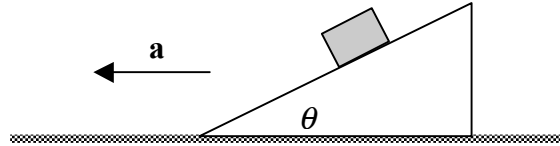


Supplementary Problems for Topics I

1. A small block of mass m is on a wedge as shown. The wedge is being accelerated to the left at rate a .

- a. If there is no friction between the block and the wedge, for what value of a will the system move with the block at rest relative to the wedge?



Now suppose there is friction, but the coefficient of static friction, μ_s , is not sufficient to keep the block from sliding if the wedge is at rest.

- b. What is the minimum value of a such that the block does not slide down the wedge?
- c. What is the maximum value of a such that the block does not slide up the wedge?

Give answers in terms of g , μ_s and θ .

2. A ball of mass m is attached to a massless string of length L , which is attached to a ceiling as shown. The ball is pulled back until the string makes angle θ with the vertical, and it is released from rest. At the bottom of the swing, the string encounters a peg at distance d below the ceiling. The upper part of the string stops moving, while the ball now rotates about the peg in a smaller circle than before.

- a. Suppose the ball makes a complete circle about the peg. What is the minimum speed it must have at the top of that circle?
- b. At what minimum value of θ must the ball be released initially so that it makes a complete circle about the peg? [Take gravitational potential energy to be zero at the bottom of the swing.]
- c. Clearly θ cannot be greater than 90° . What is the smallest value of d for which the ball can make a complete circle about the peg?

