1. PERMUTATION

Formulas:

1. The numbers of Permutation of n things when r things are taken time $\rightarrow {}^nP_r = \dfrac{n!}{(n-r)!}$

   [$P = permutation$ $n = positive\ integers$ $r = positive\ integers$ **Remember $n \geq r$**

2. **0!=1**

3. $n! = n(n-1)!$ $or, n(n-1)(n-2)!$ $or, n(n-1)(n-2)(n-3)!$

4. The number of permutation of n things taken all at a time, when q of the following things are like of one kind, r of the things are like of another kind, s of the things are like of the rest are all different is $\dfrac{n!}{p!q!s!}$

5. The number of permutation of n things taken r of time in which m particular things always occur is ${}^rP_m \times {}^{n-m}P_{r-m}$

6. The number of permutation of n things taken r of a time in which m particular time things never occur is ${}^{n-m}P_r$ where $n-m > r$.

   * when two events are occur at the same time → **multiply**

   * when two events are not occur at the same time → **add**

7. The liner permutation of n things can be arranged in → **n! ways**

8. The circular permutation of n things is arranged in → **(n-1)! Ways.**

PRACTICAL PROBLEMS

1. Find the value of **(i) 4!** **(ii) 8!** **(iii) ${}^5P_2$** **(iv) ${}^4P_0$** **(v) ${}^6P_6$**

2. In how many different ways can 5 boys take their seats in a beach? [**ans.:120**]

3. In how many different ways 4 letters can be put in 4 different envelopes? [**ans.:24**]

4. There are 6 colleges in south Calcutta. In how many ways can a man send 4 of his son to a college so that no two of them may come in the same college? [**ans.:360**]

5. In how many different ways can 4 prizes distributed among 10 students (each student being eligible for one prize)? [**ans.:5040**]

6. There are 25 stations on a railway line. How many different kinds of single third class tickets must be printed in order that it may be possible to travel from one station to another? [**ans.:600**]

7. There are 17 stations from Howrah to Bandel on the railway line. How many kinds of single third class tickets must be printed so as to enable a passenger to travel from one station to another? [**ans.: 272**]

8. How many different permutations can be made by taking all the letters of word "Bengali"? [**ans.:5040**]

9. How many different permutations can be made by taking 5 of the letters of word 'Thursday'? [**ans.:6720**]

10. In how many ways can the letters of the word 'Logarithm' be arranged? How many of these arrangements being with I? how many being with I and do not end with m? [**ans.: 362880; 40320; 35280**]

11. How many words can be made using all the letters in the word 'Monday'? How many of them being with m and do not end with y? [**ans.:720;120; 96**]

12. **(i)** How many different permutation can be made with the letters of the word 'draught' so that the vowels are always together?
    (ii) How many different arrangements of the letters of the word 'Bengal' can be made so that the two vowels do not come together?
    (iii) In how many ways can the letters of the word 'strange' be arranged so that the vowels may appears in the add places?

(iv) find how many words can be formed of the word 'failure', the four vowels always coming together. **[ans.: (i)1440 (ii) 480   (iii)1440   (iv) 576]**

13. How many words can be made from the letters of the word costing so that the vowels **(i)** are always together **(ii)** are never together **(iii)** may occupy only odd positions. **[ans.: (i) 1440 (ii)3600 (iii)1440]**

14. **(a)** 6 papers are set in an examination, of which 2 are mathematical. In how many different orders can the papers be arranged so that **(i)** the two mathematical papers are together **(ii)** the two mathematical paper are to consecutive? **[ans.: (i) 240 (ii)480]**
    (b) In how many ways 3 boys and 5 girls can arranged in a row so that all the three boys are together?

15. In how many ways can 12 examination papers be arranged so that the best and worst papers may never come together? **[ans.:$^{12}P_{12} - {}^{11}P_{11} \times {}^2P_2$]**

16. **(i)** in how many ways the letters of the name 'Gavaskar' be arranged so that three a's may come together? **[ans.:720]**
    (ii) In how many different ways can the letters of the works of the word 'football' be arranged so that two o's do not come together? **[ans.:7560]**

17. Find the numbers of different permutations than can be made out of the letters of the following words:
    (i) commerce   **(ii)** accountant   **(iii)** engineering   **(iv)**statistics   **(v)** success
    [ans.:(i) 5040 (ii) 226800 (iii) $\frac{(11)!}{3!3!2!2!}$ (iv) 60480 (v) 420]

18. How many different arrangements can be made out of the letters in the expression $x^3y^2z^4$ when written at full length? **[ans.:1260]**

19. In how many ways can 8 oranges of different sizes be distributed among 8 boys of different ages so that the largest orange is always given to the youngest boy?

