MELUHA INTERNATIONAL SCHOOL

HYDERABAD

SR MPC JEE MAINS Time:	UNIT – 1 ASSIGNMENT – 3	Date: 19-04-2020 Max. Marks:

MATHS

Syllabus: ***ALGEBRA: 1.SETS AND RELATIONS; 2.FUNCTIONS; 3. MATRICES AND DETERMINANTS; 4.PERMUTATIONS AND COMBINATIONS; 5. BINOMIAL THEOREM; 6. QUDTRATIC EQUATIONS & EXPRESIONS; 7. THEORY OF EQUATIONS.***

1. In the binomial expansion of $(a-b)^n$, $n \geq 5$, the sum of the 5^{th} and 6^{th} terms is zero. Then a/b equals

   (A) $\frac{n-5}{6}$ (B) $\frac{n-4}{5}$ (C) $\frac{5}{n-4}$ (D) $\frac{6}{n-5}$

2. Let T_n denote the number of triangles which can be formed using the vertices of a regular polygon of n sides. If $T_{n+1} - T_n = 21$, then n equals

   (A) 5 (B) 7 (C) 6 (D) 4

3. For $2 \leq r \leq n$, $\binom{n}{r} + 2\binom{n}{r-1} + \binom{n}{r-2} =$

   (A) $\binom{n+1}{r-1}$ (B) $2\binom{n+1}{r-1}$ (C) $2\binom{n+2}{r}$ (D) $\binom{n+2}{r}$

4. If in the expression of $(1+x)^m (1-x)^n$, then coefficient of x and x^2 are 3 and – 6 respectively, then m is

   (A) 6 (B) 9 (C) 12 (D) 24

5. If $a_n = \sum_{r=0}^{n} \frac{1}{{}^nC_r}$, then $\sum_{r=0}^{n} \frac{r}{{}^nC_r}$ equals

   (A) $(n-1)a_n$ (B) na_n (C) $\frac{1}{2} n\, a_n$ (D) none of these

6. The expression $\{(x + (x^3-1)^{1/2})^5\} + \{x - (x^3-1)^{1/2}\}^5$ is polynomial of degree

   (A) 5 (B) 6 (C) 7 (D) 8

7. If C_r stands for ${}^nC_r$, then the sum of the series

   $\frac{2\left(\frac{n}{2}\right)! \cdot \left(\frac{n}{2}\right)!}{n!}\left[C_0^2 - 2C_1^2 + 3C_2^2 - \ldots\ldots + (-1)^n (n+1) C_n^2\right]$, where n is an even positive integer, is equal to

   (A) 0 (B) $(-1)^{n/2}(n+1)$ (C) $(-1)^n (n+2)$ (D) $n(-1)^{(n/2)-1} + 2$

8. The coefficient of x^4 in $\left(\frac{x}{2} - \frac{3}{x^2}\right)^{10}$ is

   (A) $\frac{405}{256}$ (B) $\frac{504}{259}$ (C) $\frac{450}{263}$ (D) none of these

9. The value of the expression ${}^{47}C_4 + \sum_{j=1}^{5} {}^{(52-j)}C_3$ is equal to

   (A) ${}^{47}C_5$ (B) ${}^{52}C_5$ (C) ${}^{52}C_4$ (D) none of these

10. Given positive integers $r > 1$, $m > 2$, and that the coefficients of $(3r)^{th}$ term and $(r+2)^{th}$ terms in the binomial expansion of $(1+r)^{2n}$ are equal. Then

    (A) $n = 2r$ (B) $n = 2r + 1$ (C) $n = 3r$ (D) none of these

11. The number of digits in 5^{30} is, $(\log_{10} 2 = 0.3010)$

    (A) 30 (B) 22 (C) 21 (D) none of these

12. The coefficient of x^n in $\left(1-x+\frac{x^2}{2!}-\frac{x^3}{3!}+....+\frac{(-1)^n x^n}{n!}\right)^2$ is

(A) $\frac{(-n)^n}{n!}$ (B) $\frac{(-2)^n}{n!}$ (C) $\frac{1}{(n!)^2}$ (D) $-\frac{1}{(n!)^2}$

13. The sum of the rational terms in the expression of $\left(\sqrt{2}+3^{1/5}\right)^{10}$ is

(A) 41 (B) 40 (C) 42 (D) none of these

14. If n is a positive integer then the value of $\frac{1}{81^n}\left(1-10^{2n}C_1+10^2\ {}^{2n}C_2-.....+10^{2n}\right)$ is equal to

(A) one (B) two (C) zero (D) none of these

15. The coefficients of x^m and x^n in the expansion of $(1+x)^{m+n}$ is

(A) ${}^{m+n}C_m$ (B) ${}^{m+n}C_{m-1}$ (C) ${}^{m+n-1}C_m$ (D) none of these

16. The sum of coefficients in the expansion of the binomial $(5p-4q)^n$ where n is a positive integer

(A) 0 (B) –1 (C) 1 (D) none of these

17. The term independent of x in the expansion $\left(x^2-\frac{1}{x}\right)^9$ is

(A) 1 (B) –1 (C) 48 (D) none of these

18. Greatest coefficient in the expansion of $(1+x)^{10}$ is

(A) $\frac{10!}{5!\ 6!}$ (B) $\frac{10!}{(5!)^2}$ (C) $\frac{10!}{5!\ 7!}$ (D) none of these

19. The value of $\frac{C_1}{C_0}+2\frac{C_2}{C_1}+3\frac{C_3}{C_2}+....+n\frac{C_n}{C_{n-1}}$ is equal to

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

20. The co-efficient of $x^k\ (0\le k\le n)$ in the expansion of $E=1+(1+x)+(1+x)^2+.....+(1+x)^n$ is

(A) ${}^{n+1}C_{k+1}$ (B) ${}^nC_k$ (C) ${}^{n+1}C_{n-k+1}$ (D) ${}^{n+1}C_{k-1}$

21. For $|x|<1$, the value of $1+3x+6x^2+10x^3+.....\infty$ is

(A) $\frac{4}{(1-x)^4}$ (B) $\frac{3}{(1-x)^3}$ (C) $\frac{1}{(1-x)^3}$ (D) None of these

22. If $1+99^n n$, being an odd positive integer greater than 1, is divisible by 10^m, then largest m is equal to

(A) 2 (B) 3 (C) 4 (D) 5

23. The coefficient of the middle term in the expansion of $(1+x)^{2n}$ is 5^X+5^{-X}

(A) ${}^nC_n$ (B) ${}^{3n}C_n$ (C) ${}^{2n}C_n$ (D) ${}^{2n}C_{n/2}$

24. If $(1+ax)^n=1+8x+24x^2.....$, then the values of a and n are equal to

(A) 2 , 4 (B) 2 , 3 (C) 3,6 (D) 1 , 2

25. The sum of the coefficients in $\left(1+x-3x^2\right)^{2143}$ is

(A) 2^{2143} (B) 0 (C) 1 (D) –1

26. The co-efficients of x^n in $(1+x)^{2n}$ and $(1+x)^{2n-1}$ are in the ratio of

(A) 1: 2 (B) 1:3 (C) 3:1 (D) 2:1

27. The number of terms free from radical sign in the expansion of $\left(1+3^{1/3}+7^{1/7}\right)^{10}$ is

(A) 1 (B) 6 (C) 11 (D) none of these

28. The remainder of 51^{51}, when divided by 25 is
(A) 0 (B) 1 (C) 2 (D) None of these

29. The sum of the series $^{20}C_0 + ^{20}C_1 + ^{20}C_2 + ... + ^{20}C_{10}$ is
(A) 2^{20} (B) 2^{19} (C) $2^{19} + \frac{1}{2}{}^{20}C_{10}$ (D) $2^{19} - \frac{1}{2}{}^{20}C_{10}$

30. The number of rational terms in the expansion $\left(2^{1/5} + 3^{1/10}\right)^{45}$ is
(A) 4 (B) 10 (C) 5 (D) 11

31. If the coefficient of x^7 and x^4 are equal in magnitude but opposite in sign in the expansion of $\left(\frac{x^2}{a} - \frac{b}{x}\right)^{11}$, then
(A) ab = 1 (B) a = b (C) a + b = 0 (D) none of these

32. If the sum of the binomial coefficients in the expansion $(x+y)^n$ is 1024. Then the greatest binomial coefficient occurs in the
(A) 5^{th} term (B) 6^{th} term (C) 7^{th} term (D) 8^{th} term

33. The number of terms in the expansion of $(x+y+z)^{20}$ is
(A) 231 (B) 241 (C) 251 (D) none of these

34. In the binomial expansion of $(a-b)^n$ where $n \le 5$, the sum of the 5^{th} and 6^{th} terms is zero. Then $\frac{a}{b}$ equals
(A) $\frac{n-5}{6}$ (B) $\frac{n-4}{5}$ (C) $\frac{5}{n-4}$ (D) $\frac{6}{n-5}$

35. If in the expansion of $(1+x)^m, (1-x)^n$, the coefficient of x and x^2 are 3 and –6 respectively, then m is
(A) 6 (B) 9 (C) 12 (D) 24

36. The expansion $\left[x + \left(x^3-1\right)^{1/2}\right]^5 + \left[x - \left(x^3-1\right)^{1/2}\right]^5$ is a polynomial of degree
(A) 5 (B) 6 (C) 7 (D) 8

37. The value of $2C_0 + 2^2\frac{C_1}{2} + 2^3\frac{C_2}{3} + ... + 2^{n+1}\frac{C_n}{n+1}$ is
(A) $\frac{1}{2(n+1)}$ (B) 0 (C) $\frac{2^{n+1}-1}{2^{n+1}}$ (D) $\frac{3^{n+1}-1}{n+1}$

38. The sum of coefficients of even powers of x in the expansion of $\left(x + \frac{1}{x}\right)^{11}$ is
(A) $11 \times {}^{11}C_5$ (B) $\frac{11}{2} \times {}^{11}C_6$ (C) $11\left({}^{11}C_5 + {}^{11}C_6\right)$ (D) 0

39. The value of $^{2n}C_n - {}^nC_1 \cdot {}^{2n-2}C_n + {}^nC_2 \cdot {}^{2n-4}C_n - .....$ is equal to
(A) 3^n (B) 4^n (C) 5^n (D) none of these

40. The sum to (n + 1) terms of the series $\frac{C_0}{2} - \frac{C_1}{3} + \frac{C_2}{4} - \frac{C_3}{5} + ...$ is
(A) $\frac{1}{n+1}$ (B) $\frac{1}{n+2}$ (C) $\frac{1}{n(n+1)}$ (D) none of these

41. If $a_n = \sum_{r=0}^{n} \frac{1}{{}^nC_r}$, then $\sum_{r=0}^{n} \frac{r}{{}^nC_r}$ is equal to
(A) $(n-1)a_n$ (B) na_n (C) $\frac{n}{2}a_n$ (D) none of these

42. If ${}^{n}C_{r} = \frac{n\ !}{r\ !\ (n-r)\ !}$ then the sum of the series $1+{}^{n}C_{1}+{}^{n+1}C_{2}+{}^{n+2}C_{3}+.....+{}^{n+r-1}C_{r}$ is equal to

(A) ${}^{n+r}C_{r}$ (B) ${}^{n+r-1}C_{r}$ (C) ${}^{n+r}C_{r-1}$ (D) none of these

43. The integral part of $\left(\sqrt{2}+1\right)^{6}$ is

(A) 198 (B) 197 (C) 198 (D) none of these

44. If n is an even natural number and coefficient of x^{r} in the expansion of $\frac{(1+x)^{n}}{1-x}$ is $2^{n}, (|x|<1)$, then

(A) $r \le \frac{n}{2}$ (B) $r \ge \frac{n-2}{2}$ (C) $r \le \frac{n+2}{2}$ (D) $r \ge n$

45. If coefficient of $x^{2}y^{3}z^{4}$ in $(x+y+z)^{n}$ is A, then coefficient of $x^{4}y^{4}z$ is

(A) 2A (B) $\frac{nA}{2}$ (C) $\frac{A}{2}$ (D) none of these

46. If $(121)^{\log_{3}\sqrt{3}}+5^{\log 2^{4}}=10^{\log_{x}36}$ then x is equal to

(A) 10 (B) e (C) One (D) None of these

47. If $\left(1-x+x^{2}\right)^{n}=a_{0}+a_{1}x+a_{2}x^{2}+.....+a_{2n}x^{2n}$, then $a_{0}+a_{2}+a_{4}+.....+a_{2n}$ is equal to

(A) $\frac{1}{2}\left(3^{n}-1\right)$ (B) $\frac{1}{2}\left(1-3^{n}\right)$ (C) $\frac{1}{2}\left(3^{n}+1\right)$ (D) none of these

48. If $(1+x)^{n}=\sum_{r=0}^{n}C_{r}x^{r}$,then $\left(1+\frac{C_{1}}{C_{0}}\right)\left(1+\frac{C_{2}}{C_{1}}\right).....\left(1+\frac{C_{n}}{C_{n-1}}\right)$

(A) $\frac{n^{n-1}}{(n-1)!}$ (B) $\frac{(n+1)^{n-1}}{(n-1)!}$ (C) $\frac{(n+1)^{n}}{n!}$ (D) $\frac{(n+1)^{n+1}}{n!}$

49. If the sum of the coefficients in the expansion of $\left(\alpha x^{2}-2x+1\right)^{35}$ is equal to the sum of coefficients in the expansion of $(x-\alpha y)^{35}$, then α equals to

