Biophysical Chemistry 6582
Exam 3
April 5, 2004

I will not cheat today, signed ____________ print name:___KEY_______________

1) (30 points total) Patterson Function: For crystal with only a single atom in unit cell a = 10, b = 20, c = 30 (Å), $\alpha = \beta = \gamma = 90°$:

a) (10) What peaks would you expect in Patterson Space if the position of the atom in fractional coordinates is (0.10, 0.10, 0.10) in space group is P1? [give peak positions in 3D (i.e., with three coordinates) with units Å]

If an atom is located at (0.10, 0.10, 0.10), by translational symmetry additional atoms are located at (1.10, 0.10, 0.10), (0.10, 1.10, 0.10), (1.10, 1.10, 0.10), etc (fractional cords). There is no additional symmetry in space group P1. Therefore Patterson peaks are found at (0,0,0), (±1,0,0), (±1, ±1,0), (0, ±1,0), (0,0, ±1), etc. In Å, these positions are (0,0,0), (±10,0,0), (±10, ±20,0), (0, ±20,0), (0,0, ±30), etc.

b) (10) What peaks would you observe in Patterson Space if the position in fractional coordinates is (0.20, 0.40, 0.33) in space group is P1?

Same as above..

c) (10) What peaks would you expect in Patterson Space if the position in fractional coordinates is (0.20, 0.40, 0.33) and the space group is P2?

A 2-fold along c transforms (0.20, 0.40, 0.33) to (0.-20, 0.-40, 0.33). Therefore Patterson peaks will be observed at (±0.4, ±0.8, 0) (fractional), which is (±4, ±16, 0) (Å). Addition peaks will arise because of translational symmetry, as explained above.

2) (20 points) Draw 1,2 dichloro benzene and indicate the symmetry.

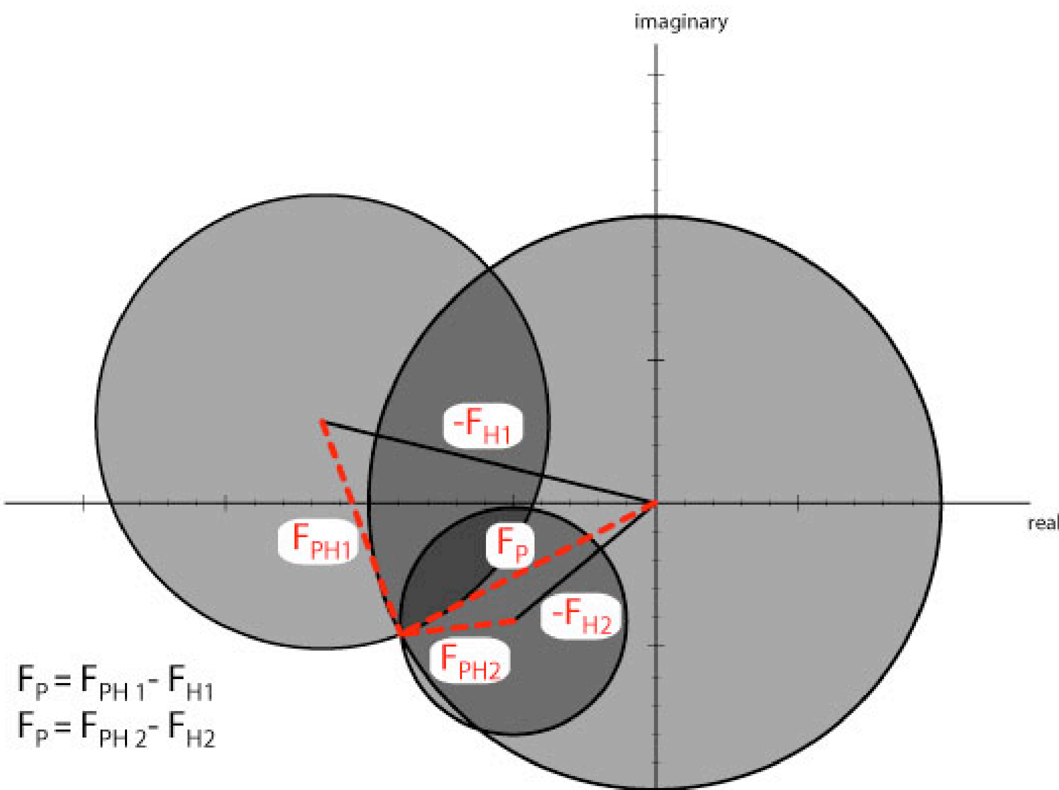
A 2-fold bisects Cl-C-C-Cl,
A mirror bisects Cl-C-C-Cl,
A mirror is located in the plane of molecule.

3) (10 points) Draw a schematic diagram of 2 cycles of a PCR reaction. Indicate all the reactants (primers, templates) and products.

see assigned paper

4) (24 points) Fill in the blanks in the following diagram.

MIR Argand Diagram



$F_P = F_{PH\,1} - F_{H1}$

$F_P = F_{PH\,2} - F_{H2}$

$|F_P| = 10$ $|F_{PH1}| = 8$

$|F_{H1}| = $ 12 $|F_{H2}| = $ 6 $|F_{PH2}| = $ 4

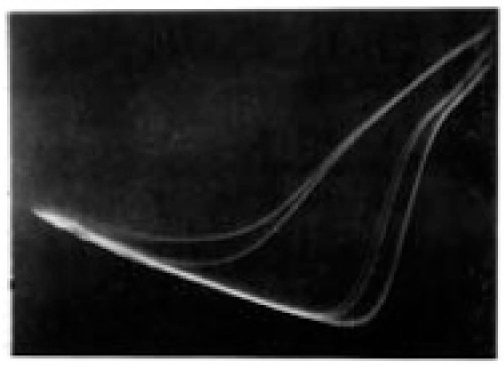
$\Phi_{H1} = $ -15= 345 $\Phi_{H2} = $ 60

$\Phi_{PH1} = $ 110 $\Phi_{PH2} = $ 5 $\Phi_P = $ 205

5) (16 points) Regarding the figure below. What is it? (two sentences) Label the axes.

This is a denaturing gradient, or temperature gradient gel, showing the melting profile of several DNA fragments.

Distance



temperature→