JEE Main MODEL GRAND TEST

Time: 3 Hours **Max.Marks: 432**

INSTRUCTIONS

1. The test is of **3 hours** duration.

2. The Test Booklet consists of **90** questions. The maximum marks are **432**.

3. There are **three** parts in the question paper.

The distribution of marks subject wise in each part is as under for each correct response.

Part A - Physics (144 Marks) - Questions No. 1 to 2 and 9 to 30 consist **FOUR (4)** marks each and Question No. 3 to 8 consist **EIGHT (8)** marks each for each correct response.

Part B - Chemistry (144 Marks) - Questions No. 31 to 39 and 46 to 60 consist **FOUR (4)** marks each and Question No. 40 to 45 consist **EIGHT (8)** marks each for each correct response.

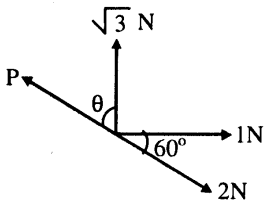
Part C - Mathematics (144 Marks) - Questions No. 61 to 82 and 89 to 90 consist **FOUR (4)** marks each and Question No. 83 to 88 consist **EIGHT (8)** marks each for each correct response.

4. Candidates will be awarded marks as stated above in instructions No. 3 for correct response of each question. 1/4 (one fourth) marks will be deducted for indicating incorrect response of each question. No deduction from the total score will be made if no response is indicated for an item in the answer sheet.

5. Each of the following questions has four choices of which **ONLY ONE** is correct.

PART – A: PHYSICS

1. Four coplanar concurrent forces are acting on a body as shown in figure to keep it in equilibrium. Then the values of P and θ are respectively



1) 4 N, 60° 2) 2 N, 90° 3) 1 N, 45° 4) 4 N, 90°

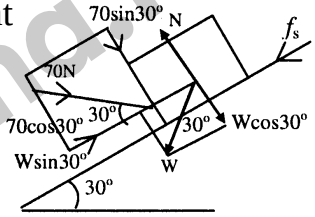
2. A stone is thrown up just from the mouth of well at gm/s. As it passes the mouth into the well another stone is dropped along side with first stone. Two splashes are heard at an interval of 1 second. The depth of the well is

1) g 2) 2g 3) g/2 4) $\sqrt{g}$

3. A bomb of mass M at rest explodes into three pieces in the ratio 1 : 1 : 2. The smaller ones are thrown off in perpendicular directions with velocities 3 ms^{-1} and 4 ms^{-1}. What is the velocity of the third piece after the explosion?

1) 1.5 ms^{-1} 2) 2 ms^{-1} 3) 2.5 ms^{-1} 4) 3 ms^{-1}

4. A box weighing 60 N is kept on an incline plane inclined at an angle of 30°. A force of 70 N is applied as shown in figure. If the system is in equilibrium what is the normal reaction on the box?

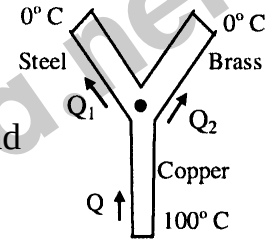


1) 95 N 2) 86 N 3) 9.5 N 4) 9.8 N

5. A sphere of mass 10 π kg and diameter 20 cm is attached to a string of length 4 m from the ceiling. The diameter of the string is 2 mm and the Young's modulus is 2×10^{11} N/m^2. When this pendulum is at rest the bottom of the pendulum sphere is 4 mm above the ground. When it is oscillating it just grazes the floor of the room. The velocity of the sphere at its lowest position is ($g = 10\ m/s^2$)

1) 41.04 m/s 2) 6.40 m/s 3) 10 π m/s^2 4) 40 π m/s

6. Rods of copper, brass and steel are welded together to form a Y - shaped figure as shown. The cross section area of each rod is 2 m^2. The end of copper rod is maintained at 100°C and the ends of brass and steel rods at 0°C. The lengths of copper, brass and steel rods are 46 cm, 13 cm and 12 cm respectively. The temperature at the junction is



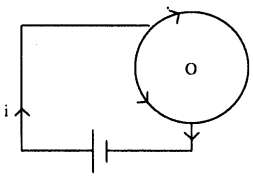
($K_{copper} = 0.92$, $K_{brass} = 0.26$, $K_{steel} = 0.12$ in cal/s/cm 1°C)

1) 20°C 2) 30°C 3) 40°C 4) 60°C

7. A diode is connected in the forward bias to a battery of emf 5 V and a series resistance R. In its V – I characteristics it is found that a minimum current of 1 mA flows at the knee point (0.7 V) then the maximum value of R will be

