

# Warm Up Exercises: Springs, Inclines, and Homework Exercises with Friction

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## 1 Memory Bank

- $\vec{s} = -k\Delta\vec{x}$  ... Spring force.
- $w_x = mg \sin \theta$  ... Weight down the incline, for incline planes.
- $w_y = mg \cos \theta$  ... Weight perpendicular to surface, for incline planes.
- $f = \mu N$  ... Force of friction.

## 2 Force of Friction

1. Suppose 10 sled dogs pull a dogsled across snow. The waxed wood of the sled runners has a coefficient of kinetic friction against dry snow of 0.08. The combined weight of the sled and rider is 250 kg. (a) What is the acceleration, if each dog pulls with a force of 40 N? (b) How long does it take for the system to reach 8 m/s, if initial speed is zero? (c) Proceeding at 8 m/s, how long would it take for the system to travel 10 km?

## 3 Spring Forces and Inclines

1. Suppose a 0.5 kg mass is hung from a spring, and the spring stretches 0.5 m. (a) What is the spring constant,  $k$ ? (b) Assume the spring constant from the prior problem, but now assume the mass is stretching the spring along a 30 degree incline plane (no friction). What is the new  $\Delta x$ ? (c) Now assume there is a *static* coefficient of friction of 0.1 between the mass and the plane. What is the new  $\Delta x$ ?