(A) 0 (B) 1 (C) 2 (D) 3

50. The coefficient of x^{17} in the expansion of (x –1) (x –2) ….(x –18) is

(A) 342 (B) –171 (C) $\frac{171}{2}$ (D) 684

51. The term independent of x in $\left[\sqrt{\left(\frac{x}{3}\right)}+\sqrt{\left(\frac{3}{2x^{2}}\right)}\right]^{10}$ is

(A) ${}^{10}C_{1}$ (B) $\frac{5}{12}$ (C) 1 (D) none of these

52. The number of distinct terms in the expansion of $(x+y-z)^{16}$ is

(A) 136 (B) 153 (C) 16 (D) 17

53. If $\frac{1}{1-2x+x^{2}}=1+a_{1}x+a_{2}x^{2}+.....$, then the value of a_{r} is

(A) 2 (B) r +1 (C) r (D) 2r

54. The co-efficient of x^{7} in the expansion of $\left(1-x^{4}\right)(1+x)^{9}$ is

(A) 27 (B) –24 (C) 48 (D) –48

55. The number of terms in $\left(x+1+\frac{1}{x}\right)^{n}$, n being a natural number, is

(A) 3n (B) 3n+1 (C) 2n (D) 2n+1

56. The sum of the numerical co–efficient in the expansion of $\left(1+\frac{x}{3}+\frac{2y}{3}\right)^{12}$ is

(A) 0 (B) 2^{11} (C) 2^{12} (D) none of these

57. $\left[5\sqrt{5}+11\right]^{2n+1}$ is always (where [.] denotes greatest integral part)

(A) an odd integer (B) an even integer (C) 0 (D) none of these

58. The coefficient of x^{15} in the product of $(1-x)(1-2x)\left(1-2^2x\right).....\left(1-2^{15}x\right)$ is equal to

(A) $2^{105}-2^{121}$ (B) $2^{121}-2^{105}$ (C) $2^{120}-2^{104}$ (D) none of these

59. The coefficients of x^9 in the expansion of (x – a) (x – 4) (x – 7) …. (x – 28)

(A) 117 (B) -145 (C) 145 (D) none of these

60. If the last term in the binomial expansion of $\left(\sqrt[3]{2}-\frac{1}{\sqrt{2}}\right)^n$ is $\left(\frac{1}{3.\sqrt[3]{9}}\right)^{\log_3 8}$, then the 5^{th} term from the beginning is

(A) ${}^{10}C_6$ (B) $2.{}^{10}C_4$ (C) $\frac{1}{2}{}^{10}C_4$ (D) none of these

61. The middle term in the expansion of $\left(\frac{2x}{3}-\frac{3}{2x^2}\right)^{2n}$ is

(A) ${}^{2n}C_n$ (B) $(-1)^n\,{}^{2n}C_n x^{-n}$ (C) ${}^{2n}C_n\frac{1}{x^n}$ (D) none of these

62. The value of $\sum_{r=1}^{10} r.\frac{{}^nC_r}{{}^nC_{r-1}}$ equal to

(A) 5(2n − 9) (B) 10n (C) 9(n − 4) (D) none of these

63. The sum of $1\cdot{}^{20}C_1-2\cdot{}^{20}C_2+3\cdot{}^{20}C_3-.....-20\cdot{}^{20}C_{20}$ is equal to

(A) 2^{19} (B) 0 (C) $2^{20}-1$ (D) none of these

64. Coefficient of x^{29} in the polynomial

$\left(x-\frac{1}{1\times3}\right)\left(x-\frac{2}{1\times3\times5}\right)\left(x-\frac{3}{1\times3\times5\times7}\right).....\left(x-\frac{30}{1\times3\times.....\times61}\right)$ is

(A) $\frac{1}{2}\left(1-\frac{1}{1\times3\times.....\times61}\right)$ (B) $-\frac{1}{2}+\frac{1}{1\times3\times.....\times61}$

(C) $-\frac{1}{2}\left(1-\frac{1}{1\times3\times.....\times61}\right)$ (D) $\frac{29}{1\times3\times.....\times61}$

65. The number of irrational terms in the expansion of $\left((5^{1/8})+(6^{1/6})\right)^{100}$ is

(A) 97 (B) 98 (C) 96 (D) 99

66. The last digit of the number $(32)^{32}$ is equal to

(A) 2 (B) 4 (C) 6 (D) 8

67. Sum of $\sum_{0\le i<j\le 20}\sum\left(C_i+C_j\right)$ is equal to

(A) 20.2^{19} (B) 20.2^{20} (C) 20.2^{18} (D) 20.2^{21}

68. The coefficient of x^{20} in the expansion of $(1+x)^{40}\left(x+2+\frac{1}{x^2}\right)^{-5}$ is

(A) ${}^{30}C_{10}$ (B) ${}^{30}C_{15}$ (C) ${}^{30}C_8$ (D) ${}^{30}C_{21}$

69. If the second, third and fourth terms in the expansion $(x+a)^n$ are 240, 720 and 1080 respectively then the value of n is

(A) 15 (B) 20 (C) 10 (D) 5

70. $49^n + 16n - 1$ is divisible by
(A) 3 (B) 19 (C) 64 (D) 29

71. The two successive terms in the expansion of $(1+x)^{29}$ whose coefficients are in the ratio 4 : 1 are
(A) 20^{th} and 21^{st} terms (B) 24^{th} and 25^{th} terms
(C) 12^{th} and 13^{th} terms (D) 23^{rd} and 24^{th} terms

72. The coefficients of x^4 in the expansion of $(1+x+x^2+x^3)^n$ is
(A) ${}^nC_4$ (B) ${}^nC_4 + {}^nC_2$
(C) ${}^nC_4 + {}^nC_2 + ({}^nC_4\ {}^nC_2)$ (D) ${}^nC_4 + {}^nC_2 + {}^nC_1\ {}^nC_2$

73. $(1-x)^{2n-1} = \sum_{r=0}^{2n-1} a_r x^r$, then $a_{r-1} + a_{2n-r} =$
(A) n (B) 1 (C) 0 (D) none of these

74. The number of terms which are free from radical sign in the expansion of $(y^{1/5} + x^{1/10})^{55}$ is
(A) 4 (B) 5 (C) 6 (D) 7

75. The coefficient of x^{10} in the expansion of $(1+x^2-x^3)^8$ is
(A) 476 (B) 496 (C) 500 (D) 528

76. The coefficient of x^r in the expansion of $\left(x+\frac{1}{x}\right)^n$ is
(A) ${}^nC_r$ (B) ${}^{2n}C_r$ (C) $\frac{n!}{\left(\frac{n-r}{2}\right)!\left(\frac{n+r}{2}\right)!}$ (D) none of these

77. If $k \in R$ and the middle term of $\left(\frac{k}{2}+2\right)^8$ is 1120, then value of k is
(A) 3 (B) 2 (C) –3 (D) –4

78. The expression $\left(\sqrt{2x^2+1}+\sqrt{2x^2-1}\right)^6 + \left(\frac{2}{\sqrt{2x^2+1}+\sqrt{2x^2-1}}\right)^6$ is a polynomial of degree
(A) 3 (B) 6 (C) 5 (D) not a polynomial

79. The number of $101^{100} - 1$ is divisible by (max possible)
(A) 100 (B) 1000 (C) 10000 (D) 100000

80. The coefficient of x^{12} in $(1+3x+3x^2+x^3)^4$ is
(A) 0 (B) $3^{14} \times {}^{14}C_{12}$ (C) ${}^{42}C_{12}$ (D) none of these

81. The co-efficient of middle term in the expansion of $(1+x)^{2n}$ is
(A) $\frac{1.3.5.....(2n-1)}{n!}.2^n$ (B) ${}^{2n}C_{n-1}$
(C) ${}^{2n}C_{n+1}$ (D) none of these

82. The co-efficient of x^p and x^q (p and q are positive integers) in the expansion of $(1+x)^{p+q}$ are
(A) Equal (B) Equal with opposite sign
(C) Reciprocal to each other (D) none of these

83. In the expansion of $\left(\frac{x+1}{x^{2/3}-x^{1/3}+1} - \frac{x-1}{x-x^{1/2}}\right)^{10}$, the term which does not contain x, is equal to
(A) ${}^{10}C_0$ (B) ${}^{10}C_7$ (C) ${}^{10}C_4$ (D) none of these.

84. If $\frac{1}{1-2x+x^2} = 1 + a_1x + a_2x^2 + \ldots..$, then the value of a_r is

(A) 2 (B) r +1 (C) r (D) 2r

85. Let the coefficients of x^n in $(1+x)^{2n}$ and $(1+x)^{2n-1}$ be P and Q respectively then

(A) P = Q (B) 2P = Q (C) P = 2Q (D) none of these

86. The number of ways in which 5 boys and 3 girls can sit around a table so that all the girls do not come together is

(A) 4020 (B) 4120 (C) 4220 (D) 4320

87. The value of 1 + 1.1! + 2.2! + 3.3! +…+ n.n! is

(A) (n + 1)! + 1 (B) (n – 1)! + 1 (C) (n + 1)! – 1 (D) (n + 1)!

88. The remainder obtained when 1! + 2! +… 49! is divide by 20 is

(A) 13 (B) 33 (C) 12 (D) 11

89. The number of different signals can be given by using any number of flags from 4 flag of different colours is

(A) 24 (B) 256 (C) 64 (D) 60

90. The number of ways in which 5 boys and 5 girls can be arranged in a row so that no two girls are together is

(A) 10! (B) 5! 6! (C) $(5!)^2$ (D) 2 $(5!)^2$

91. The number of three digit numbers having only two consecutive digit identical is

(A) 153 (B) 162 (C) 168 (D) 163

92. The letters of the word MASTER are permuted in all possible ways and the words thus formed are arranged as in a dictionary. The rank of the word STREAM is

(A) 597 (B) 480 (C) 612 (D) 285

93. 7 women and 7 men are to sit round a circular table such that there is a man on either side of every women. The number of seating arrangements is

(A) $(7!)^2$ (B) $(6!)^2$ (C) 6! 7! (D) 7!

94. The number of four digit numbers that can be formed with the digits 1, 2, 3, 4 and 5 in which atleast two digits are identical is

(A) $4^5 - 5!$ (B) $5^4 - 5!$ (C) $4^5 - 5$ (D) $5^4 - 5$

95. The number of ways of wearing 6 different rings to 5 fingers is

(A) 5^6 (B) 6^5 (C) 5^5 (D) 6^6

96. In the word 'ENGINEERING' if all E's are not together and N's come together then number of permutations is

(A) $\frac{9!}{2!2!} - \frac{7!}{2!2!}$ (B) $\frac{9!}{3!2!} - \frac{7!}{2!2!}$ (C) $\frac{9!}{3!2!2!} - \frac{7!}{2!2!2!}$ (D) $\frac{9!}{3!2!2!} - \frac{7!}{2!2!}$

97. In a college of 300 students, every student read 5 newspapers and every newspaper is read by 60 students. The number of newspaper is

(A) At least 30 (B) At most 20 (C) Exactly 25 (D) 24

98. The number of ways in which a TRUE or FALSE examination of 'n' statements can be answered on the assumption that no two consecutive questions are answered the same way is

(A) 2^{n-1} (B) 2^n (C) 1 (D) 2

99. The number of positive integral divisors of 1200 which are multiplies of '6' is

(A) 6 (B) 12 (C) 8 (D) 24

100. Largest value of n, so that 10^n divides 51!

(A) 47 (B) 12 (C) 35 (D) 59

101. The sum of the even divisors of 168 is
(A) 448 (B) 460 (C) 42 (D) 122

102. Let T_n denote the number of triangles which can be formed using the vertices of a regular polygon of n sides. If $T_{n+1} - T_n = 10$, then the value of n is
(A) 5 (B) 10 (C) 8 (D) 7

103. A committee of 5 is to be formed from 6 boys and 5 girls. The number of ways that the committee can be formed so that the committee contains atleast one boy and one girl having majority of boys is
(A) 240 (B) 245 (C) 250 (D) 275

104. The number of quadratric expression with the coefficients drawn from the set {1, 2, 3, 4} is
(A) 27 (B) 36 (C) 64 (D) 48

105. The number of 5 digit numbers that can be made using the digits 1 and 2 and in which atleast one digit is different is
(A) 31 (B) 32 (C) 30 (D) 29

106. If $^{n-1}C_3 + {}^{n-1}C_4 > {}^{n}C_3$, then the value of n can be
(A) 4.000 (B) 6.000 (C) 7.000 (D) 8.000

107. $\frac{{}^{n}P_{r+1}}{a} = \frac{{}^{n}P_{r}}{b} = \frac{{}^{n}P_{r-1}}{c}$, then $b^2 - (a+b)c$ is equal to
(A) 0 (B) 1.00 (C) – 1.00 (D) – 2.00

108. The remainder when n = 1! + 2! + 3! +…+ 100! Is divided by 240, is m then m/100 =
(A) 1.53 (B) 3.35 (C) 7.39 (D) 1.87

109. The number of ways of selecting 15 teams from 15 men and 15 women, such that each team consists of a man and a woman is m then m/1000 is
(A) 1.120 (B) 1.240 (C) 1.880 (D) 1.960

110. The number of ways of arranging 6 players to throw the cricket ball so that the oldest player may not throw first is λ then $-\lambda/100$ is
(A) – 1.20 (B) – 6.00 (C) 7.20 (D) – 7.156

111. The number of ways of distributing 9 identical balls in 3 distinct boxes so that none of the boxes is empty is
(A) $^{8}C_3$ (B) 28 (C) 3^8 (D) 5

112. A guard of 15 men is formed from a group of n soldiers. The number of times two particular soldiers will be guards
(A) $\frac{n!}{13!2!}$ (B) $\frac{(n-2)!}{13!}$ (C) $\frac{(n-2)!}{13!(n-15)!}$ (D) $\frac{(n-2)!}{13!2!}$

