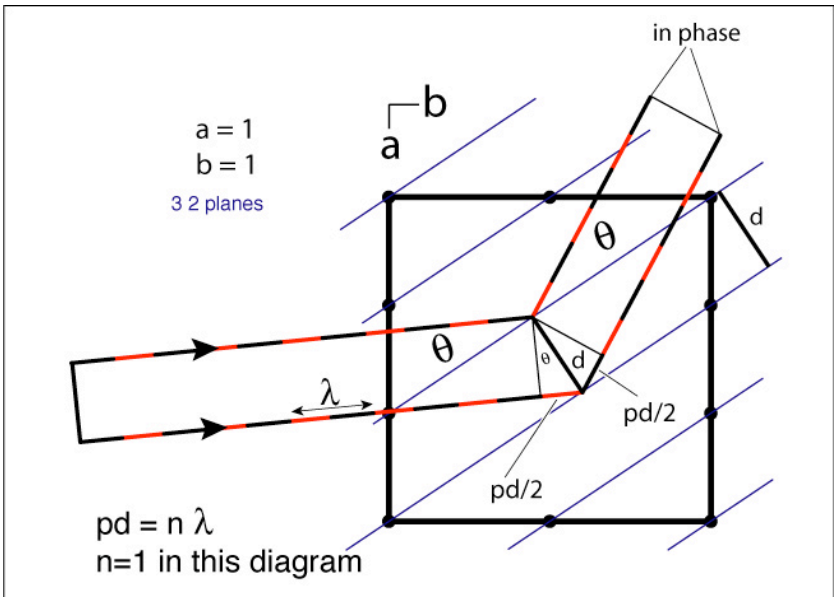
Biophysical Chemistry 6582
Exam 1
MARCH 1, 2004,

I will not cheat today, signed _____ print name: KEY

1. (25) Consider a two-dimensional unit cell with a axis = 100 and b axis = 100, with gamma = 90,
(a) sketch the cell, and add the 3 2 planes,
(b) in (a) illustrate Braggs law, sketch two incoming and outgoing rays, indicate the angle theta, the d-spacing and the path difference,



(no calculations are required to answer c-h, circle the correct response)
(c) would the d-spacing for the 3 3 planes be
less than, **greater than**, or equal to
the d-spacing for the 4 4 planes? **[comment: increasing h and k decreases the spacing]**
(d) would the d-spacing for the 3 3 planes be
less than, greater than, or equal to
the d-spacing for the 2 3 planes? **[decreasing either h or k alone increases the spacing]**
(e) would the d-spacing for the 3 3 planes be
less than, greater than, or equal to
the d-spacing for the 3 2 planes?
(f) would the angle theta for the 3 3 planes be
less than, greater than, or equal to
the angle theta for the 4 4 planes? **[increasing the d spacing decreases θ (nλ=2dsinθ)]**
(g) would the angle theta for the 3 3 planes be
less than, **greater than**, or equal to
the angle theta for the 2 3 planes?
(h) would the angle theta for the 3 3 planes be
less than, **greater than,** or equal to
the angle theta for the 3 2 planes?

2) (25) Indicate the point symmetry (not necessarily the point group) of the following molecules (draw the molecule and the symmetry operators:

a) Water (H_2O)

A twofold bisects the H-O-H bonds. One mirror is in the plane of the three atoms H, O, H. A second mirror is perpendicular to first, and contains the twofold axis.

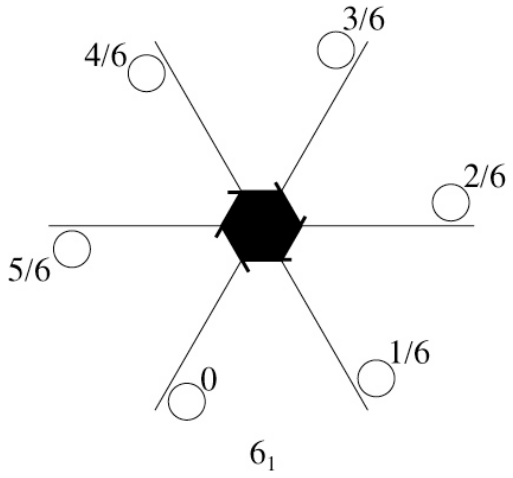
b) Carbon tetrachloride (CCl_4)

There are threefolds along each C-Cl bond. Twofolds bisect each pair of C-Cl bonds There are mirrors in the plane of each set of Cl-C-Cl.

c) CIFClBr (Carbon bonded with 4 different kinds of halogen atoms)

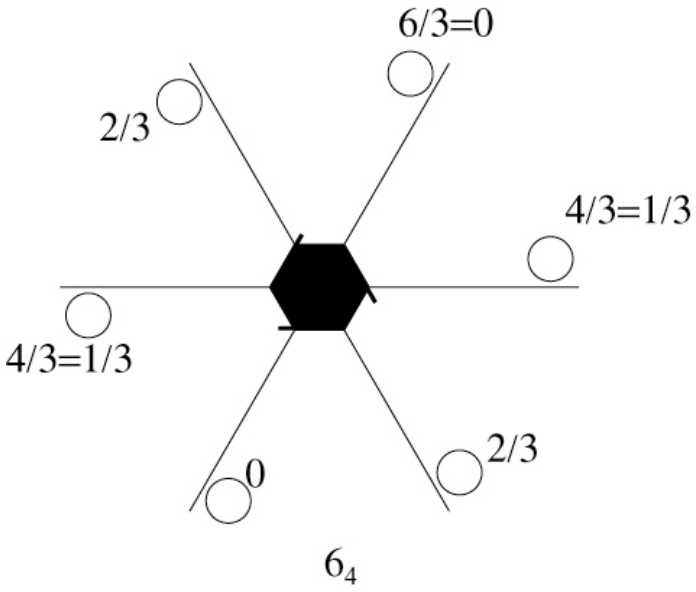
No symmetry at all.

3) (25) For the questions below:
(For full credit, the c-displacement indicators must be equal to or less than 0, and equal to or less than 1)
(a) Sketch a 6_1 screw axis (viewing down the screw axis, i.e., the c-axis) with all the equivalent positions.



6_1

(b) Sketch a 6_4 screw axis (viewing down the axis) with all the equivalent positions.



6_4

4) (25) Add the equivalent positions to the symmetry elements below.