1) 4.3 Ω 2) 4.3 K Ω 3) 5.7 Ω 4) 5.7 K Ω

8. A circular loop of radius r is connected across a cell as shown in the figure. The magnetic field at the centre of the loop is

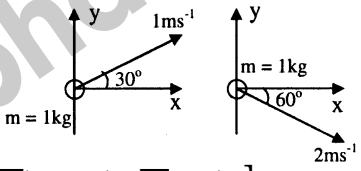


1) $\frac{\mu_0 i}{4r}$ 2) $\frac{\mu_0 i}{2r}$ 3) $\frac{\mu_0 i}{r}$ 4) Zero

9. A cricket ball of mass 150 g is moving with a velocity of 12 m/s and is hit by a bat so that the ball is turned back with a velocity of 20 m/s. The force of blow acts on the ball for 0.01 s, then the average force exerted by the bat on the ball is

1) 480 N 2) 12 N 3) 120 N 4) 4.8 N

10. The velocity of centre of mass of the system as shown in the figure is



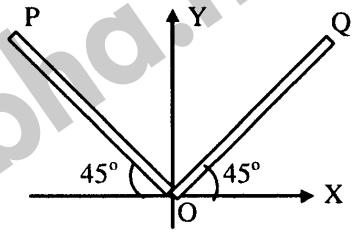
1) $\frac{1}{6}\left[(\sqrt{3}+2)\,i + (1-2\sqrt{3})\,j\right]$ 2) $\frac{1}{6}\left[(1-2\sqrt{3})\,i + (\sqrt{3}+2)j\right]$

3) $\frac{1}{4}\left[(\sqrt{3}+2)\,i + (1-2\sqrt{3})j\right]$ 4) $\frac{1}{3}\left[(1-2\sqrt{3})i + (\sqrt{3}+2)\,j\right]$

11. Four point size metal spheres each of mass 1 kg are placed on a turn table and are connected by four strings of equal length 1 m to form a square. If the spheres are rotated with an angular velocity $1/\pi$ rps, the tension in the connecting strings is

1) 4 N 2) 2 N 3) 1 N 4) 3 N

12. Two rods OP and OQ of equal length and mass are lying on XY plane as shown. If I_x, I_y and I_z be the moments of inertia of both the rods about X, Y and Z axes respectively, then

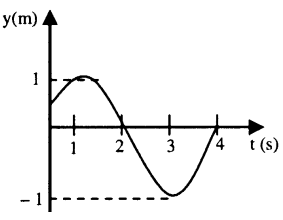


1) $I_x = I_y > I_z$ 2) $I_x = I_y < I_z$ 3) $I_x > I_y > I_z$ 4) $I_z > I_y > I_x$

13. The mass of the earth is 81 times that of the moon and radius is nearly 4 times that of the moon. If orbital velocity of a particle very close to the surface of earth is v_0, the corresponding value very close to the surface of moon is (ignore the effect of atmosphere of the earth)

1) $\frac{2}{9}v_0$ 2) $\frac{v_0}{6}$ 3) $\frac{v_0}{5}$ 4) $\frac{9}{2}v_0$

14. The figure shows displacement-time graph of a particle executing SHM. The equation of motion of the particle is



1) $y = 0.5\sin\left(\frac{\pi}{2}t + \frac{\pi}{3}\right)m$ 2) $y = \sin\left(\pi t + \frac{\pi}{6}\right)m$

3) $y = \sin\left(\frac{\pi}{2}t + \frac{\pi}{3}\right)m$ 4) $y = \sin\left(0.5\pi t + \frac{\pi}{6}\right)m$

15. Several spherical drops of a liquid, each of radius r, coalesce to form a single drop of radius R. If T is the surface tension and V is the volume of the big drop, then the release of energy is

1) $3VT\left[\frac{1}{r}+\frac{1}{R}\right]$ 2) $3VT\left[\frac{1}{r}-\frac{1}{R}\right]$

3) $VT\left[\frac{1}{r}-\frac{1}{R}\right]$ 4) $VT\left[\frac{1}{r^2}+\frac{1}{R^2}\right]$

16. Water in a river 20 m deep is flowing at a speed of 10 ms^{-1}. The shearing stress between the horizontal layers of water in the river in Nm^{-2} is (coefficient of viscosity of water = 10^{-2} SI units)

1) 2×10^{-2} 2) 0.5×10^{-2} 3) 1×10^{-3} 4) 0.5×10^{-3}

17. A vessel is completely filled with 1000 gram of mercury and 500 gram of water. When heated through 40°C it is found that 3.52 grams of water is expelled out. The coefficient of real expansion of mercury (The expansion of the vessel is negligible. $\gamma_w = 1.5\times10^{-4}$/ °C and density of mercury is 13.6 gm/cm^3)

1) 17.68×10^{-4}/ °C 2) 1.768×10^{-4}/ °C

3) 176.8×10^{-4}/ °C 4) 18.10^{-3}/ °C

18. A wire produces a fundamental frequency 'n' under a tension 'T'. The wire is stretched to twice its length and kept under the same tension. The fundamental frequency of the wire is

1) 2n 2) n 3) $\sqrt{2n}$ 4) $n/\sqrt{2}$

19. On one face of a prism of refractive index μ and refracting angle A, a ray of light is incident at angle i. After refraction from the other refracting surface, the ray travels at grazing emergence.