113. The number of integral solutions to the system of equations $x_1 + x_2 + x_3 + x_4 + x_5 = 20$ and $x_1 + x_2 = 15$ when $x_k \geq 0 (k = 1,2,3,4,5)$ is
(A) 300 (B) 350 (C) 336 (D) 316

114. If N is the number of positive integral solutions of $x_1 x_2 x_3 x_4 = 770$, then N =
(A) 256 (B) 729 (C) 900 (D) 770

115. The number (36)! Is divisible by
(A) 2^{36} (B) 2^{38} (C) $(12)^{17}$ (D) $(24)^{12}$

116. A man goes in for an examination in which there are 4 papers with a maximum of 10 marks for each paper. The number of ways of getting 20 marks on the whole is
(A) 750 (B) 860 (C) 881 (D) 891

117. The sum of divisors of $2^5.3^4$ is

(A) $\frac{2^5-1}{2-1}.\frac{3^4-1}{3-1}$ (B) $\frac{2^6-1}{2-1}.\frac{3^5-1}{3-1}$ (C) $\frac{2^4-1}{2-1}.\frac{3^3-1}{3-1}$ (D) $2^5 . 3^4$

118. The number of ways in which a pack of 52 cards of four different suits be distributed equally among 4 players so that each may have ace, king, queen and knave of the same suit is

(A) $\frac{4!(36!)}{(9!)^4}$ (B) $\frac{36!}{(9!)^4}$ (C) $\frac{2(36!)}{(9!)^4}$ (D) $\frac{3(36!)}{(9!)^4}$

119. The number of ways of distributing 8 identical balls in three distinct boxes so that none of the boxes is empty

(A) 5 (B) ${}^8C_3$ (C) 3^8 (D) 21

120. If a, b, c are three natural numbers in AP and a + b + c = 21 then the possible number of ordered triplets (a, b, c) is

(A) 15 (B) 14 (C) 13 (D) 12

121. The number of ways of selecting 8 books from a library which has 9 books each of Mathematics, Physics, Chemistry and English is

(A) 165 (B) ${}^{27}C_8$ (C) 3^8 (D) 81

122. Out of 5 apples, 10 mangoes and 15 oranges, the number of ways of distributing 15 fruits each to two persons is

(A) 56 (B) 64 (C) 66 (D) 72

123. The number of rational numbers lying in the interval (2002, 2003) all of whose digits after the decimal point are non-zero and are in decreasing order is

(A) $\sum_{i=1}^{9} {}^9P_i$ (B) 2^9 (C) $2^9 - 1$ (D) $2^{10} - 1$

124. 8 points are marked on the circumference of a circle at equal distances. Then how many squares can be drawn by joining them?

(A) ${}^8P_4$ (B) ${}^8C_4$ (C) ${}^8C_4/2$ (D) 2

125. Number of squares of all dimensions of 5 × 7 game board

(A) 70 (B) 75 (C) 80 (D) 85

126. The number of ways of dividing 15 men and 15 women into 15 couples, each consisting of a man and a woman is

(A) 1240 (B) 1840 (C) 15! (D) 2005

127. The exponent of 2 in N = 20 × 19 × 18 × … × 11 is

(A) 10 (B) 15 (C) 20 (D) 12

128. Number of positive integral solutions of $15 < x_1 + x_2 + x_3 \le 20$ is

(A) 625 (B) 635 (C) 655 (D) 685

129. Number of ways of selecting 6 shoes, out of 8 pairs of shoes, having exactly two pairs is

(A) 1680 (B) 240 (C) 120 (D) 3360

130. Number of ways in which 5 balls can be selected from a bag containing 5 identical and 5 different balls is

(A) 24 (B) 30 (C) 32 (D) 36

131. If six points are taken on a circle. The number of triangles formed inside the circle is N. Then $\frac{N}{9}$ is

(A) 2.555 (B) 5.222 (C) 2.222 (D) 1.222

132. If N is number of rectangles on chess board then $\frac{N}{1000}$

(A) 1.296 (B) 2.040 (C) 2.916 (D) 6.912

133. 5 letters are posted for 5 different addresses, if number of ways so that each of the letter reaches wrong address 10x + y where $x, y \in \square$. Then $\frac{x}{y}$ is

(A) 2.000 (B) 0.500 (C) 1.000 (D) 1.200

134. The number of ways to give away 20 apples to 3 boys, each boy receiving at least 4 apples, is

(A) $^{10}C_8$ (B) 90 (C) $^{22}C_{20}$ (D) None of these

135. If a, b, c are positive integers such that $a + b + c \leq 8$ then the number of possible values of the ordered triplet (a, b, c) is

(A) 84 (B) 56 (C) 83 (D) None of these

136. Four couples (husband and wife) decide to form a committee of four members. The number of different committees the can be formed in which no couple finds a place is

(A) 10 (B) 12 (C) 14 (D) 16

137. The number of triangles that can be formed with 10 points as vertices, n of them being collinear, is 110. Then n is

(A) 3 (B) 4 (C) 5 (D) 6

138. The number of subsets of the set
$A = \{a_1, a_2, \ldots, a_n\}$ which contains an even number of elements is

(A) 2^n (B) $2^n - 1$ (C) 2^{n-2} (D) 2^{n-1}

139. Number of divisors of $2^2.3^3.5^3.7^5$ of the form $4n + 1,\ n \in N$ is

(A) 46 (B) 47 (C) 96 (D) 48

140. Messages are conveyed by arranging 4 white, 1 blue and 3 red flags on a pole. Flags of the same colour are alike. If a message is transmitted by the order in which the colours are arranged then the total number of messages that can be transmitted if exactly 6 flags are used is

(A) 45 (B) 65 (C) 125 (D) 185

141. 3^r divides 50!, then maximum value of r =

(A) 27 (B) 25 (C) 23 (D) 22

142. The maximum number of points of intersection of 8 circles is

(A) 16 (B) 24 (C) 28 (D) 56

143. Number of ways by which 4 letters can be put in 4 corresponding envelopes so that all letters go in wrong envelopes is

(A) 2 (B) 9 (C) 44 (D) 265

144. The number of n-digit numbers, no two consecutive digits being the same, is

(A) n! (B) 9! (C) 9^n (D) n^9

145. Triplet (x, y, z) is chosen from the set {1, 2, 3, …., n}, such that $x \leq y < z$. The number of such triplets is

(A) n^3 (B) $^nC_3$ (C) $^nC_2$ (D) none of these

146. Let S be the set of 6-digit numbers $a_1a_2a_3a_4a_5a_6$ (all digits distinct) where $a_1 > a_2 > a_3 > a_4 < a_5 < a_6$. Then n(S) is equal to

(A) 210 (B) 2100 (C) 4200 (D) 420

147. Number of positive integers n less than 15, for which n! + (n+1)! + (n+2)! is an integral multiple of 49, is
(A) 3 (B) 4 (C) 5 (D) 6

148. Total number of ways in which n^2 number of identical balls can be put in n numbered boxes (1, 2, 3, ……, n) such that i^{th} box contains atleast i number of balls is
(A) ${}^{n^2}C_{n-1}$ (B) ${}^{n^2-1}C_{n-1}$ (C) ${}^{\frac{n^2+n-2}{2}}C_{n-1}$ (D) none of these

149. The number of permutations of the letters of the word HINDUSTAN such that neither the pattern 'HIN' nor 'DUS' nor 'TAN' appears, are
(A) 166674 (B) 169194 (C) 166680 (D) 181434

150. 6 letters are to be posted in three letter boxes. The number of ways of posting the letters when no letter box remains empty is
(A) 270 (B) 540 (C) 537 (D) none of these

151. The sum of the products of the 2n numbers $\pm 1, \pm 2, \pm 3, \ldots, \pm n$, taking two at a time, is
(A) $\frac{n^2(n+1)^2}{4}$ (B) $-\frac{n^2(n+1)^2}{4}$ (C) $-\frac{n(n+1)(2n+1)}{6}$ (D) $\frac{n(n+1)(2n+1)}{6}$

152. The number of ways in which 15 boys and 2 girls can sit in a row such that between the girls at the most 2 boys sit is
(A) $17! - (12! \times 3!)$ (B) $17! - ({}^{12}C_3 \times 3!)$ (C) $17! - ({}^{12}C_3 \times 15!)$ (D) $17! - (91 \times 2! \times 15!)$

153. A polygon has 44 diagonals. The number of its sides is
(A) 10 (B) 11 (C) 12 (D) 13

154. The sum of the digits in the unit place of all number s formed with the help of 3,4,5,6 taken all at a time is
(A) 18 (B) 108 (C) 432 (D) 144

155. Six identical coins are arranged in a row. The number of ways in which the number of tails is equal to number of heads is
(A) 20 (B) 120 (C) 9 (D) 40

156. The number of ways in which a mixed doubles tennis game can be arranged between 10 players consisting of 6 men and 4 women is
(A) 180 (B) 90 (C) 48 (D) 12

157. Number of even divisors of 504 is
(A) 12 (B) 24 (C) 6 (D) 18

158. The number of solutions of $x_1 + x_2 + x_3 = 51$ (x_1, x_2, x_3 being odd natural numbers) is
(A) 300 (B) 325 (C) 330 (D) 350

159. The number of ways in which five different books be distributed among three people (each get atleast one) is
(A) 10 (B) 25 (C) 60 (D) 150

160. The number of 4 digit numbers made with the digits 0, 1, 2, 3, 4 (digits being unrepeated) divisible by 6 is
(A) 96 (B) 24 (C) 63 (D) none of these

161. If $x_1x_2x_3 = 2 \cdot 5 \cdot 7^2$, then the number of solution set for (x_1, x_2, x_3) where $x_i \in N$, $x_i > 1$, is
(A) 24 (B) 81 (C) 36 (D) 21

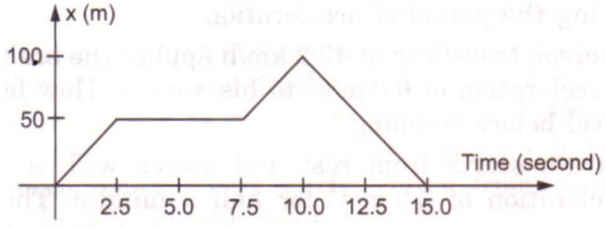
162. If m and n are positive integers more than or equal to 2, m > n, then (mn)! is divisible by
(A) $(m!)^n$ (B) $(n!)^m$ (C) (m + n)! (D) (m - n)!

163. 'n' locks and 'n' corresponding keys are available. But the actual combination is not known. The maximum numbers of trials that are needed to **assign** the keys to their corresponding locks are
(A) ${}^{n}C_2$ (B) $\sum_{k=2}^{n}(k-1)$ (C) n! (D) ${}^{n+1}C_2$

PHYSICS

Syllabus: ***MECHANICS:– 1. KINEMATICS (1D AND 2D); 2. LAWS OF MOTION; 3. WORK, ENERGY AND POWER AND ROTATIONAL MOTION***

1. A car starts moving rectilinearly, first with acceleration $w=5.0\,m/s^2$ (the initial velocity is equal to zero), then uniformly, and finally, decelerating at the same rate w, comes to a stop. The total time of motion equals τ = 25s. The average velocity during that time is equal to (υ) = 72 km per hour. How long does the car move uniformly?
   (A) 20 s (B) 15 sec (C) 18 sec (D) 30 sec
2. An elevator car whose floor-to-ceiling distance is equal to 2.7 m starts ascending with constant acceleration 1.2 $m/s^2; 2.0\,s$ after the start a bolt begins falling from the ceiling of the car. Find the bolt's free fall time;
   (A) 0.7 s (B) 1.3 s (C) 1.0 se (D) 0.5 se
3. In the previous question, find the distance covered by the bolt during the free fall. As seen by a man standing on the ground.
   (A) 1.3 m (B) 2.7 m (C) 0.7 m (D) 1.0 m
4. At the moment t = 0 a particle leaves the origin and moves in the positive direction of the x axis. Its velocity varies with time as $v=v_0(1-t/\tau)$, where v_0 is the initial velocity vector whose modulus equals $v_0 = 10.0\ cm/s; \tau = 5.0s$. Find the x coordinates of the particle at the moments of time 6.0s;
   (A) 4.0 m (B) 0 m (C) 0.24 m (D) 2.0 m
5. The distance travelled by a particle in a straight line motion is directly proportional to $t^{1/2}$, where t = time elapsed. What is the nature of motion?
   (A) Increasing acceleration (B) Decreasing acceleration
   (C) Increasing retardation (D) Decreasing retardation
6. A body moves with a velocity of 3 m/s due east and then turns due north to travel with the same velocity. If the total time of travel is 6s, the acceleration of the body is
   (A) $\sqrt{3}\,m/s^2$ towards north west (B) $\frac{1}{\sqrt{2}}\,m/s^2$ towards north west
   (C) $\sqrt{2}\,m/s^2$ towards north east (D) all of the above
7. Two cars start in a race with velocities u_1 and u_2 and travel in a straight line with accelerations 'α' and 'β'. If both reach the finish line at the same time, the range of the race is
   (A) $\frac{2(u_1-u_2)}{(\beta-\alpha)^2}(u_1\beta-u_2\alpha)$ (B) $\frac{2(u_1-u_2)}{\beta+\alpha}(u_1\alpha-u_2\beta)$ (C) $\frac{2(u_1-u_2)^2}{(\beta-\alpha)^2}$ (D) $\frac{2u_1u_2}{\beta\alpha}$
8. The displacement of a particle is given by $x=(t-2)^2$ where x is in metre and t in second. The distance covered by the particle in first 4 seconds is
   (A) 4 m (B) 8 m (C) 12 m (D) 16 m
9. Which of the sets given below may represent the magnitudes of three vectors adding to zero?
   (A)2, 4, 8 (B) 4, 8, 16 (C) 1, 2, 1 (D) 0.5, 1, 2..
10. Figure shows the graph of the x-coordinates of a particle going along the X-axis as a function of time. Find the average velocity during the first 10s.



