PHY 6/75101 November 16, 2007

Classical Mechanics — Homework #7

The due date for this homework is Monday November 26.

A. Find the eigenfrequencies for small oscillations of the symmetric diatomic molecule, using normal coordinates from the beginning.

B. Three identical springs (force constant k) are joined in a loop and are constrained to lie along the circumference of a circle. Three identical masses m are attached to the springs, one at each junction. Neither gravity nor friction need be considered. Find the eigenfrequencies for small oscillations along the arc of the circle, and describe each normal mode of oscillation. For the latter purpose, it is sufficient to find the relative amplitude and phase of the vibration of each mass.

C. Find the eigenfrequencies for small oscillations in a system similar to problem B above, but with six instead of three identical springs and masses. This has applications as a simple model of the benzene ring. Find the six eigenfrequencies of this system. You are not asked to identify the normal modes of oscillation.

D. The linear triatomic molecule can be treated as a problem in two degrees of freedom y_1 and y_2 by requiring that the center-of-mass of the system remains at rest. Find the eigenfrequencies and normal modes of oscillation in this coordinate system and verify that your results agree with the alternative treatment in section 6-4 of Goldstein.