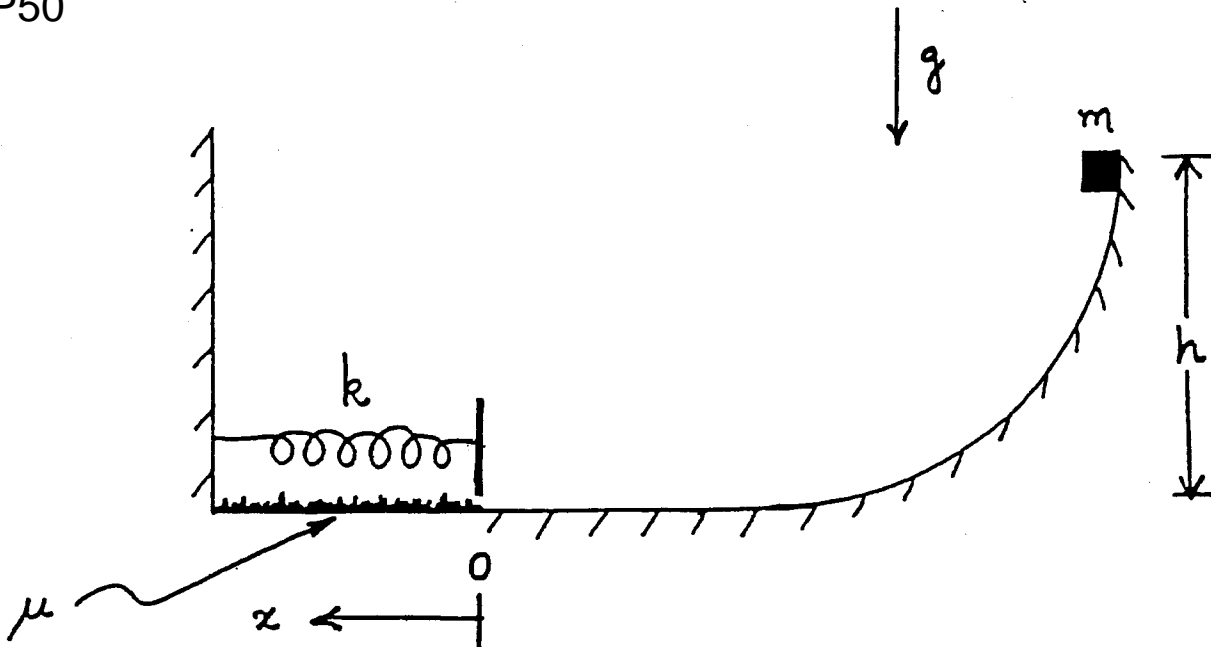


QP50



A block of mass m starts at rest and slides down a frictionless circular ramp from a height h . At the bottom, it hits a massless spring with spring constant k and in addition begins to experience a frictional force. The coefficient of kinetic friction is given by μ .

- (1 point) (a) What is the speed of the block at the bottom of the ramp just before it hits the spring?
- (2 points) (b) Find the total horizontal force on the mass after it hits the spring as a function of the coordinate x given in the diagram.

The mass first comes to rest instantaneously at $x=x_s$. It then rebounds back up the ramp, reaching a maximum height $h' < h$. In the following, express your answer in terms of x_s :

- (2 points) (c) What is the total work done on the mass by the spring and friction between $x=0$ and $x=x_s$?
- (2 points) (d) What is the total energy W_f that has been dissipated by friction when the spring first returns to $x=0$?
- (2 points) (e) Find the vertical height h' up the ramp to which the block rebounds. You may express your answer in terms of W_f .
- (1 point) (f) Find x_s in terms of the quantities shown above.