   (A) 20 m/s (B) 10 m/s (C) 25 m/s (D) 50 m/s

11. A bullet travelling with a velocity of 16 m/s penetrates a tree trunk and comes to rest in 0.4 m. Then the time taken during the retardation will be,
(A) 0.05 s (B) 0.1 s (C) 0.025 s (D) 0.5 s

12. A ball is dropped from a balloon going up at a speed of 7 m/s. If the balloon was at a height 60m at the time of dropping the ball, how long will the ball take in reaching the ground(approx.)
(A) 8.5 s (B) 6.1 s (C) 4.3 s (D) 7.1 s

13. A healthy young man standing at a distance of 7 m from a 11.8m high building sees a kid slipping from the top floor. With what speed (assumed uniform) should he run to catch the kid at the arms height (1.8m)?
(A) 1.5 m/s (B) 15 m/s (C) 10 m/s (D) 4.9 m/s

14. A ball is dropped from a height. If it takes 0.200 s to cross the last 6.00 m before hitting the ground, find the height fromwhich it was dropped. Take g = 10 m/s^2.
(A) 48m (B) 96m (C) 30m (D) 45m

15. Two forces P and Q act at an angle of 120° with each other. If the resultant is at right angles to P and P is equal to 4 kg-wt, then the value of Q is
(A) 4 kgwt (B) 8 kgwt (C) 6 kgwt (D) 3 kgwt

16. The resultant of two vectors $\vec{P}$& $\vec{Q}$ is $\vec{R}$. If the magnitude of $\vec{Q}$ is doubled the new resultant becomes perpendicular to $\vec{P}$then magnitude of $\vec{R}$is
(A) $\frac{P^2-Q^2}{2PQ}$ (B) $\frac{P+Q}{P-Q}$ (C) Q (D) $\frac{P}{Q}$

17. If $\vec{a}=m\vec{b}+\vec{c}.$ then scalar m is
(A) $\frac{\vec{a}.\vec{b}-\vec{b}.\vec{c}}{b^2}$ (B) $\frac{\vec{c}.\vec{b}-\vec{a}.\vec{c}}{a^2}$ (C) $\frac{\vec{c}.\vec{b}-\vec{b}.\vec{c}}{c^2}$ (D) $\frac{\vec{a}.\vec{b}-\vec{b}.\vec{c}}{a^2}$

18. Three particles A, B & C start from the origin at the same time; A with a velocity 'a' along x-axis, B with velocity 'b' along y-axis and C with velocity 'c' in XYplane along the line x = y. The magnitude of 'c' in XY plane along the line x = y. The magnitude of 'c' so that the three always remain collinear is:
(A) $\frac{a+b}{2}$ (B) $\sqrt{ab}$ (C) $\frac{ab}{a+b}$ (D) $\frac{\sqrt{2}ab}{a+b}$

19. Two forces F_1 and F_2 are acting at a point, whose resultant is F. If F_2 is doubled *F* is also doubled. If F_2 is reversed than also *F* is doubled. Then $F_1:F_2:F$ is
(A) $\sqrt{2}:\sqrt{2}:\sqrt{3}$ (B) $\sqrt{3}:\sqrt{3}:\sqrt{2}$ (C) $\sqrt{3}:\sqrt{2}:\sqrt{3}$ (D) $\sqrt{2}:\sqrt{3}:\sqrt{2}$

20. Driver of a train moving at a speed v_1 sights a freight train at a distance d ahead of him on the same track moving in the same direction with a slow speed v_2. He puts on the brakes and gives his train a constant deceleration α . Then, there will be no collision, if
(A) $d>\left(\frac{v_1-v_2}{2\alpha}\right)$ (B) $d<\frac{(v_1-v_2)^2}{2\alpha}$ (C) $d>\frac{(v_1-v_2)^2}{2\alpha}$ (D) None of these

21. An object is projected with a velocity of 20m/s making an angle of 45° with horizontal. The equation for trajectory is $h=Ax-Bx^2$, where h is height, x is horizontal distance. A and B are constants. The ratio A:B is (g=10m/s^2)
(A)1:5 (B)5:1 (C)1:40 (D) 40:1

22. A ground to ground projectile is at point A at $\frac{T}{3}$, is at point B at $t=\frac{5T}{6}$ and reaches the ground at t=T. The difference in heights between points A and B is
(A) $\frac{gT^2}{6}$ (B) $\frac{gT^2}{12}$ (C) $\frac{gT^2}{18}$ (D) $\frac{gT^2}{24}$

23. A particle starts travelling on a circle with constant tangential acceleration. The angle between velocity vector and acceleration vector, at the moment when particle complete half the circular track, is

(A) $\tan^{-1}(2\pi)$ (B) $\tan^{-1}(\pi)$ (C) $\tan^{-1}(3\pi)$ (D) Zero

24. A cart is moving horizontally along a straight line with a constant speed of 30m/s. A projectile is to be fired from the moving cart in such a way that it will return to the cart (at the same point on cart) after the cart has moved 80m. At what velocity (relative to the cart) must be projectile be fired? (Take g= 10m/s^2)

(A) $10 m/s$ (B) $\frac{20}{3} m/s$ (C) $\frac{40}{3} m/s$ (D) $\frac{80}{3} m/s$

25. A projectile is thrown with some initial velocity at an angle α to the horizontal. Its velocity when it is at the highest point is $(2/5)^{1/2}$ times the velocity when it is at height half of the maximum height. Find the angle of projection α with the horizontal.

(A) $30°$ (B) $45°$ (C) $60°$ (D) $37°$

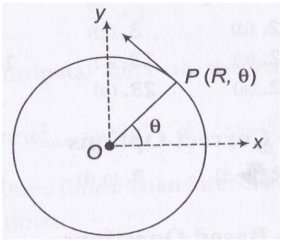
26. On a calm day, a boat can go across a lake and return in time t_0 at a speed V. On a rough day, there is uniform current at speed v to help the onward journey and impede the return journey. If the time taken to go across and return on the rough day be T, then T/T_0 is

(A) $1-v^2/V^2$ (B) $\frac{1}{1-v^2/V^2}$ (C) $1+v^2/V^2$ (D) $\frac{1}{1+v^2/V^2}$

27. A stationary man observes that the rain is falling vertically downward. When he starts running with a velocity of 12km/h, he observes that the rains is falling at an angle $60°$ with the vertical. The actual velocity of rain is

(A) $12\sqrt{3} km/h$ (B) $6\sqrt{3} km/h$ (C) $4\sqrt{3} km/h$ (D) $2\sqrt{3} km/h$

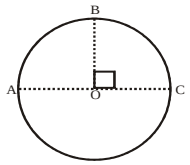
28. For a particle in uniform circular motion, the acceleration a at a point $P(R,\theta)$ on the circle of radius R is (here θ, is measured from the x-axis)



(A) $-\frac{v^2}{R}\cos\theta\hat{i}+\frac{v^2}{R}\sin\theta\hat{j}$ (B) $-\frac{v^2}{R}\sin\theta\hat{i}+\frac{v^2}{R}\cos\theta\hat{j}$

(C) $-\frac{v^2}{R}\cos\theta\hat{i}-\frac{v^2}{R}\sin\theta\hat{j}$ (D) $\frac{v^2}{R}\hat{i}+\frac{v^2}{R}\hat{j}$

29. Three particles A, B and C move in a circle of radius $r = \frac{1}{\pi} m,$ in anti clock-wise direction with speed 1m/s, 2.5 m/s and 2m/s respectively. The initial positions of A,B and C are as shown in figure.



The ratio of distance travelled by B and C by the instant A,B and C meet for the first time is
(A) $3:2$ (B) $5:4$ (C) $3:5$ (D) $3:7$

30. A particle moves with constant speed v along a circular path of radius r and completes the circle in time T. The acceleration of the particle is

(A) $\frac{2\pi v}{T}$ (B) $\frac{2\pi r}{T}$ (C) $\frac{2\pi r^2}{T}$ (D) $\frac{2\pi v^2}{T}$

31. Two points move in the same straight line staring at the same moment from the same point in it. The first moves with constant velocity u and the second with constant acceleration *f*. During the time elapses before the second catches, the first greatest distance between the particle is

(A) $\frac{u}{f}$ (B) $\frac{u^2}{2f}$ (C) $\frac{f}{2u^2}$ (D) $\frac{f}{u^2}$

32. A person walks up a stalled escalator in 90s. When just standing on the same moving escalator, he is carried in 60s. The time it would take him to walk up the moving escalator will be
(A) $27s$ (B) $50s$ (C) $18s$ (D) $36s$

33. The speed of a boat is 5km/h in still water. It crosses a river of width 1km along the shortest possible path in 15min. Then, velocity of river will be
(A) $4.5km/h$ (B) $4km/h$ (C) $1.5km/h$ (D) $3km/h$

34. Particle A is moving along x-axis. At time t=0, is has velocity of 10m/s and acceleration of -4m/s^2. Particle B has velocity of 20m/s and acceleration -2m/s^2. Initially, both the particles are at origin. At time t=2s, distance between the two particles is
(A) $24m$ (B) $36m$ (C) $20m$ (D) $42m$

35. A ball is dropped from the top of a building 100m high. At the same instant, another ball is thrown upwards with a velocity of 40ms^{-1} from the bottom of the building. The two balls will meet after
(A) $5s$ (B) $2.5s$ (C) $2s$ (D) $3s$

36. A boy can throw a stone up to a maximum height of 10m. The maximum horizontal distance that the boy can throw the same stone up to will be
(A) $20\sqrt{2}m$ (B) $10m$ (C) $10\sqrt{2}m$ (D) $20m$

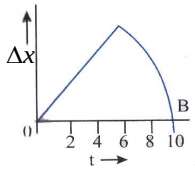
37. A boy throws a ball with velocity $v_0 = 20m/s$ the wind impart horizontal acceleration of 4m/s^2 to the left. The angle θ(with vertical) at which the ball must be thrown so that the ball returns to the boy's hand is (g=10m/s^2)
(A) $\tan^{-1}(1.2)$ (B) $\tan^{-1}(0.2)$ (C) $\tan^{-1}(2)$ (D) $\tan^{-1}(0.4)$

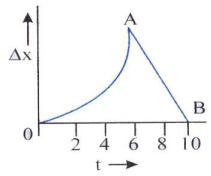
38. Two trains A and B, 100m and 60m long, are moving in opposite directions on parallel tracks. The velocity of the shorter train is 3 times that of the longer one. If the trains take 4s to cross each other, the velocities of the trains are

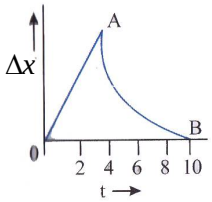
(A) $v_A = 10ms^{-1}, v_B = 30ms^{-1}$ (B) $v_A = 2.5ms^{-1}, v_B = 7.5ms^{-1}$

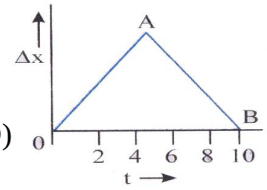
(C) $v_A = 20ms^{-1}, v_B = 60ms^{-1}$ (D) $v_A = 5ms^{-1}, v_B = 15ms^{-1}$

39. Two stones are thrown up simultaneously with initial speeds of u_1 and u_2 ($u_2 > u_1$). They hit the ground after 6s and 10s respectively. Which graph in figure correctly represents the time variation of $\Delta x = (x_2 - x_1)$, the relative position of the second stone with respect to the first upto t=10s? Assume that the stones do not rebound after hitting the ground.

(A) 

(B) 

(C) 

(D) 

40. A police van moving on a highway with a speed of 30kmph fires a bullet at a thief's car speeding away in the same direction with a speed of 192 kmph. If the muzzle speed of the bullet is 150m/s, with what speed does the bullet hit the thief's cart? (Note: Obtain that speed which is relevant for damaging the thief's car).

(A) $25m/s$ (B) $50m/s$ (C) $75m/s$ (D) $105m/s$

41. Two stones are projected from the top of a tower in opposite direction, with the same velocity V but at 30° & 60° with horizontal respectively. The relative velocity of first stone relative to second stone is

(A) $2v$ (B) $\sqrt{2}v$ (C) $\frac{2V}{\sqrt{3}}$ (D) $\frac{V}{\sqrt{2}}$

42. At a given instant of time the position vector of a particle moving in a circle with a velocity $3\hat{i} - 4\hat{j} + 5\hat{k}$ is $\hat{i} + 9\hat{j} - 8\hat{k}$. Its angular velocity at that time is

(A) $\frac{\left(13\hat{i} - 29\hat{j} - 31\hat{k}\right)}{\sqrt{146}}$ (B) $\frac{\left(13\hat{i} - 29\hat{j} - 31\hat{k}\right)}{146}$ (C) $\frac{\left(13\hat{i} + 29\hat{j} - 31\hat{k}\right)}{\sqrt{146}}$ (D) $\frac{\left(13\hat{i} + 29\hat{j} + 31\hat{k}\right)}{146}$

43. The coach throws a baseball to a player with an initial speed of $20ms^{-1}$ at an angle of 45° with the horizontal. At the moment the ball is thrown, the player is 50m from coach. The speed and the direction that the player has to run to catch the ball at the same height at which it was released in ms^{-1} is

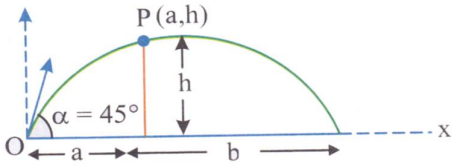
(A) $\frac{5}{\sqrt{2}}$ *away from coach* (B) $\frac{5}{\sqrt{2}}$ *towards coach*

(C) $\frac{\sqrt{2}}{5}$ *towards coach* (D) $\frac{\sqrt{2}}{5}$ *away from the coach*

44. A particle when fired at an angle $\theta = 60°$ along the direction of the breadth of rectangular building of dimension 9m×8m×4m so as to sweep the edges. Find the range of the projectile.

