JEE Main

CLASS XI

Physics : Mechanical Properties of Solids, Mechanical Properties of Fluids, Thermal Properties of Matter, Thermodynamics

Chemistry : Redox Reactions; Hydrogen; The *s*-Block Elements; The *p*-Block Elements (Groups 13 and 14)

Mathematics : Sequences and Series; Straight Lines; Conic Sections; Introduction to Three Dimensional Geometry

PART TEST - 3

Instructions:

I. The JEE Main Chapterwise Test Paper consists of one paper containing 60 objective questions (four options with single correct answer) and 30 numerical value type questions from the above mentioned chapters of Physics, Chemistry and Mathematics.
II. The duration of paper would be 3 hours (180 minutes).
III. There will be total 90 questions : Physics - 30, Chemistry - 30, Mathematics - 30.
IV. Each question will carry 4 marks. For each correct response the applicant will be awarded four marks. For each incorrect answer there will be deduction of one mark.
V. There will be no negative marking for unattended questions. More than one answer of single question will also be considered as incorrect response and will be negatively marked.

Max. Marks : 300 **Time :** 180 minutes

PHYSICS

Section-A (Multiple Choice Questions)

1. The average depth of Indian ocean is about 3000 m. The fractional compression, $\frac{\Delta V}{V}$ of water at the bottom of the ocean (given that the bulk modulus of the water $= 2.2 \times 10^9$ N m^{-2} and $g = 10$ m s^{-2}) is
(a) 0.82% (b) 0.91% (c) 1.36% (d) 1.24%

2. A body floats in water with 40% of its volume outside water. When the same body floats in an oil, 60% of its volume remains outside oil. The relative density of oil is
(a) 0.9 (b) 1.0 (c) 1.2 (d) 1.5

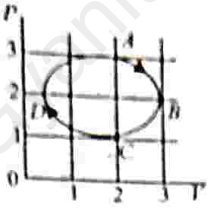
3. 1.56×10^5 J of heat is conducted through a 2 m^2 wall of 12 cm thick in one hour. Temperature difference between the two sides of the wall is 20°C. The thermal conductivity of the material of the wall is (in W m^{-1} K^{-1})
(a) 0.11 (b) 0.13 (c) 0.15 (d) 1.2

4. An ideal gas is compressed isothermally until its pressure is doubled and then allowed to expand adiabatically to regain its original volume ($\gamma = 1.4$ and $2^{-1.4} = 0.38$). The ratio of the final to initial pressure is
(a) 0.76 : 1 (b) 1 : 1 (c) 0.66 : 1 (d) 0.86 : 1

5. A square lead slab of side 50 cm and thickness 10 cm is subjected to a shearing force (on its narrow face) of 9×10^4 N. The lower edge is riveted to the floor. How much will be the upper edge displaced?
(Shear Modulus of lead = 5.6×10^9 N m^{-2})
(a) 1.6 cm (b) 0.16 cm
(c) 1.6 mm (d) 0.16 mm

6. The lower end of a capillary tube of diameter 2.00 mm is dipped 8.0 cm below the surface of water in a beaker. What is the pressure required in the tube in order to blow a hemispherical bubble at its end in water?
Surface tension of water = 7.3×10^{-2} N m^{-1},
(1 atmosphere = 1.01×10^5 Pa, $g = 9.8$ m s^{-2},
density of water = 10^3 kg m^{-3})
(a) 1.02×10^5 Pa (b) 1.03×10^5 Pa
(c) 1.04×10^5 Pa (d) 1.05×10^5 Pa

7. The figure shows the *P-V* plot of an ideal gas taken through a cycle *ABCDA*. The part *ABC* is a semi-circle and *CDA* is half of an ellipse.



Then,

(a) the process during the path $A \to B$ is isothermal

(b) heat flows out of the gas during the path $B \to C \to D$

(c) work done during the path $A \to B \to C$ is zero

(d) negative work is done by the gas in the cycle $ABCDA$.

