TEST NO - 12

TOPICS

MATHEMATICS : SETS, RELATIONS, FUNCTIONS, PROGRESSIONS

CHEMISTRY : MOT AND DIPOLE MOMENT, IDEAL GAS EQUATION, GRAHAM'S LAW OF DIFFUSION

PHYSICS : KINEMATICS, 2D&3D, RELATIVE VEL.OCITY

MATHEMATICS

Answer all the following questions. Each correct answer carries +3 marks and (–1) for wrong answer

1 If S_n denotes the sum of n terms of an A.P., then $S_{n+3} - 3S_{n+2} + 3S_{n+1} - S_n =$

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

2. If x, y, z are the three geometric means between 6 and 54, then z =

1) $9\sqrt{3}$ 2) 18 3) $18\sqrt{3}$ 4) 27

3. (666.... ndigits)^2 + (888.....n digits) =

1) $\frac{4}{9}(10^n - 1)$ 2) $\frac{4}{9}(10^{2n} - 1)$ 3) $\frac{4}{9}(10^n - 1)^2$ 4) $\frac{4}{9}(10^{2n} - 1)^2$

4. If $a_1, a_2, a_3, ...$ are in A.P. such that

$a_1 + a_5 + a_{10} + a_{15} + a_{20} + a_{24} = 225$ then $a_1 + a_2 + a_3 + ... + a_{23} + a_{24} =$

1) 909 2) 75 3) 750 4) 900

5. If H_1, H_2,....., H_n are 'n' harmonic means between 'a' and 'b' then the value of $\frac{H_1 + a}{H_1 - a} + \frac{H_n + b}{H_n - b} =$

1) n + 1 2) n – 1 3) 2n 4) 2n + 3

6. If a, b, c are in A.P., p, q, r are in H.P and ap, bq, cr are in G.P., then $\frac{p}{r} + \frac{r}{p} =$

1) $\frac{a}{c} + \frac{c}{a}$ 2) $\frac{a}{c} - \frac{c}{a}$ 3) $\frac{b}{q} + \frac{q}{b}$ 4) $\frac{b}{q} - \frac{a}{p}$

7. If the geometric mean between a and b is $\frac{a^{n+1} + b^{n+1}}{a^n + b^n}$ then n =

1) 0 2) 1/2 3) – 1/2 4) $\frac{1}{4}$

8. If (1 + 3 + 5+.....+p) + (1 + 3 + 5+.....+q) = (1 + 3 + 5 + ... + r) where each set of parentheses contains the sum of consecutive odd integers as shown, the smallest possible value of p + q + r, (where p > 6) is

1) 12 2) 21 3) 45 4) 54

9. The interior angles of a polygon are in A.P. If the smallest angle is 100^o and the common difference is 4^o, then the number of sides is

1) 5 2) 7 3) 36 4) 44

10. If $1-\frac{1}{3}+\frac{1}{5}-\frac{1}{7}+\frac{1}{9}-\frac{1}{11}+...=\frac{\pi}{4}$, then value of $\frac{1}{1.3}+\frac{1}{5.7}+\frac{1}{9.11}+....$ is

1) $\pi/8$ 2) $\pi/6$ 3) $\pi/4$ 4) $\pi/36$

11. If $-1 < a, b, c < 1$ and $x=\sum_{n=0}^{\infty}a^n, y=\sum_{n=0}^{\infty}b^n, z=\sum_{n=0}^{\infty}c^n$, here a, b, c are in A.P. and then x, y, z are in

1) A.P. 2) G.P. 3) H.P. 4) A.G.P.

