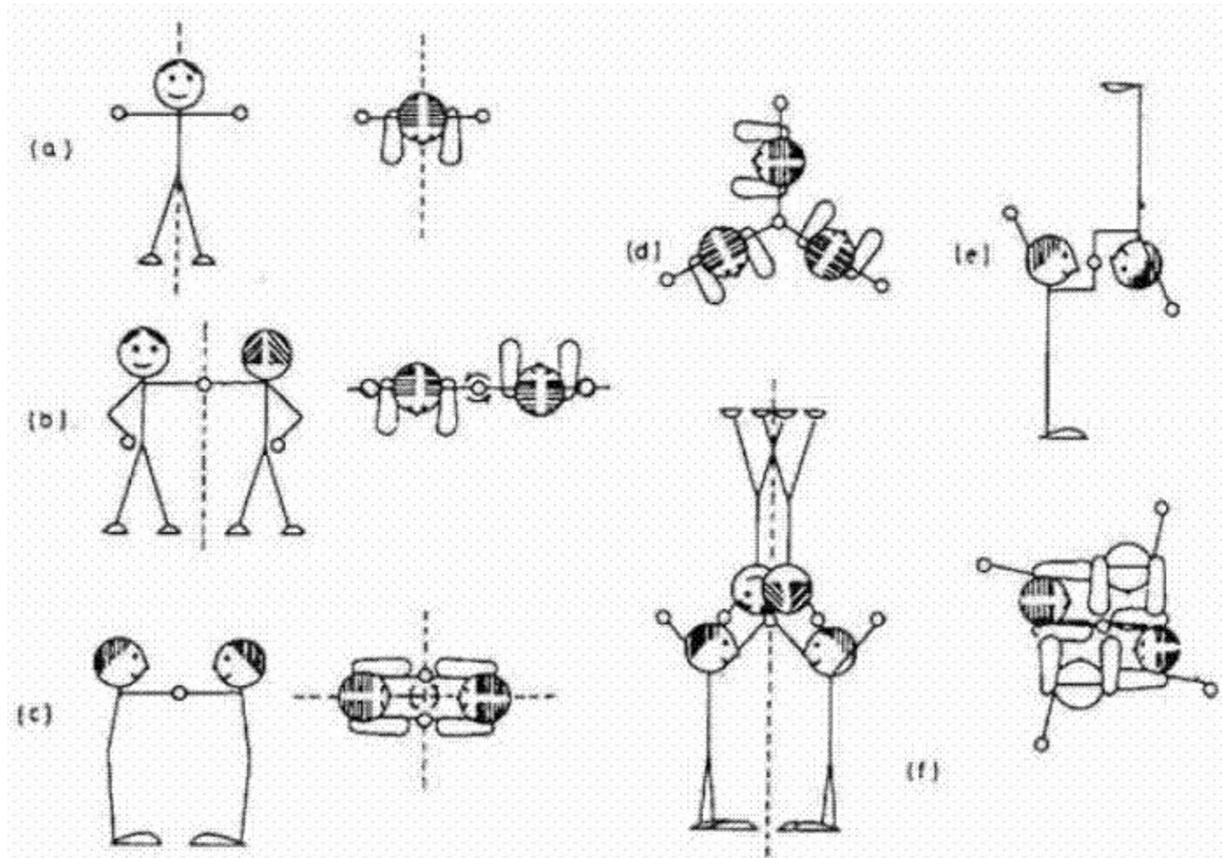


## 5. Homework “Symmetry Operations and Elements”.

1. Find the symmetry elements for each of the pictures below:



2. An object has a *2-fold rotation symmetry axis* (rotation along x-axis) and an *inversion center* (has only diagonal elements, all equal to -1). Prove that this object accepts also the *mirror plane*, perpendicular to the rotation axis.

3. Find the matrices of the next transformations:

- Rotating by  $120^\circ$  around the z-axis and reflecting in the plane perpendicular to the x-axis.
- Rotating by  $90^\circ$  around the y-axis and inverting.

- c) Reflecting in the plane that is parallel to the x,y-axes and rotating by  $60^\circ$  around the x-axis.
- d) Rotating by  $90^\circ$  around the x-axis and rotating by  $120^\circ$  around the z-axis.

4. Find the transformation matrix describing a *6-fold rotation axis* (rotation along z-axis). Show that this *6-fold axis* can be derived from a combination of the *3-fold rotation axis* and the *2-fold rotation axis*.