SOLUTIONS

1. (B)

2. (C)

3. (B)

$$M(L-x)+\frac{M}{3}(-x)=0 \Rightarrow L-x=\frac{3L}{4}$$

4. (D)

5. (C)

6. (D)
Theory

7. (BD)

$$KE_{sys}=\frac{1}{2}M_{sys}V_{CM}{}^2+\frac{1}{2}\mu\left(V_{rel}{}^2\right)$$

8. (AC)

9. (BCD)

$$\frac{1}{2}\times\frac{5\times2}{5+2}(10-3)^2=\frac{1}{2}\times1120\times x^2 \Rightarrow x=\frac{1}{4}m$$

10. (ABCD)

String is taut when $V_0t-\frac{1}{2}gt^2=\frac{1}{2}gt^2 \Rightarrow t=\frac{V_0}{g}$

After string is taut

$$MV_0+0=2MV \Rightarrow V=\frac{V_0}{2}$$

11. (ACD)
Conservation of linear momentum

$MV_0 = 3MV_x \Rightarrow V_x = \frac{V_0}{3}$

Conservation of mechanical energy

$\frac{1}{2}MV_0^2 = \frac{1}{2}3MV_x^2 + Mgh$

12. (CD)

Conservation of linear momentum

$0 = (m+M)v$ _____(1)

Conservation of mechanical energy

$0 + mgR = \frac{1}{2}(m+M)v^2 + mgH$

13. (ABD)

14. (AB)

15. (B,C)

16. (5)

After 1 sec, conservation of momentum in vertical.

$4\times10 = 1\times v_y \Rightarrow v_y = 40\,m/s$

$H_{max} = \frac{40^2}{2g} + 15m = 95\,m$

17. (3)

$\frac{\rho\frac{2}{3}\pi R^3.\frac{3}{8}R - \rho\pi R^3.\frac{R}{2}}{5\frac{\pi R^3}{3}\rho} = -\frac{3R}{20}$

18. (5)

19. (6)

$\frac{2\sqrt{5}\,R}{\pi+4}$

20. (8)

Conservation of linear momentum $500\times10 = 50\times28 + 450x$

IIT – JEE: 2024 **TW TEST (ADV)** **DATE: 29/01/23**

TOPIC: GOC

ANSWER KEY

21. (B)
22. (B)
23. (A)
24. (B)
25. (C)
26. (ABC)
27. (ACD)
28. (ABCD)
29. (ABD)
30. (ABC)
31. (ABCD)
32. (ABCD)
33. (AB)
34. (ABCD)
35. (AB)
36. (6)
37. (4)
38. (4)
39. (5)
40. (3)

SOLUTIONS

41. (C)

All 5 letters word is = 100000

All five letters word which have no any letter repeated is = $10 \times 9 \times 8 \times 7 \times 6 = 30240$

Number of words which have at least one letter repeated is

$= 100000 - 30240 = 69760$

42. (A)

Word SURITI

order of dictionary is IIRSTU

total words started with I = $\lfloor 5 = 120$

total words started with R = $\frac{\lfloor 5}{\lfloor 2} = 60$

words started with SI = $\lfloor 4 = 24$

words started with SR = $\frac{\lfloor 4}{\lfloor 2} = 12$

words started with ST = $\frac{\lfloor 4}{\lfloor 2} = 12$

words started with SUI = $\lfloor 3 = 6$

word started with SURIIT = 1 = 1

word SURITI = 1 = 1

Rank = 120 + 60 + 24 + 12 + 12 + 6 + 1 + 1 = 236

43. (A)

Required ways = $\lfloor 3 \lfloor 4$

44. (D)

Total number of triangles are = ${}^{8}C_{3} = 56$

Triangle whose one side is side of octagon are = 8.(8 – 4) = 32

Triangles whose two sides are sides of octagon are = $4 \times 2 = 8$

Required number of triangles which none of side not the side of octagon are

$= 56 - 32 - 8 = 16$

45. (B)

Total card = 52

4 ace + 4 king + 4 Queen + 4 Jack = 16 card
Remaining card = 52 – 16 = 36
Distribute equally between four players

ways = $\frac{\lfloor 36}{\lfloor 9 \lfloor 9 \lfloor 9 \lfloor 9}$

ways for distributing
ace, king, queen, jack of same suit = $\lfloor 4$

Total ways = $\frac{\lfloor 36 \lfloor 4}{(\lfloor 9)^4}$

46. (ABC)

47. (BCD)
4 to be occupied say s s s s
Remaining 6 are | x | x | x | x | x | x |.
Now 4 can be selected in ${}^7C_4$ ways and can be arranged in ${}^7C_4$. 4 ! ways.