12. The sum to infinity of the series $1+\frac{4}{5}+\frac{7}{5^2}+\frac{10}{5^3}+...$ is

1) $\frac{16}{35}$ 2) $\frac{11}{8}$ 3) $\frac{35}{16}$ 4) $\frac{17}{6}$

13. The H.M. and G.M. of two numbers are in the ratio 12 : 13, then the numbers are in the ratio.

1) 1 : 2 2) 2 : 3 3) 3 : 5 4) 4 : 9

14. If cos(x–y), cos x and cos (x+y) are in H.P, then value of cos x sec (y/2) is

1) $\pm\sqrt{2}$ 2) $\pm\sqrt{3}$ 3) ±2 4) ±1

15. The domain of definition of the function $y(x)$ given by the equation $2^x+2^y=2$ is

1) $0<x\le1$ 2) $0\le x\le1$ 3) $-\infty<x\le0$ 4) $-\infty<x<1$

16. If $f(x)=4^x-2^{x+1}+5$ then the range of 'f' is

1) $[4,\infty)$ 2) $(4,\infty)$ 3) $(5,\infty)$ 4) R

17. For a real number x, [.] denotes the greatest integer. The value of $\left[\frac{1}{2}\right]+\left[\frac{1}{2}+\frac{1}{100}\right]+\left[\frac{1}{2}+\frac{2}{100}\right]+...+\left[\frac{1}{2}+\frac{99}{100}\right]$ is:

1) 49 2) 50 3) 48 4) 51

18. Let $f(x)=\frac{\alpha x}{x+1}, x\neq-1$. Then, for what value of 'α', is $f\{f(x)\}=x$?

1) $\sqrt{2}$ 2) $-\sqrt{2}$ 3) 1 4) -1

19. If $f(x+y,x-y)=xy$, then the arithmetic mean of $f(x,y)$ and $f(y,x)$ is

1) y 2) x 3) 0 4) xy

20. If $3f(x)+5f\left(\frac{1}{x}\right)=\frac{1}{x}-3, \forall x(\neq0)\in R$ then $f(x)=$

1) $\frac{1}{14}\left(\frac{3}{x}+5x-6\right)$ 2) $\frac{1}{16}\left(-\frac{3}{x}+5x-6\right)$ 3) $\frac{1}{14}\left(-\frac{3}{x}+5x+6\right)$ 4) $-\frac{3}{x}+5x-6$

21. The domain of the function $f(x)=\log_{10}[1-\log_{10}(x^2-5x+16)]$ is
1) (2, 3) 2) [2, 3] 3) (2, 3] 3) [2, 3)

22. If A={x|x is a letter in the word "ACCOUNTANCY"} then cardinality of A is
1) 5 2) 6 3) 7 4) 8

23. If $n(\mu)=60, n(A)=21, n(B)=43$ then Greatest value of $n(A\cup B)$ and least value of $n(A\cup B)$ are
1) 60, 43 2) 50, 36 3) 70, 44 4) 60, 38

24. In a mathematics class, 20 children had forgotten their rulers and 17 had forgotten their pencils, "Go and borrow them from someone at once", said the teacher, 24 children left the room, then how many children had forgotten both is
1) 11 2) 12 3) 13 4) 14

25. If $f(x)=\frac{(x-a)(x-b)}{x}$ and $\frac{f(x)}{(x-y)(x-z)}+\frac{f(y)}{(y-z)(y-x)}+\frac{f(z)}{(z-x)(z-y)}=\frac{k}{xyz}$ then k =
1) a 2) b 3) ab 4) 3ab

26. If X is a finite set. Let P(X) denote the set of all subsets of X and let n(X) denote the number of elements in X. If for two finite subsets A, B, n(P(A)) = n(P(B))+15 then n(B) = ..., n(A)=.....
1) 6, 2 2) 8, 4 3) 0, 4 4) 0, 1

27. If relation 'R' is defined by $R=\{(x,y):2x^2+3y^2\le 6\}$ then the domain of 'R' is
1) $[-3,3]$ 2) $\left[-\sqrt{3},\sqrt{3}\right]$ 3) $\left[-\sqrt{2},\sqrt{2}\right]$ 4) $[-2,2]$

28. Let R be the relation over the set of all straight lines in a plane such that $l_1 R l_2 \Leftrightarrow l_1 \perp l_2$. Then, R is
1) symmetric 2) reflexive 3) transitive 4) an equivalence

