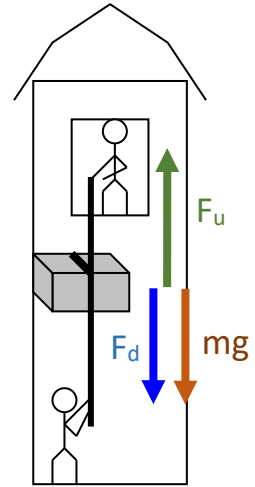


Two men are having a vertical tug of war with a bale of hay. The man standing in the hayloft is pulling with a force of 585 N while the man standing on the ground is pulling with a force of 351 N. The bale of hay has a mass of 22.0 kg. (This tug of war occurs on earth where $g = 9.80 \text{ m/s}^2$)



- a) Draw the free body diagram illustrating all the forces acting on the bale of hay. (3 pts)

- b) Write out Newton's second equation and then explicitly incorporate all the forces acting on the bale of hay. (4 pts)

$$\sum \vec{F} = m\vec{a}$$

$$\vec{F}_d + \vec{F}_u + \vec{W} = m\vec{a}$$

$$-F_d\hat{j} + F_u\hat{j} - mg\hat{j} = ma\hat{j}$$

$$-F_d + F_u - mg = ma$$

- c) Find the magnitude of the acceleration of the bale of hay. (2 pts)

$$a = \frac{-F_d + F_u - mg}{m} = \frac{-351 \text{ N} + 585 \text{ N} - (22.0 \text{ kg})(9.80 \text{ m/s}^2)}{22.0 \text{ kg}}$$

$$a = \frac{-351 \text{ N} + 585 \text{ N} - 216 \text{ N}}{22.0 \text{ kg}} = \frac{18 \text{ N}}{22.0 \text{ kg}} = 0.818 \text{ m/s}^2$$

- d) Who will win the tug of war? (1 pt)

Since the acceleration is positive, it is in the upward direction. The man in the hayloft wins the tug of war.