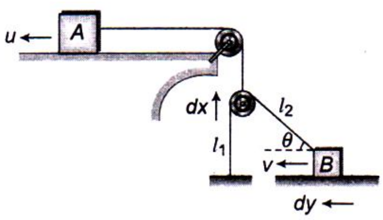
WEEKLY TEST TARGET - JEE -01 TEST - 08
SOLUTION Date 30-06-2019

[PHYSICS]

1.



Let in a small time dt, displacement of A is dx and displacement of B is dy. Increase in length $l_1 = dx$.

Increase in length $\ell_2 = dx\sin\theta - dy\cos\theta$

But net increase in length should be zero, so

$$dx + dx\sin\theta - dy\cos\theta = 0$$

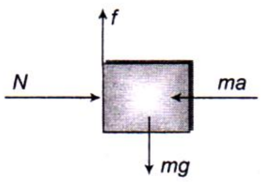
$$\Rightarrow \quad dy = \frac{(1+\sin\theta)dx}{\cos\theta}$$

$$\Rightarrow \quad \frac{dy}{dt} = \left(\frac{1+\sin\theta}{\cos\theta}\right)\frac{dx}{dt} \Rightarrow v = \left(\frac{1+\sin\theta}{\cos\theta}\right)u$$

2.

Common acceleration of the system:

$$a = \frac{F - \mu(M+m)g}{(M+m)}$$



$$f = mg \quad \ldots(i)$$

$$f \le \mu N$$

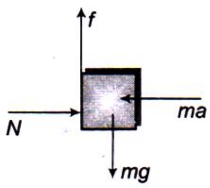
$$mg \le \mu m\left[\frac{F - \mu(M+m)g}{(M+m)}\right]$$

$$\frac{(M+m)g}{\mu} \le \left[F - \mu(M+m)g\right]$$

$$F \ge (M+m)\,g\left[\frac{1}{\mu} + \mu\right]$$

3.

$$a = \frac{m_A g - \mu_1(M+m)g}{(m_A + m + M)} \quad \ldots(i)$$



If the block m is not sliding acceleration of the system

F.B.D. of m w.r.t. M

If m is not sliding

$f = mg$ ...(ii)

and $N = ma$ ...(iii)

and $f \leq \mu_2 N$

$mg \leq m_2 ma$

$$g \leq \mu_2 \left[\frac{m_A g - \mu_1(M+m)g}{m_A + m + M}\right]$$

$$(m_A + m + M) \leq \mu_2(m_A - \mu_1(M+m)$$

$$(\mu_2 - 1)m_A \geq (M+m) + \mu_1\mu_2(M+m)$$

$$m_A \geq \frac{(M+m)\left[1 + \mu_1\mu_2\right]}{(\mu_2 - 1)}$$

4.

The tension in the string initially is zero. If $\mu_1 > \tan\alpha$ and $\mu_2 > \tan\beta$, both the blocks will not move down the incline and the tension in the string shall continue to remain zero.

5.

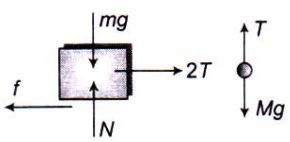
Let the value of 'a' be increased from zero. As long as $a \leq \mu g$, there shall be no relative motion between m_1 or m_2 and platform, that is, m_1 and m_2 shall move with acceleration a.

As $a > \mu g$ the acceleration of m_1 and m_2 shall become μg each.

Hence, at all instants the velocity of m_1 and m_2 shall be same

$\therefore$ The spring shall always remain in natural length.

6.



$f = 2T$ ...(i)

and $T = Mg$ ...(ii)

If m be at rest friction will be static

$f \leq mN$

$$2Mg \leq \mu mg \Rightarrow M = \frac{\mu g}{2}$$

7.

Taking (A + B) as the system, net external force on system is less than the limiting value of static friction. Hence, the blocks are at rest.
Further, if F_1 is more than μMg, then there will be tension in the string. If F_1 is less than μMg, then there will be no tension in the string and friction on B acts towards right.

8.

Taking block as system, the friction is only force which work on the block. Using work energy theorem $W = \Delta K$.

