A-5

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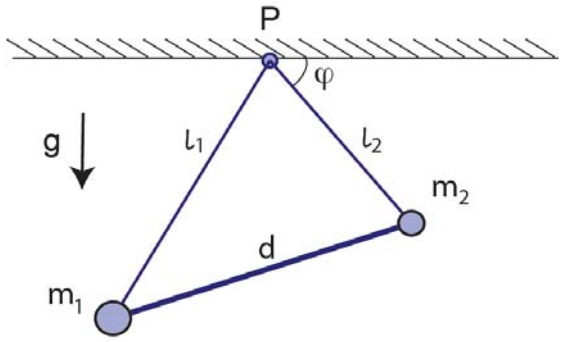

Two masses m_1 and m_2 ($m_1 \neq m_2$) are connected by a rigid rod of length d and of negligible mass. An extensionless string of length l_1 is attached to m_1 and connected to a fixed point of support P. Similarly, a string of length l_2 ($l_1 \neq l_2$) connects m_2 and P. The assembly is subject to a uniform gravitational field of magnitude g directed as shown in the figure, and is able to move only within the plane of the figure.

(a) Using the Lagrangian or otherwise, obtain the equation of motion for the angle ϕ defined in the accompanying figure. Do not assume ϕ is small.

(b) Find the frequency of small oscillations around the equilibrium position of the assembly ϕ_O. You do not need to find ϕ_O explicitly but you must write down an equation that it satisfies.