8. If the longitudinal strain in a cubical body is three times the lateral strain then Young's modulus Y and modulus of rigidity η are related by

(a) $\eta = \frac{Y}{8}$ (b) $\eta = \frac{3Y}{8}$

(c) $Y = \frac{3\eta}{8}$ (d) $Y = \eta$

9. A large open tank has two holes in its wall. One is a square hole of side a at a depth of x from the top and the other is a circular hole of radius r at depth $4x$ from the top. When the tank is completely filled with water, the quantities of water flowing out per second from both holes are the same. Then r is equal to

(a) $2\pi a$ (b) a (c) $\frac{a}{2\pi}$ (d) $\frac{a}{\sqrt{2\pi}}$

10. 22320 cal of heat is supplied to 100 g of ice at 0°C. If the latent heat of fusion of ice is 80 cal g–1 and latent heat of vaporization of water is 540 cal g–1, the final amount of water thus obtained and its temperature respectively are

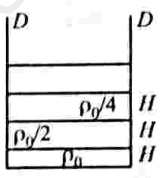
(a) 8 g, 100°C (b) 100 g, 90°C

(c) 92 g, 100°C (d) 82 g, 100°C

11. To what depth must a rubber ball be taken in deep sea so that its volume is decreased by 0.1%.
(Take, density of sea water = 10^3 kg m^{-3}, bulk modulus of rubber = 9×10^8 N m^{-2}, $g = 10$ m s^{-2})

(a) 9 m (b) 18 m (c) 90 m (d) 180 m

12. In the given figure, incompressible liquid layers of height H each, fill a very high cylindrical vessel. The densities of the liquid layers from the bottom are $\rho_0, \frac{\rho_0}{2}, \frac{\rho_0}{4}, \ldots$. If a sphere of mass M is dropped into the cylindrical vessel



and if sphere floats in the vessel then pressure at the bottom of vessel is (ignore any effect of the atmosphere)
(Assume gravity remains constant *i.e.*, g)

(a) $2H\rho_0 g + \frac{Mg}{A}$ (b) $H\rho_0 g + \frac{2Mg}{A}$

(c) $2H\rho_0 g + \frac{Mg}{2A}$ (d) $H\rho_0 g + \frac{Mg}{A}$

(where A is cross-sectional area of bottom)

13. Eight equal drops of water are falling through air with a steady velocity of 10 cm s^{-1}. If the drops combine to form a single drop big in size, then the terminal velocity of this big drop is

(a) 40 cm s^{-1} (b) 10 cm s^{-1}

(c) 30 cm s^{-1} (d) 80 cm s^{-1}

14. A Carnot refrigerator extracts 35.0 kJ as heat during each cycle, operating with a coefficient of performance of 4.60. Find the energy per cycle transferred as heat to the surroundings.

(a) 42.6 kJ (b) 53.2 kJ (c) 63.9 kJ (d) 72.5 kJ

15. A piece of metal floats on mercury. The coefficient of expansion of the metal and mercury are λ_1 and λ_2 respectively. f_s is the fraction of metal submerged. The temperature of both mercury and metal are increased by ΔT. By what factor, the volume of the metal submerged in mercury changes.

(a) $\frac{(\gamma_2 - \gamma_1)\Delta T}{(1+\gamma_1 \Delta T)}$ (b) $\frac{(\gamma_2 - \gamma_1)\Delta T}{(1+\gamma_2 \Delta T)}$

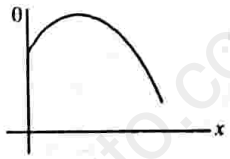
(c) $\frac{(1-\gamma_1)\Delta T}{(1-\gamma_2)}$ (d) $\frac{(1-\gamma_2)\Delta T}{(1-\gamma_1)}$

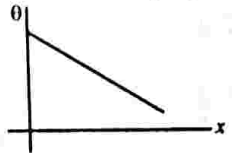
16. C_P and C_V are specific heats at constant pressure and constant volume respectively. It is observed that
$C_P - C_V = a$ for hydrogen gas
$C_P - C_V = b$ for nitrogen gas
The correct relation between a and b is

(a) $a = \frac{1}{14} b$ (b) $a = b$

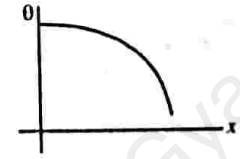
(c) $a = 14b$ (d) $a = 28b$

17. A long metallic bar is carrying heat from one of its ends to the other end under steady-state. The variation of temperature 0 along the length x of the bar from its hot end is best described by which of the following figure.

