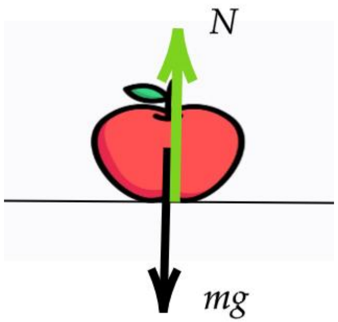
Newton's Laws. Normal Force

Normal Force for the object at rest:

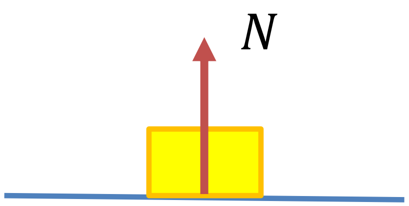
$$N = m \cdot g$$

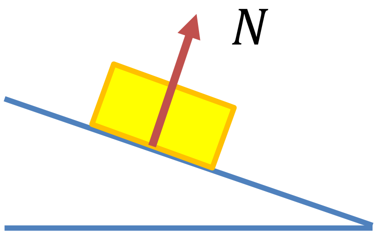


In the elevator moving up with acceleration a:

$$F_{net} = N - m \cdot g = m \cdot a \quad \longrightarrow \quad N = m \cdot g + m \cdot a$$

Normal Force is perpendicular to the surface:





Homework 9

Problem 1.

In this problem, using the data obtained in the elevator experiment, you will need to calculate the upward and downward acceleration of the elevator. On the next page is the plot (the result of our experiment) of how normal force acting on a person riding an elevator changes with time. To find the person's mass, use the fact that when there is no acceleration, the normal force measured by the scales equals the gravitational force acting on the person. Knowing the mass and normal force during downward acceleration, you will **find the downward acceleration**. Then, similarly, **find the upward acceleration**. You can use $\mathrm{g} = 10\,\frac{m}{s^2}$.

Problem 2.

Now, imagine that you have lived in the elevator your whole life and have never been outside. From this perspective, it seems that the gravity force varies with time. Sometimes, it seems to be less than $m \cdot g$, and sometimes, it seems bigger. How would you explain this paradox? **Does the Earth's gravity force change with time inside the elevator, or maybe some of Newton's laws need to be corrected**? It is an open-ended question, so any creative answers are welcome!

Problem 3* (bonus problem).

Find the force with which a $1\ kg$ block attracts the Earth due to gravity. What is Earth's acceleration due to this force (assuming this was the only force acting on the Earth)? Earth's mass is approximately $6 \cdot 10^{24}\ kg$.

The plot of the Normal force acting on a person in the elevator