29. If $A=\{1,2,3\}$, $B=\{1,4,6,9\}$ and R is a relation from A to B defined by 'x is greater than y'. The range of R is
1) {1, 4, 6, 9} 2) {4, 6, 9} 3) {1} 4) {4, 6}

30. ***Assertion(A):*** $f(x)=1+x^2$ is a one one function from $R^+\to R$
Reason (R):: Every strictly monotonic function is a one one function
1) Both A and R are true and R is the correct explanation of A
2) Both A and R are true but R is not correct explanation of A
3) A is true but R is false 4) A is false but R is true

31. ***Assertion(A):*** If $X=\{x:-1\le x\le 1\}$ and $f:X\to X$ defined by $f(x)=sin\pi x, \forall x\in A$ is not invertible function
Reason (R): For a function 'f' to have inverse, it should be a bijection
1) Both A and R are true and R is the correct explanation of A
2) Both A and R are true but R is not correct explanation of A
3) A is true but R is false 4) A is false but R is true

32. If $f:R\to R$ is defined by $f(x)=x-[x]-\frac{1}{2}\forall\in R$

[x] is the greatest integer not exceeding x then $\left\{x \in R : f(x) = \frac{1}{2}\right\} =$

1) the set of all integers 2) N, the set of all natural numbers
3) ϕ , the empty set 4) R

33. If $f : R \to R$ is defined by $f(x) = \begin{cases} x+4 & for \quad x < -4 \\ 3x+2 & for \quad -4 \le x < 4 \\ x-4 & for \quad x \ge 4 \end{cases}$

then the correct matching of list I to List II is.

List - I	List - II
A) $f(-5)+f(-4) =$	i) 14
B) $f(\lvert f(-8)\rvert) =$	ii) 4
C) $f[f(-7)+f(3)] =$	iii) - 11
D) $f(f(f(f(0))))+1$	iv) - 1
	v) 1
	vi) 0

	A	B	C	D		A	B	C	D
1)	iii	vi	ii	v	2)	iii	iv	ii	vi
3)	iv	iii	ii	I	4)	ii	vi	v	ii

34. $f : N \to N$ is defined as $f(n) = \begin{cases} 2, & n = 3k, \quad k \in Z \\ 10-n, & n = 3k+1, \quad k \in Z \\ 0, & n = 3k+2, \quad k \in Z \end{cases}$ then $\{n \in N : f(n) > 2\} =$

1) {3, 6, 4} 2) {1, 4, 7 } 3) {4, 7 } 4) {7}

35 The functions are defined as $f : R \to R, g : R \to R$

$f(x) = 0$ when x is rational
$= 1$ when x is irrational
$g(x) = -1$ when x is rational
$= 0$ when x is irrational
$(fog)(\pi) + (gof)(e) =$

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

CHEMISTRY

(GASEOUS STATE AND CHEMICAL BOND)

Answer all the following questions. Each correct answer carries +3 marks and (–1) for wrong answer

36. What would be IUPAC name of the element with atomic number z = 120.
1) Unnilnilium 2) Unbinilium 3) Unnilsepium 4) Unbrienium

37. The covalency and oxidation state of '$A\ell$' in $\left[A\ell C\ell(H_2O)_5\right]^{2+}$ are
1) 6, 6 2) 3, 6 3) 6, 3 4) , 6

38. Correct order of nonmetallic character of the elements B, C, N, F Si is
1) B > C > Si > N > F 2) Si > C > B > N > F

3) F > N > C > B > Si 4) F > N > C > Si > B

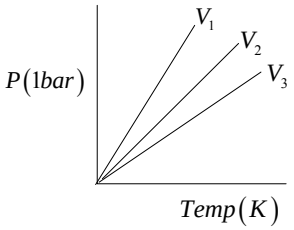
39. On a ship sailing in Pacific Ocean where temperature is 23.4^0C a balloon is filled with 2lt air. What will be the volume of the balloon when the ship reaches Indian Ocean, where temperature is 26.1^0C ?