(a) 

(b) 

(c) 

(d) 

18. A pan filled with hot food cools from 94°C to 86°C in 2 min, when the room temperature is 20°C. The time taken for the food to cool from 86°C to 74°C will be

(a) 500 s (b) 420 s (c) 200 s (d) 210 s

19. Two Carnot engines A and B are operated in series. The engine A receives heat from the source at temperature T_1 and rejects the heat to the sink at temperature T. The second engine B receives the heat at temperature T and rejects to its sink at temperature T_2. For what value of T the efficiencies of the two engines are equal.

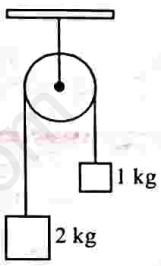
(a) $\frac{T_1 - T_2}{2}$ (b) T_1T_2 (c) $\sqrt{T_1T_2}$ (d) $\frac{T_1 + T_2}{2}$

20. A 10 kW drilling machine is used to drill a bore in a small aluminium block of mass 8 kg. Find the rise in temperature of the block in 2.5 minutes, assuming 50% power is used up in heating the machine itself or lost to the surroundings.
(Specific heat of aluminium = 0.91 J g^{-1} °C^{-1})
(a) 100 °C (b) 103 °C (c) 150 °C (d) 155 °C

Section-B (Numerical Value Type)

Attempt any 5 questions out of 10

21. Two blocks of masses 1 kg and 2 kg are connected by a metal wire going over a smooth pulley as shown.
The breaking stress of the metal is $\frac{40}{3\pi} \times 10^6$ N m^{-2}.
If g = 10 m s^{-2}, then the minimum radius of the wire (in mm) used if it is not to break is _____.



22. A sphere made of iron is rotating about its diameter as axis, $\alpha = 1 \times 10^{-5}$ °C^{-1}. If the temperature rises by 100°C, the percentage increase in its moment of inertia is_____.

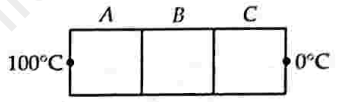
23. Two narrow bores of diameters 3.0 mm and 6.0 mm are joined together to form a U-tube open at both ends. If the U-tube contains water, the difference in its levels in the two limbs (in mm up to two decimal value) of the tube is _____.
(Surface tension of water at the temperature of the experiment is 7.3×10^{-2} N m^{-1}. Take angle of contact = 0°, density of water = 1.0×10^3 kg m^{-3}, g = 9.8 m s^{-2}).

24. Suppose4.0molofanidealgasundergoesareversible isothermal expansion from volume V_1 to volume $V_2 = 2.0V_1$ at temperature T = 400 K. The entropy change in (J/K) of the gas is _____.
(Take ln 2 = 0.693)

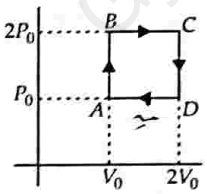
25. A copper wire of length 2.2 m and a steel wire of length 1.6 m, both of diameter 3 mm are connected end to end. When stretched by a load, the net elongation is found to be 0.70 mm. The load applied is _____N.
($Y_S = 2.0 \times 10^{11}$ N m^{-2})
($Y_C = 1.1 \times 10^{11}$ N m^{-2})

26. A fully loaded Boeing aircraft has a mass of 3.3×10^5 kg. Its total wing area is 500 m^2. It is in level flight with speed of 960 km/h. The fractional increase in the speed of the air on the upper surface of the wing relative to the lower surface (density of air is 1.2 kg/m^3) is _____.

