

## Quiz No. 2

Wednesday, December 10, 2003

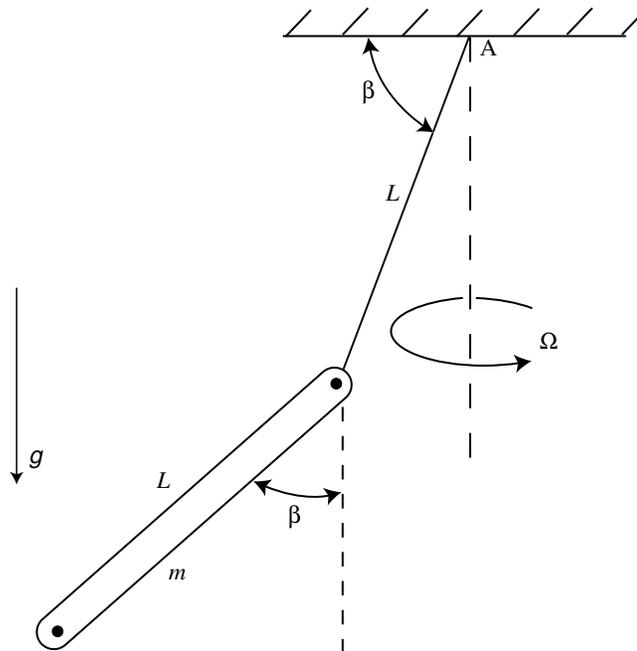
This is a CLOSED BOOK Quiz. Each student may only bring two  $8\frac{1}{2}\times 11$  inch sheets of self-prepared notes.

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**Problem 1** (10 points)

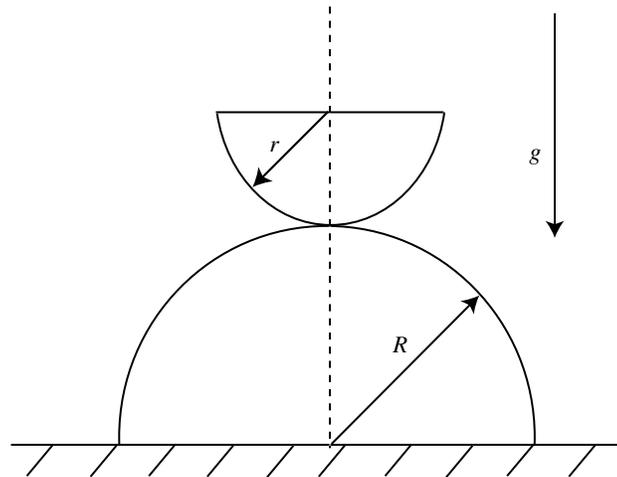
A slender rigid bar (of mass  $m$  and length  $L$ ) is suspended by a cable (of length  $L$  and negligible mass) from pivot A and executes a steady precession about the vertical axis at angular speed  $\Omega$  as it maintains the orientation shown in the sketch below.

Determine  $\Omega$  and the angle of inclination  $\beta$ .



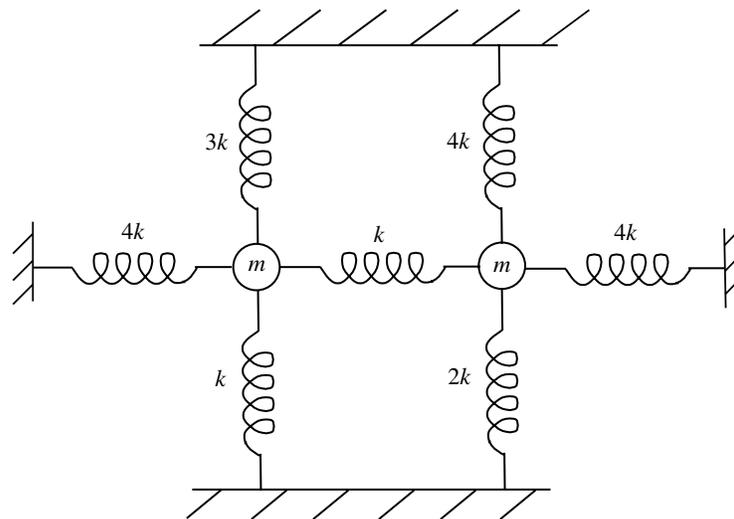
**Problem 2** (10 points)

A rigid half cylinder of radius  $r$  and uniform mass density rests on top of a fixed half cylinder of radius  $R$ , as shown below. Assuming that no slipping occurs, under what conditions is the equilibrium position stable to small perturbations?



**Problem 3** (10 points)

The motion of the two masses shown below is restricted to the plane of the sketch. Neglecting the effect of gravity, determine the natural frequencies of vibration and associated mode shapes for small departures from equilibrium of this system.



\*\*\*\*\* HAPPY HOLIDAYS \*\*\*\*\*