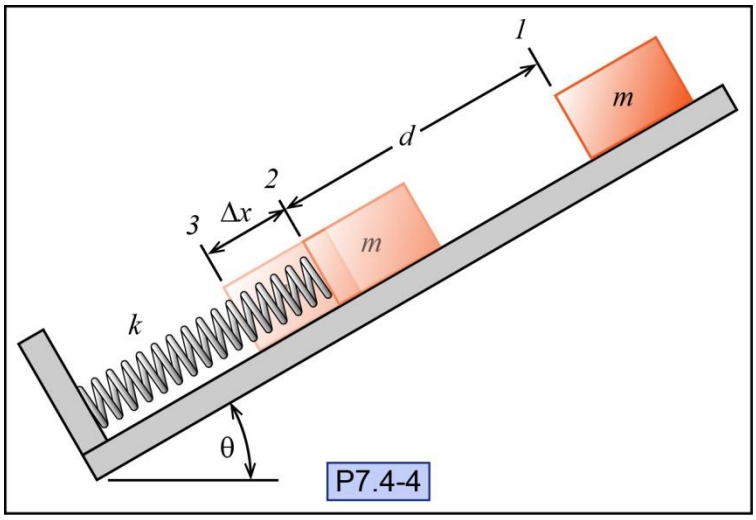
P7.4-4) A 7-kg mass slides down an inclined surface (θ = 40º) until it hits and compresses a spring. The spring is a hard spring with a spring force that is defined by the equation $F_s = kx^2$, where k = 1000 N/m^2. The mass is released from rest at position *1* and slides down the inclined surface d = 2 m before it encounters the spring. If the coefficient of kinetic friction between the mass and inclined surface is 0.62, determine the maximum compression of the spring Δx.

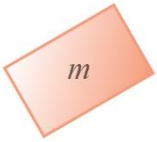


Given:

Find:

Solution:

Free-body diagram



Is this a conservative or non-conservative system?

Which forces are

Conservative:

Non-conservative:

Do no work on the crate:

Friction

Calculate the kinetic friction.

F_{fk} = _____

Work

Derive the work done by the non-conservative forces in variable form.

U_{non} = _____

Derive the work done by the spring force in variable form.

U_s = _____

Work-Energy Balance

Write down the work-energy balance equation in variable form.

WE.Eq: _____

Calculate the maximum spring compression.

Δx = 0.44 m