27. A, B and C are the three identical conductors but made from different materials. They are kept in contact as shown. Their thermal conductivities are K, $2K$ and $\frac{K}{2}$. The free end of A is at 100°C and the free end of C is at 0°C. During steady state, the temperature of the junction of A and B is nearly _____ °C.

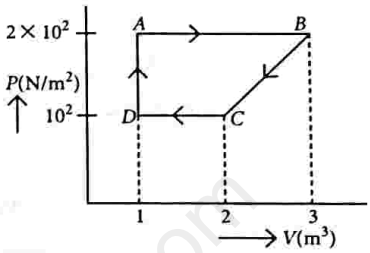


28. Helium gas goes through a cycle $ABCDA$ (consisting of two isochoric and two isobaric lines) as shown in figure. Efficiency of this cycle is nearly (Assume the gas to be close to ideal gas) _____



29. Two wires P and Q are made of same material. The wire P has a length l and diameter r while the wire Q has length $2l$ and diametre $r/2$. If the two wires are stretched by the same force, the elongation in P divided by the elongation in Q is $1/x$. Here the value of x is _____.

30. A cyclic process is shown in the figure. The work done (in J) during the cyclic process $ABCDA$ is _____ J.



CHEMISTRY

Section-A (Multiple Choice Questions)

31. The correct sequence of thermal stability of the following carbonates is
(a) $BaCO_3 < SrCO_3 < CaCO_3 < MgCO_3$
(b) $BaCO_3 < CaCO_3 < SrCO_3 < MgCO_3$
(c) $MgCO_3 < CaCO_3 < SrCO_3 < BaCO_3$
(d) $MgCO_3 < SrCO_3 < CaCO_3 < BaCO_3$

32. **Assertion (A) :** In the representation $E^\circ_{Fe^{3+}/Fe^{2+}}$ and $E^\circ_{Cu^{2+}/Cu}$, Fe^{3+}/Fe^{2+} and Cu^{2+}/Cu are redox couples.

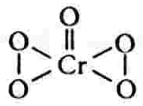
Reason (R) : Redox couple is the combination of oxidised and reduced form of a substance involved in an oxidation or reduction half cell.

(a) Both (A) and (R) are true and (R) is the correct explanation of (A).
(b) Both (A) and (R) are true but (R) is not the correct explanation of (A).
(c) (A) is true but (R) is false.
(d) Both (A) and (R) are false.

33. For the properties mentioned, the correct trend for the different species is
(a) strength as Lewis acid – $BCl_3 > AlCl_3 > GaCl_3$
(b) inert pair effect – Al > Ga > In
(c) oxidising property – $Al^{3+} > In^{3+} > Tl^{3+}$
(d) first ionization enthalpy – B > Al > Tl

34. Which of the following is correct for hydrogen?
(a) It can form bonds in +1 as well as –1 oxidation state.
(b) It is always collected at cathode.
(c) It has a very low ionization potential.
(d) It has same electronegativity as halogens.

35. Compound CrO_5 has structure as shown :



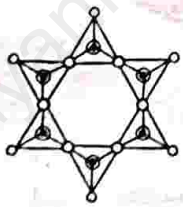
The oxidation number of Cr in the above compound is
(a) +10 (b) +5 (c) +4 (d) +6

36. In KO_2, the nature of oxygen species and the oxidation state of oxygen atom are respectively
(a) superoxide and –1/2 (b) oxide and –2
(c) peroxide and –1/2 (d) superoxide and –1.

37. Dihydrogen forms three types of hydrides. (i) hydrides are formed by alkali metals and alkaline earth metals. (ii) hydrides are formed by non-metals and (iii) hydrides are formed by *d*- and *f*-block elements at elevated temperature. Complex metal hydrides such as (iv) and (v) are powerful reducing agents.

