9}{2}$
- 81 If A and B are acute angles such that $A+B$ and $A-B$ satisfy the equation $\tan^2 \theta - 4 \tan \theta + 1 = 0$ then $(A, B) =$
1. $\left(\frac{\pi}{4}, \frac{\pi}{6} \right)$ 2. $\left(\frac{\pi}{4}, \frac{5\pi}{6} \right)$ 3. $\left(\frac{3\pi}{4}, \frac{\pi}{6} \right)$ 4. $\left(\frac{\pi}{4}, \frac{\pi}{3} \right)$
- 82 Given that $0 \leq a \leq 3, 0 \leq b \leq 3$ and if the equation $x^2 + 4 + 3 \cos(ax+b) = 2x$ has atleast one solution then $a + b =$ _____
1. 0 2. π 3. 2π 4. $\frac{\pi}{2}$
- 83 If $a \tan \alpha + b \tan \beta + c \tan \gamma = k$ where a, b, c, k are constants then the minimum value of $\tan^2 \alpha + \tan^2 \beta + \tan^2 \gamma$ is _____

1. $\frac{a^2+b^2+c^2}{K^2}$ 2. $\frac{a^2+b^2+c^2}{K}$ 3. $\frac{K^2}{a^2+b^2+c^2}$ 4. K^2

84 In a ΔABC , if $a^2 + b^2 + c^2 = ca + ab\sqrt{3}$ then the triangle is

1. Equilateral 2. Isosceles
3. Right angled and Isosceles 4. Right angled but not isosceles

85 In any Δ le ABC , $\frac{a^2+b^2+c^2}{R^2}$ has the maximum value of _____

1. 18 2. 27 3. 9 4. 3

86 The number of real solutions of the equation $\tan^{-1}\sqrt{x^2-3x+2} + \cos^{-1}\sqrt{4x-x^2-3} = \pi$ is _____

1. 1 2. 2 3. 0 4. 4

87 Total number of solutions of $\sin x \cdot \tan 4x = \cos x$ belonging to $(0, \pi)$ is _____.

1. 30 2. 20 3. 15 4. 5

88 $\tan^{-1}x + \tan^{-1}\left(\frac{2x}{1-x^2}\right) = \pi + \tan^{-1}\left(\frac{3x-x^3}{1-3x^2}\right)$ ($x > 0$) is true if

1. $x < \frac{1}{\sqrt{3}}$ 2. $x > \frac{1}{\sqrt{3}}$
3. $\frac{1}{\sqrt{3}} < x < \sqrt{3}$ 4. $\frac{1}{\sqrt{3}} < x < 1$

89 If the graphs of $y = \cos x$ and $y = \tan x$ intersect at some value say θ in the first quadrant. Then the value of $\sin \theta$ is

1. $\frac{-1+\sqrt{2}}{2}$ 2. $\frac{-1+\sqrt{3}}{2}$ 3. $\frac{-1+\sqrt{5}}{2}$ 4. $\frac{-1\pm\sqrt{5}}{2}$

90 In a triangle ABC , $\angle A = 72^\circ$, $b = 2$ and $c = \sqrt{5} + 1$ then the triangle ABC is

1. obtuse isosceles 2. acute isosceles
3. right isosceles 4. not isosceles

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