Friction – Static and Kinetic

Solving Problems with Friction

Some sprinters use a weight to help in training for sprint races. A strap is attached to a block and then dragged behind the sprinter. In this example a 25 kg block is used. The coefficient of static friction (μ_s)is 0.40 and the coefficient of kinetic friction is (μ_k)is 0.30 between the block and the track.

A.   The sprinter can apply of constant force of 100N on the block.
   a. Is the applied force high enough to start the block moving?
   b. If the block does start moving, how long (in seconds) does it take to travel 20m and at what velocity will the block be moving at the 20m mark.
B.   At the end of the 20m the sprinter releases the strap and allows the block to coast to a stop. How long (in seconds) and how far does the block travel before stopping?
C.   In this example a balloon is attached to the block to "lighten" the load. The lift provided by the balloon is 45N. How long (in secs) does it take in this new scenario to travel 20m and at what velocity will the block be moving at the 20m mark?

Friction Practice Questions (only for students who want extra practice):

1. A horizontal force of 50.0N is required to pull a 8.0kg block of aluminum at a <u>uniform</u> velocity across a horizontal wooden desk. What is the coefficient of kinetic friction between the block and the desk?
2. A 125kg block of steel is being pushed across a wooden floor. If the coefficient of static friction (μ_s)is 0.45 and the coefficient of kinetic friction (μ_k)is 0.25 calculate the minimum force required to get the steel block moving and the force required to keep it moving once it is moving at a constant speed.
3. The driver of a 2.00×10^3 kg car applies the brakes on a dry concrete roadway. Calculate the force of friction between the tires and the road surface if μ_k=1.02.
4. A 20 kg box is dragged across a level floor with a force of 100N. The coefficient of kinetic friction between the box and the floor is 0.32 and the coefficient of static friction is 0.45.
a. Will the box start moving and if so what is the acceleration?
b. If a 10 kg weight is added to the box, will the 100N be enough to start the box moving and if so what is the acceleration?

a.

20kg $\longrightarrow F_{app}$ = 100N

b.   10kg

20kg $\longrightarrow$ F_{app} = 100N
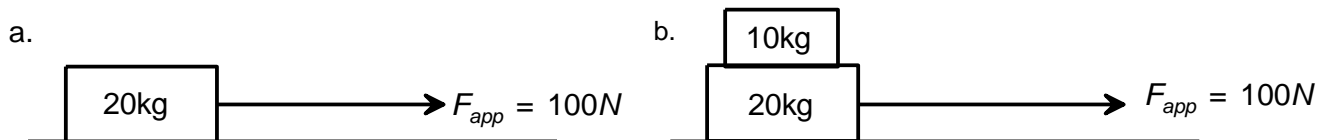
5. A 0.170 kg hockey puck is travelling at 19m/s when it strikes a rough patch of ice with a coefficient of kinetic friction (μ_k)equal to 0.47. How far will the puck travel before it stops on this rough ice?