	(i)	(ii)	(iii)	(iv)	(v)
(a)	Covalent	Molecular	saline	NaH	LiH
(b)	Molecular	Covalent	ionic	$LiAlH_4$	CaH_2
(c)	Ionic	Covalent	interstitial	$LiAlH_4$	$NaBH_4$
(d)	Covalent	Saline	interstitial	$LiAlH_4$	$NaBH_4$

38. Which type of silicate is shown in the given figure?



(a) Orthosilicate (b) Pyrosilicate
(c) Metasilicate (d) Cyclosilicate

39. The standard reduction electrode potentials of the three electrodes *P*, *Q* and *R* are respectively –1.76 V, 0.34 V and 0.8 V. Then
(a) metal *Q* will displace the cation of *P* from its aqueous solution and deposit the metal *P*
(b) both metals *Q* and *R* will displace the cation of *P* from its aqueous solution and deposit the metal *P*
(c) metal *R* will displace the cation of *P* from its aqueous solution and deposit the metal *R*
(d) metal *P* will displace the cation of *R* from its aqueous solution and deposit the metal *R*.

40. Highly dilute solution of sodium in liquid ammonia
(i) shows blue colour
(ii) exhibits electrical conductivity
(iii) acts as strong oxidising agent
(iv) produces nitrogen gas
(a) (i), (ii), (iii) (b) (i), (ii)
(c) (iii), (iv) (d) only (ii)

41. The products of the following reaction are
$SiO_2 + C \xrightarrow{\Delta}$
(a) SiC and CO_2 (b) SiO and CO
(c) SiC and CO (d) Si and CO_2

42. The bond angle and dipole moment of water respectively are
(a) 109.5°, 1.84 D (b) 107.5°, 1.56 D
(c) 104.5°, 1.84 D (d) 102.5°, 1.56 D

43. In the reaction : $I_2 + 2S_2O_3^{2-} \rightarrow 2I^- + S_4O_6^{2-}$
(a) I_2 is reducing agent.
(b) I_2 is oxidising agent and $S_2O_3^{2-}$ is reducing agent.
(c) $S_2O_3^{2-}$ is oxidising agent.
(d) I_2 is reducing agent and $S_2O_3^{2-}$ is oxidising agent.

44. **Statement-1 :** LiCl is predominantly a covalent compound.
Statement-2 : Electronegativity difference between Li and Cl is too small.
(a) Both statement-1 and 2 are true and statement-2 is a correct explanation for statement-1.
(b) Both statement-1 and 2 are true but statement-2 is not a correct explanation for statement-1.
(c) Statement-1 is false, statement-2 is true.
(d) Statement-1 is true, statement-2 is false.

45. **Assertion (A) :** Ionic compounds are less soluble in D_2O than H_2O.
Reason (R) : Density of D_2O is higher than H_2O.
(a) Both (A) and (R) are correct and (R) is correct explanation of (A).
(b) Both (A) and (R) are correct but (R) is not correct explanation of (A).

(c) (A) is not correct but (R) is correct.
(d) (A) is correct but (R) is not correct.

46. Of the following chemical equations :

$P + 3LiAlH_4 \longrightarrow X + 3LiF + 3AlF_3$

$X + 6H_2O \longrightarrow Y + 6H_2$

$X + 3O_2 \xrightarrow{\Delta} B_2O_3 + 3H_2O$

P, X and Y respectively are

(a) $Na_2B_4O_7$, H_3BO_3, B_2O_3
(b) H_3BO_3, B_2H_6, BF_3
(c) BF_3, B_2H_6, H_3BO_3
(d) H_3BO_3, $Na_2B_4O_7$, B_2O_3

47. Which one of the following orders present the correct sequence of the increasing basic nature of the given oxides?

(a) $Al_2O_3 < MgO < Na_2O < K_2O$
(b) $MgO < K_2O < Al_2O_3 < Na_2O$
(c) $Na_2O < K_2O < MgO < Al_2O_3$
(d) $K_2O < Na_2O < Al_2O_3 < MgO$