1) $\mu=\sqrt{1+\left(\frac{\sin A+\cos i}{\sin A}\right)^2}$ 2) $\mu=\sqrt{1+\left(\frac{\sin i+\cos A}{\sin A}\right)^2}$

3) $\mu=\sqrt{1-\left(\frac{\sin i+\cos A}{\sin A}\right)^2}$ 4) $\mu=\sqrt{1+\left(\frac{\sin i+\cos A}{\sin i}\right)^2}$

20. Two light waves are represented by $y_1 = 3\sin\omega t$ and $y_2 = 4\sin\left(\omega t+\frac{\pi}{3}\right)$

When they produce interference, resultant amplitude is

1) $\sqrt{21}$ 2) $\sqrt{28}$ 3) $\sqrt{47}$ 4) $\sqrt{37}$

21. Two metallic spheres of radii 20 cm and 10 cm respectively have each 150 μC of positive charge. The common potential after they are put in contact

1) 9 MV 2) 4.5 MV 3) 18 MV 4) 13.6 MV

22. A particle of mass 2 g and having a charge 1 μC is held at rest on a frictionless horizontal surface at a distance of 1 m from a fixed charge by 1 mc. When released the particle gets repelled. The speed of the particle when it is at a distance of 10 m from the fixed charge is

1) 300 m/s 2) 90 m/s 3) 60 m/s 4) 45 m/s

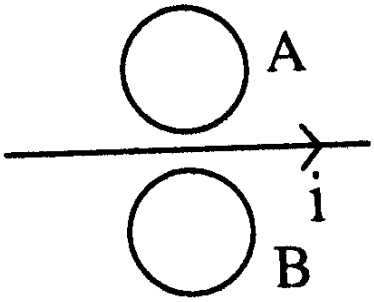
23. Two wires of equal diameters of resistivities ρ_1 and ρ_2, lengths x_1 and x_2 respectively are joined in series. The equivalent resistivity of the combination is

1) $\frac{\rho_1 x_1 + \rho_2 x_2}{x_1 + x_2}$ 2) $\frac{\rho_1 x_2 - \rho_2 x_1}{x_1 - x_2}$ 3) $\frac{\rho_1 x_2 - \rho_2 x_1}{x_1 + x_2}$ 4) $\frac{\rho_1 x_1 - \rho_2 x_2}{x_1 - x_2}$

24. One junction of a certain thermocouple is at a fixed temperature T_1 and the other junction is at a temperature T_2. The electromotive force for this expressed by $E = K(T_2 - T_1)\left(T_0 - \frac{1}{2}(T_2 + T_1)\right)$. At a temperature $T_2 = \frac{T_0}{2}$ the thermoelectric power is

1) $\frac{KT_0}{4}$ 2) $\frac{KT_0}{3}$ 3) $\frac{KT_0}{2}$ 4) $\frac{KT_0}{5}$

25. Two conducting loops A and B are placed in the plane of the paper near a straight current (i) carrying conductor as shown in the figure.



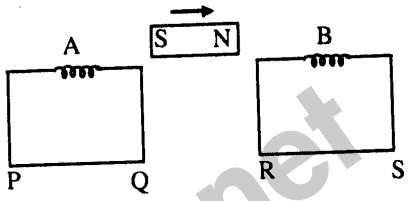
1) The induced currents in A and B are clockwise and anticlockwise respectively when i is constant.

2) The induced currents in A and B are clockwise and anticlockwise respectively when i is increasing.

3) The induced currents in A and B are clockwise and anticlockwise respectively when i is decreasing

4) The currents in A and B are anticlockwise and clockwise respectively when i is increasing.

26. A bar magnet is arranged co-axially in between two conducting coils A and B. If the magnet moves towards B, the directions of induced currents in A and B are respectively.