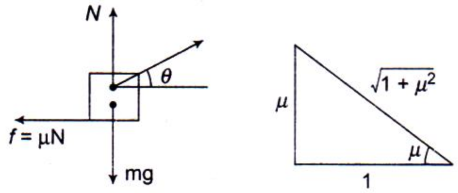
$$\mu mg \cdot s = \frac{1}{2}mv_2^2 - \frac{1}{2}mv_1^2$$

$$s = \frac{1}{2}\frac{(v_2^2 - v_1^2)}{\mu g} = \frac{1}{2}\frac{(4^2 - 3^2)}{0.3 \times 10} = \frac{7}{6}m$$

9.

The work done by the force F is

$$W = F_{min} x \cos\theta \quad \text{(i)}$$



$$\cos\theta = \frac{1}{\sqrt{1+\mu^2}}, \ \sin\theta = \frac{\mu}{\sqrt{1+\mu^2}}$$

F is minimum when $\tan\theta = \mu$ ...(ii)

$F_{min} = mg \sin\theta$ ...(iii)

Using equations (i) and (iii),

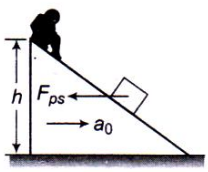
$$W = (mg\sin\theta) \times \cos\theta$$

$$= mg \cdot \frac{\mu}{\sqrt{1+\mu^2}} x \frac{1}{\sqrt{1+\mu^2}} = \frac{\mu mgx}{1+\mu^2}$$

10.

Since $\vec{F}_{ps} = -m\vec{a}_0$ is a constant force, $W_{ps} = \vec{F}_{ps} \cdot \vec{S}$

$$= -m\vec{a}_0 \cdot \vec{S}$$



$$= -m(a_0\hat{i}) \cdot (-\ell\hat{i} + b\hat{j}) = ma_0 \ell$$

11.

Work done does not depend on time.

12.

$$W = \vec{F}.\vec{s} = (5\hat{i} + 3\hat{j}).(2\hat{i} - \hat{j}) = 10 - 3 = 7 \text{ J}$$

13.

Work done = area under curve and displacement axis

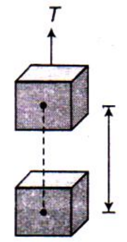
$$= 1 \times 10 - 1 \times 10 + 1 \times 10 = 10 \text{ J}$$

14.

Displacement w.r.t. ground = $\vec{s} + \vec{s}_0$

Since train is moving with constant velocity net force acting on block is $\vec{F}$. Therefore work done = $\vec{F}.(\vec{s} + \vec{s}_0)$

15.



When the block moves vertically downward with acceleration $\frac{g}{4}$ then tension in the cord

$$T = M\left(g - \frac{g}{4}\right) = \frac{3}{4}Mg$$

Work done by the cord = $\vec{F}.\vec{s} = Fs\cos\theta$

$$Td\cos(180°) = -\left(\frac{3Mg}{4}\right) \times d = -\frac{3}{4}Mgd$$

16.

$$\frac{1}{2}mv^2 \propto t$$

$$\frac{1}{2}mv^2 = At \qquad \text{where } A \text{ is constant}$$

$$v = \sqrt{\frac{2A}{m}}\, t^{1/2}$$

$$v \propto \sqrt{t}$$

$$a = \frac{dv}{dt} = \sqrt{\frac{2A}{m}}\,\frac{1}{2\sqrt{t}}$$

$$F = ma = \sqrt{2Am} \cdot \frac{1}{2\sqrt{t}}$$

$$F \propto \frac{1}{v}$$

17.

Work done = Force × displacement

= Weight of the book × Height of the book shelf

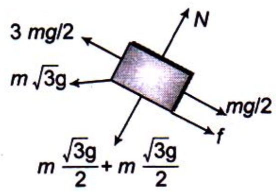
18.

The retardation r of the block while moving up is g (sin θ + μ cos θ) while the acceleration a of the block while moving down is g (sin $\theta - \mu$ cos θ).

$$t_1 \propto \frac{1}{\sqrt{r}} \text{ and } t_2 \propto \frac{1}{\sqrt{a}} \quad \text{since } r = a,\ t_2 > t_1$$

19.

