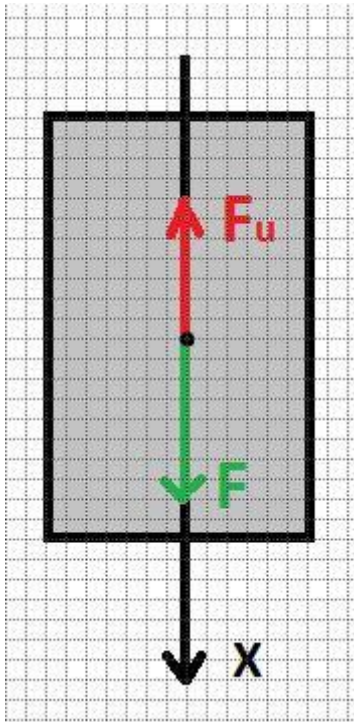$$3.8 \left(\frac{m}{s^2} \right)$$

Question

An upward force of $1.2 * 10^4 \, N$ acts on an elevator of mass $2.0 * 10^3 \, kg$. Calculate the acceleration of the elevator. Take $g = 9.8 \frac{m}{s^2}$.

Solution

Denote the upward force (F_u), the gravity force (F). Consider coordinate system as displayed on the picture.

Write down relevant formulae:

$$ma = \sum_i F_i$$

$$\sum_i F_i = F - F_u$$

$$F = mg,$$

where m – mass of the elevator, a – acceleration, $\sum_i F_i$ – result force.

Rearrange formulae and factor out a:

$$ma = F - F_u$$

$$ma = mg - F_u$$

$$a = g - \frac{F_u}{m}$$

Plug in numbers:

$$a = 9.8 - \frac{1.2 * 10^4}{2 * 10^3} = 9.8 - 0.6 * 10^1 = 9.8 - 6.0 = 3.8 \left(\frac{m}{s^2} \right)$$

Note: acceleration directed downwards.