1) from P to Q and R to S
2) from P to Q and S to R
3) from Q to P and R to S
4) from Q to P and S to R

27. The instantaneous values of voltage and current in an ac circuit are represented by the equations $v = 2\sqrt{2}\sin\left(100\,\pi t + \frac{\pi}{4}\right)$ and $i = \frac{1}{\sqrt{2}}\sin 100\pi t$. The impedance of the circuit is

1) 1 Ω
2) 2 Ω
3) 4 Ω
4) zero

28. How much energy will approximately be released if all the atoms of 1 kg of deuterium could undergo fusion? (Two deuterons combine to form a helium nucleus releasing energy of 23.6 MeV)

1) 9×10^{13} J
2) 6×10^{11} J
3) 2×10^{7} kwh
4) 8×10^{2} MeV

29. In an amplitude modulated wave for audio frequency of 500 cycle/sec, the appropriate carrier frequency will be

1) 50 cycle/sec
2) 100 cycle/sec
3) 500 cycle/sec
4) 50,000 cycle/sec

30. The wavelength λ of the K_α line of x-ray spectrum for an anticathode element of atomic number Z is nearly proportional to

1) Z^2
2) $(Z-1)^2$
3) $\frac{1}{(Z-1)}$
4) $\frac{1}{(Z-1)^2}$

PART – B : CHEMISTRY

31. Which one of the following is a radial probability distribution function

1) Ψ^2
2) $4\pi r^2 \Psi^2$
3) $4\pi r^2\, dr\, \Psi^2$
4) $4\pi r^2\, dr\, \Psi$

32. Among the following, identify the set of ions in which all the ions have d^2 configuration

1) Ti^{2+}, V^{3+}, Mn^{5+}
2) Ti^{4+}, V^{3+}, Mn^{5+}
3) Ti^{2+}, V^{4+}, Mn^{5+}
4) Ti^{2+}, V^{3+}, Mn^{2+}

33. Paramagnetism of oxygen is explained on the basis of its electronic configuration of

1) $(2\pi_{px}{}^{8})^{1}\ (2_{py}\pi)^{1}$ 2) $(2\pi_{px}{}^{*})^{1}\ (2\pi_{py}{}^{*})^{1}$

3) $(2\sigma_{s}{}^{*})^{1}\ (2\pi_{py})^{1}$ 4) $(2\sigma_{s})^{1}\ (2\lambda_{py}{}^{*})^{1}$

34. Dalton's law of partial pressures is not applicable to the following mixture

1) $H_2 + O_2$ 2) $N_2 + O_2$

3) $NO + O_2$ 4) Xe + Ar

35. Which of the following pairs of gases contain same number of molecules?

1) 11 g of CO_2, 7 g of N_2 2) 28 g of N_2O_2, 22 g of O_2

3) 44 g of CO_2, 14 g of N_2 4) 16 g of O_2, 14 g of N_2

36. In the reaction $B_2H_6 \xrightarrow[120^\circ C]{NH_3} A, \xrightarrow{200^\circ C} B$, A and B in order are

1) B_2H_6, $6NH_3$ and $B_3N_6H_9$ 2) BN and $(NH)_3B$

3) $B_2H_6.2NH_3$ and $B_3N_3H_6$ 4) $B_3N_3H_6$ and NH_3

37. The possible structures for an alkyne with molecular formula C_5H_8 are

1) 5 2) 4

3) 3 4) 2

38. The only cations present in a slightly acidic solution are Fe^{3+}, Zn^{2+} and Cu^{2+}. The reagent that when added in excess to this solution would identify and separate Fe^{3+} in one step is

1) 2 M HC*l* 2) 6 M NH_3

3) 6 M NaOH 4) H_2S gas

39. When propionic acid is treated with aqueous sodium bicarbonate, CO_2 is liberated. The 'C' of CO_2 comes from

1) Methyl group 2) Carboxylic acid group

3) Methylene group 4) Bicarbonate

40. The correct order of magnetic moments (spin only values in B.M.) among is (Atomic no. Mn = 25, Fe = 26, Co = 27)

1) $[MnCl_4]^{2-} > [CoCl_4]^{2-} > [Fe(CN)_6]^{4-}$

2) $[MnCl_4]^{2-} > [Fe(CN)_6]^{4-} > [CoCl_4]^{2-}$

3) $[Fe(CN)_6]^{4-} > [MnCl_4]^{2-} > [CoCl_4]^{2-}$

4) $[Fe(CN)_6]^{4-} > [CoCl_4]^{2-} > [MnCl_4]^{2-}$

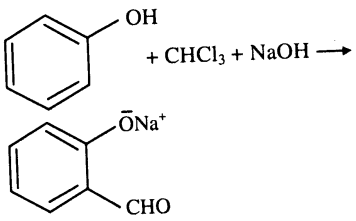
41. Reaction of one molecule of HBr with one molecule of 1, 3-butadiene at 40°C gives predominantly

1) 3 – bromobutene under kinetically controlled conditions

2) 1 – bromo – 2 – butene under thermo dynamically controlled conditions

3) 3 – bromobutene under thermo dynamically controlled conditions

4) 1 – bromo – 2 – butene under kinetically controlled conditions

42. 

