Exercise-sheet 8 (July 4, 2017)

1 Homework - due Date: July 11, 2017 (20 points).

1.1 Character table of the octahedral group $\mathcal{O}$

Use the set of real basis functions for the irreducible representations of the octahedral group

	Basis
A_1	$x^2+y^2+z^2$
A_2	xyz
E	x^2-y^2, $3z^2-r^2$
T_1	x, y, z
T_2	xy, yz, zx

and its conjugacy classes to generate the character table of the group.

1.2 Decomposition of the $s-$, $p-$, $d-$ and $f-$representations into the irreducible representations of $\mathcal{O}$

Use

(a) the characters of the representations provided by the $s-$, $p-$, $d-$ and $f-$functions, that is, the irreducible representations of SO(3) derived in the tutorial,

(b) the characters of the octahedral group $\mathcal{O}$ derived in the exercise above and

(c) the orthogonality relation for the number of times the jth irreducible representation occurs in a general representation

$$a_j = \frac{1}{\mathcal{N}} \sum_{k=1}^{r} \mathcal{N}_k \, \chi_j^*(\mathcal{C}_k)\chi(\mathcal{C}_k), \tag{1}$$

where $\mathcal{N}$ is the order of the group, the summations is over the classes $\mathcal{C}$ and $\mathcal{N}_k$ is the number of elements in the kth conjugacy class,

to decompose the $s-$, $p-$, $d-$ and $f-$representations into the irreducible representations of the octahedral group $\mathcal{O}$.