48. (AD)
${}^5C_2$. ${}^7C_2 + {}^7C_3$. ${}^5C_1 + {}^7C_4$] [${}^{12}C_4 - ({}^5C_4 + {}^5C_3$. ${}^7C_1) \Rightarrow 495 - (5 + 70) = 420$

49. (BC)
a = 36; b = 18; c = 36
$a = \frac{4!}{2!} \times \frac{3!}{2!} = 12 \times 3 = 36;\ b = \frac{3!}{2!} \times \frac{3!}{2!} \times 2! = 18;\ c = \frac{4!}{2!} + \frac{4!}{2!} \times 2! = 12 + 24 = 36$.

50. (ABCD)
(A) ${}^7C_2 \times \frac{6!}{2! \cdot 2!} = 21 \times 180 = 3780.$

(B) ${}^7C_2 \times \frac{6!}{2! \cdot 2!} - {}^6C_2 \times \frac{5!}{2!} = 3780 - 900 = 2880.$

(C) ${}^6C_2 \times \frac{5!}{2!} = 900.$

(D) $\frac{6!}{2!} = 360.$

51. (AD)
Required no. of ways
= (m persons can be seated in n seats in ${}^nC_m$ ways) × (m persons can be arranged in m! ways)
= ${}^nC_m \times m!$, = ${}^nP_m$
∴ Option (A) and (D) are correct answers.

52. (BD)
$x_1 + x_2 + x_3 + x_4 + p = n$
non negative integral solution
= ${}^{n+5-1}C_{5-1} = {}^{n+4}C_4$ or ${}^{n+4}C_n$

53. (ABC)

$N = {}^5C_0 + {}^5C_1 + {}^5C_2 + {}^5C_3 + {}^5C_4 + {}^5C_5 = 2^5 = 32$

$\therefore \frac{N}{4} = 8$

54. (BD)

Number of words in which alike letters are together

$\overset{\text{(II)}}{}, \overset{\text{(LL)}}{}$, B, N, G

$= 5!$

Number of words in which alike letters are not adjacent

$\Rightarrow$ Total – (Both I's together + Both L's together – Both I's and both L's is together)

$= \frac{7!}{2!\,2!} - \left(\frac{6!}{2!} + \frac{6!}{2!} - 5! \right) = 660$

55. (ABC)

$\overset{2}{C}\ \overset{1}{A}\ \overset{2}{L}\ \overset{2}{U}\ \overset{1}{S}$

Type number of permutation

(2I + 2I + 1D) $\longrightarrow {}^3C_2 \cdot {}^3C_1 \cdot \frac{5!}{2!\ 2!\ 1!} = 270$

(2I + 3D) $\longrightarrow {}^3C_1 \cdot {}^4C_3 \cdot \frac{5!}{2!} = 720$

(All 5 different) $\longrightarrow 120$

$\therefore$ Total number of word = 1110

56. (5)

With each selection of men, say A, B, C, D 3 games can be played (AB, CD ; AC, BD ; AD, BC)

$\therefore \quad {}^{2M}C_4 . 3 = 630$

$\therefore \quad m = 5$

57. (4)

Total triangles = ${}^{10}C_3 - {}^4C_3 = 116$

58. (3)

5 circles, 4 straight lines

${}^5C_2 \times 2 + {}^4C_2 \times 1 + {}^5C_1 \times {}^4C_1 \times 2$

$= \frac{5 \times 4}{2} \times 2 + \frac{4 \times 3}{2} + 5 \times 4 \times 2 = 66$

59. (9)

The number is = Coefficient of x^{20} in

$\left(x + x^2 + x^3 + ... + x^{20} \right)^2 \left(x^4 + x^8 + x^{12} + ... + x^{20} \right)$

= Coefficient of x^{18} in $(1-x)^{-2} \left(x^4 + x^8 + x^{12} + ... + x^{20} \right)$

= Coefficient of x^{18} in $(1 + 2x + 3x^2 + 4x^3 + ...21x^{20})\ (x^4 + x^8 + x^{12} + ... + x^{20})$

= 15 + 11 + 7 + 3 = 36

$\therefore$ Sum of the digits = 9

60. (6)

$$\frac{8!}{4!4!2!}\times 2!\times\frac{6!}{3!3!2!}\times 2!\times\frac{5!}{3!2!}\times 2!=\frac{8!\ 6!\ 5!}{(4!)^2(3!)^3}=\frac{8!\ 6!\ 5\lambda}{576\times 54} \qquad \therefore\ \lambda=6$$