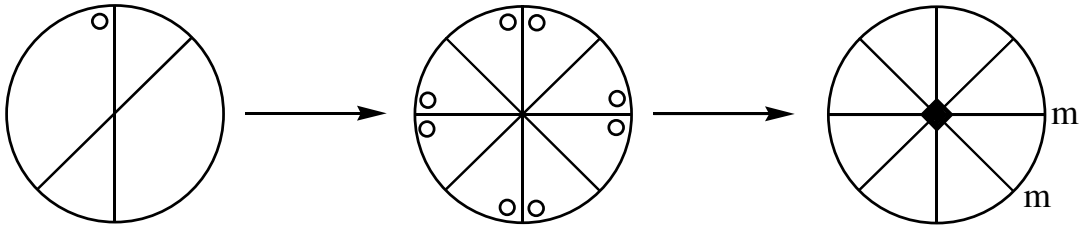
Chemistry 208—Spring 2008 **Problem Set 1**
Professor K. N. Raymond **Answer Key**

1.

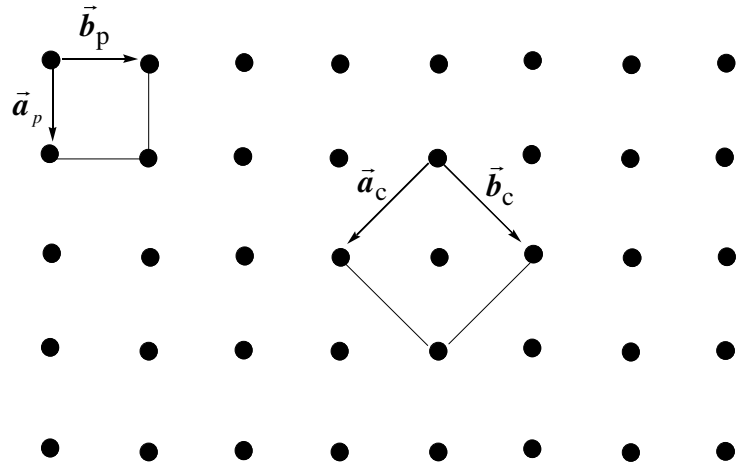
(a) Since the '3' is in the second position, this must be a cubic group. (If you are looking at the symmetry operations from character tables as a cross reference, remember that $\bar{3} = S_6$). The full name of m3 is $\frac{2}{m}\bar{3}1$, which equates to T_h.

(b)



2.

(a), (b)



Both the primitive and centered cells have the same symmetry. The centered cell does not have higher symmetry than the primitive cell. It is a C-centered cell (on the *ab* plane)

$$\vec{a}_c = \vec{a}_p - \vec{b}_p \qquad \vec{b}_c = \vec{a}_p + \vec{b}_p$$

$$\begin{pmatrix} \vec{a}_c \\ \vec{b} \end{pmatrix} = \begin{pmatrix} 1 & -1 \\ 1 & 1 \end{pmatrix} \begin{pmatrix} \vec{a}_p \\ \vec{b}_p \end{pmatrix}$$

(c) A C-centered tetragonal cell can always be reduced to a primitive tetragonal cell.

3.

Crystal Type	Hermann-Maugin	Schoenflies
Triclinic	1	C_1
Monoclinic	2	***C_2***
Orthorhombic	mmm	***D_{2h}***
Tetragonal	4mm	***C_{4v}***
Trigonal / Hexagonal	32	D_3
Hexagonal	***6***	C_6
Cubic	23	***T***
Cubic	***432***	O

4) For each of the 2-D patterns given below, outline what you consider to be the "best" unit cell. Each diagram represents an infinitely repeating pattern. If no satisfactory unit cell can be found, say "none". (You may draw directly on the pattern and turn it in.)