Name KEY

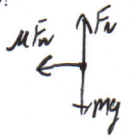
Worksheet #1

Newton's 2nd Law

1. A car is traveling at 22.8 m/s on a horizontal highway.

   a. If the coefficient of friction between road and tires on a rainy day is 0.105, what is the minimum distance in which the car will stop?

   254 m



$ma = \mu(mg)$

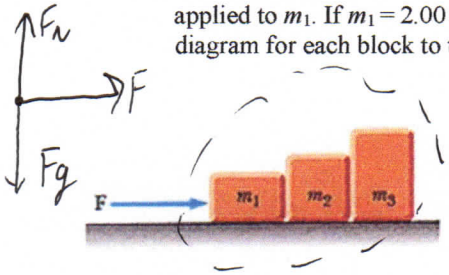
$F_N = mg$ $\quad a = (0.105)(10) = -1.05\ m/s^2$

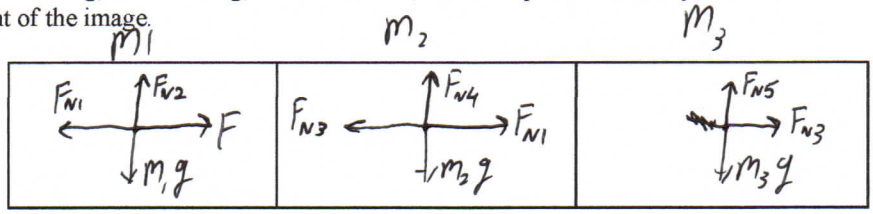
$0 = (22.8\ m/s)^2 + 2(-1.05)(\Delta x)$

$\Delta x = 247.543\ m$

↳ varies bc I used $g = 10$

2. Three blocks are in contact with each other on a frictionless, horizontal surface. A horizontal force **F** is applied to m_1. If $m_1 = 2.00$ kg, $m_2 = 3.00$ kg, $m_3 = 6.00$ kg, and F = 16.0 N, draw a separate free-body diagram for each block to the right of the image.





   a. Find the acceleration of the blocks

   1.45 m/s² (to the right)

$(m_1 + m_2 + m_3)(a) = F$

$(11\ kg)(a) = 16N$

$a = 1.45\ m/s^2$

   b. Find the magnitude of the contact force between m_1 and m_2.

   13.1 N

$(m_1)(a) = F - F_{N1}$

$(2kg)(1.45\ m/s^2) = (16N) - F_{N1}$

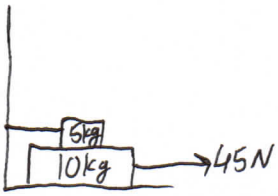
$F_{N1} = 13.1\ N$

   c. Find the magnitude of the contact force between m_2 and m_3.

   8.73 N

$(m_3)(a) = F_{N3}$

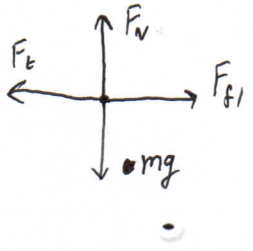
$(6kg)(1.45\ m/s^2) = F_{N3} = 8.73\ N$



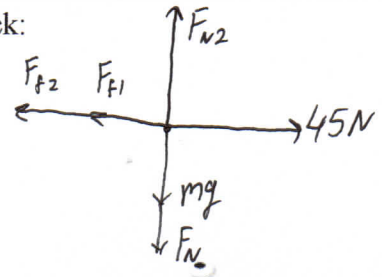
3. A 5.00 kg block is placed on top of a 10.0 kg block. A horizontal force of 45.0 N is applied to the 10.0 kg block, and the 5.00 kg block is tied to the wall. The coefficient of kinetic friction between all surfaces is 0.190.

   a. Draw a force diagram for each block.

5kg Block:



10kg Block:



   b. Determine the tension in the string and the magnitude of the acceleration of the 10 kg block.

9.31 N

0.776 m/s²

$F_N = mg$

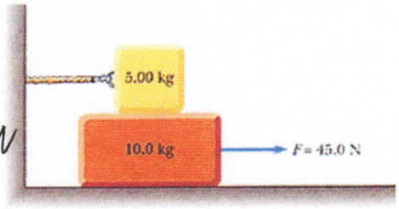
$F_{f1} = F_t$

$F_t = (0.190)(5kg)(9.8\ N/kg) = 9.31N$

$F_{N2} = (10kg)(9.8\ N/kg) + (5kg)(9.8\ N/kg)$

$F_{N2} = 147N$

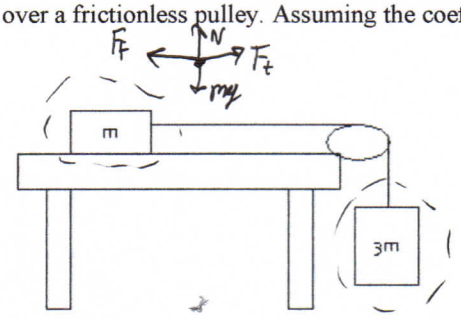
$F_{f2} = (147N)(0.19) = 27.93N$

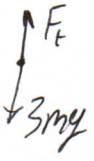


$(10kg)(a) = (45N) - (27.93N + 9.31N)$

$a = 0.776\ m/s^2$

4. Two masses are tied together by a string of negligible mass. The block of mass *m* is set on a table, while the block of mass *3m* is draped over a frictionless pulley. Assuming the coefficient of friction between the table and block *m* is u_k:





$3ma = 3mg - F_t$

$ma = F_t - F_f$

   a. Write an expression for the coefficient of kinetic friction in terms of a and g.

$4ma = 3mg - (F_N)(\mu_k)$

$4ma = 3mg - (mg)(\mu_k)$

$\mu_k = \dfrac{3mg - 4ma}{g}$

   b. Write an expression for the tension force acting on the block of mass *3m* in terms of m, a, and g.

$F_t = 3mg - 3ma$