(iii) Identity Properties:

There exists an identity element $E \in G$, such that for all $A \in G$,

$$E \circ A = A \circ E = A \qquad \forall\ E, A \in G$$

E is known as the identity element of G.

(iv). Inverse Properties:-

for any element $A \in G$, there exist a unique element $B \in G$, such that

$$A \circ B = B \circ A = E$$

then B is called the inverse of A and vice versa.

The number of elements in a group is called its order. A group containing a finite number of elements is called a finite group. A group containing infinite number of elements is called infinite group. An infinite group may be either discrete or continuous. If the number of the elements in a group is denumeriably infinite, the group is known as discrete. such as the number of all integers. If the number of the elements in a group is nondenumerably infinite such as the number of all real number, the group is continuous infinite group.

It is not necessary that the elements of a group commute with each other i.e $B \circ A \neq A \circ B$. but it will be group.

If the elements of a group commute with each other than this type of group is said to be an abelian group.

Example: 1:- Prove that the group of all symmetry transformations of a system is called the group of the system.

Proof:- A transformation which leaves a physical system invariant is called a symmetric transformation of the system. Thus any rotation of a circle about an axis passing through its centre and perpendicular to the plane of the circle is a symmetry transformation for it. A permutation of two identical atoms in a molecule is a symmetry transformation for the molecule.

First of all it is observed that if there are two symmetry transformations of system successively, the system remains invariant. Then the composition of any two symmetry transformations of the system is again a symmetry transforation of the systems i.e. the set is closure under the law of successive transformation. Now identity property of successive transformation also holds because this transformation leaves the system unchanged. Given transformation, it is seen that there exists an inverse transformation which also belongs to this set. Finally, the successive transformation of the system obeys the associative law. The proves that the group of all symmetry transformations of system is called the group of system. This property is applicable in identical physical systems.