The electrophile involved in the above reaction is

1) dichloro methyl cation ($\overset{\oplus}{C}HCl_2$) 2) dichlorocarbene ($:CCl_2$)

3) trichloromethyl anion ($\overset{\oplus}{C}Cl_3$) 4) formyl cation ($\overset{\oplus}{C}HO$)

43. In both DNA and RNA, heterocyclic base and phosphate ester linkages are at

1) $C_{5'}$ and $C_{2'}$ respectively of the sugar molecule

2) $C_{2'}$ and $C_{5'}$ respectively of the sugar molecule

3) $C_{1'}$ and $C_{5'}$ respectively of the sugar molecule

4) $C_{5'}$ and $C_{1'}$ respectively of the sugar molecule

44. Among the following compounds which can be dehydrated very easily is

1) $CH_3CH_2CH_2CH_2CH_2OH$ 2) $CH_3CH_2CH_2\underset{\displaystyle OH}{\underset{|}{C}}HCH_3$

3) $CH_3CH_2\underset{\displaystyle OH}{\underset{|}{C}}CH_2CH_3$ 4) $CH_3CH_2\underset{\displaystyle CH_3}{\underset{|}{C}}HCH_2CH_2OH$

45. On mixing ethyl accrete with aqueous sodium chloride, the composition of the resultant solution is

1) $CH_3COOC_2H_5 + NaCl$

2) $CH_3COONa + C_2H_5OH$

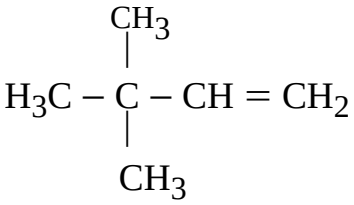
3) $CH_3COCl + C_2H_5OH + NaOH$

4) $CH_3Cl + C_2H_5COONa$

46. Which oxide of nitrogen is a coloured gas?

1) N_2O 2) NO 3) N_2O_5 4) NO_2

47. The IUPAC name of the compound having the following formula is



1) 3, 3, 3 – Trimethyl – 1 – propene

2) 1, 1, 1 – Trimethyl – 2 – propene

3) 3, 3 – Dimethyl – 1 – butene

4) 2, 2 – Dimethyl – 3 – butene

48. According to Huckel, monocyclic compounds will show aromaticity when

1) It has 4π – electron 2) It has no π – electron

3) It has 4 π +2 electron 4) It has $(4n+2)\pi$ – electron

49. When propyne is treated with aqueous H_2SO_4 in presence of $HgSO_4$ the major product is

1) Propanal 2) Acetone

3) Propyl hydrogen sulphate 4) Propanol

50. Arrange the following compounds in order of increasing dipole moment:

Toluene (I) m – Dichlorobenzene (II)

o – Dichlorobenzene (III) p – Dichlorobenzene (IV)

1) I < IV < II < III 2) IV < I < II < III

3) IV < I < III < II 4) IV < II < I < III

51. Sodium thiosulphate is prepared by

1) Reducing Na_2SO_4 solution with H_2S

2) Boiling $Na_2S_2O_3$ solution with S in alkaline

3) Neutralising $H_2S_2O_3$ solution with NaOH

4) Boiling Na_2SO_3 solution with S in acidic medium

52. For an endothermic reaction where ΔH represents the enthalpy of the reaction in kJ/mol, the minimum value for the energy of activation will be

1) < ΔH 2) 0 3) > ΔH 4) = ΔH

53. Which of the following is an inner orbital complex as well as dia-magnetic in behaviour

1) $[Cr(NH_3)_6]^{3+}$ 2) $[CO(NH_3)_6]^{3+}$

3) $[Ni(NH_3)_6]^{2+}$ 4) $[Zn(NH_3)_6]^{2+}$

54. Which of the following is the strongest acid

1) $ClO_3(OH)$ 2) $ClO_2(OH)$

3) $SO(OH)_2$ 4) $SO_2(OH)_2$

55. Of the given anion, the strongest Bronsted base is

1) ClO^- 2) ClO_2^-

3) ClO_3^- 4) ClO_4^-

56. When the same amount of zinc is treated separately with excess of sulphuric acid and excess of NaOH, the ratio of volumes of hydrogen evolved is

1) 1 : 1 2) 1 : 2

3) 2 : 1 4) 9 : 4

57. 0.004 M Na_2SO_4 solution is isotonic with 0.01 M glucose solution. The degree of dissociation of Na_2SO_4 is

1) 25% 2) 75% 3) 85% 4) 50%

58. An antiferromagnetic substance in the following is

1) ZnO_2 2) VO_2

3) CrO_2 4) $ZnFe_2O_4$

59. In the electrolysis of alkaline water 2 moles of gases (H_2 & O_2) are released. How many moles of water are decomposed?

