

Problems

1. A force of 1.2 N [\leftarrow] is applied to an object of mass 1.5 kg. It accelerates at 0.50 m/s² [\leftarrow] along a surface. Determine the force of friction that is acting and the coefficient of kinetic friction involved.



From x dir:

$$\begin{aligned} F_{app} - F_f &= ma \\ F_f &= F_{app} - ma \\ F_f &= 1.2\text{ N} - (1.5\text{ kg})(0.50\text{ m/s}^2) \\ F_f &= 0.45\text{ N} \\ F_f &= 0.45\text{ N } [\rightarrow] \end{aligned}$$

From y dir:

$$\begin{aligned} F_N - F_g &= 0 \\ F_N &= F_g \\ F_f &= \mu F_N \\ \mu &= \frac{F_f}{F_N} \\ \mu &= \frac{0.45\text{ N}}{(1.5\text{ kg})(9.8\text{ m/s}^2)} \\ \mu &= 0.03 \end{aligned}$$

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?



$$\begin{aligned} \Sigma F_y &= F_N - F_g = 0 \\ F_N - F_g &= 0 \\ F_N &= F_g \end{aligned}$$

$$\begin{aligned} \Sigma F_x &= F_1 - F_2 - F_f = ma \\ a &= \frac{F_1 - F_2 - \mu mg}{m} \\ a &= \frac{8.4\text{ N} - 3.6\text{ N} - (0.18)(2.4\text{ kg})(9.8\text{ m/s}^2)}{2.4\text{ kg}} \\ a &= 0.236\text{ m/s}^2 \\ a &= 0.24\text{ m/s}^2 \text{ [N]} \end{aligned}$$

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?



$$\begin{aligned} \Sigma F_y &= F_N - F_g = 0 \\ F_N - F_g &= 0 \\ F_N &= F_g \end{aligned}$$

$$\begin{aligned} \Sigma F_x &= F_{app} - F_f = ma \\ F_{app} - F_f &= 0 \\ F_{app} &= \mu mg \\ F_{app} &= (0.20)(1.0\text{ kg})(9.8\text{ m/s}^2) \\ F_{app} &= 1.96\text{ N} \\ F_{app} &> 2.0\text{ N} \end{aligned}$$

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.



$$\begin{aligned} \Sigma F_y &= F_N - F_g = 0 \\ F_N - F_g &= 0 \\ F_N &= F_g \end{aligned}$$

$$\begin{aligned} \Sigma F_x &= F_{app} - F_f = ma \\ F_{app} - F_f &> 0? \\ F_{app} - \mu mg &> 0? \\ 4.0\text{ N} - (0.25)(2.0\text{ kg})(9.8\text{ m/s}^2) &> 0? \\ -0.9\text{ N} &> 0? \end{aligned}$$

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

Tao Wei



Dynamics Problems And Solutions:

Unveiling the Magic of Words: A Report on "**Dynamics Problems And Solutions**"

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