$N = \sqrt{3}\, mg$



$$f_{max} = \sqrt{3} \times \frac{\sqrt{3}}{2} mg = \frac{3}{2} mg$$

$\therefore$ Block will not slide

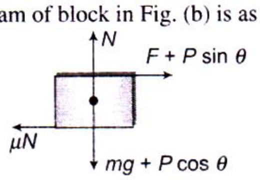
Since $f = \frac{3mg}{2} - \frac{mg}{2} = mg < f_{max}$

20.

The minimum force required to pull a block of mass m place on rough horizontal surface is $\frac{\mu mg}{\sqrt{\mu^2 + 1}}$. Hence, the minimum force required to pull the system of mass $2m$ is $\frac{2\mu mg}{\sqrt{\mu^2 + 1}}$.

21.

The free-body diagram of block in Fig. (b) is as shown.



$\therefore$ $N = mg + P \cos \theta$

and acceleration of block

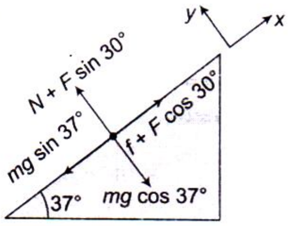
$$a = \frac{F + P\sin\theta - \mu(mg + P\cos\theta)}{m}$$

$$a = \frac{F + P\sin\theta - \frac{\sin\theta}{\cos\theta}(mg + P\cos\theta)}{m} = \frac{F - \mu mg}{m}$$

Hence, P does not change acceleration.

22.

Drawing free body diagram of block, $\Sigma Fy = 0$



$\Rightarrow \quad N + F\sin 30° = mg\cos 37°$

or $\quad N = mg\cos 37° - F\sin 30°$

$$= (4)(10)\left(\frac{4}{5}\right) - (10)\left(\frac{1}{2}\right)$$

or $\quad N = 27$ N ... (i)

$$f_{max} = \mu N = 0.5 \times 27 = 13.5 \text{ N}$$

$$mg\sin 37° = (4)(10)\left(\frac{4}{5}\right) = 32 \text{ N}$$

and $\quad F\cos 30° = (10)\left(\frac{\sqrt{3}}{2}\right) = 8.66$ N

Now since $mg\sin 37° > f_{max} + F\cos 30°$

Therefore block will slide down and friction will be kinetic.

23.

If we consider blocks 2 and 1 independently, then there accelerations would be for block (1)

$$a_1 = g\sin\theta - \mu_1 g\cos\theta = g\left[\frac{\sqrt{3}}{2} - \frac{1}{2}\times\frac{1}{2}\right] = \frac{g[2\sqrt{3}-1]}{4}$$

For block (2)

$$a_2 = g\sin\theta - \mu_2 g\cos\theta = g\left[\frac{\sqrt{3}}{2} - \frac{2}{5}\times\frac{1}{2}\right] = \frac{g}{10}[5\sqrt{3}-2]$$

Since $a_2 > a_1$ so both blocks will move separately.

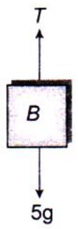
24.

Let m_A and m_B be the mass of blocks A and B respectively.
As the force F increases from 0 to $\mu_s m_A g$, the frictional force f on block A is such that $f = F$. When $F = \mu_s m_A g$, the frictional force f attains maximum value $f = \mu_s mg$.
As F is further increased to $\mu_s(m_A + m_B)g$, the block A does not move. In this duration frictional force on block A remains constant at $\mu_s m_A g$.
Hence, (c) is correct choice.

25.

Maximum frictional force between C and ground = 300 N
Max. frictional force between B and ground = 360 N
So man is unable to pull B. Hence, $T = 0$.

26.



Since the given system is in equilibrium therefore tension in the string is $5g$.

When we consider the combination of A and C, then

$T = \mu R$

or $T = 0.2[10 + \text{mass of } C]g$

or $5g = 0.2[10 + \text{mass of } C]g$

or mass of $C = 15$ kg

27.

