Point symmetry, point groups of molecules

An action that leaves an object looking the same after it has been carried out is called a symmetry operation.

There is a corresponding symmetry element for each symmetry operation.

1. symmetry elements (five) and symmetry operations (Schönflies symbols)

symmetry operation	symmetry element
n-fold rotation	C_n
reflection	σ
inversion	i
n-fold improper rotation	S_n
identity	E

2. symmetry point group

According to their inherent symmetry elements, molecules can be classified systematically in so called symmetry groups (point groups).

There are two systems of notation. One is Schoenflies system, the other is Hermann-Mauguin system. The Schoenflies system is more common for the discussion of individual molecules. The Hermann-Mauguin system is used almost exclusively in the discussion of crystal symmetry. Here, we use Schoenflies symbols.

Examples for point group symbols are: Cs, Td, Oh…

To determine the point group of a molecule "Decision Trees) can be used (see for instance reference 1)

Examples:

SiIClBrF	C_1
H_2O	C_{2v}
$SiCl_4$	T_d

Reference:
1) Shriver and Atkins, Inorganic chemistry, Oxford, 4th edition, 2006, 196
2) Atkins, Physical chemistry, Oxford, 8th edition, 2006, 405