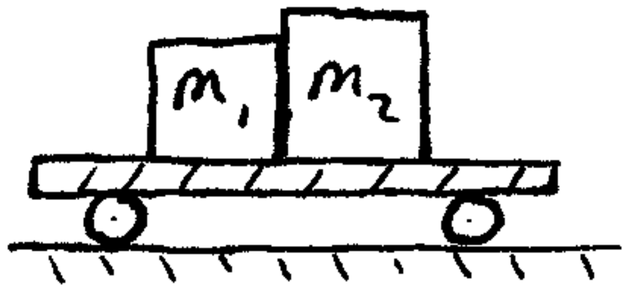
real-world-physics-problems.com
Sep. 24, 2020

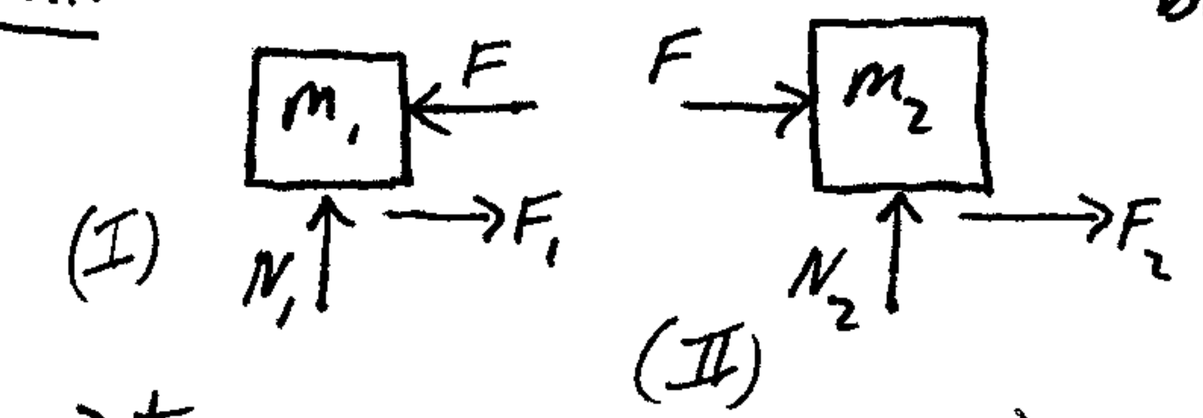
This is a force and motion problem involving friction.



Two blocks are sitting on a wheeled platform which is initially stationary. The coefficient of kinetic friction between the left block and the platform is 0.15, and the coefficient of kinetic friction between the right block and the platform is 0.10. The platform is given a sudden push to the right causing slippage between it and the blocks. Determine the acceleration of the blocks and the force between them. Note that $m_1 = 15\,kg$ and $m_2 = 20\,kg$.

Solution:

Free-body diagrams



$\rightarrow +$ (sign convention)

$\rightarrow a$ (same acceleration for both blocks)

(I) Apply Newton's second law:

$$F_1 - F = m_1 a \,, \quad F_1 = 0.15 N_1 = 0.15 m_1 g$$

$$\Rightarrow \quad 0.15 m_1 g - F = m_1 a \quad (1)$$

(II) Apply Newton's second law:

$$F_2 + F = m_2 a \,, \quad F_2 = 0.10 N_2 = 0.10 m_2 g$$

$$\Rightarrow \quad 0.10 m_2 g + F = m_2 a \quad (2)$$

Add equations (1) and (2):

$$0.15m_1g + 0.10m_2g = (m_1 + m_2)a$$

Substitute known values:

$$0.15(15)(9.8) + 0.10(20)(9.8) = (15+20)a$$

(acceleration of both blocks) $a = 1.19\ m/s^2 \rightarrow$ (answer)

Now, determine F from equations (1) or (2):

$$F = 0.15m_1g - m_1a$$

$$F = 0.15(15)(9.8) - 15(1.19)$$

(Force between blocks) $F = 4.2\ N$ (answer)