The sliding shall start at lower surface first

if $F > 0.5\ [10 + 10]$ g

or $F > 100$ N

28.

$F_{1(max)} = 0.2 \times 10 \times 10 = 20$ N

$F_2 = 0.1 \times 30 \times 10 = 30$ N

$F_{1(max)} < F_{2(max)}$

$\Rightarrow$ B can never move.

29.

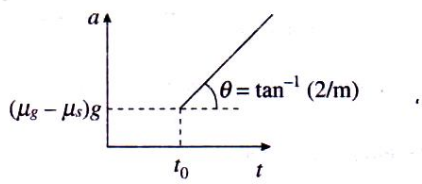
Let t_o be the time when friction force is maximum

$F = 2t_o = \mu_s$ mg

The block just starts moving immediately after this instant, with acceleration

$$= \frac{\mu_s mg - \mu_k mg}{m} = (\mu_s - \mu_k)g$$

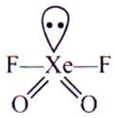
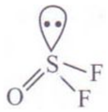
For $t > t_0$ the acceleration of the block is

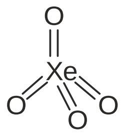
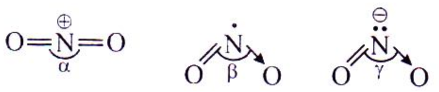


$$a = \frac{2t_o - \mu_k mg}{m}$$

30.

[CHEMISTRY]

31. $CH_2=CH–CH_2–C\equiv CH$ has 10σ-bonds are 3π-bonds
32. SiF_4 is tetrahedral and SF_4 is see-saw shaped.
33. 34 electrons
34. $BrO_3^{\ominus}$ and XeO_3 both have sp^3-hybridisation and pyramidal shape.
35. $\overset{\otimes}{N}O_2$ is $O=\overset{\otimes}{N}=O$ linear ion.
36.
37. Bond orders are : $He_2^+ = 0.5;\ O_2^- = 1.5;\ NO = 2.5; C_2^{2-} = 3.0$
38. Four atoms directly related with C≡C are linearly arrnaged
39.
40. 
41. 
42. Each f C^1 and C^2 are forming two sigma bonds. Hence, both are sp-hybridised.
43. CO has triple bond $:\overset{-}{C}\equiv\overset{+}{O}:$, CO_2 has double bonds O=C=O,

    CO_3^{2-} has C–O bond intermediate between single and double bond.
44.  XeO_4 has 4σ- and 4π-bonds.
45. In methane C-atom is sp^3-hybridized with 25 s-character. In ethene, it is sp^2 with 33 s-character has to be less than 25 (actual value is 21.43)
46. Bond orders are : $O_2^- = 1.5,\ NO = 2.5,\ C_2^{2-} = 3.0$
47.  ; $\alpha > \beta > \gamma$
48.
49. Bond order of N_2^{2-} and N_2^{2+} is 2.

    Bond order of N_2^{2-} and N_2^{2+} is 2.5

    Bond order of N_2 is 3
50. Bond orders of O_2^{2-}, O_2^-, O_2 and O_2^+ are 1, 1.5, 2 and 2.5 respectively. (Please, refer to the text article no. 5.25)
51.
52. NO has 15 electrons : KK $(\sigma_{1s})^2\ (\pi^*_{1s})\ (\pi_{2p_x})^2(\pi_{2p_y})^2(\sigma_{2p_z})^2(\pi^*_{2p_x})^1$ with bond order 2.5, paramagnetic nature.

    NO^+ has 14 electrons, where $(\pi^*_{2p_z})^1$ electron is lost. The bond order increases to 3 and diamagnetic nature is attained.
53.
54.

[MATHEMATICS]

61. (b) $\frac{56!}{(50-r)!} \times \frac{(51-r)!}{54!}$

$= \frac{30800}{1} \Rightarrow 56 \times 55 \times (51-r) = 30800 \Rightarrow r = 41$.

62. (a) Number of words in which all the 5 letters are repeated $= 10^5 = 100000$ and the number of words in which no letter is repeated are $^{10}P_5 = 30240$.