1) 1/2 2) 2/3 3) 4/3 4) 1/3

60. Which of the following is the strongest acid?

1) $ClO_3(OH)$ 2) $ClO_2(OH)$

3) $SO(OH)_2$ 4) $SO_2(OH)_2$

PART – C : MATHEMATICS

61. The domain of $f(x) = \dfrac{\sin^{-1}(x-3)}{\sqrt{9-x^2}}$ is

1) {2, 3} 2) [2, 3) 3) [1, 2] 4) [1, 2)

62. Consider the following statements.

St – I: If det A = 0, then det (adj A) = 0.

St – II: If A is non – singular then $\det(A^{-1}) = (\det A)^{-1}$

Which of the above statement is/are correct?

1) Both I and II 2) Neither I nor II

3) I only 4) II only

63. The greatest positive integer n, for which 6^n divides 30! is

1) 14 2) 13 3) 12 4) 11

64. The values of x satisfying the equation $(81)^{\sin^2 x} + (81)^{\cos^2 x} = 30$ in the interval $\left[0, \frac{\pi}{2}\right]$ are

1) $\frac{\pi}{6}, \frac{\pi}{3}$ 2) $\frac{\pi}{6}, \frac{\pi}{2}$ 3) $\frac{\pi}{3}, \frac{\pi}{2}$ 4) $\frac{\pi}{2}, \frac{\pi}{4}$

65. The sides of a triangle are $\sin\alpha$, $\cos\alpha$ and $\sqrt{1 + \sin\alpha\cos\alpha}$ for some α, $0 < \alpha < \frac{\pi}{2}$. Then the greatest angle of the triangle is

1) 60° 2) 90°

3) 120° 4) 150°

66. **Assertion (A):** If $3 + ix^2y$ and $x^2 + y + 4i$ are conjugate complex numbers, then $x^2 + y^2 = 3$.

Reason (R): If the sum and product of two complex numbers is real, then they are conjugate complex numbers. Then the correct answer is

1) A is true, R is true and R is a correct explanation of A.

2) A is true, R is true and R is not a correct explanation of A.

3) A is true, R is false. 4) A is false, R is true.

67. From the bottom of a pole of height h, the angle of elevation of the top of a tower is α. The pole subtends an angle β at the top of the tower. The height of the tower is

1) $\frac{h \sin\alpha \cos(\alpha + \beta)}{\cos\beta}$ 2) $\frac{h \sin\alpha \cos(\alpha - \beta)}{\sin\beta}$

3) $\frac{h \sin\alpha \sin(\alpha + \beta)}{\cos\beta}$ 4) $\frac{h \sin\alpha \sin(\alpha - \beta)}{\sin\beta}$

68. The value of $\text{Arg}(i\omega) + \text{Arg}(i\omega)^2 =$

1) $-\pi$ 2) $\pi/4$ 3) $\pi/2$ 4) $3\pi/2$

69. A, B, C are three points with position vectors $a - 2b + 3c$, $2a + 3b - 4c$, $-7b + 10c$. If $AC = \lambda AB$, then λ equals

1) 1 2) -1 3) 2 4) -2

70. For the three events A, B and C, P(exactly one of A or B occurs) = P(exactly one of B or C occurs) = P (exactly one of C or A occurs) = p and P(all the three events occur simultaneously) = p^2, where $0 < p < \frac{1}{2}$. Then, the probability that at least one of A, B, C occurs is

1) $\frac{3p + 2p^2}{2}$ 2) $\frac{p + 3p^2}{4}$ 3) $\frac{p + 3p^2}{2}$ 4) $\frac{3p + p^2}{4}$

71. The number of integer values of m for which the X coordinate of the point of intersection of the lines $3x + 4y - 9$ and $y = mx + 1$ is an integer is

1) 2 2) 0 3) 4 4) 1

72. **Assertion (A):** If $(-3, 5, 2)$ and $(6, 2, 5)$ are respectively the orthocenter and circumcentre of a triangle, then $(3, 3, 4)$ will be its centroid.

Reason (R): Centroid of a triangle divides the line segment joining orthocenter and circumcentre in 2 : 1 ratio.

1) A and R are true and R is correct explanation to A.