(A) $8\sqrt{3}$ (B) $4\sqrt{3}$ (C) $\frac{8}{\sqrt{3}}$ (D) $\frac{4}{\sqrt{3}}$

45. From a point on the ground at a distance a from the foot of a pole, a ball is thrown at an angle of 45°, which just touches the top of the pole and strikes the ground at a distance of b, on the other side of it. Find the height of the pole.



(A) $\frac{ab}{a-b}$ (B) $\frac{ab}{a+b}$ (C) $\frac{2ab}{a+b}$ (D) $\frac{ab}{a+2b}$

46. A very broad elevator is going up vertically with a constant acceleration of $2m/s^2$. At the instant when the velocity is 4m/s a ball is projected from the floor of the lift with a speed of 4m/s relative to the floor at an elevation of 30°. The time taken by the ball to return the floor is ($g=10m/s^2$)

(A) $\frac{1}{2}s$ (B) $\frac{1}{3}s$ (C) $\frac{1}{4}s$ (D) $1s$

47. A man standing, observes rain falling with velocity of 20m/s at an angle of 30° with the vertical. Find out velocity of man so that rain again appears to fall at the 30° with the vertical.

(A) $20m/s$ (B) $30m/s$ (C) $40m/s$ (D) $10m/s$

48. A particle moves in the XY plane under the action of a force $\vec{F}$ such that the value of its linear momentum $\left(\vec{P}\right)$ at any time 't' is $P_x = 2\cos t$, $P_y = 2\sin t$. The angle 'θ' between $\vec{F}$ and $\vec{P}$ at a given time 't' will be

(A) $\theta = 0°$ (B) $\theta = 30°$ (C) $\theta = 90°$ (D) $\theta = 180°$

49. Given that $\vec{A}+\vec{B}+\vec{C}=0$, out of three vectors two are equal in magnitude and the magnitude of third vector is $\sqrt{2}$ times that of either of two having equal magnitude. Then angle between vectors are given by

(A) $30°, 60°, 90°$ (B) $45°, 135°, 150°$ (C) $90°, 135°, 150°$ (D) $90°, 135°, 135°$

50. Two vectors of equal magnitude P are inclined at some angle such that the difference in magnitude of resultant and magnitude of either of the vectors is 0.732 times either of the magnitude of vectors. If the angle between them is increased by half of its initial value then find the magnitude of difference of the vectors

(A) $2P$ (B) $\sqrt{2}P$ (C) $3P$ (D) $\sqrt{3}P$

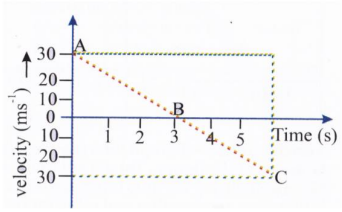
51. The friction of the air causes a vertical retardation equal to 10% of the acceleration due to gravity. Take $g=10m/s^2$. The maximum height and time to reach the maximum height will be decreased by

(A) 9%, 9% (B) 11%, 11% (C) 9%, 10% (D) 11%, 9%

52. Water drops fall from a tap on the floor 5.0m below at regular intervals of time. The first drop strikes the floor when the fifth drop begins to fall. The height at which the third drop will be from ground, at the instant when the first drop strikes the ground is (Take g=10ms^{-2})

(A) $1.25m$ (B) $2.15m$ (C) $2.75m$ (D) $3.75m$

53. The velocity-time graph of a stone thrown vertically upward with an initial velocity of 30ms^{-1} is shown in the figure. The velocity in the upward direction is taken as positive and that in the downward direction as negative. What is the maximum height to which the stone rises?

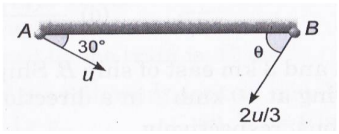


(A) $30m$ (B) $45m$ (C) $60m$ (D) $90m$

54. Four persons A,B, C and D initially at the corner of a square of side length 'd'. If every person starts moving with same speed v such that each one faces the other always, the person will meet after time

(A) $\frac{d}{v}$ (B) $\frac{\sqrt{2}d}{v}$ (C) $\frac{d}{2v}$ (D) $\frac{d}{\sqrt{2}v}$

55. Anoop (A) hits a ball along the ground with a speed u in a direction which makes an angle 30° with the line joining him and the fielder Babul(B). Babul runs to intercept the ball with a speed $\frac{2u}{3}$. At what angle θ should he run to intercept the ball?



(A) $\sin^{-1}\left[\frac{\sqrt{3}}{2}\right]$ (B) $\sin^{-1}\left[\frac{2}{3}\right]$ (C) $\sin^{-1}\left[\frac{3}{4}\right]$ (D) $\sin^{-1}\left[\frac{4}{5}\right]$

56. Two particles are moving along two long straight lines, in the same plane with same speed equal to 20cm/s. The angle between the two lines is 60° and their intersection point is O. At a certain moment, the two particles are located at distances 3m and 4m from O and are moving towards O. Subsequently, the shortest distance between them will be

(A) $50cm$ (B) $40\sqrt{2}cm$ (C) $50\sqrt{2}cm$ (D) $50\sqrt{3}cm$

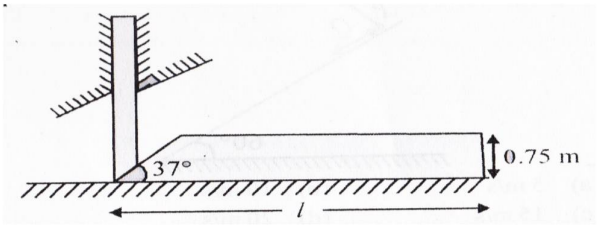
57. Two particles A and B separated by a distance 2R are moving counter clockwise along the same circular path of radius R each with uniform speed v. At time t=0, A is given a tangential acceleration of magnitude $a=\frac{72v^2}{25\pi R}$.

(A)The time lapse for the two bodies to collide is $\frac{6\pi R}{5v}$

(B)The angle covered by A is $11\pi/6$ (C)Angular velocity of A is $\frac{11v}{5R}$

(D)Radial acceleration of A is $289v^2/5R$

58. From the given position, as shown in figure, the plank starts moving towards left with initial velocity zero and acceleration $8 m/s^2$. The rod flies in the air and falls back on the plank. With all surfaces smooth, what should be the least possible length ℓ, so that the rod doesn't fall on the plank?



(A) 4.84m (B) 3.84m (C) 5.62m (D) 4.62m

59. Two drag racers accelerate from rest down a drag strip. The engine of each car produces a constant forward force of 1200N on the car. Car A has a mass of 1.25×10^3kg, while car B has a mass of 1.20×10^3kg. When car A has gone 1.00×10^2m, car B will be

(A) 2m behind car A (B) 4m behind car A

(C) 2m ahead of car A (D) 4m ahead of car A

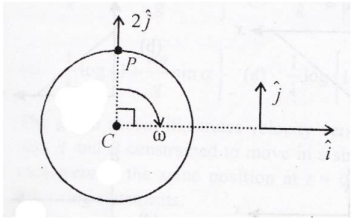
60. A particle is projected at an angle of elevation α and after t seconds it appears to have an angle of elevation β as seen from point of projection. The initial velocity will be

(A) $\frac{gt}{2\sin(\alpha-\beta)}$ (B) $\frac{gt\cos\beta}{2\sin(\alpha-\beta)}$ (C) $\frac{\sin(\alpha-\beta)}{2gt}$ (D) $\frac{2\sin(\alpha-\beta)}{gt\cos\beta}$

61. It was calculated that a shell when fired from a gun with certain velocity and at an angle of elevation $5\pi/36$ rad should strike a given target. In actual practice, it was found that a hill just prevented the trajectory. At what angle of elevation should the gun be fired to hit all the target

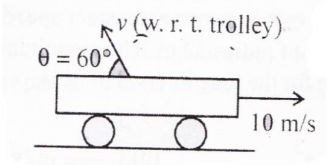
(A) $\frac{5\pi}{36}rad$ (B) $\frac{11\pi}{36}rad$ (C) $\frac{7\pi}{36}rad$ (D) $\frac{13\pi}{36}rad$

62. A disc having plane parallel to the horizontal is moving such that velocity of point P with respect to ground on its periphery is 2m/s $\hat{j}$ as shown in figure. If radius of disc is R=1m and angular speed of disc about vertical axis passing through disc is $\omega = 2$ rad/s, the velocity of centre of disc in m/s is



(A) $2\hat{j}$ (B) $2\hat{i}+2\hat{j}$ (C) $-2\hat{i}+2\hat{j}$ (D) None of these

63. For an observer on trolley direction of projection of particle is shown in the figure, while for observer on ground ball rise vertically. The maximum height reached by ball from trolley is



(D)10m (B)15m (C)20m (D) 5m

64. A bullet is fired from horizontal ground at some angle passes through the point $\left(\frac{3R}{4},\frac{R}{4}\right)$, where R is the range of the bullet. Assume point of the fire to be origin and the bullet moves in x-y plane with x-axis horizontal and y-axis vertically upwards. Then angle of projection is

(A) 30° (B)53° (C)37° (D) None of these

65. A stone is projected horizontally with speed v from a height h above ground. A horizontal wind is blowing in direction opposite to velocity of projection and gives the stone a constant horizontal acceleration f (in direction opposite to initial velocity). As a result the stone falls on ground at a point vertically below the point of projection. Then the value of height h in terms of f, g, v is (g is acceleration due to gravity)

(A) $\frac{2gv^2}{f^2}$ (B) $\frac{gv^2}{2f^2}$ (C) $\frac{gv^2}{f^2}$ (D) $\frac{\sqrt{2}gv^2}{f^2}$

66. A gun is firing bullets with velocity v_0 by rotating it through 360° in the horizontal plane. The maximum area covered by the bullets is

(A) $\frac{\pi v_0^2}{g}$ (B) $\frac{\pi^2 v_0^2}{g}$ (C) $\frac{\pi v_0^4}{g^2}$ (D) $\frac{\pi^2 v_0^4}{g}$

67. A particle is moving in a circular path with a constant speed. If θ is the angular displacement, then starting from $\theta = 0$, the maximum and minimum change in the linear momentum will occur when value of θ is respectively

(A) $45° \& 90°$ (B) $90° \& 180°$ (C) $180° \& 360°$ (D) $90° \& 270°$

68. A point moves along a circle having a radius 20cm with a constant tangential acceleration 5cm/s^2. How much time is needed after motion begins for the normal acceleration of the point to be equal to tangential acceleration?

(A) $1s$ (B) $2s$ (C) $3s$ (D) $4s$

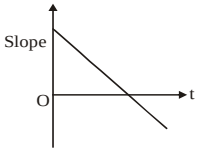
69. Two particles revolve concentrically in horizontal plane in the same direction. The time required to complete one revolution for particle A is 3 min, while for particle B is 1 min. The time required for A to complete one revolution relative to B is

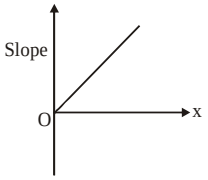
(A) 2min (B) 1min (C) 1.5min (D) 1.25min

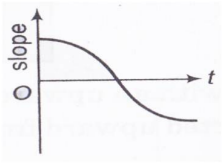
70. Average velocity of a particle in projectile motion between its starting point and the highest point of its trajectory is (projection speed =u, angle of projection from horizontal = θ)

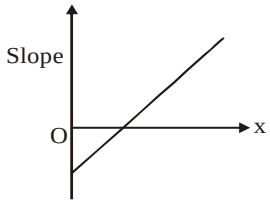
(A) $u\cos\theta$ (B) $\frac{u}{2}\sqrt{1+3\cos^2\theta}$ (C) $\frac{u}{2}\sqrt{2+\cos^2\theta}$ (D) $\frac{u}{2}\sqrt{1+\cos^2\theta}$

71. A heavy particle is projected with a velocity at an angle with the horizontal into the uniform gravitational field. The slope of the trajectory of the particle varies as

(A) 

(B) 

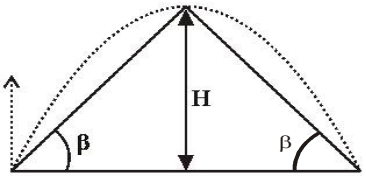
(C) 

(D) 

72. A particle moves along the parabolic path $x = y^2 + 2y + 2$ is such a way that Y-component of velocity vector remains 5ms^{-1} during the motion. The magnitude of the acceleration of the particle is

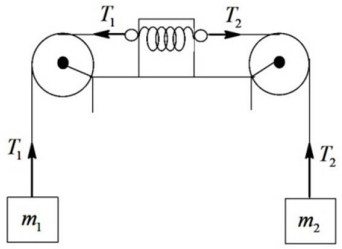
(A) $50ms^{-2}$ (B) $100ms^{-2}$ (C) $10\sqrt{2}ms^{-2}$ (D) $0.1ms^{-2}$

73. A shell fired from the base of a mountain just clear it. If α is the angle of projection, then the angular elevation of summit β is



