Name: KEY

Date:

Section C D F

The Masters School
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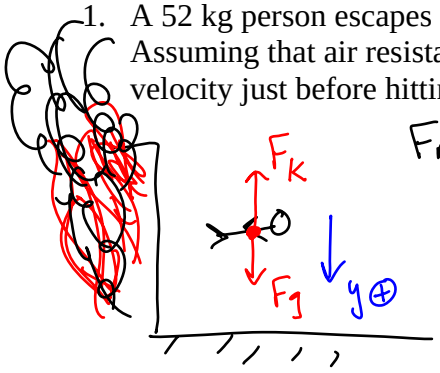
Physics

Forces III

1. A 52 kg person escapes from a burning building by jumping from a window 35 m above a catching net. Assuming that air resistance exerts a 95 N force on the person during the fall, determine the person's velocity just before hitting the net.



$F_{net,y} = F_g - F_K \neq 0$

$= (52)(9.81) - 95$

$F_{net,y} = 415.12\ N = ma$

$\frac{415.12}{52} \quad a = 7.98$

$\Delta x = 35\ m$

$v_i = 0$

$v_f = ?$

$a = 7.98$

$\Delta t =$

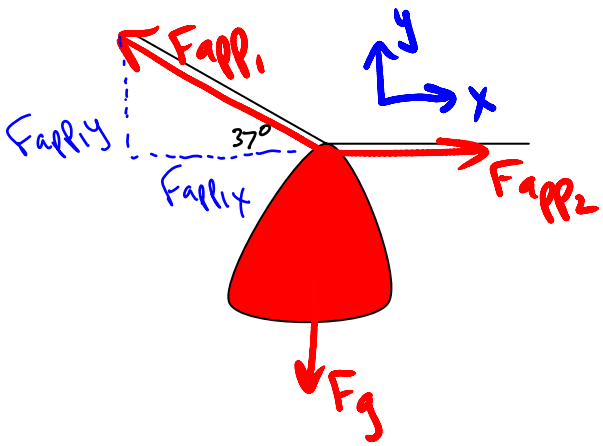
$v_f^2 = v_i^2 + 2a\Delta x$

$= 0 + 2(7.98)(35)$

$v_f^2 = 558.8\ m/s$

$v_f = 23.64\ m/s$

2. If the left cable is inclined at an angle 37° above the horizontal, find the force exerted by each cable to support the 800 N bag in Figure 4-32.



$F_{net,x} = F_{app_2} - F_{app_1x} = 0$

$F_{net,y} = F_{app_1y} - F_g = 0$

$F_{app_2} = F_{app_1x}$

$F_{app_1y} = F_g$

$F_g = 800\ N = F_{app_1y}$

$\sin 37° = \frac{F_{app_1y}}{F_{app_1}}$

$F_{app_1} = \frac{F_{app_1y}}{\sin 37} = \frac{800}{\sin 37}$

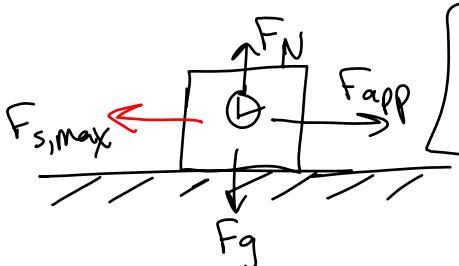
$F_{app_1} = 1329.3\ N$

$\tan\theta = \frac{F_{app_1y}}{F_{app_1x}}$

$F_{app_1x} = \frac{F_{app_1y}}{\tan\theta}$

$F_{app_2} = 1061.6\ N$

3. A 94 kg clock is initially at rest on a horizontal floor.
   a. If it takes a 656 N horizontal force to set it in motion, find μ_s.



$F_{net,x} = F_{app} - F_{s,max} = 0$

$F_{net,y} = F_N - F_g = 0$

$F_{app} = F_{smax} = 656\ N$

$F_g = F_N = mg = 922.14\ N$

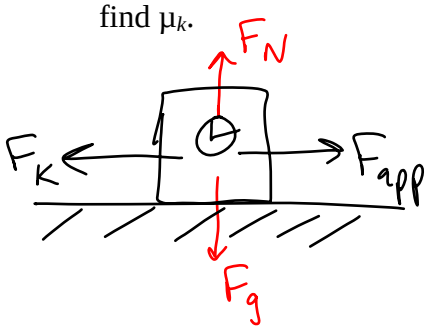
$\mu_s = \frac{F_{s,max}}{F_N}$

$\mu_s = \frac{656}{922}$

$\mu_s = .711$

   b. After the clock is in motion, if a horizontal force of 555 N keeps it moving with a constant speed, find μ_k.

