Homework #2

Assigned: 1.11.2019   **Deadline: 15.10.2019**

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

1. *(7 points)* Determine the symmetry grouop of benzene molecule (C_6H_6) in its equilibrium geometry and construct character table of its 12-element subgroup C_{6v}. The solution must contain unambiguous step by step explanation of the procedure.

2. *(6 points)* Consider function space with a basis of $\{x^2, y^2, z^2, xy, xz, yz\}$. Determine irreducible invariant subspaces of this vector space under the action of C_{6v} and assign them (i.e., their bases) to the irreducible representations found in the previous sub-task.

Note: Systematic solution of the second sub-task will be only discussed in the 8.11. lecture. The key is the decomposition of a representation obtained as a direct product of two vector representations (with represenation space defined by the basis $\{x, y, z\}$). However, the problem can be solved already now with the aid of some geometrical visualization.

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 determine according to which irreducible representations are transformed the vectors (linear functions x, y, z) and pseudovectors.

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).