2) A and R are true but R is not correct explanation to A.

3) A is true, R is false. 4) A is false, R is true.

73. The direction cosines of a line which is perpendicular to the lines whose direction ratios are $3, -1, 1$ and $3, -2, 4$ are

1) $\frac{1}{\sqrt{23}}, \frac{9}{2\sqrt{23}}, \frac{3}{2\sqrt{23}}$ 2) $-\frac{2}{7}, \frac{6}{7}, \frac{3}{7}$

3) $\frac{2}{7}, \frac{6}{7}, \frac{3}{7}$ 4) $\frac{-2}{2\sqrt{23}}, \frac{9}{2\sqrt{23}}, \frac{3}{2\sqrt{23}}$

74. The image of the point $(-1, 3, 4)$ in the plane $x - 2y = 0$ is

1) (15, 11, 4) 2) $\left(-\frac{17}{3}, -\frac{19}{3}, 1\right)$

3) $\left(\frac{9}{5}, -\frac{13}{5}, 4\right)$ 4) $\left(-\frac{17}{3}, -\frac{19}{3}, 4\right)$

75. Through a fixed point (h, k) secants are drawn to the circle $x^2 + y^2 = r^2$. The locus of the mid-points of the portions of the secants intercepted by the circle is

1) $x^2 + y^2 + hx + ky = 0$ 2) $x^2 + y^2 + 2hx + 2ky = 0$

3) $x^2 + y^2 - 2hx - 2ky = 0$ 4) $x^2 + y^2 - hx - ky = 0$

76. If two circles $(x-1)^2 + (y-3)^2 = r^2$ and $x^2 + y^2 - 8x + 2y + 8 = 0$ intersect at two distinct points, then

1) $2 < r < 8$ 2) $r < 2$ 3) $r = 2$ 4) $r > 2$

77. **Assertion (A):** PQ is a double ordinate of a parabola. $\overline{QR}$ is a focal chord then $\overline{PR}$ is perpendicular to the directrix.

Reason (R): The chord joining the points t_1 and t_2 of a parabola is a focal chord if $t_1t_2 = -1$. Then which one of the following is true?

1) Both A and R are true and R is the correct explanation of A

2) Both A and R are true and R is not the correct explanation of A

3) A is true and R is false 4) A is false and R is true

78. AB is a diameter of the ellipse. If the eccentric angle of A is $\pi/3$, then the eccentric angle of B is

1) $-2\pi/3$ 2) $\pi/6$ 3) $-\pi/6$ 4) $5\pi/6$

79. If a hyperbola having the transverse axis of length $2\sin\theta$ is confocal with the ellipse $3x^2 + 4y^2 = 12$, then its equation is

1) $x^2\text{cosec}^2\theta - y^2\sec^2\theta = 1$ 2) $x^2\sec^2\theta - y^2\text{cosec}^2\theta = 1$

3) $x^2\sin^2\theta - y^2\cos^2\theta = 1$ 4) $x^2\cos^2\theta - y^2\sin^2\theta = 1$

80. $\lim\limits_{x \to -\infty} \left[\dfrac{x^4 \sin\left(\frac{1}{x}\right) + x^2}{1 + |x|^3}\right] =$

1) 0 2) -1 3) 1 4) does not exist

81. If $x = e^{y + e^{y+\ldots \text{ to } \infty}}$, $x > 0$, then $\dfrac{dy}{dx}$ is

1) $\dfrac{1+x}{x}$ 2) $\dfrac{1}{x}$ 3) $\dfrac{1-x}{x}$ 4) $\dfrac{x}{1+x}$

82. If x is real, the minimum value of $\dfrac{x^2 - 2x + 9}{x^2 + 2x + 9}$ is

1) 1 2) 2 3) 1/2 4) 3

83. Observe the following Lists:

List – I	**List – II**
(i) $nP(n-1, r-1)$	(a) $\dfrac{\lfloor n}{\lfloor n-r \rfloor r}$
(ii) The number of Permutations of n dissimilar things taken r at a time (repetition allowed)	(b) 1
(iii) ${}^{n-1}C_{r-1} + {}^{n-1}C_r$	(c) n!