4.



$F_{net,x} = F_{app} - F_K = 0$

$F_{net,y} = F_N - F_g = 0$

$F_{app} = F_K = 555\ N$

$F_N = F_g = 922.14$

$\mu_K = \frac{F_K}{F_N}$

$\mu_K = \frac{555}{922}$

$\mu_K = .602$

A 3.50 kg block starts from rest at the top of a 30.0° incline and slides 2.60 m down the incline in 1.50 s.

a. Find the acceleration of the block.

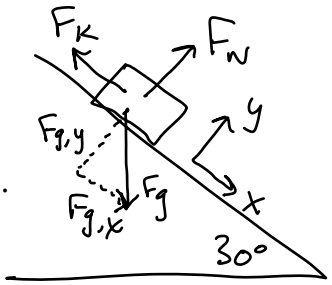
$\Delta x = 2.6\,m$, $v_i = 0$, $v_f = ?$, $a = ?$, $\Delta t = 1.5$

$\Delta x = v_i \Delta t + \frac{1}{2} a \Delta t^2$

$\frac{2\Delta x}{\Delta t^2} = a$

$a = \frac{2 \cdot 2.6}{1.5^2}$

$a = 2.31\ m/s^2$



b. Find the coefficient of kinetic friction between the block and the incline.

$\mu_k = \frac{F_K}{F_N} = \frac{9.0825}{29.735}$

$\mu_k = .305$

$F_{net,x} = F_{g,x} - F_K \neq 0$

$F_{net,y} = F_N - F_{g,y} = 0$

$F_N = F_{g,y} = mg\cos\theta$

$F_N = F_{g,y} = 29.735\ N$

$F_{g,x} = mg\sin\theta$

$F_{g,x} = 17.1675\ N$

c. Find the frictional force acting on the block.

$F_{net_x} = m \cdot a_x$

$F_{net,x} = (3.5)(2.31)$

$F_{net_x} = 8.085$

$F_{net,x} = F_{g,x} - F_K$

$8.085 = 17.1675 - F_K$

$F_K = 9.0825$

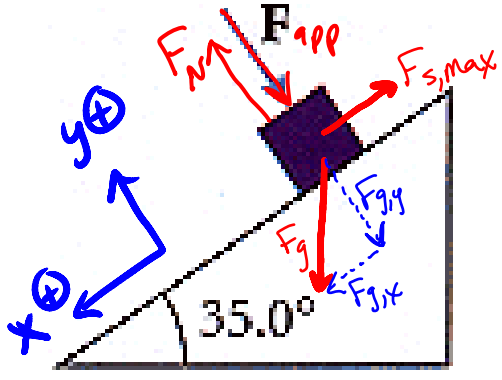
d. Find the speed of the block after it has slid a distance of 2.60 m.

$\Delta x = 2.6$, $v_i = 0$, $v_f = ?$, $a = ?$, $\Delta t = 1.5$

$\Delta x = \frac{1}{2}(v_i + v_f)\Delta t$

$\frac{2\Delta x}{\Delta t} = v_f = \frac{2(2.6)}{1.5} = 3.47\ m/s$

5. The coefficient of static friction between the 22 kg crate and the 35.0° incline of Figure 4-34 is 0.1. What is the minimum force, **F**, that must be applied to the crate perpendicular to the incline to prevent the crate from sliding down the incline?



$F_{net,x} = F_{g,x} - F_{s,max} = 0$ $\quad F_{g,x} = F_{s,max}$

$F_{net,y} = F_N - F_{app} - F_{g,y} = 0$

$F_g = mg = 215.82$

$F_{g,x} = mg\sin\theta = 123.79$

$F_{g,y} = mg\cos\theta = 176.79$

$\mu_s = .1 = \frac{F_{s,max}}{F_N}$

$F_N = \frac{F_{s,max}}{\mu_s} = \frac{123.79}{.1} = 1237.89\ N$

$F_{net,y} = F_N - F_{app} - F_{g,y} = 0$

$F_{app} = F_N - F_{g,y}$

$F_{app} = 1237.89 - 176.79 = 1061.1\ N$