Hence the required number of ways are

$100000 - 30240 = 69760$.

63. (b) The word ARRANGE, has AA, RR, NGE letters, that is two A' s, two R's and N, G, E one each.

$\therefore$ The total number of arrangements

$= \frac{7!}{2!2!1!1!1!} = 1260$

But, the number of arrangements in which both RR are together as one unit $= \frac{6!}{2!1!1!1!1!} = 360$

$\therefore$ The number of arrangements in which both RR do not come together $= 1260 - 360 = 900$.

64. (a) We know that a five digit number is divisible by 3, if and only if sum of its digits (= 15) is divisible by 3, therefore we should not use 0 or 3 while forming the five digit numbers. Now, (i) In case we do not use 0 the five digit number can be formed (from the digit 1, 2, 3, 4, 5) in $^5P_5$ ways.

(ii) In case we do not use 3, the five digit number can be formed (from the digit 0, 1, 2, 4, 5) in $^5P_5 - {}^4P_4 = 5! - 4! = 120 - 24 = 96$ ways.

$\therefore$ The total number of such 5 digit number

$= {}^5P_5 + ({}^5P_5 - {}^4P_4) = 120 + 96 = 216$.

65. (b) Since the number of students giving wrong answers to at least i question $(i = 1, 2, ..., n) = 2^{n-i}$.

The number of students answering exactly $i\,(1 \le i \le -1)$ questions wrongly = {the number of students answering at least i questions wrongly, $i = 1, 2, ..., n)$} – {the number of students answering at least $(i+1)$ questions wrongly $(2 \le i+1 \le n)$}

$= 2^{n-i} - 2^{n-(i+1)}(1 \le i \le n-1)$.

Now, the number of students answering all the n questions wrongly $= 2^{n-n} = 2^0$.

Thus the total number of wrong answers

$= 1(2^{n-1} - 2^{n-2} + 2(2^{n-2} - 2^{n-3}) + 3(2^{n-3} - 2^{n-4})$

$+ .... + (n-1)(2^1 - 2^0) + n(2^0)$

$= 2^{n-1} + 2^{n-2} + 2^{n-3} + ... + 2^0 = 2^n - 1$ ($\because$ Its a G.P.)

$\therefore$ As given $2^n - 1 = 2047 \Rightarrow 2^n = 2048 = 2^{11} \Rightarrow n = 11$

66. (b) The number of ways can be deduce as follows :

1 woman and 4 men $= {}^4C_1 \times {}^6C_4 = 60$

2 women and 3 men $= {}^4C_2 \times {}^6C_3 = 120$

3 women and 2 men $= {}^4C_3 \times {}^6C_2 = 60$

4 women and 1 man $= {}^4C_4 \times {}^6C_1 = 6$

Required number of ways $= 60 + 120 + 60 + 6 = 246$.

67. (d) Out of 10 persons, A is in and G and H are out of the team, so we have to select 4 more from 7 remaining. This can be done in ${}^7C_4$ ways. These 5 persons can be arranged in a line in $5!$ ways. Hence the number of possible arrangements is ${}^7C_4 . 5! = {}^7C_3.(5!)$.

68. (b) Since 2 persons can drive the car, therefore we have to select 1 from these two. This can be done in ${}^2C_1$ ways. Now from the remaining 5 persons we have to select 2 which can be done in ${}^5C_2$ ways.

Therefore the required number of ways in which the car can be filled is ${}^5C_2 \times {}^2C_1 = 20$.

69. (c) We have got $2P^s, 2R^s, 3O^s, 1I, 1T, 1N$ *i.e.* 6 types of letters. We have to form words of 4 letters. We consider four cases

(i) All 4 different : Selection ${}^6C_4 = 15$

Arrangement $= 15 \,.\, 4! = 15 \times 25 = 360$

(ii) Two different and two alike :

P^s, R^s and O^s in ${}^3C_1 = 3$ ways. Having chosen one pair we have to choose 2 different letters out of the remaining 5 different letters in ${}^5C_2 = 10$ ways. Hence the number of selections is $10 \times 3 = 30$. Each of the above 30 selections has 4 letters out of which 2 are alike and they can be arranged in $\frac{4!}{2!} = 12$ ways.

