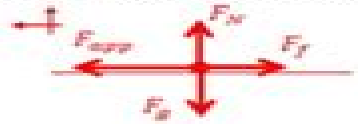
Problems

1. A force of 1.2 N [←] is applied to an object of mass 1.5 kg. It accelerates at 0.50 m/s^2 [←] along a surface. Determine the force of friction that is acting and the coefficient of kinetic friction involved.



$\sum F_x = F_{app} - F_f = ma$

$\sum F_y = F_N - F_g = 0$

From x dir:

$F_{app} - F_f = ma$

$F_f = F_{app} - ma$

$F_f = 1.2\,N - (1.5\,kg)(0.50\,m/s^2)$

$F_f = 0.45\,N$

$F_f = 0.45\,N\,[\rightarrow]$

From y dir:

$F_N - F_g = 0$

$F_N = F_g$

$F_f = \mu F_N$

$\mu = \frac{F_f}{mg}$

$\mu = \frac{0.45\,N}{(1.5\,kg)(9.8\,m/s^2)}$

$\mu = 0.03$

2. Two children pull a toy truck of mass 2.4 kg along a rough horizontal surface. One child pulls with a force of 8.4 N [N] and the other pulls with a force of 3.6 N [S]. The coefficient of friction between the toy and surface is 0.18. What is the acceleration of the toy?

$\sum F_y = F_N - F_g = 0$

$F_N - F_g = 0$

$F_N = F_g$

$\sum F_x = F_1 - F_2 - F_f = ma$

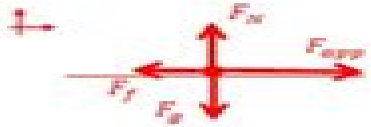
$a = \frac{F_1 - F_2 - \mu mg}{m}$

$a = \frac{8.4\,N - 3.6\,N - (0.18)(2.4\,kg)(9.8\,m/s^2)}{2.4\,kg}$

$a = 0.236\,m/s^2$

$a = 0.24\,m/s^2\,[N]$

3. What minimum magnitude of force would be required to start a 1.0-kg object sliding along a horizontal surface if the coefficient of static friction is 0.20?



$\sum F_y = F_N - F_g = 0$

$F_N - F_g = 0$

$F_N = F_g$

$\sum F_x = F_{app} - F_f = ma$

$F_{app} - F_f = 0$

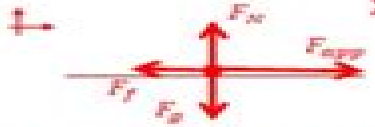
$F_{app} = \mu mg$

$F_{app} = (0.20)(1.0\,kg)(9.8\,m/s^2)$

$F_{app} = 1.96\,N$

$F_{app} > 2.0\,N$

4. Show that an applied force of 4.0 N is insufficient to get a stationary 2.0-kg object to move horizontally if the coefficient of starting friction is 0.25.



$\sum F_y = F_N - F_g = 0$

$F_N - F_g = 0$

$F_N = F_g$

$\sum F_x = F_{app} - F_f = ma$

$F_{app} - F_f > 0?$

$F_{app} - \mu mg > 0?$

$4.0\,N - (0.25)(2.0\,kg)(9.8\,m/s^2) > 0?$

$-0.9\,N > 0?$

Since the applied force is not large than the force of static friction, their sum is less than 0 N and therefore insufficient to get the object moving.

Dynamics Problems And Solutions

Léo Pomar

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Chemical News and Journal of Physical Science William Crookes,James H. Gardiner,Gerald Druce,H. W. Blood-Ryan,1919

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