1) 2 Lt 2) 4 Lt 3) 1.009 Lt 4) 2.018 Lt

40. A graph is plotted between 'P' (bar) vs 'T' (K) . Then the following is obtained, the relation between V_1, V_2, V_3 is

1) $V_1 < V_3 < V_2$ 2) $V_1 < V_2 < V_3$

3) $V_3 < V_2 < V_1$ 4) $V_3 = V_2 = V_1$



41. At 25^0C and 760 mm of Hg pressure a gas occupies $600m\ell$ of volume. What will be its pressure at height where temperature is 10^0C and volume of the gas is $640m\ell$?

1) 676.6 mm of Hg 2) 776.6 mm of Hg 3) 576.6 mm of Hg 4) 600 mm of Hg

42. The correct order of diffusion of the gases H_2, N_2, O_2 and NH_3 is

1) $H_2 > N_2 > O_2 > NH_3$ 2) $NH_3 > O_2 > N_2, > H_2$

3) $H_2 > N_2 > NH_3 > O_2$ 4) $H_2 > NH_3 > N_2 > O_2$

43. A uniform glass tube of 100 cm length is connected to bulb containing H_2 at one end and another bulb containing O_2 at another end at the same temperature and pressure. The two gases meet for the first time at the following distance from oxygen end

1) 20 cm 2) 80 cm 3) 50 cm 4) 6.66 cm

44. At constant temperature what would be the percentage increase in pressure for a 10 % decrease in the volume of gas ?

1) 5 % 2) 11.11 % 3) 10 % 4) 5.26 %

45. The species having one unpaired electron is

1) NO 2) CO 3) CN^- 4) O_2

46. Pick out the isoelectronic structures from the following

I. CH_3^+ II. H_3O^+ III. NH_3 IV. CH_3^-

1) I and II 2) I and IV 3) I and III 4) II, III and IV

47. $o-$ nitrophenol is more volatile than $p-$ nitrophenol. It is due to

1) intramolecular hydrogen bonding in $o-$ nitrophenol and intermolecular hydrogen bonding in $p-$ nitrophenol

2) intermolecular hydrogen bonding in $o-$ nitrophenol and intramolecular hydrogen bonding in $p-$ nitrophenol

3) more stronger intramolecular hydrogen bonding in $o-$ nitrophenol as compared to $p-$ nitrophenol

4) more stronger intermolecular hydrogen bonding in $o-$ nitrophenol as compared to $p-$ nitrophenol

48. Which one of the following statements is correct?

1) Molecular hydrogen is paramagnetic 2) Molecular nitrogen is paramagnetic

3) Molecular oxygen is paramagnetic 4) Molecular oxygen is diamagnetic

49. Which of the following statements is not correct from the viewpoint of molecular orbital?
1) Be_2 is not a stable molecule
2) He_2 is not stable but He^+ is expected to exist
3) Bond strength of N_2 is maximum amongst the homonuclear diatomic molecules
4) Li_2 molecule cannot exit

50. Which of the following molecules has unpaired electrons in antibonding molecular orbitals ?
1) O_2 2) N_2 3) C_2 4) B_2

51. The compound in which C uses its sp^3 hybrid orbitals in bonding is
1) HCOOH 2) $(H_2N)_2CO$ 3) $(CH_3)_3COH$ 4) CH_3CHO

52. Which of the following contains both polar and non-polar bonds?
1) $NH_4C\ell$ 2) HCN 3) H_2O_2 4) CH_4

53. Molecular shape of SF_4, CF_4, and XeF_4 are
1) the same, with 2, 0 and 1 lone pair of electrons, respectively
2) the same, with 1, 1 and 1 lone pair of electrons, respectively
3) different, with 0, 1 and 2 lone pair of electrons, respectively
4) different, with 1, 0 and 2 lone pair of electrons, respectively

54. The hybridization of atomic orbitals of nitrogen in NO_2^+, NO_3^- and NH_4^+ are
1) sp, sp^3 and sp^2 respectively
2) sp, sp^2 and sp^3 respectively
3) sp^2, sp and sp^3 respectively
4) sp^2, sp^3 and sp respectively

