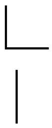
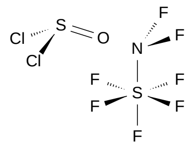
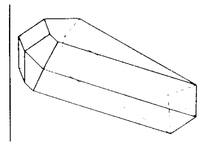
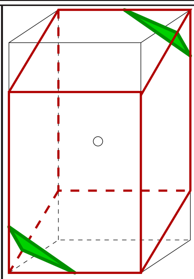
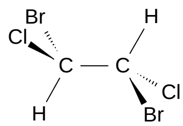
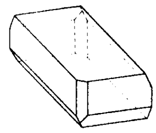
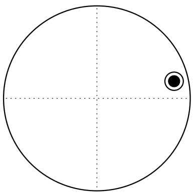
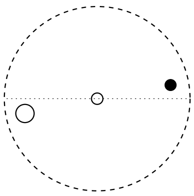
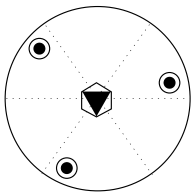
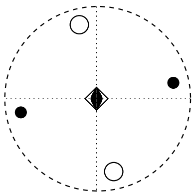
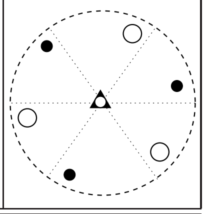
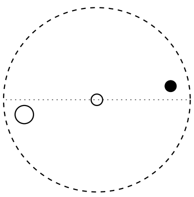
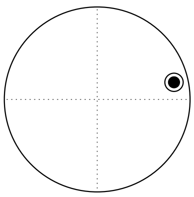
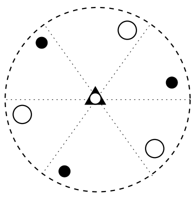
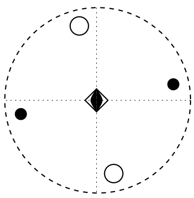
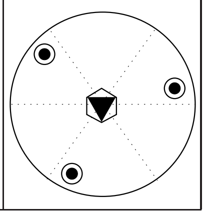
2.2. Symmetrie-Elemente/Operationen (2- und 3-dimensional)

Spiegelebene, Inversionszentrum

Hermann-Mauguin-	Schönflies-	Zeichen	Beispiele			
Symbol			2-dimensional	3-dimensional		
				div.	Moleküle	Kristallpolyeder
m	σ					 $Ca_8B_{18}O_{33}Cl_4 \cdot 4H_2O$
$\bar{1}$	i					 $MnSiO_3$

Zusammengesetzte Symmetrie-Elemente/Operationen

Elemente	n=1	n=2	n=3	n=4	n=6
Drehspiegelachse	S_1 σ	S_2 i	S_3 C_{3h}	S_4	S_6
$\mathbf{S_n}$					
Drehinversionsachse	$\bar{1}$ i	$\bar{2}$ m	$\bar{3}$ 3+i	$\bar{4}$	$\bar{6}$ $\frac{3}{m}$
$\bar{\mathbf{n}}$					

Mathematische Beschreibung: Matrizen der Symmetrieoperationen

bzgl. Koordinatensystem mit z als Drehachse/Drehinversionsachse/Drehspiegelachse (kartesische Koordinaten, 3-dimensional)

Basissymmetrieoperationen:

Drehung (Drehwinkel α)

$$\begin{pmatrix} \cos\alpha & \sin\alpha & 0 \\ -\sin\alpha & \cos\alpha & 0 \\ 0 & 0 & 1 \end{pmatrix}$$

Spiegelung (m $\perp$ z)

$$\begin{pmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & -1 \end{pmatrix}$$

Inversion

$$\begin{pmatrix} -1 & 0 & 0 \\ 0 & -1 & 0 \\ 0 & 0 & -1 \end{pmatrix}$$

Zusammengesetzte Symmetrieoperationen:

Drehungspiegelung (Drehwinkel α)

$$\begin{pmatrix} \cos\alpha & \sin\alpha & 0 \\ -\sin\alpha & \cos\alpha & 0 \\ 0 & 0 & -1 \end{pmatrix}$$

Drehinversion (Drehwinkel α)

$$\begin{pmatrix} -\cos\alpha & -\sin\alpha & 0 \\ \sin\alpha & -\cos\alpha & 0 \\ 0 & 0 & -1 \end{pmatrix}$$