(iv) ${}^{n}C_{n}\ {}^{n}P_{n}$ (d) $\frac{\lfloor n}{\lfloor n-r}$

(e) n^r

Then the match for List I from List II is

1) i - d, ii - e, iii - a, iv - c 2) i - d, ii - e, iii - b, iv - a

3) i - a, ii - e, iii - d, iv - c 4) i - a, ii - e, iii - b, iv - d

84. Match the following.

List – I	**List – II**
(i) Area of the region bounded by $y = 2x - x^2$ and X – axis is	(a) $\frac{1}{3}$
(ii) Area of the region $\{(x, y): x^2 \le y \le \lvert x\rvert\}$	(b) $\frac{1}{2}$
(iii) Area bounded by $y = x$ and $y = x^3$ is	(c) $\frac{2}{3}$
(iv) Area bounded by $y = x\lvert x\rvert$, X – axis and $x = -1, x = 1$ is	(d) $\frac{4}{3}$

The correct match from List I to List II is

1) i - b, ii - c, iii - a, iv - d 2) i - c, ii - d, iii - a, iv - b

3) i - d, 2 - a, iii - b, iv - c 4) i - a, ii - b, iii - c, iv - d

85. Passage: If a, b and c are non coplanar vectors and $d = xa + yb + zc$, then $x = \frac{[bcd]}{[abc]}$, $y = \frac{[cad]}{[abc]}$, $z = \frac{[abd]}{[abc]}$ Answer the following questions.

(I) $a = i + j$, $b = j + k$, $c = k + i$ and $i + j + k = xa + yb + zc$,

then $x + y + z =$

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

(II) If $i + j + k = x(b \times c) + y(c \times a) + z(a \times b)$ then $x + y - z =$

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

(III) If $i + j + k = \frac{x(b \times c)}{[abc]} + \frac{y(c \times a)}{[abc]} + \frac{z(a \times b)}{[abc]}$

then $x + y + z =$

A) $\frac{3}{2}$ B) 1 C) 2 D) 6

1) I - D, II - B, III - C 2) I - A, II - D, III - B

3) I - B, II - A, III - D 4) I - A, II - B, III - D

86. **Assertion (A):** $\int_{-2}^{2} x^3 |x| \, dx = 0$

Reason (R): If f is an odd function, then $\int_{-a}^{a} f(x) \, dx = 0$ Select the correct answer.

1) A is true, R is true and R is correct explanation for A.

2) A is true, R is true. R is not correct explanation for A.

3) A is true, R is false.

4) A is false, R is true.

87. Let $Q(x) = f(x) + f(1 - x)$ and $f''(x) < 0$ for $0 < x < 1$. Then, on $(0, \frac{1}{2})$

1) Q(x) is increasing 2) Q(x) is decreasing

3) Q(x) is constant 4) Q(x) is not increasing

88. If $f(x) = \begin{vmatrix} 2\cos x & 1 & 0 \\ x - \frac{\pi}{2} & 2\cos x & 1 \\ 0 & 1 & 2\cos x \end{vmatrix}$. Then $f'\left(\frac{\pi}{2}\right)$

1) 2 2) $\frac{\pi}{2}$ 3) 1 4) 4

89. If $f(x) = x^n$ then the value of $f(1) - \frac{f'(1)}{1!} + \frac{f''(1)}{2!} + \frac{f'''(1)}{3!} + \ldots + (-1)^n \frac{f^n(1)}{n!}$ is

1) 0 2) 1 3) 2^{n-1} 4) 2^n

90. $\int_{0}^{\pi} x \sin^3 x \cos^2 x \, dx =$

1) $\frac{3\pi}{16}$ 2) $\frac{15\pi^2}{32}$ 3) $\frac{2\pi}{15}$ 4) $\frac{5\pi^2}{16}$

PHYSICS

1-2; 2-1; 3-4; 4-2; 5-2; 6-3; 7-2; 8-4; 9-1; 10-3; 11-2; 12-2; 13-1; 14-4; 15-2; 16-2; 17-2; 18-4; 19-2; 20-4; 21-1; 22-2; 23-1; 24-3; 25-2; 26-1; 27-3; 28-2; 29-4; 30-4.

CHEMISTRY

31-3; 32-1; 33-2; 34-3; 35-1; 36-3; 37-3; 38-2; 39-4; 40-4; 41-3; 42-2; 43-3; 44-3; 45-1; 46-4; 47-3; 48-4; 49-2; 50-2; 51-2; 52-3; 53-2; 54-3; 55-1; 56-1; 57-2; 58-4; 59-3; 60-1.

MATHEMATICS

61-2; 62-1; 63-2; 64-1; 65-3; 66-4; 67-2; 68-1; 69-2; 70-1; 71-1; 72-1; 73-1; 74-3; 75-4; 76-1; 77-4; 78-1; 79-1; 80-2; 81-3; 82-3; 83-1; 84-3; 85-4; 86-1; 87-1; 88-1; 89-1; 90-3.

(ఈ నమూనా ప్రశ్నపత్రాన్ని హైదరాబాద్‌లోని కృష్ణమూర్తి ఐఐటీ అకాడెమీ నిపుణులు రూపొందించారు)