(A) $\frac{\alpha}{2}$ (B) $\tan^{-1}\left(\frac{1}{2}\right)$ (C) $\tan^{-1}\left(\frac{\tan\alpha}{2}\right)$ (D) $\tan^{-1}(2\tan\alpha)$

74. Two masses m_1 and m_2 are attached to a spring balance S as shown in Figure. If $m_1 > m_2$ then the reading of spring balance will be



(A) $(m_1 - m_2)$ (B) $(m_1 + m_2)$ (C) $\frac{2m_1m_2}{m_1+m_2}$ (D) $\frac{m_1m_2}{m_1+m_2}$

75. A body of mass M is being pulled by a string of mass m with a force P applied at one end. The force exerted by the string on the body is

(A) $\frac{Pm}{(M+m)}$ (B) $\frac{PM}{(M+m)}$ (C) $Pm(M+m)$ (D) $\frac{P}{(M-m)}$

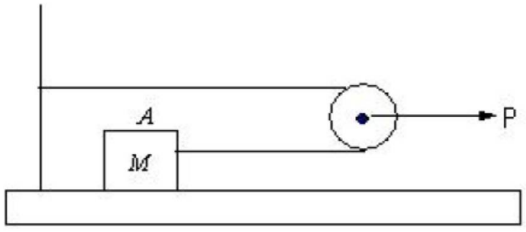
76. Two blocks of masses m and M are placed on a horizontal frictionless table connected by light spring as shown in the figure. Mass M is pulled to the right with a force F. If the acceleration of mass m is a, then the acceleration of mass M will be

(A) $\frac{(F-ma)}{M}$ (B) $\frac{(F+ma)}{M}$ (C) $\frac{F}{M}$ (D) $\frac{am}{M}$

77. A straight rope of length 'L' is kept on a frictionless horizontal surface and a force 'F' is applied to one end of the rope in the direction of its length and away from that end. The tension in the rope at a distance 'ℓ' from that end is

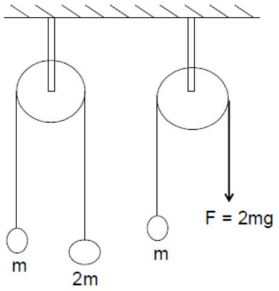
(A) $\frac{F}{\ell}$ (B) $\frac{LF}{\ell}$ (C) $\left(1-\frac{\ell}{L}\right)F$ (D) $\left(1+\frac{\ell}{L}\right)F$

78. In the following figure, the pulley is mass less and frictionless. There is no friction between the body and the floor. The acceleration produced in the body



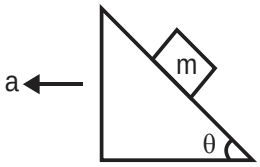
(A) $\frac{P}{M}$ (B) $\frac{P}{2M}$ (C) $\frac{P}{3M}$ (D) $\frac{P}{4M}$

79. The pulley arrangements shown in figure are identical, the mass of the rope being negligible. In case I, the mass m is lifted by attaching a mass 2m to the other end of rope while in case II with a constant downward force F = 2mg, where g is acceleration due to gravity. The acceleration of mass m is case I is



(A) zero (B) more than that is case II
(C) less than that in case II (D) equal to that in case II

80. The value of acceleration 'a' so that block leaves the contact with the wedge is



(A) g tan θ (B) g cot θ (C) g sin θ (D) g cos θ

81. If a body is projected on an inclined plane of inclination 'β', for maximum range. Find the ratio of their ranges, when projected up the inclined & down the inclined respectively

(A) $\frac{1+\cos\beta}{1-\cos\beta}$ (B) $\frac{1-\cos\beta}{1+\cos\beta}$ (C) $\frac{1-\sin\beta}{1+\sin\beta}$ (D) $\frac{1+\sin\beta}{1-\sin\beta}$

82. A passenger is travelling a train moving at 40 $m\,s^{-1}$. His suitcase is kept on the berth. The driver of train applies breaks such that the speed of the train decreases at a constant rate to 20 $m\,s^{-1}$ in 4 s. What should be the minimum coefficient of friction between the suitcase and the berth if the suitcase is not to slide during retardation of the train ?

(A) 0.3 (B) 0.5 (C) 0.1 (D) 0.2

83. The force required to just move a body up the inclined plane is double the force required to just prevent the body from sliding down the plane. The coefficeient of friction is μ. If θ is the angle of inclination of the plane than tan θ is equal to

(A) μ (B) 3 μ (C) 2 μ (D) 0.5 μ

84. A block of mass m is placed at rest on an inclined plane of inclination θ to the horizontal. If the coefficient of friction between the block and the plane is μ, then the total force the inclined plane exerts on the block is

(A) mg (B) μ mg cos θ (C) mg sin θ (D) μ mg tan θ

85. A smooth inclined plane of length L having inclination θ with the horizontal is inside a lift which is moving down with a retardation a. The time taken by a body to slide down the inclined plane from rest will be

(A) $\sqrt{\frac{2L}{(g+a)\sin\theta}}$ (B) $\sqrt{\frac{2L}{(g-a)\sin\theta}}$ (C) $\sqrt{\frac{2L}{a\sin\theta}}$ (D) $\sqrt{\frac{2L}{g\sin\theta}}$

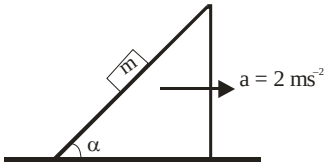
86. A body moves along a circular path of radius 5m. The coefficient of friction between the surface of the path and the body is 0.5. The angular velocity in rad/s with which the body should move so that it does not leave the path is (g = 10 m/s^{-2})

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

87. What is the smallest radius of a circle at which a bicyclist can travel if his speed is 7 m/s and the coefficient of static friction the between tyres and road is 0.25

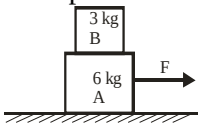
(A) 10 m (B) 40 m (C) 5 m (D) 15

88. A block of mass m is lying on a wedge having inclination angle $\alpha = \tan^{-1}\left(\frac{1}{5}\right)$. Wedge is moving with a constant acceleration a = 2 ms^{-2}. The minimum value of coefficient of friction μ so that m remains stationary w.r.t wedge is



(A) 2/9 (B) 5/12 (C) 1/5 (D) 2/5

89. The blocks A and B of masses 6 kg and 3 kg rest on a smooth horizontal surface as shown in the figure. If coefficient of friction between A and B is 0.4, the maximum horizontal force which can make them move without separation is



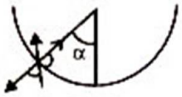
(A) 72 N (B) 40 N (C) 36 N (D) 20 N

90. A body of mass M is kept on a rough horizontal surface (friction coefficient = μ). A person is trying to pull the body by applying a horizontal force but the body is not moving. The force by the surface on the body is F where:

(A) F = mg (B) $Mg \le F \le Mg\sqrt{1+\mu^2}$

(C) F = μMg (D) $Mg \ge F \ge Mg\sqrt{1-\mu^2}$

91. An insect crawls up a hemispherical surface very slowly. The coefficient of friction between the insect and the surface is 1/3. If the line joining the centre of the hemispherical surface to the insect makes an angle α with the vertical, the maximum possible value of α is given by:

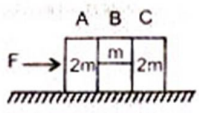


(A) cot α = 3 (B) tan α = 3 (C) sec α = 3 (D) cosec α = 3

92. The force F_1 required to just move a body up an inclined plane is double the force F_2 required to just prevent the body from sliding down the plane. The coefficient of friction is μ. The inclination θ of the plane is :

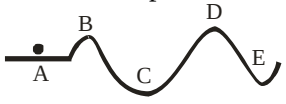
(A) $\tan^{-1}\mu$ (B) $\tan^{-1}\frac{\mu}{2}$ (C) $\tan^{-1} 2\mu$ (D) $\tan^{-1} 3\mu$

93. The system is pushed by the force F as shown. All surfaces are smooth expect between B& C. Friction coefficient between B & C is μ. Minimum value of F to prevent block B form downward slipping is:



(A) $\left(\frac{5}{2\mu}\right)mg$ (B) $\left(\frac{5}{2}\right)\mu mg$ (C) $\left(\frac{3}{2\mu}\right)mg$ (D) $\left(\frac{3}{2}\right)\mu mg$

94. A particles moves along on a road with constant speed at all points as shown in figure. The normal reaction of the road on the particle is:



(A) Same at all points (B) Maximum at point B
(C) Maximum at point C (D) Maximum at point E

95. A car running with a velocity 72 kmph on a level road, is stopped after travelling a distance of 30 m after disengaging its engine ($g = 10\ ms^{-2}$). The coefficient friction between the road and the tyres is
(A) 0.33 (B) 4.5 (C) 0.67 (D) 0.8

96. On the horizontal surface of a truck a block of mass 1 kg is placed ($\mu = 0.6$) and truck is moving with acceleration 5 m/sec^2. The frictional force on block will be
(A) 5 N (B) 6N (C) 5.88 N (D) 8N

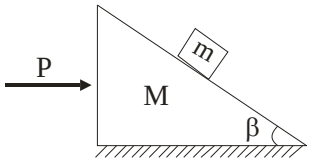
97. A body of 5 kg weight kept on a rough inclined place of angle 30^o starts with a constant velocity. Then the coefficient of friction is
(A) $1/\sqrt{3}$ (B) $2/\sqrt{3}$ (C) $\sqrt{3}$ (D) $2\sqrt{3}$

98. The mass of a person in a lift is 100 kg. When the lift is going up with an acceleration 2 m/s^2 then the vertical upward force acting on the person will be
(A) 1200 N (B) 55 N (C) 50 N (D) zero

99. A chain lies on a rough horizontal table. It starts sliding when one-fourth of its length hangs over the edge of the table. The coefficient of static friction between the chain and the surface of the table is :
(A) $\frac{1}{2}$ (B) $\frac{1}{3}$ (C) $\frac{1}{4}$ (D) $\frac{1}{5}$

100. A body moves along a circular path of radius 5m (on a horizontal surface). The coefficient of friction between the surface of the path and body is 0.5. The maximum angular velocity, in rad/s with which the body can move so that it does not leave the path is ($g = 10 m/s^2$)
(A) 4 (B) 3 (C) 2 (D) 1

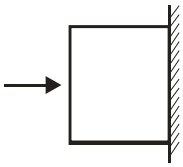
101. Two wooden blocks are moving on a smooth horizontal surface such that the mass m remains stationary with respect to block of mass M as shown in the figure. The magnitude of force P is



(A) $(M+m)g\tan\beta$ (B) $g\tan\beta$
(C) $mg\cos\beta$ (D) $(M+m)g\,\text{cosec}\,\beta$

102. A body of mass m is launched up on a rough inclined plane making an angle 45^o with horizontal. If the time of ascent is half of the time of descent, the frictional coefficient between plane and body is
(A) $\frac{2}{5}$ (B) $\frac{3}{5}$ (C) $\frac{3}{4}$ (D) $\frac{4}{5}$

103. A horizontal force of 25 N is necessary to just hold a block stationary against a wall. The coefficient of friction between the block and the wall is 0.4. The weight of the block is



(A) 2.5 N (B) 20 N (C) 10 N (D) 5 N

104. A lift is moving downwards with an acceleration equal to acceleration due to gravity 'g'. A block of mass m, kept on the rough horizontal floor of the lift having coefficient of friction μ, is pulled horizontally. The friction force acting on the block is
(A) zero (B) mg (C) μmg (D) 2μmg

105. A block of mass 2 kg begins to slide down an inclined plane of inclination 45^o with a constant velocity. If acceleration due to gravity is 'g' the force of friction acting on the block is

(A) $\frac{g}{\sqrt{2}}$ (B) $\sqrt{2}\,g$ (C) g/2 (D) 2g

106. The coefficient of friction between a hemispherical bowl and an insect is $\sqrt{0.44}$ and the radius of the bowl is 0.6 m. The maximum height to which an insect can crawl in the bowl will be

(A) 0.4 m (B) 0.2 m (C) 0.3 m (D) 0.17 m

107. Two balls of masses 2 kg, 4 kg respectively are dropped from a height of 60 m. After falling 30 m each towards Earth their respective kinetic energies will be in the ratio of

(A) $\sqrt{2}$: 1 (B) $1:\sqrt{2}$ (C) 1 : 4 (D) 1 : 2

108. In the above question, what will be the ratio of the respective kinetic energies of the two balls if they have moved for the same time 10 s towards Earth.