20. **(i)** How many numbers each lying between 100 and 1000 can be formed with digits 2, 4, 6, 8, 9 each of the digits once in each number?
    (ii) find the number of different odd numbers of 5 digit that can be formed with digits 1, 2, 3, 4, 5, 6 without repetition.
    (iii) how many numbers between 5000 and 6000 can be formed with the digits 4, 5, 6, 7, 8, 9?
    (iv) how many odd numbers of five significant digits can be formed with the digits 3, 2, 4, 1, 0, when no digits is repeated.
    (v) find the number of each less than 999 and divisible by 2 which can be formed with the digits 2, 3, 4, 5, 6 and 7, no digit occurring more than ones in any numbers. **[ans.: (i)6; (ii)360; (iii) 60; (iv)36; (v)78]**

21. How many numbers each lying between 1,000 and 10,000 can be formed with the digits 1, 2, 3, 4, 5, 6, 7 (none digits being repeated in any number)? **[ans.:840]**

22. How many odd numbers of 6 significant digits can be formed with the digits 0, 1, 2, 3, 4 and 5, none digits being repeated in any of the numbers so forms? **[ans.:288]**

23. How many even numbers greater than 300 can be formed of the digits 1, 2, 3, 4 and 5, no repetitios are allowed? **[ans.:111]**

24. **(a)** in how many of the permutations of 12 things taken 3 at a time will one particular things **(i)** always occur **(ii)** never occur? **[ans.:(i) 330   (ii) 990]**
    (b) in how many of the permutations of 12 things taken 6 at a time will 3 particular things **(i)** always occur **(ii)** never occur? **[ans.:(i) 60480 (ii)]**

25. **I**n how many of the permutations of 20 things taken 5 at a time so that one particular thing **(i)** will always occur **(ii)** will never occur? **[ans.: 465120 (ii) 1395360]**

26. In how many ways can 10 children sit in a merry-go-round relatively from another? **[ans.:9!]**

27. In how many different ways can 15 different flowers be arranged to from a garland? **[ans.:$\frac{1}{2} \times 14!$]**

28. In how many ways can 6 boys from a ring? **[ans.:120]**

29. In how many ways can 6 beads of different colors be arranged to from a necklace? **[ans.:60]**

<div align="center">**C.U. QUESTION**</div>

1. How many numbers between 100 and 1000 can be formed with the digits 2, 3, 4, 0, 8, 9, each digit occurring only once? **[ans.:100][1985]**   **[2012(G)2016(H)][2017(H)]**
2. show that $^nP_r = {}^{n-1}P_r \cdot {}^{n-1}P_{r-1}$ **[2012(G)]**
3. In how many ways can the latter of the word 'FRIDAY' be arrange so that words do not begin with F.**[ans.:600 ways]**   **[2012(G)]**
4. How much permutation can be done from the word DELHI taken altogether?
   Or, in how many ways 3 boys and 5 girls can be arranged in a row so that no two boys sit together?
   [ans.:14400]   **[2013(G)]**
5. How many (i) odd numbers (ii) even numbers of five digits can be formed with the digits 0, 1, 2, 3, 5?
   [ans.: (i)54 (ii)42]   **[2013(G)]**
6. In how many ways can the latter of the word 'FRIDAY' be arrange so that words will start 'M' but does not end with 'Y'.**[ans.:96][1995]**   **[2013(H)]**
7. find the value n if $^{n+1}P_3 = 2. {}^nP_3$. **[ans.:5]**   **[2013(H)]**
8. How many ways can six men stand in a row, if two of them A and B always stand together? **[ans.:240]**
                                                                                              [2013(H)]
9. If $^nP_5 = 12$ then find n. **[ans.:]**   **[2014(G),'17]**
10. If $^nP_5 : {}^nP_3 = 2:1$, then find n. **[ans.: n= 2; 5]**   **[2014(G),'17]**
11. How many odd numbers of five digits can be formed with the digits 0, 1, 2, 3, 4? **[ans.:36]**
12. If $^{2n-1}P_5 : {}^{2n+1}P_{n-1} = 5:3$, then find n. **[ans.:4]**   **[2014(H)]**
13. In how many ways can 8 oranges of different sizes be distributed among 8 boys of different ages so that the largest orange is always given to the youngest boy? **[ans.:5040]**   [2014(H)]
14. How many words can be formed taking all letters of MONDAY? **[ans.:720]**   [2015(G)]
15. $^{n+1}P_4 : {}^{n-1}P_3 = 72:5$, then find n. **[ans.:]**   **[2015(G)]**
16. If $^{n+1}P_5 : {}^{n-1}P_5 = 11:24$, find n. **[ans.:15]**   **[2015(H)]**
17. If $^nP_6 = 30, {}^nP_4$, find the value of n.**[ans.:10]**   **[2015(H)]**
18. Show that $^nP_r = {}^{n-1}P_{r+r} \cdot {}^{n-1}P_{r-1}$.   **[2016(G)]**
19. In how many ways can six students stand in a row, if two of them always stand together? **[ans.:240]**
                                                                                              [2016(G)]
20. In how many ways can a team of 7 players be formed out of 11 players? **[ans.:330]**   **[2016(G)]**
21. For what value of n, $^nP_4 = 12 \times {}^nP_2$? **[ans.: 6]**   Or, If $^nC_r = x.{}^nP_r$, what is the value of x?**[ans.:$\frac{1}{r!}$][2016(H)]**
22. In how many ways can the letter of the word 'DAUGHTER' be arranged show that the vowels may never be separated? **[ans.:4320]**   **[2016(H)]**
23. If $^nC_x = 56$ and $^nP_x = 336$, find n and x. **[ans.: x=3, n=8]**   **[2017(G)]**
24. Find the number or different odd number of 5 digit that can be formed with the digits, of 1, 2, 3, 4, 5 and 6 without repetition. **[ans.:360]**   [2017(G)]
25. If $^nP_2 = 20$, find n. **[ans.:5]**   **[2017(H)]**
26. How many different arrangements can be made with the letters of the word 'GENTLEMENT'? **[ans.:]**
                                                                                              [2017(H)]