Hence number of arrangements is $12 \times 30 = 360$.

(iii) 2 like of one kind and 2 of other :

Out of these sets of three like letters we can choose 2 sets in ${}^3C_2 = 3$ ways. Each such selection will consist of 4 letters out of which 2 are alike of one kind, 2 of the other. They can be arranged in $\frac{4!}{2!\,2!} = 6$ ways.

Hence the number of arrangements is $3 \times 6 = 18$.

(iv) 3 alike and 1 different :

There is only one set consisting of 3 like letters and it can be chosen in 1 way. The remaining one letter can be chosen out of the remaining 5 types of letters in 5 ways.

Hence the number of selection $= 5 \times 1$. Each consists of 4 letters out of which 3 are alike and each of them can be arranged in $\frac{4!}{3!} = 4$ ways.

Hence the number of arrangements is $5 \times 4 = 20$.

From (i), (ii), (iii) and (iv), we get

Number of selections $= 15 + 30 + 3 + 5 = 53$

Number of arrangements

$= 360 + 360 + 18 + 20 = 758$.

70. (a) The number of words before the word CRICKET is $4 \times 5! + 2 \times 4! + 2! = 530$.

71. (c) Here we have $1\,M$, $4\,I$, $4\,S$ and $2P$.

Therefore total number of selections of one or more letters $= (1+1)(4+1)(4+1)(2+1) - 1 = 149$.

72. The women choose in ${}^4P_2$ ways. Then the men select in ${}^6P_3$ ways. The total arrangements are ${}^4P_2 \times {}^6P_3$.

73. ${}^{n+1}C_3 - {}^nC_3 = 21$

$\Rightarrow \frac{(n+1)(n)(n-1)}{6} - \frac{n(n-1)(n-2)}{6} = 21$

$\Rightarrow n(n-1) = 42 = 7 \times 6$ giving $n = 7$.

74. **Two are already selected, so we have to select only 9. Four are excluded and two already selected, so we have to select out of $22 - 6 = 16$. The number of ways is ${}^{16}C_9$.**

75. **A, B, C, D can stand in this order in only one way. Either of the rest two persons stand together, then the number of ways is $5 \times 2 = 10$. If they stand separately, the number of ways is $5 \times 4 = 20$. Since these two arrangements are mutually exclusive, the total number is $10 + 20 = 30$.**

76. **(a) $x = 6! \times 6! + 6! \times 6! = 2(6!)^2$ and $y = 5! \times 6!$**

$\therefore \frac{x}{y} = 2 \times 6 \Rightarrow x = 12y$

77. (c). Let the product $\left(x^0+x^1+x^2...x^9\right)\left(x^0+x^1+x^2...x^6\right)...6$ factors

$\therefore$ Number of ways in which the sum of the digits will be equal to 12 equal to the coefficient of x^{12} in the above product.

$\therefore$ Required number of ways

$= \text{coefficient of } x^{12} \text{ in } \left(x^0+x^1+x^2+...x^9\right)^6$

$= \text{coefficient of } x^{12} \text{ in } \left(\frac{1-x^{10}}{1-x}\right)^6$

$= \text{coefficient of } x^{12} \text{ in } \left(1-x^{10}\right)^6(1-x)^{-6}$

$= \text{coeff. of } x^{12} \text{ in } (1-x)^6\left(1-{}^6C_1x^{10}+...\right)$

$= \text{coeff. of } x^{12} \text{ in } (1-x)^{-6} - {}^6C_1. \text{ Coeff. of } x^2 \text{ in } (1-x)^{-6}$

$= {}^{12+6-1}C_{6-1} - {}^1C_1 \times {}^{2+6-1}C_{6-1} = {}^{17}C_5 - 6\times{}^7C_5 = 6062$

