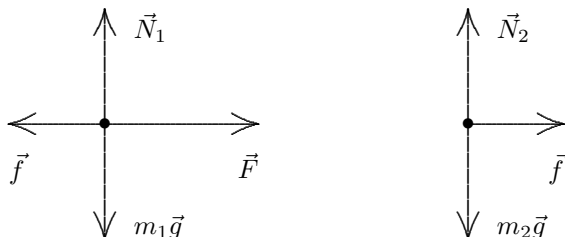


31. The free-body diagrams for part (a) are shown below. \vec{F} is the applied force and \vec{f} is the force exerted by block 1 on block 2. We note that \vec{F} is applied directly to block 1 and that block 2 exerts the force $-\vec{f}$ on block 1 (taking Newton's third law into account).



- (a) Newton's second law for block 1 is $F - f = m_1a$, where a is the acceleration. The second law for block 2 is $f = m_2a$. Since the blocks move together they have the same acceleration and the same symbol is used in both equations. From the second equation we obtain the expression $a = f/m_2$, which we substitute into the first equation to get $F - f = m_1f/m_2$. Therefore,

$$f = \frac{Fm_2}{m_1 + m_2} = \frac{(3.2\text{ N})(1.2\text{ kg})}{2.3\text{ kg} + 1.2\text{ kg}} = 1.1\text{ N} .$$

- (b) If \vec{F} is applied to block 2 instead of block 1 (and in the opposite direction), the force of contact between the blocks is

$$f = \frac{Fm_1}{m_1 + m_2} = \frac{(3.2\text{ N})(2.3\text{ kg})}{2.3\text{ kg} + 1.2\text{ kg}} = 2.1\text{ N} .$$

- (c) We note that the acceleration of the blocks is the same in the two cases. In part (a), the force f is the only horizontal force on the block of mass m_2 and in part (b) f is the only horizontal force on the block with $m_1 > m_2$. Since $f = m_2a$ in part (a) and $f = m_1a$ in part (b), then for the accelerations to be the same, f must be larger in part (b).