Chemistry 24b (Spring Term 2004)
Problem Set #4
Due: May 10, 2004

Part I

From Tinoco, Sauer, Wang, and Puglisi, Chapter 12: Problems 5, 14, 15, and 17

Part II

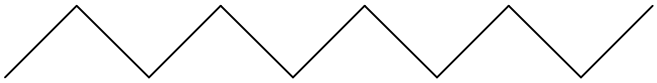
Problem A

(a) What is the theoretical lower limit to the measured spacings of a crystal structure if copper radiation (λ = 1.54Å) is employed?

(b) Suppose you wish to record 2Å resolution x-ray data on photographic film with copper radiation. With square sheets of film 12.5 cm on an edge, what is the maximum distance the film can be placed from the crystal to receive all desired data? Assume the film is perpendicular to the beam of x-rays.

Problem B

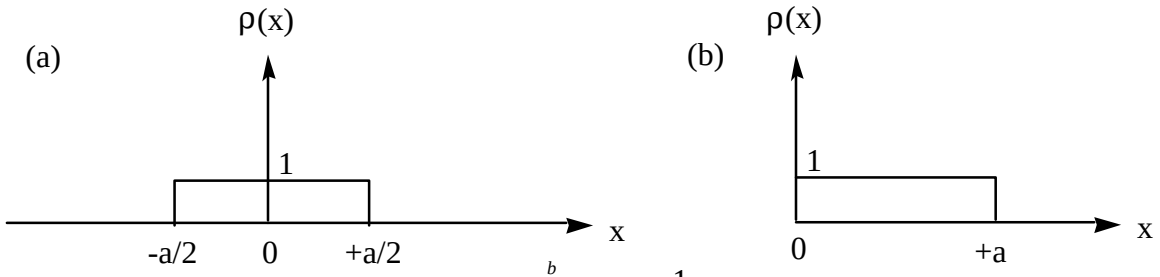
Describe and draw the form of the diffraction pattern of a helix, given that (1) the diffraction pattern of a linear array of points is a set of parallel lines, each perpendicular to the array and the diffraction pattern of a set of parallel lines is a linear array of points perpendicular to the lines. And (2) the structure of a helix can be represented crudely by two sets of parallel line segments:



Problem C

Evaluate analytically the observed scattering pattern from the following one-dimensional objects, using the relationship:

$$F(S) = \int_{-\infty}^{\infty} r(x) e^{2piSx} dx$$



Note: This integral may be helpful: $\int_a^b e^{px} dx = \frac{1}{p}\left(e^{pb} - e^{pa}\right)$