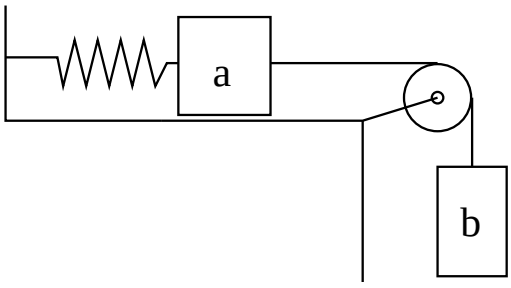
Problem 1. **Two masses, m_a and m_b are connected by a massless string looped over a massless pulley. Mass m_a slides along a frictionless surface and is also connected to a massless spring with constant k. Mass m_a is held in place at point where the spring is unstretched and is then suddenly released.**



a) Find the tension in the string just after the mass is released.

COMMENTS

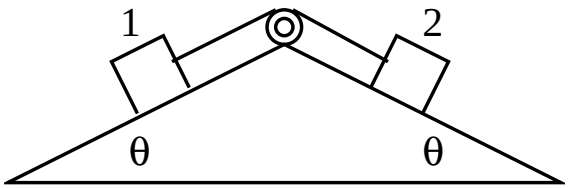
b) Mass m_b falls and the spring stretches a maximum distance D at which point the direction of motion reverses. Find the tension in the string at the instant that the motion reverses.

COMMENTS

c) Suppose that the position of mass m_a is gently adjusted until the system is in its equilibrium configuration. By how much is the spring stretched?

COMMENTS

Problem 2. Two blocks, m_1 and m_2 are connected by a massless string looped over a massless pulley. They slide along a double incline whose two sides make angle θ to the horizontal. The coefficient of friction between each of the blocks and the incline is μ. The mass of block m_2 is greater than that of m_1. You may take the coefficients of sliding and static friction to be equal.



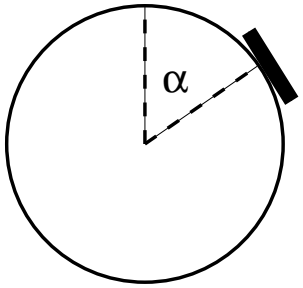
a) Assuming that the blocks *do* accelerate, find the accleration of m_2

COMMENTS

b) Taking m_1 to be given, find the minimum value of m_2 required for the blocks to accelerate.

COMMENTS

Problem 3. A skier starts at the top of a very large frictionless snowball with a very small initial speed and skis straight down the side (the figure at right shows only the skis). At what point does she lose contact with the snowball and fly off at a tangent? That is, at the instant she loses contact with the snowball, what angle α does a radial line from the center of the snowball to the skier make with the vertical?



COMMENTS

Problem 4. An object with mass m moves in one dimension, x under the influence of a consrvative force given by $F = -(4Px^3 - 2Qx)$ where both P and Q are positive.

a) What are the units of P and Q?

COMMENTS

b) Find the potential energy of the mass as a function of its position.

COMMENTS

c) Find a position at which the mass is in stable equilibrium.

COMMENTS

d) Find the work done by the force on the object as it moves from $x = 0$ to $x = \sqrt{\frac{Q}{2P}}$.

COMMENTS