MATRL 218 : Assignment 2

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1. You have seen the glide g in 1D and 2D. Look up a, b, c, n and d glides in 3D crystals and depict them with appropriate sketches.

2. Cubic cells always have a $\bar{3}$ or 3 in the space group label. What is the $\bar{3}$ symmetry element in a cube?

3. show that $\bar{6}$ also implies a 3-fold rotation.

4. Sketch the 6_1 and 6_5 mirror pairs of symmetry operations and the 6_2 and 6_4 mirrow pairs. Use a low-symmetry motif of the letter "R" for your illustration.

5. Sketch 2D objects with the following symmetries: (i) $2m'$ and (ii) $4mm$. Indicate the mirror lines. Also, mention any other symmetry operations that you find.

6. The plane groups $p31m$ and $p3m1$ differ in that, in one of them but not the other, all rotation axes are on mirrors. Sketch examples of the two plane groups, indicating rotation axes and mirrors.

7. I purchased some interesting postage stamps last year (see below). (i) Identify the outline of the unit cell. (ii) Identify the plane group. Remember to listen to Hendrix while you ponder this problem.

8. Use VESTA to sketch the structures of (i) α-Po, whose structure is given in your notes and determine the coordination number (number of nearest neighbors) and distances of shortest contact. Ensure that the structural images you submit *look* good, like structures that you will find in the PDF file on Oxide Structures on the website.

9. (Bonus) is there any symmetry (when you consider the artwork) to be found in this picture of Janice Joplin's famous Porsche cabriolet?