78. (a). We know that the sum of all n-digit numbers formed by using n-digits from the digits 1, 2, 3, 4, 5, 6, 7, 8, 9

$$= (\text{sum of the digits})(n-1)!\left(\frac{10^n-1}{10-1}\right)$$

Required sum $= (1+2+3+4+5)\,4!\left(\frac{10^5-1}{10-1}\right)$

$= 360\frac{(100000-1)}{9} = 40\times999999 = 3999960$

79. (a) Let $n = 2m+1$. Then, the common difference of the A.P. can be 1, 2, 3, ...m. The number of AP's with 1, 2, 3, ...m common differences are $(2m-1), (2m-3),...,1$ respectively:

So, total number of APs $= (2m-1) + ... + 1$

$$= m^2 = \left(\frac{n-1}{2}\right)^2$$

Hence, total number of ways $= \left(\frac{n-1}{2}\right)^2$

80. (c) ${}^{n+1}C_{n-2} - {}^{n+1}C_{n-1} \le 100$

$\Rightarrow$ ${}^{n+1}C_{3-1}{}^{n+1}C_2 \le 100$

$\Rightarrow$ $\frac{(n+1)n(n-1)}{6} - \frac{(n+1)n}{2} \le 100$

$\Rightarrow$ $(n+1)n(n-1) - 3n(n+1) \le 600$

$\Rightarrow$ $(n+1)\,n\,(n-4) \le 600$:

The values of n satisfying this inequality are 2, 3, 4, 5, 6, 7, 8, 9.

81. (a) Excluding the two particular persons, the remaining five can be arranged at the round table in 4! ways. There are five gaps between them in every arrangement. Two particular persons can be arranged in these gaps in ${}^5P_2$ ways.

So, the required number of ways = 4! × ${}^5P_2$ = 480.

82 (a) The number of three element subsets containing a_3 is equal to the number of ways of selecting 2 elements out of $n - 1$ elements. So, the required number of subsets is ${}^{n-1}C_2$.

83. (a) We just arrange m white counters and n red counters on the left of the central mark, as the arrangement on the right central mark is just a reflection of the left hand side in a mirror placed at the central mark. The number of ways of arranging m white counters and n red counters in a row is $(m + n)/(m!\ n!)$.

84. (b) Considering four particular flowers as one flower, we have five flowers which can be strung to form a garland in 4! ways. But 4 particular flowers can be arranged in 4! ways. Thus, the required number is 4!×4!

85. (c) Here, we have 1M, 41's,4 S's and P's

∴ Total number of selections

86. (a) Out of 9 men, 2 men can be chosen in ${}^9C_2$ ways.

But no husband and wife are to play in the same game.

∴ We have to select two women from the remaining 7 women. It can done in ${}^7C_2$ ways. Let M_1, M_2 and W_1, W_2 are chosen, then a team can be constituted in 4 ways viz. $M_1, W_2; M_1, W_1; M_2, W_1, M_2, W2$. *Thus* number of ways of arranging the game

$= {}^9C_2 \times {}^7C_2 \times 4$

$= 3024.$

87. (a). Choose any two of the seven digits. This may be done in 7C2 ways. Put 2 in these two digits. The remaining 5 digits may be arranged using 1 and 3 in 2^5 ways.

∴ Required number of numbers = ${}^7C_2 \times 2^5$.

88. (a) Here,

$$E_2(24!) = \left[\frac{24}{2}\right] + \left[\frac{24}{2^2}\right] + \left[\frac{24}{2^3}\right] + \left[\frac{24}{2^4}\right]$$

$$= 12 + 6 + 3 + 1 = 22$$

and $E_3(24!) = \left[\frac{24}{3}\right] + \left[\frac{24}{3^2}\right] = 8 + 2 = 10$

$$\therefore \quad 24! = 2^{22} \times 3^{10} = \left(2^7\right) \times 3^{10} \times 2$$

$$= \left(2^3 \times 3\right)^7 \times 3^3 \times 2 = (24)^7 \times 3^3 \times 2$$

Clearly 24! is divisible by 24^6.

89. (a) The required number of ways =

$(10 + 1)(9 + 1)(7 + 1) - 1 = 879.$

90. (a) Ten candidates can be ranked in 10! ways. In half of these ways A_1 is above A_2 and in another half A_2 is above A_1

So, required number of ways is 10!/2.