

**PHYS 222 Classical Mechanics II (Spring 2019)**  
**Homework #3, due Thursday Feb 28 in class**

Coupled oscillations.

1. Problem 12-16 in Marion. Find eigenfrequencies only (no need to find the two sets of initial conditions asked in the problem).  
*Hint: In this problem it is convenient to use two generalized coordinates: i) the angle between the vertical and the line that connects the fixed point and the center of the hoop ii) the angle between the vertical and the line that connects the center of the hoop and the small mass.*
2. Problem 12-21 in Marion.
3. Problem 12-23 in Marion. You may skip doing example 12-3.
4. Problem 12-27 in Marion. For simplicity assume that  $m_1 = m_2 = m$  and  $L_1 = L_2 = L$ .
5. Consider a linear triatomic molecule,  $AB_2$ , where atom A is in the center and has mass  $M$ , while atoms B are on the sides and their masses are  $m$ . In the case of small oscillations, we may assume that atom A is connected to each atom B with a spring of stiffness  $k$ . Find eigenfrequencies of this molecule and describe its normal modes (i.e. indicate which atom moves in which direction).