55. Which bond angle, θ would result in the maximum dipole moment for the triatomic molecule xy_2 ?
1) $\theta = 120^0$ 2) $\theta = 90^0$ 3) $\theta = 180^0$ 4) $\theta = 150^0$

56. Dielectric constant of different solvents A, B, C are 0, 2 and 32 respectively .
Then which of the following is correct ?
A) $KC\ell$ is more soluble in A and B
B) $LiC\ell$ is soluble in solvents A and B
C) $KC\ell$ is more soluble in C than A and B
1) All are correct 2) B and C 3) B only 4) C only

57. The bond present between nitrogen and boran in the salt $[H_3N \rightarrow BF_3]$ is due to overlapping of
1) sp^3 and pure p orbital
2) sp^3 and sp^2
3) $sp^3 - sp^3$
4) $sp^3 - sp$

58. The pair likely to form strongest hydrogen bonding
1) SiH_4 and $SiC\ell_4$
2) CH_3COOH and CH_3COCH_3
3) CH_3COOH and CH_3OCH_3
4) H_2O and H_2O_2

59. Which of the molecule has no co-ordinate bond ?
1) HNO_3 2) CO 3) CO_3^{-2} 4) $CH_3 - NC$

60. Which of the following has lowest single bond energy ?
1) C - C 2) N – N 3) O – O 4) F – F

61. Solid $PC\ell_5$ exists as ionic compound. Which of the following is correct statement ?
1) hybridization of 'P' atom in cation is sp^3d

2) Geometry of anionic part is tetrahedral

3) Geometry of cationic part is octahedral

4) Hybridisation of P in cation and anion are sp^3 and sp^3d^2

62. Dipolement is highest in

1) NH_3 2) NF_3 3) BF_3 4) All having equal values

63. Correctly matched set

1) $BrF_5 - (octahedral) - sp^3d^2$ 2) $XeF_4 - Tetrahedral - sp^3$

3) SF_4 - see saw – sp^3d^3 4) $C\ell F_5$ = Square pyramid - sp^3 d^2

64. Correct order of C – O bond length

1) $CO_3^{-2} < CO_2 < CO$ 2) $CO_2 < CO_3^{-2} < CO$

3) $CO < CO_3^{-2} < CO_2$ 4) $CO < CO_2 < CO_3^{-2}$

Q.No.:65 to 68 are related to the given passage : -

Passage : one of the methods to construct molecular orbitals is the linear combination of atomic orbitals. The combination of two atomic orbitals gives two molecular orbtals; one involves positive combination, whereas the other involves negative combination. Of these, one involving positive overlap gives a molecular orbital which is more stable than the stabler of the two atomic orbitals and the second one involving negative overlap gives a molecular orbital which is lesser stable than the less stable atomic orbital. The former is know as bonding molecular orbital and the latter as antibonding molecular orbital. The end-to-end overlap leads to σ molecular orbital and side-ways overlap leads to π molecular orbital. Thus, the above combinations lead to $\sigma 2s, \sigma^* 2s, \sigma 2p_z, \sigma^* 2p_z, \pi 2p_x, \pi^* 2p_x, \pi 2p_y$ and $\pi^* 2p_y$ molecular orbitals

65. The pair of molecular orbital, which have two nodal planes

1) σ_{2x}, π_{2px} 2) π^*_{2py}, π^*_{2pz} 3) π^*_{1s}, π^*_{2s} 4) π^*_{2px}, π^*_{2py}

66. For N_2 molecule the incorrect order of regarding energy of molecular orbital

1) $\sigma^*_{1s} < \sigma_{2s}$ 2) $\pi_{2px} = \pi_{2py}$ 3) $\sigma_{2pz} < (\pi_{2px} = \pi_{2py})$ 4) $\pi^*_{2px} = \pi^*_{2py} < \sigma^*_{2pz}$

67. Which of the following about C_2 molecule is correct ?

a) it cannot exist according to M.O theory b) it has two π bonds

c) it has one σ and one π bond d) four electrons are in 'π' molecular orbitals only

