

Answer on Question #40804, Physics, Mechanics

Question:

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

Answer:

Newton's second law of motion:

The acceleration of a body is directly proportional to, and in the same direction as, the net force acting on the body, and inversely proportional to its mass. Thus,

$$F = ma$$

where F is the net force acting on the object, m is the mass of the object and a is the acceleration of the object.

$$F = F_{up} - mg$$

Therefore:

$$a = \frac{F_{up} - mg}{m} = \frac{F_{up}}{m} - g = \left(\frac{1.2}{2} \times 10^4 - 9.8 \times 2.0 \times 10^3\right) \frac{\text{m}}{\text{s}^2} = -3.8 \frac{\text{m}}{\text{s}^2}$$

Therefore acceleration directed downward.

Answer: $3.8 \frac{\text{m}}{\text{s}^2}$