(A) $\sqrt{2}:1$ (B) $1:\sqrt{2}$ (C) 1 : 4 (D) 1 : 2

109. A running man has half the kinetic energy of that of a boy of half his mass. The man speeds up by 1 m/s and then has the same kinetic energy as that of the boy. The original speeds of man and boy (in m/s) respectively, are

(A) $\left(\sqrt{2}+1\right),\ \left(\sqrt{2}-1\right)$ (B) $\left(\sqrt{2}+1\right),\ 2\left(\sqrt{2}+1\right)$

(C) $\left(\sqrt{2}-1\right),\left(\sqrt{2}+1\right)$ (D) $\left(\sqrt{2}+1\right),\ 2\left(\sqrt{2}-1\right)$

110. A block of mass m is kept on a rough inclined plane of inclination θ fixed in a lift. The lift moves up with a constant velocity 'v' and the block remains at rest with respect to the wedge. The work done by the friction force on the block in time 't' is

(A) zero (B) mgvt sin 2θ (C) $mgvt\cos^2\theta$ (D) $mgvt\sin^2\theta$

111. A particle of mass 100 g is thrown vertically upwards with a speed of 5 m/s. The work done by gravitational force till the particle reaches maximum height is

(A) –0.5 J (B) –1.25 J (C) 1.25 J (D) 0.5 J

112. A body of mass m = 3000 kg is lifted by a winch with an acceleration a = 2 m/s^2. Find the work done on the block by the rope during the first one and a half seconds from the beginning of motion

(A) 13.5 J (B) 13.5 kJ (C) 81 J (D) 81 kJ

113. The potential energy of a spring when stretched by 2 cm is U. If the spring is stretched by 8 cm the potential energy stored in it is

(A) U/4 (B) 4U (C) 8U (D) 16 U

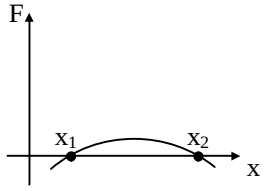
114. A 3 kg body moves such that its position x (in m) varies with time t (in s) as $x = t^2/2$. The work done by the force acting on the body in first three seconds is

(A) 13.5 J (B) 27 J (C) 81 J (D) 109 J

115. A spring of force constant k is stretched by a length x. It is then further stretched by another length y. The magnitude of work done by spring during the second stretching is

(A) $\frac{1}{2}ky(2x+y)$ (B) $\frac{1}{2}k\left(x^2+y^2\right)$ (C) $\frac{1}{2}ky^2$ (D) $\frac{1}{2}k\left(y^2-x^2\right)$

116. The force F acting on a body moving along x-axis varies with the position x of the particle as shown in the graph. The body is in stable equilibrium at



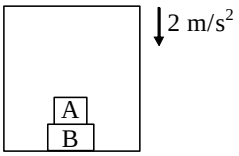
(A) $x = x_1$ (B) $x = x_2$

(C) Both $x = x_1$ and $x = x_2$ (D) neither $x = x_1$ nor $x = x_2$

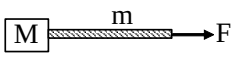
117. A ball of mass 0.2 kg is thrown vertically upwards by applying a force by hand. If the hand moves 0.2 m while applying the force and the ball goes upto a 2m height further (after leaving the hand), find the magnitude of the force ($g = 10\ m/s^2$)
(A) 4 N (B) 16 N (C) 20 N (D) 22 N

118. A mass of 0.5 kg moving with a speed of 1.5 m/s on a horizontal smooth surface collides with a spring
($k = 50$ N/m). The maximum compression in the spring will be
(A) 0.12 m (B) 0.5 m
(C) 1.5 m (D) 0.15 m

119. The elevator shown in figure is descending with an acceleration of 2 m/s^2. The mass of the block A = 0.5 kg. The force exerted by the block A on block B is
(A) 2 N (B) 4 N
(C) 6 N (D) 8 N

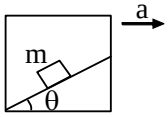


120. The block is placed in a frictionless surface in gravity free space. A heavy string of a mass m is connected and force F is applied on the string, then the tension at the middle of rope is



(A) $\frac{\left(\frac{m}{2}+M\right)F}{m+M}$ (B) $\frac{\left(\frac{M}{2}+m\right)F}{m+M}$ (C) zero (D) $\frac{MF}{m+M}$

121. A block is sliding along inclined as shown in figure. If the acceleration of chamber is 'a' as shown in figure. The time required to cover a distance L along incline is



(A) $\sqrt{\frac{2L}{g\sin\theta - a\cos\theta}}$ (B) $\sqrt{\frac{2L}{g\sin\theta + a\sin\theta}}$
(C) $\sqrt{\frac{2L}{g\sin\theta + a\cos\theta}}$ (D) $\sqrt{\frac{2L}{g\sin\theta}}$

122. When a person walks on a rough surface
(A) The frictional force exerted by the surface keeps him moving
(B) Reaction of force applied by the man on the surface keeps him moving
(C) The force applied by the man keeps him moving
(D) Weight of the man keeps him moving

123. A block weighing 10 kg is at rest on a horizontal table. The coefficient of static friction between the block and the table is 0.5. If a force acts down at 60^o from the horizontal, how large can it be without causing the block to move? ($g = 10\ m/s^2$)
(A) 346 N (B) 446 N (C) 746 N (D) 846 N

124. A vehicle is moving with a velocity v on a curved road of which b and radius of curvature R. For counteracting the centrifugal force on the vehicle the difference. In elevation required in between the outer and inner edges of the road is
(A) $\frac{v^2b}{Rg}$ (B) $\frac{rb}{Rg}$ (C) $\frac{vb^2}{Rg}$ (D) $\frac{vb}{R^2g}$

125. Three point masses each of mass m are joined together using a string to form an equilateral triangle of side a. The system is placed on a smooth horizontal surface and rotated with a constant angular velocity ω about a vertical axis passing through the centroid. Then the tension in each string is

(A) $ma\omega^2$ (B) $3ma\omega^2$ (C) $\frac{ma\omega^2}{3}$ (D) $\frac{ma\omega^2}{\sqrt{3}}$

126. Kinetic energy of a particle moving along the circle is ax2. If the radius of the circle, the radial force on the particle is

(A) $\frac{2ax^2}{R}$ (B) $\left[\frac{1+x^2}{R^2}\right]^{1/2}$ (C) 2ax (D) $2\frac{aR^2}{x}$

127. A particle is projected with a velocity 9m/sec at an angle 45° with the horizontal. What is the radius of curvature of the trajectory of the particle at the position x = R/3 is (R – Range of the projectile).

(A) $3\sqrt{20}m$ (B) $3\sqrt{10}$ (C) $\frac{3\sqrt{10}}{2}m$ (D) $\frac{3}{4}\sqrt{10}m$

128. Water of density 'ρ flows with a linear speed 'v' through a horizontal rubber tube having the form of a ring of radius 'R'. If the diameter of the tube is 'd' (d<< R). Then the tension developed in the rubber tube is

(A) $\frac{\pi d^2\rho v^2}{4}$ (B) $\frac{\pi d^2\rho v^2}{8}$ (C) $\frac{\pi d^2\rho v^2}{6}$ (D) none

129. The radius of a solid sphere is R and its density D. When it is made to rotate about an axis passing through any diameter of sphere, expression for its moment of inertia is

(A) $\frac{8}{7}\pi DR^5$ (B) $\frac{8}{15}\pi DR^5$ (C) $\frac{28}{15}\pi DR^5$ (D) $\frac{28}{5}\pi DR^5$

130. Four point size bodies each of mass M are fixed at four corners of a light square frame of side length L. The moment of inertia of the four bodies about an axis perpendicular to the plane of frame and passing through its centre is

(A) $4ML^2$ (B) $2\sqrt{2}ML^2$ (C) $2ML^2$ (D) $\sqrt{2}ML^2$

131. A diatomic molecule is formed by two atom which may be treated as mass points m_1 and m_2 joined by a massless rod of length r. Then the moment of inertia of molecule about an axis passing through centre of mass and perpendicular to the rod is:

(A) zero (B) $(m_1+m_2)r^2$ (C) $\left(\frac{m_1m_2}{m_1+m_2}\right)r^2$ (D) $\left(\frac{m_1+m_2}{m_1m_2}\right)r^2$

132. I is moment of inertia of a thin square plate about an axis passing through opposite corners of plate. The moment of inertia of same plate about an axis perpendicular to the plane of plate and passing through its centre is

(A) I/2 (B) $I/\sqrt{2}$ (C) $\sqrt{2}I$ (D) 2I

133. A hollow sphere rolls down a 30° incline of length 6m without slipping. The speed of centre of mass at the bottom of plane is

(A) $6ms^{-1}$ (B) $3ms^{-1}$ (C) $6\sqrt{2}ms^{-1}$ (D) $3\sqrt{2}ms^{-1}$

134. For a body rolling along a level surface, the translational and rotational K.E. are equal. The body is
(A) solid cylinder (B) disc (C) ring (D) hollow sphere

135. A ring and a disc of same mass roll without slipping along a horizontal surface with same velocity. If the K.E. of ring is 8J, then that of disc is
(A) 2J (B) 4J (C) 6J (D) 16J

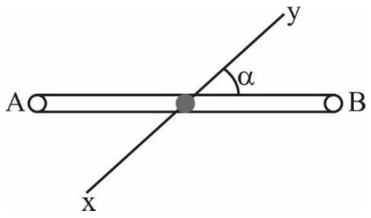
136. A circular disc is rotating about its own axis at uniform angular velocity ω. The disc is subjected to uniform angular retardation by which its angular velocity is decreased to $\omega/2$ during 120 rotations. The number of rotations further made by it before coming to rest is
(A) 120 (B) 60 (C) 40 (D) 20S

137. A roller of mass 300 kg and of radius 50 cm lying on horizontal floor is resting against a step of height 20 cm. The minimum horizontal force to be applied on the roller passing through its centre to turn the roller on to the step is
(A) 980N (B) 1960 N (C) 2940N (D)3920N

138. A thin rod of mass M and length L is bent into a circular ring. The expression for moment of inertia of ring about an axis passing through its diameter is
(A) $\frac{ML^2}{2\pi^2}$ (B) $\frac{ML^2}{4\pi^2}$ (C) $\frac{ML^2}{8\pi^2}$ (D) $\frac{ML^2}{\pi^2}$

139. A wheel starting from rest is uniformly accelerated with $\alpha = 4 rad/s^2$ for 10 seconds. It is then allowed to rotate uniformly for the next two seconds and is finally brought to rest in the next 10 seconds. Find the total angle rotated by the wheel
(A) 200 rad (B) 400 rad (C) 300 rad (D) 480 rad

140. The moment of inertia of a uniform rod of length 2I and mass m about an axis xy passing through its centre and inclined at an enable α is
(A) $\frac{ml^2}{3}\sin^2\alpha$ (B) $\frac{ml^2}{12}\sin^2\alpha$
(C) $\frac{ml^2}{6}\cos^2\alpha$ (D) $\frac{ml^2}{2}\cos^2\alpha$

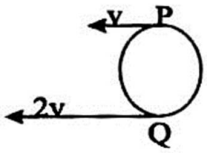


141. The ratio of radii of two solid spheres of same material is 1 : 2. The ratio of moments of inertia of smaller and larger spheres about axes passing through their centre is
(A) 1 : 4 (B) 1 : 8 (C) 1 : 16 (D) 1 : 32

142. A thin metal disc of radius 0.25 m and mass 2kg starts from rest and rolls down an inclined plane. If its rotational kinetic energy is 4J at the foot of the inclined plane, then its linear velocity at the same point is
(A) $1.2 ms^{-1}$ (B) $2.8 ms^{-1}$ (C) $20 ms^{-1}$ (D) $2 ms^{-1}$

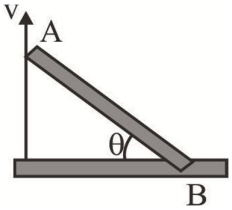
143. A thin rod of length L is vertically straight on horizontal floor. This rod falls freely to one side without slipping at its bottom. The linear velocity of the top end of the rod with which it strikes the floor is
(A) $\sqrt{2gL}$ (B) $\sqrt{\frac{3gL}{2}}$ (C) $\sqrt{3gL}$ (D) $\sqrt{\frac{3gL}{4}}$

144. Two points P and Q, diametrically opposite on a disc of radius R have linear velocities v and 2vas shown in figure. Find the angular speed of the disc.



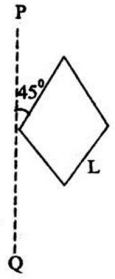
(A) $\frac{v}{R}$ (B) $\frac{2v}{R}$ (C) $\frac{v}{2R}$ (D) $\frac{v}{4R}$

145. Point A of rod AB (l = 2m) is moved upwards against a wall with velocity v = 2 m/s. Find angular speed of the rod at an instant when $\theta = 60^{\circ}$.