48. In which of the following compounds, carbon exhibits a valency of 4 but an oxidation state of –2?

(a) CH_3Cl (b) $CHCl_3$
(c) CH_2Cl_2 (d) HCHO

49. The intermediate product (X) formed in the following reaction is

$B_2H_6 + 6NH_3 \longrightarrow 3X \xrightarrow{\text{heat}} 2B_3N_3H_6 + 12H_2$

(a) $[BH(NH_3)_3]^+[BH_4]^-$ (b) $[BH_2(NH_3)_4]^+[BH_4]^-$
(c) $[BH(NH_3)_4]^+[BH_4]^-$ (d) $[BH_2(NH_3)_2]^+[BH_4]^-$

50. Match List I with List II and select the correct option.

List I		List II	
1.	Heavy water	(A)	Bicarbonates of Mg and Ca in water
2.	Temporary hard water	(B)	No foreign ions in water
3.	Soft water	(C)	D_2O
4.	Permanent hard water	(D)	Sulphates and chlorides of Mg and Ca in water

(a) 1-C, 2-D, 3-B, 4-A (b) 1-B, 2-A, 3-C, 4-D
(c) 1-B, 2-D, 3-C, 4-A (d) 1-C, 2-A, 3-B, 4-D

Section-B (Numerical Value Type)

Attempt any 5 questions out of 10

51. A mole of N_2H_4 loses 10 mol of electrons to form a new compound Y. Assuming that all the nitrogen appears in the new compound, what is the oxidation state of nitrogen in Y? (There is no change in the oxidation number of hydrogen.)

52. The sum of no. of water molecules in gypsum and Plaster of Paris is _____.

53. The degree of hardness (in ppm) of a sample of water containing 6 mg of $MgSO_4$ per kg of water is _____.

54. x-centre-y-electron bonds are known as banana bond. What is the sum of x and y?

55. While preparing microcosmic salt, we require NH_4Cl and Na_2HPO_4. So what is the sum of molar ratio of NH_4Cl and Na_2HPO_4 dissolved in hot water to prepare one mole of microcosmic salt?

56. The volume, in mL, of 0.02 M $K_2Cr_2O_7$ solution required to react with 0.288 g of ferrous oxalate in acidic medium is _____.
(Molar mass of Fe = 56 g mol^{-1})

57. Covalency of B in BF_4^- is _____.

58. Among these, how many show the behaviour of deliquescence?
$NaNO_3$, $MgSO_4 \cdot 7H_2O$, KOH, $MgCl_2$, $Na_2CO_3 \cdot 10H_2O$, $Ca(NO_3)_2$, NaOH

59. Consider the following equations :

$2Fe^{2+} + H_2O_2 \longrightarrow xA + yB$ (in basic medium)

$2MnO_4^- + 6H^+ + 5H_2O_2 \longrightarrow x'C + y'D + z'E$ (in acidic medium)

The sum of the stoichiometric coefficients x, y, x', y' and z' for products A, B, C, D and E, respectively, is _____.

60. The oxidation state of S-atom in Marshall's acid is _____.

MATHEMATICS

Section-A (Multiple Choice Questions)

61. If $\frac{bc}{ad} = \frac{b+c}{a+d} = 3\left(\frac{b-c}{a-d}\right)$, then $\frac{1}{a}, \frac{1}{b}, \frac{1}{c}, \frac{1}{d}$ are in

(a) A.P. (b) G.P
(c) A.G.P. (d) none of these

62. The radical centre of circles represented by
$S_1 : x^2 + y^2 - 7x - 6y - 4 = 0$
$S_2 : x^2 + y^2 - 8x - 4y - 4 = 0$
and $S_3 : x^2 + y^2 + 10x + 6y - 4 = 0$ is given by