1) b and d 2) a and b 3) d only 4) c only

68. Linear combination of atomic orbitals, which is not possible for two bonding atoms.

1) $\sigma 2p_z - \sigma 2p_z$ 2) $\sigma 2s - 2s$ 3) $\sigma 2p_z - 2p_x$ 4) $\pi 2p_y - \pi 2p_y$

69. Correctly matched sequence with its property

1) $O_2 > O_2^- > O_2^{-2} - Bond\ order$ 2) $O_2^{-2} > O_2 > O_2^- - Bond$ energy

3) $O_2^{-2} > O_2^- > O_2 - Bond$ length 4) Both 1 and 3

70. Observed dipolement of diatomic molecule is 1.03 Debye. Bond distance is 1.25×10^{-8} cm. The percentage ionic character in the molecule
1) 17 % 2) 83 % 3) 37 % 4) 50 %

PHYSICS

Answer all the following questions. Each correct answer carries +3 marks and (–1) for wrong answer

71. A ball is thrown at two different angles with the same speed u and from the same point. If the range is same in both the cases and y_1 and y_2 are the maximum heights attained in the two cases, then $y_1 + y_2 =$
1) u^2/g 2) $2u^2/g$ 3) $u^2/2g$ 4) $u^2/4g$

72. A person aims a gun at a monkey from a point, at a horizontal distance of 120 m. The gun can impart a velocity of 50 ms^{-1} to the bullet, The gun is present at an elevation 20 m from the ground. The instant the bullet is fired, the monkey started falling freely. Then ($g = 10\ ms^{-2}$)
1) The bullet strikes the monkey after a time 2.4 s
2) The bullet strikes the monkey after 2s
3) The bullet does not strike the monkey
4) The bullet falls on the ground at a distance > 120m

73. A ball is projected horizontally from the top of a tower of height 78.4 m with a velocity 20 ms^{-1}. Simultaneously a boy started from the foot of the tower runs with uniform acceleration and catches the ball when it is about to strike the ground. The acceleration of the boy is
1. 1.0ms^{-2} 2. 10.0 ms^{-2} 3. 12.0 ms^{-2} 4. 5.0 ms^{-2}

74. Two trains A and B are travelling on parallel tracks with velocities u and 2u in opposite directions. A ball is dropped from the train A. The trajectory of the ball as seen by a person in the train B is
1. $y = \frac{gx^2}{2u^2}$ 2. $y = \frac{gx^2}{9u^2}$ 3. $y = \frac{gx^2}{18u^2}$ 4. $y = \frac{3gx^2}{8u^2}$

75. A particle reaches its highest point when it has covered exactly one half of its horizontal range. The corresponding point on the displacement-time graph is characterised by
1) negative slope and zero curvature 2) positive slope and negative curvature
3) zero slope and positive curvature 4) positive slope and positive curvature

76. A projectile is thrown with an initial velocity of $(a\hat{i} + b\hat{j})\ ms^{-1}$. If the range of the projectile is twice then the maximum height reached by it, then
1) a = 2b 2) a = b 3) a = b/2 4) a = b/4

77. A ball is projected in to air at angle 60^0 with horizontal from the foot of an incline of inclination 30^0 and length 12 m with a velocity $20\ ms^{-1}$. The range of the projectile is
1) $40\sqrt{3}m$ 2) $10\sqrt{3}m$ 3) $20\sqrt{3}m$ 4) $15\sqrt{3}m$

78. If a projectile projected at 30° to the horizontal reaches the ground two seconds after its projection, the change in its velocity in that interval of time is
1) 9.8 ms^{-1} 2) 14.7 ms^{-1} 3) 19.6 ms^{-1} 4) 29.4 ms^{-1}

79. A body is projected at 60° with a velocity of $10\sqrt{3}\ ms^{-1}$. The velocity of the projectile when it moves perpendicular to its initial direction is
1) 30 ms^{-1} 2) 10/3 ms^{-1} 3) 10 ms^{-1} 4) 5 ms^{-1}

80. A stone projected vertically upwards from the top of a tower with a velocity u strikes the bottom of the tower with a velocity 3u. The distance travelled by the stone is

