

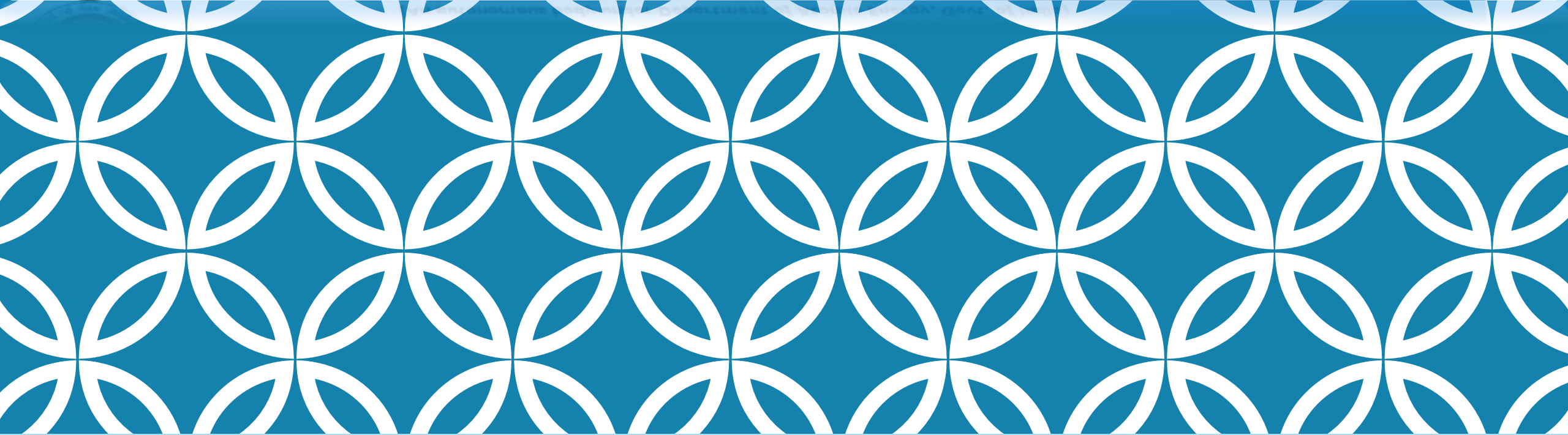


परमाणु ऊर्जा शिक्षण संस्था

(परमाणु ऊर्जा विभाग का स्वायत्त निकाय, भारत सरकार)

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CLASS: XI
SUBJECT: MATHEMATICS
CHAPTER: PERMUTATIONS
AND COMBINATIONS , MODULE-1

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In this chapter we will learn

- Addition principle of counting
- Application of addition principle of counting to daily life problems
- Fundamental principle of counting
- Application of Fundamental principal of counting



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Let's take an example,

A School Boy has 3 Science books and 4 Social books, then find the number of ways in which he can take either 3 science books or 4 social books?

Ans: The number of ways in which the boy can take science books is 3 ,

The number of ways in which the boy can take social books is 4 ,

Now the number of ways in which he can take either of 3 Science books or 4 social books , is $3+4 = 7$





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Let's see another example,

A Grid consists of 36 squares of unit area and 9 of them can be colored in blue, 4 squares can be colored in Green, then find the number of ways in which the grid can be colored either in Blue or Green?

Ans: Number of ways in which the grid can be colored either in Blue or Green is $9+4 = 13$



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From the above two examples we can generalize
ADDITION PRINCIPLE OF COUNTING:

If an event can be performed in 'm' different ways and another in 'n' different ways then the number of ways in which either of the two events can be performed is 'm+n' ways.



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Solve the questions given below :

1. A Boy has 4 blue shirts or 3 green shirts, then how many outfits are there for him to wear? (Ans 7)
2. There are 3 rabbits, 2 birds and 6 fishes. If you can choose only one animal as pet, how many choices do you have? (Ans 11)
3. A Person can choose 4 bats or 3 balls, then the number of ways in which he can choose either of them is? (Ans 7)
4. Three friends wishes to go to a shopping mall, travelling together either by 5 taxis available or by 7 buses available in their residential complex. Find the total number of such ways ?(Ans 12 ways)



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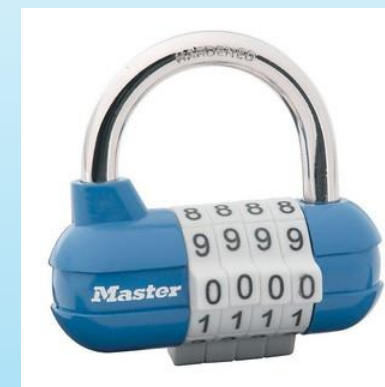
A suit case has a number lock with 4 wheels each labelled with 10 rings and the digits varies from 0 to 9. The lock can be opened if 4 specific digits are arranged in a particular sequence. Find the number of attempts that can be made, if

- (a) Repetition of digits is allowed.
- (b) Repetition of digits is not allowed.