(a) (–1, 1) (b) (1, –1)
(c) (0, 0) (d) None of these

63. If the angle between the lines represented by $6x^2 - xy - 12y^2 - 8x + 29y - 14 = 0$ is $\tan^{-1}(\alpha)$ and $a^2 + 2b^2 + 2c^2 - 2b(a + c) - 2c + 1 \le 0$, then $2a + 7b + 8c$ equals

(a) $\frac{1}{2\alpha}$ (b) $\frac{6}{\alpha}$ (c) 6α (d) $\frac{1}{6\alpha}$

64. The minimum & maximum distance of a point $(-1, 6)$ from the ellipse $25x^2 + 9y^2 + 50x + 36y - 164 = 0$ are l and m respectively then $m^2 - l^2$ equals
(a) 169 (b) 13 (c) 100 (d) 160

65. The point in the xy-plane which is equidistant from the points $(5, 0, 6)$, $(0, -3, 2)$ and $(4, 5, 0)$ is
(a) $(1, 2, 3)$ (b) $\left(\frac{75}{14}, \frac{-13}{14}, 0\right)$
(c) $(13, -2, 0)$ (d) $(3, 2, 0)$

66. Three normals with slopes m_1, m_2, m_3 are drawn from any point P not on the axis of the parabola $y^2 = 4x$. If $m_1 m_2 = a$, results in locus of P being a part of parabola, then value of a equals
(a) 2 (b) -2 (c) 4 (d) -4

67. The points $A(4, -2, 1)$, $B(7, -4, 7)$, $C(2, -5, 10)$ and $D(-1, -3, 4)$ are the vertices of a
(a) tetrahedron (b) parallelogram
(c) rhombus (d) square

68. The sum of integers that lie between 1 and 121 (both included) and divisible by 3 or 5 or 11 is
(a) 3686 (b) 3783
(c) 2960 (d) 903

69. For the curve $7x^2 - 2y^2 + 12xy - 2x + 14y - 22 = 0$ which of the following is true? It is
(a) a hyperbola with eccentricity $\sqrt{3}$
(b) a hyperbola with directrix $2x + y + 1 = 0$
(c) a hyperbola with focus $(1, -2)$
(d) All of these

70. The distance between the orthocentre and circumcentre of the triangle with vertices $(1, 2)$, $(2, 1)$ and $\left((3+\sqrt{3})/2, (3+\sqrt{3})/2\right)$, is
(a) 0 (b) $\sqrt{2}$
(c) $3+\sqrt{3}$ (d) none of these

71. Find the ratio in which the line segment joining the points $(2, 4, 5)$ and $(3, 5, -4)$ is divided by the xz-plane.
(a) 4 : 5 externally (b) 2 : 3 externally
(c) 1 : 3 externally (d) 4 : 5 internally

72. With one focus of the hyperbola $\frac{x^2}{9} - \frac{y^2}{16} = 1$ as the centre, a circle is drawn which touches the hyperbola with no part of the circle being outside the hyperbola. The radius of the circle is
(a) less than 2 (b) 2
(c) 1/3 (d) None of these

73. The sum of infinite terms of the series
$$\frac{1}{1\cdot4\cdot7} + \frac{1}{4\cdot7\cdot10} + \ldots + \frac{1}{(3n-2)(3n+1)(3n+4)} \text{ is}$$
(a) $\frac{1}{28}$ (b) $\frac{1}{24}$ (c) $\frac{1}{14}$ (d) $\frac{1}{12}$

74. If the slope of one of the line represented by $ax^2 + 2hxy + by^2 = 0$ be the square of the other, then
(a) $\frac{a-b}{h} - \frac{8h^2}{ab} = 6$ (b) $\frac{a-b}{h} - \frac{8h^2}{ab} = 4$
(c) $\frac{a+b}{h} + \frac{8h^2}{ab} = 6$ (d) None of these

75. The points $A(3, 2, 0)$, $B(5, 3, 2)$ and $C(0, 2, 4)$ are the vertices of a triangle. Find the distance of the point A from the point in which the bisector of $\angle BAC$ meets BC.
(a) $8\sqrt{510}$ (b) $\sqrt{510}$
(c) $\frac{1}{8}\sqrt{510}$ (d) None of these