1) $\frac{4u^2}{g}$ 2) $\frac{5u^2}{g}$ 3) $\frac{3u^2}{g}$ 4) $\frac{u^2}{g}$

81. A ball is projected so as to pass a wall at a distance 'a' from the point of projection at an angle of 45° and falls at a distance 'b' on the other side of the wall. Then the height of the wall is

1) $\frac{ab}{\sqrt{2}(a+b)}$ 2) $\frac{\sqrt{2}b}{a+b}$ 3) $\frac{\sqrt{2}ab}{a+b}$ 4) $\frac{ab}{a+b}$

82. The dimensions of a room are $8m \times 6m \times 10m$. An insect started at one corner reached the diagonally opposite corner. The displacement is

1) $10\sqrt{3}m$ 2) 10 m 3) $10\sqrt{2}m$ 4) 5m

83. A body is projected with a velocity u at an angle of 60° to the horizontal. The time interval after which it will be moving in a direction of 30° to the horizontal is

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

84. The angle inclination of an incline in 30^0 and its elevation is $20\sqrt{3}$ m. A ball is thrown up at angle 30^0 with a plane of the incline. It strikes the inclined at a distance 20 m. the velocity of projection is

1) $2\sqrt{5}ms^{-1}$ 2) $\sqrt{10}\ ms^{-1}$ 3) $3\sqrt{10}$ ms^{-1} 4) $10\sqrt{3}\,ms^{-1}$

85. From a certain height, two bodies are simultaneously projected horizontally in opposite directions with velocities of 1 ms^{-1} and 4 ms^{-1} respectively. The time taken for the velocity vectors of the two bodies to become perpendicular to each other is

1) 0.1 s 2) 0.2 s 3) 0.4 s 4) 0.8 s

86. For a projectile $x = 4t$; $y = 8t - 4t^2$. The range of the projectile is :

1) 6 m 2) 12 m 3) 4 m 4) 8 m

87. A balloonist drops a ballast bag from a balloon that is rising at $40ms^{-1}$. At the instant that ballast is dropped, the balloon is 100 m above the ground level. The time taken for the bag to reach the ground is $\left(g = 10\ ms^{-2}\right)$

a) 6 s b) 10 s c) -2 s d) $4\sqrt{5}$ s

1) a, b 2) b,c 3) b 4) c, d

88. A stone takes time t to fall through a height h. The increment in time when it falls further through a distance x (x << h) is approximately

1) $\frac{xt}{h}$ 2) $\frac{xt}{2}$ 3) $\frac{xt}{2h}$ 4) $\frac{2h}{xt}$

89. A ball thrown horizontally with velocity v from the top of a tower of height h reaches the ground in t seconds. Another ball of double the mass is thrown horizontally with velocity 3v from the top of another tower of height 4h. If the first ball reaches the ground at a horizontal distance d, then the second ball reaches the ground at a horizontal distance of

1) 6d 2) 3d 3) 12d 4) 4d

90. Two bodies begin to fall freely from the same height but the second falls T seconds after the first. The time, after which the first body begins to fall, when the distance between the bodies is equal to L is

1) $\frac{T}{2}$ 2) $\frac{T}{2}+\frac{L}{gT}$ 3) $\frac{L}{gT}$ 4) $T+\frac{2L}{gT}$

91. From an elevated point P, a stone is projected vertically upwards. When it reaches a distance y below the point of projection, its velocity is 3 times the velocity when it was at a height y above P. The greatest height reached by it above P is

1) y/4 2) 5y/3 3) y/3 4) 5y/4

92. For a person traveling along horizontal, rain appears to be falling vertically down with a speed $4ms^{-1}$ when the person doubles his speed rain appear at 30^0 with vertical. The velocity of the person is

1) $2ms^{-1}$ 2) $4/\sqrt{3}ms^{-1}$ 3) $4ms^{-1}$ 4) $4\sqrt{3}ms^{-1}$

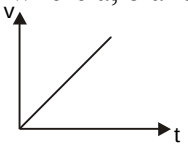
93. A particle moves with uniform acceleration and its average velocities are v_1, v_2 and v_3 over successive intervals of time t_1, t_2 and t_3 respectively. Then (v_1 - v_2) : (v_2 - v_3) is equal to

