

Homework #2

Assigned: 27.10.2021

Due: 10.11.2021

Symmetry group of benzene and character table of its subgroup C_{6v} (13 points)

1. (7 points) Determine the symmetry group of the benzene molecule (C_6H_6) in its equilibrium geometry and construct the character table of its 12-element subgroup C_{6v} . The solution must contain unambiguous step by step explanation of the procedure without any (educated) guessing involved.
2. (6 points) Consider the function space

$$\text{Span}\{x^2, y^2, z^2, xy, xz, yz\}.$$

Determine its irreducible invariant subspaces under the action of C_{6v} and assign them (i.e., their bases) to the irreducible representations.

Cyclic group (7 points)

1. (4 points) Construct the character table of an abstract 4-element cyclic group.
2. (3 points) Find some isomorphic point group and find the decompositions of the vector and pseudovector representations. Assign the linear functions x , y , z , and the rotations (or their linear combinations) to the appropriate irreducible representations.

Hint: Cyclic group is Abelian and has, therefore, only one-dimensional complex irreducible representations. For the sub-task 2 it is however necessary to find real representations, which might be higher-dimensional and, strictly speaking, reducible).