76. ABC is an equilateral triangle such that the vertices B and C lie on two parallel lines at a distance 6. If A lies between the parallel lines at a distance 4 from one of them, then the length of a side of the equilateral triangle is
(a) 8 (b) $\sqrt{\frac{88}{3}}$
(c) $\frac{4\sqrt{7}}{\sqrt{3}}$ (d) none of these

77. Find the coordinates of the points which trisect the line segment joining the points $P(4, 2, -6)$ and $Q(10, -16, 6)$.
(a) $(6, -4, -2), (8, 10, -2)$ (b) $(6, -4, -2), (8, -10, 2)$
(c) $(6, -4, -2), (8, -2, 10)$ (d) $(6, -4, 2), (8, 2, -10)$

78. The straight line $x + y = \sqrt{2}p$ will touch the hyperbola $4x^2 - 9y^2 = 36$, if
(a) $p^2 = 2$ (b) $p^2 = 5$
(c) $5p^2 = 2$ (d) $2p^2 = 5$

79. Area of the triangle formed by the lines $x^2 + 4xy + y^2 = 0$ and $x + y = 1$ is
(a) $\sqrt{3}$ sq. units (b) 2 sq. units
(c) 1 sq. unit (d) $\frac{\sqrt{3}}{2}$ sq. units

80. The sum of the infinite series
$1 + \frac{1}{2!} + \frac{1\cdot3}{4!} + \frac{1\cdot3\cdot5}{6!} + \ldots$ is
(a) e (b) e^2 (c) $\sqrt{e}$ (d) $1/e$

Section-B (Numerical Value Type)

Attempt any 5 questions out of 10

81. The polynomial $4x^4 - ax^3 + bx^2 - cx + 5 = 0$ has four positive real roots (r_1, r_2, r_3, r_4), $(r_1 < r_2 < r_3 < r_4)$ such that $\frac{r_1}{2} + \frac{r_2}{4} + \frac{r_3}{5} + \frac{r_4}{8} = 1$, then $2r_1 + r_2 + 4r_3 + r_4 =$ _____.

82. The equation of an obtuse angle bisector between lines $(\sqrt{3}-1)y=(\sqrt{3}+1)x$ and $(\sqrt{3}+1)y=(\sqrt{3}-1)x$ is $ax+by=c$, then $a+b+c=$ _____.

83. If the line $3x-4y-k=0$ touches the circle $x^2+y^2-4x-8y-5=0$ at (a, b), then the positive integral value of $\frac{k+a+b}{5}=$ _____.

84. If the points $A(-1, 0, 7)$, $B(3, 2, k)$ and $C(5,3, -2)$ are collinear, then the value of k is _____.

85. The foci of the ellipse $\frac{x^2}{16}+\frac{y^2}{b^2}=1$ and the hyperbola $\frac{x^2}{144}-\frac{y^2}{81}=\frac{1}{25}$ coincide. Then the value of b^2 is _____.

86. If s and p be sum and product of slopes of 2 lines represented by $11x^2-100xy+5y^2=0$, then $5(p+20s)$ = _____.

87. If $\sum_{r=0}^{n}\left\{\frac{{}^nC_{r-1}}{{}^nC_r+{}^nC_{r-1}}\right\}^3=\frac{25}{24}$, then n is equal to _____.

88. Normals AO, AA_1, AA_2 are drawn to parabola $y^2=8x$ from the point $A(h, 0)$. If triangle OA_1A_2 is equilateral, then the value of h is _____.

89. The length of a common tangent to the two hyperbolas $x^2-3y^2=3$ and $y^2-3x^2=3$ is _____.

90. Two vertices of a triangle are $(2, -6, 4)$ and $(4, -2, 3)$ and its centroid is $\left(\frac{8}{3}, -1, 3\right)$. The value of p, if the third vertex is$(2, p, 2)$ is _____.

SPACE FOR ROUGH WORK