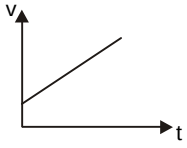
1) $(t_1+t_2):(t_2-t_3)$ 2) $(t_1-t_2):(t_2-t_3)$ 3) $(t_1-t_2):(t_2+t_3)$ 4) (t_1 + t_2) : (t_2 + t_3)

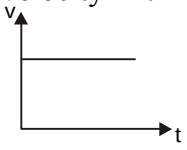
94. A body covers a distance of 10 m along a curved path of a quarter circle. The ratio of magnitude of displacement to distance is equal to

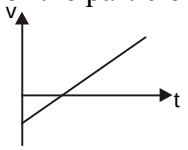
1) 11 : 7 2) $7\sqrt{2}$: 11 3) $7\sqrt{2}$: 22 4) $11\sqrt{2}$: 7

95. The position-time relation of a particle moving along the x-axis is given by $x = a-bt + ct^2$ where a, b and c are positive constants. The velocity time graph of the particle is

1) 

2) 

3) 

4) 

96. In the relation $\vec{F} = q\left(\vec{v} \times \vec{B}\right)$: F is Lorentz magnetic force, 'v' velocity , 'B' magnetic induction then

1) $\vec{F}$ is a pseudo vector 2) $\vec{B}$ is a pseudo vector
3) $\vec{v}$ is a pseudo vector 4) all are polar vectors

97. ***Assertion (A) :*** $\hat{i} \times \left(\hat{j} \times \hat{k}\right) = \left(\hat{i} \times \hat{j}\right) \times \hat{k}$

Reason (R) : Vector cross product is associative.

1) Both A and R are true and R is the correct explanation of A
2) Both A and R are true but R is not correct explanation of A
3) A is true but R is false 4) A is false but R is true

98. A car A is at distance 20 km down south of B. A is moving towards north with a velocity 30 kmph. B is moving towards East with a velocity 40 kmph. The distance of closest approach is

1) 12 2) 10 km 3) 16 km 4) $8\sqrt{2}km$

99. Two billiard balls are moving on a table and the component velocities along the edges AB and AD of the table ABCD are 5, 5 ms^{-1} for one ball and $2\sqrt{3}$, 2 ms^{-1} for the other ball. The angle between the direction of motion of the balls is

1) 15^o 2) 30^o 3) 45^o 4) 75^o

100. A mass of 10 kg is suspended by a string 3 m long. A horizontal force is applied on the mass to keep it away 2 m from a vertical line through the point of suspension. If g = 10 ms^{-2}, the magnitude of the force is nearly

1) 40 N 2) 60 N 3) 80 N 4) 90 N

101. The maximum and minimum resultants of two forces are 170 N and 70 N respectively. The resultant of the forces when the angle between them is 90^o is

1) 130 N 2) 104 N 3) 142 N 4) 96 N

102. Two vectors of magnitudes 10 and 8 have a dot product $40\sqrt{3}$. The magnitude of their cross product is

1) 120 2) 60 3) 40 4) $5\sqrt{3}$

103. The magnitude of the resultant of three coplanar forces of magnitudes P, 2P and 3P acting at a point and inclined mutually at an angle of 120^o is

1) $\sqrt{5}P$ 2) $\sqrt{3}P$ 3) $\sqrt{2}P$ 4) $2\sqrt{2}P$

104. For a body projected vertically up from the ground, velocity after traveling $\frac{3}{4}$th of the total distance is $10ms^{-1}$. The maximum height attained is

1) $15m$ 2) $10\sqrt{2}m$ 3) $10m$ 4) $20m$

105. Position of a particle changing with time is $6+2t-3t^2$. The displacement of the particle at the instant its velocity become zero is

1) $\frac{19}{3}$ 2) $\frac{1}{3}$ 3) $\frac{4}{3}m$ 4) $\frac{5}{3}m$