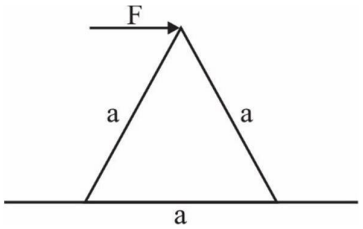
(A) 4 rad/s (B) 1.155 rad/s (C) 2 rad/s (D) 2.50 rad/s

146. A square is made by joining four rods each of mass M and length L. Its moment of inertia about an axis PQ, in its plane and passing through one of its corner is



(A) $6\ ML^2$ (B) $\frac{4}{3}ML^2$ (C) $\frac{8}{3}ML^2$ (D) $\frac{10}{3}ML^2$

147. An equilateral prism of mass m rests on a rough horizontal surface with coefficient of friction μ. A horizontal force F is applied on the prism as shown. If the coefficient of friction is sufficiently high so that the prism does not slide before toppling, the minimum force required to topple the prism is



(A) $\frac{mg}{\sqrt{3}}$ (B) $\frac{mg}{4}$ (C) $\frac{\mu mg}{\sqrt{3}}$ (D) $\frac{\mu mg}{4}$

148. The mass of a metallic beam of uniform thickness and of length 6 m is 60 kg. The beam is horizontally and symmetrically lies on two vertical pillars which are separated by a distance 3 m. A person of mass 75 kg is walking on this beam. The closest distance to which the person can approach one end of the beam so that the beam does not tilt down is (neglect thickness of pillars)

(A) 30 cm (B) 20 cm (C) 15 cm (D) 10 cm

149. A uniform meter scale of mass 1 kg is placed on table such that a part of the scale is beyond the edge. If a body of mass 0.25 kg is hung at the end of the scale that should lie on the table so that it does not tilt is
(A) 90 cm (B) 80 cm (C) 70 cm (D) 60 cm

150. The moment of inertia of a hollow sphere of mass M having internal and external radii R and 2R about an axis passing through its centre and perpendicular to its plane is
(A) $\frac{3}{2}MR^2$ (B) $\frac{13}{32}MR^2$ (C) $\frac{31}{35}MR^2$ (D) $\frac{32}{35}MR^2$

CHEMISTRY

Syllabus: ***FIRST YEAR IN ORGANIC CHEMISTRY:– 1.CLASSIFICATION OF ELEMEMTS AND PERIODICITY INPROPRTIES , 2. CHEMICAL BONDING, 3. ALKALI METALS AND ALKALINE EARTH METALS , 4. ELEMENTS OF GROUP IIIA, 5. ELEMENTS OF GROUP IVA , 6. ENVIRONMENTAL CHEMISTRY 7. HYDROGEN AND ITS COMPOUNDS.***

1. Sodium conduct the electricity because
(A) It is a soft alkali metal (B) It has mobile electrons
(C) It gives hydrogen with water (D) It has only one electron in the outermost orbit
2. The alkali metal that reacts with nitrogen directly to form nitride is
(A) Li (B) Na (C) K (D) Rb
3. Which of the following is also known as chile salt petre?
(A) KNO_3 (B) $LiNO_3$ (C) $NaNO_3$ (D) Na_2SO_4
4. The least basic oxide is
(A) Li_2O (B) Na_2O (C) K_2O (D) Cs_2O
5. Which of the following has highest lattice energy?
(A) RbF (B) CsF (C) KF (D) NaF
6. Which of the following does not illustrate the anomalous properties of lithium?
(A) Lithium is much softer than the other group I metals
(B) Lithium forms a nitride unlike other group I metals
(C) The melting and boiling points of lithium are comparatively high
(D) The ion of lithium and its compound are more heavily hydrated than those of the rest of the elements of the group
7. In Solvay ammonia process, sodium bicarbonate is precipitated due to
(A) Presence of ammonia (B) Reaction with carbon dioxide
(C) Reaction with brine solution (D) Reaction with sodium hydroxide
8. The byproduct of Solvay ammonia process is
(A) Carbon dioxide (B) Ammonia (C) Calcium chloride (D) Calcium carbonate
9. Sodium reacts with water more vigorously then lithium because
(A) It has higher atomic mass (B) It is more electronegative
(C) It has low melting point (D) It is a metal
10. The lightest metal among the following is
(A) K (B) Na (C) Rb (D) Cs
11. Sodium is made by the electrolysis of a molten mixture of about 40% NaCl and 60% $CaCl_2$because
(A) $CaCl_2$ helps in conduction of electricity
(B) $CaCl_2$ decreases the melting point of NaCl
(C) Ca^{2+} ion can displace Na from NaCl
(D) Ca^{2+} can reduce Na^+ ion into Na
12. With the increase in atomic weights melting points of alkali metals
(A) Increase (B) Decrease
(C) Remain constant (D) Do not show definite trend
13. Sodium carbonate reacts with SO_2 in aqueous medium to give
(A) $NaHSO_3$ (B) $Na_2S_2O_3$ (C) $NaHSO_4$ (D) Na_2SO_4

14. Which of the following salt does not from alums?
(A) Li_2SO_4 (B) K_2SO_4 (C) Na_2SO_4 (D) $Al_2(SO_4)_3$

15. A metal is burnt in air and the ash on moistening smells of ammonia. The metal is
(A) Na (B) Li (C) K (D) Cs

16. A piece of magnesium ribbon was heated to redness in an atmosphere of nitrogen and on cooling water was added, the gas evolved was
(A) Ammonia (B) Hydrogen (C) Nitrogen (D) Oxygen

17. Which of the following is a covalent oxide?
(A) BaO (B) BeO (C) CaO (D) MgO

18. Al and Ga have nearly the same covalent atomic radii because of
(A)greater shielding effect of s-electrons
(B) poor shielding effect of s-electrons
(C) poor shielding effect of d-electrons
(D) increase in the repulsion between d-electrons

19. BH_3 forms an adduct with THF, the hybridization of boron in adduct
(A) sp^3 (B) sp^2 (C) sp^2d (D) sp

20. Boric acid is a weak acid but in presence of certain organic compounds, it acts as a strong acid. Which one of the following organic compound may affect such change?
(A) Glycerol (B) Acetic acid (C) Ethyl alcohol (D) Benzene

SECTION-II
(Numerical Value Answer Type)

21. B_2H_6molecule contains X terminal hydrogen atoms and Y 2e-3C bonds. The ratio of X/Y is?
(A) 2 (B) 4 (C) 3 (D) 1

22. Lithium chloride forms hydrated salt of formula LiCl. x H_2O, the value of x is
(A) 0 (B) 4 (C) 6 (D) 2

23. The number of B-O-B bonds around each boron atom in $\left[B_4O_5(OH)_4\right]^-$ is
(A) 3 (B) 1 (C) 2 (D) 4

24. A metal ${}_ZM^A$ readily forms water soluble sulphate MSO_4. Water insoluble hydroxide $M(OH)_2$ and oxide MO, which becomes inert on heating. The hydroxide is soluble in NaOH. The approx. ratio of A/Z of metal is
(A) 2.0 (B) 2.25 (C) 2.21 (D) 1.75

25. The basicity of boric acid in aqueous medium in presence of ethylene glycol is
(A) 3 (B) 2 (C) 1 (D) 1.5

26. Alkali metals are strong reducing agents because
(A) These are metals (B) These are monovalent
(C) Their ionic radii is large (D) Of low IP value

27. Most reactive metal among the following is
(A) K (B) Li (C) Na (D) Cs

28. Sodium as compared to potassium
(A) Less electropositive character (B) Less density
(C) Less ionisation potential (D) Lower melting point

29. Which one of the following represents a correct sequence of reducing power of the following elements (in aq solution)?
(A) Li > Cs > Rb (B) Rb > Cs > Li (C) Cs > Li > Rb (D) Li > Rb > Cs

30. The most basic oxide among the following is
(A) Na_2O (B) BeO (C) As_2O_3 (D) $A\ell_2O_3$

31. Potassium when heated strongly in excess of oxygen it forms

(A) K_2O (B) KO_2 (C) K_2O_2 (D) KO

32. When a cristal of caustic soda is exposed to air a liquid layer is deposited because the crystal
(A) Melts (B) Loses water
(C) Absorbs moisture and CO_2 (D) Sublimes

33. The compound called microscomic salt is
(A) $Na_2HPO_4.2H_2O$ (B) $Na(NH_4)HPO_4.4H_2O$
(C) $Na_2NHPO_4.2H_2O$ (D) $(NH_4)_2HPO_4.2H_2O$

34. Select the incorrect statement.
(A) Ortho hydrogen can se prepared in pure form
(B) Normal hydrogen contains ortho and para hydrogen in the ratio of 3 : 1
(C) Ortho and para are two different allotropes of hydrogen
(D) Both A and B

35. Ionization potential of 'Li' will be….than that of sodium
(A) Lower (B) Equal (C) Greater (D) None

36. What is borax?
(A) $Na_2B_4O_7.10H_2O$ (B) $Na_2B_4O_7.6H_2O$
(C) $Na_2B_4O_7.5H_2O$ (D) $NaKB_4O_7$

37. The percentage of s-characters in the hybrid orbitals of boron in B_2H_6 is
(A) 50% (B) 66% (C) 20% (D) 25%

38. Consider the following statements
(i) B_2H_6 has tau bonds in its structure
(ii) All B-H_t bonds in B_2H_6 are of equal length
(iii) The H_t-B-H_t bond angle is smaller than H_b-B-H_b bond angle
(iv) the boron hydrides are readily hydrolysed
Select the correct answer from the following
(A) (i) and (ii) are correct statements (B) only (iii) is correct
(C) (i) and (iv) are correct statements (D) only (vi) is correct

39. Thermite is a mixture of
(A)Iron and Aluminium (B) Ferric oxide and aluminium
(C) Barium peroxide and aluminium powder (D) Magnesium and aluminium

40. $AlCl_3$ on hydrolysis gives
(A) $Al_2O_3.H_2O$ (B) $Al_2O_3.6H_2O$ (C) $Al(OH)_3$ (D) Al_2O_3

41. Which of the following statement about anhydrous aluminum chloride is incorrect?
(A)It exists as Al_2Cl_6 in solid state (B) It is a Lewis acid
(C) It has 2e and 3c bonds (D) It is not easily hydrolysed

42. The end point of boric acid and NaOH titration can be detected in presence of.
(A) Glycerol (B) Acetic acid (C) Ethyl alcohol (D) Benzene

43. When ethylene glycol is added in boric acid solution
(A) Basicity of acid increases
(B) pH of solution decreases
(C) Hydrogen ion concentration decreases
(D) Basicity of acid decreases

44. Which of the following is known as inorganic benzene?
(A) $B_3N_3H_6$ (B) $(BN)_x$ (C) $Al(OH)_3$ (D) $B(OH)_3$

45. Boron nitride can best be prepared by

(A) $2B + N_2 \xrightarrow{1000^0 C} 2BN$ (B) $2B + Air \xrightarrow{burn} 2BN$

(B) $B_2O_3 + 3C + N_2 \xrightarrow{1800^0 C} 2BN$ (D) $2B + N_2 \xrightarrow{1800^0 C} 2BN$

46. When aluminum is heated in atmosphere of nitrogen forms a nitride of formula:
(A) AlN (B) AlN_3 (C) Al_3N (D) Al_2N_3

47. Consider the reaction

$$B_2H_6 + X \rightarrow \left[BH_2(X)_2\right]^+ \left[BH_4\right]^-$$

The compound X can be
(A) NH_3 (B) Cl_2 (C) $(Me)_3N$ (D) H_2

48. The oxidation state of Ga in Ga_2Cl_4 is / are
(A) +2 only (B) +1 & +3 (C) +1 only (D) +2 & +3

49. Thermodynamically most stable (crystalline) form of carbon is:
(A) Diamond (B) Graphite (C) Fullerene (D) Carbon black

50. Select the correct order of stability?
(A) $SiX_2 > GeX_2 > SnX_2 > PbX_2$ (B) $SiX_2 > GeX_2 < SnX_2 > PbX_2$
(C) $SiX_2 < GeX_2 < SnX_2 < PbX_2$ (D) $SiX_2 > GeX_2 = SnX_2 < PbX_2$

51. Select the correct statement from the following?
(A) BF_3 is stronger Lewis acid than BCl_3 (B) $SiCl_4$ do not hydrolyzed
(C) SiF_4 can be hydrolyzed with water (D) CCl_4 is ionic halide

52. Hybridization of C in graphite and fullerene respectively is
(A) sp^2 and sp^3 (B) sp^2 and sp^2 (C) sp and sp^2 (D) sp^3 and sp^2

53. The correct equilibrium order for the interconversion of different forms of SiO_2 is
(A) *Tridymite* ⇌ *quartz* ⇌ *cristobalite* ⇌ *liquid* SiO_2
(B) *Quartz* ⇌ *Tridymite* ⇌ *Cristobalite* ⇌ *liquid* SiO_2
(C) *Quartz* ⇌ *Cristobalite* ⇌ *Tridymite* ⇌ *liquid* SiO_2
(D) *Cristobalite* ⇌ *Tridymite* ⇌ *Quartz* ⇌ *liquid* SiO_2

54. Which of the following is incorrect for C_3O_2
(A) It is a linear molecule with sp hybrid carbon atoms
(B) It has carbon in fractional oxidation state
(C) It is a linear molecule with no unpaired electrons
(D) It has same number of σ and π bonds

55. Which of the following is a consequence of inert pair effect?
(A) Existence of PbI_4 is doubtful (B) CCl_2 is highly unstable
(C) Pb^{2+} is a good oxidizing agent (D) CO_2 exists in gaseous state

SECTION-II
(Numerical Value Answer Type)

56. Total number of atoms in the ring of cyclic silicate of formula $[Si_6O_{18}]^{12-}$ are:
(A) 6 (B) 8 (C) 12 (D) 10

57. Maximum number atoms in the same plane in diborane is
(A) 4 (B) 2 (C) 8 (D) 6

58. How many five membered rings are present in the structure of C_{60} molecule?
(A) 20 (B) 12 (C) 10 (D) 0

59. In SiO_2 (solid) one Si bonded with how many oxygen atoms?
(A)4 (B) 2 (C) 6 (D) 10

60. $Al(OH)_3$ on reaction with NaOH forms a compound of formula $NaAlO_x$. The value of x is

(A) 2 (B) 4 (C) 3 (D) 5

61. Stability of hydrides of carbon family

(A) $CH_4 > SiH_4 > GeH_4 > SnH_4 > PbH_4$ (B) $CH_4 < SiH_4 < GeH_4 < SnH_4 < PbH_4$

(C) $CH_4 > SnH_4 > GeH_4 > SnH_4 > PbH_4$ (D) None of these

62. Difference between diamond and graphite is due to -

(A) Graphite combines with oxygen to form carbon dioxide but diamond does not

(B) The atoms in each have different masses

(C) The crystal structure in diamond is different from that in graphite

(D) All

63. Graphite conducts electricity because of the

(A) Highly polarized nature of π-electrons.

(B) Highly delocalized nature of π-electrons.

(C) Highly localized nature of π-electrons.

(D) None of these

64. What happens when steam is passed over red hot carbon?

(A) $C + 2H_2 \rightarrow CO_2 + 2H_2$ (B) $C + H_2O \rightarrow CO + H_2$

(C) Water vapour dissociates into H_2 and O_2 (D) None of these

65. Identify the correct statement with respect to CO

(A) It combines with water to give carbonic acid

(B) It reacts with haemoglobin in red blood cells

(C) It is a powerful oxidising agent

(D) It is used to prepare aerated drinks

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