Ans :

- (a) As the repetition of digits is allowed, each wheel can be arranged from 10 rings. Then the number of ways is $10 \times 10 \times 10 \times 10 = 10^4$
- (b) Repetitions are not allowed, the first wheel can be chosen from 10 rings, the second wheel from 9 rings, third wheel from 8 rings and fourth wheel from 7 rings.

Hence, The number of ways of opening the number lock is $10 \times 9 \times 8 \times 7 = 5040$





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To solve more such questions, we can apply the fundamental principle of counting, which states that

“ If an event can occur in m different ways ,following which another event can occur in n different ways,then the total number of occurrence of the events in the given order is $m \times n$ ”.



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The above principle may be generalized for any finite number of events .For examples for three events,the principle is as follows:

“ If an event can occur in m different ways, second event can occur in n different ways, following which a third event can occur in p ways, then the total number of occurrence of the events in the given order is $m \times n \times p$ ”



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Some Examples on fundamental principle of counting:

- There are 4 doors to enter the Hall and 3 doors to exit, then find the number of ways of entering the Hall and leaving the Hall.

Ans: The number of doors for entry is 4 and the number of doors for exit is 3, hence by the fundamental principle of counting the total number of ways of entering the Hall and leaving the Hall is $4 \times 3 = 12$.



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- Find the number of different signals that can be generated by arranging 2 flags, one below the other out of 5 different flags?

Ans: The number of ways in which one flag can be selected out of 5 flags is 5 and the number of ways in which second flag can be selected out of the remaining flags is 4 .

Hence the total number of signals that can be generated if these two flags can be placed one below the other is $5 \times 4 = 20$.



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How many 5 digit numbers can be formed out of the numbers 1 to 9 ,

- (i) if the repetition of digits is not allowed
- (ii) if the repetition of digits are allowed.

Ans: By the fundamental principle of counting ,if the repetition of digits is not allowed

(i) the number of ways in which the units place can be filled out of 9 digits is 9, the number of ways in which the ten's place can be filled out of 8 digits is 8, similarly the three other places of the 5 digits can be filled is 7,6,5 respectively .

Hence the total number of 5 digits that can be formed out of 9 digits that can be formed is $9 \times 8 \times 7 \times 6 \times 5 = 15120$



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(ii) As repetitions are allowed, the number of ways in which the units place can be filled out of 9 digits is 9, the number of ways in which the ten's place can be filled is also 9, similarly the three other places of the 5 digits can also be filled is also 9,9,9

Hence the total number of 5 digits that can be formed out of 9 digits when repetitions are allowed is $9 \times 9 \times 9 \times 9 \times 9 = 9^5$.



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- Find the number of positive integers greater than 6000 and less than 7000 which are divisible by 5, provided that no digit is to be repeated.



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Ans: We know that a number is divisible by 5, if at the units place of the number is 0 or 5.

We have to form 4 digit number which is greater than 6000 and less than 7000 .so ,units digit can be filled in 2 ways.

Since ,repetition is not allowed ,therefore ,tens place can be filled in 8 Ways, similarly hundreds place can be filled in 7 ways. But we have to form a number greater than 6000 and less than 7000. Hence ,thousand place can be filled in only 1 ways.

Therefore the total number of integers = $1 \times 7 \times 8 \times 2$
= 112

Practice Questions:

1. Find the number of integers greater than 7000 that can be formed with the digits 3,5,7,8 and 9 where no digits are repeated. (Ans 192)
2. How many 4-letter code can be formed using the first 10 letters of the English alphabet, if no letter can be repeated? (Ans 5040)
3. Find the number of ways to colour the unit square of a 2 by 2 table with either black or white colour. (Ans 16)
4. How many ways are there to choose 1 consonant and 2 vowels from a set of English alphabets? (Ans 420)
5. Find the number of different signals that can be generated by arranging at least 2 flags in order (one below the other) on a vertical staff, if five different flags are available) (Ans 320)



**THANK YOU
HAPPY LEARNING**

REFERENCES:
NCERT TEXT BOOK,
NCERT EXEMPLAR,
DIKSHA WEBSITE