

Force

Forces describe how strongly objects interact with each other, either via a direct contact (pushing or pulling each other) or indirectly (like gravity).

Gravity: any object is pulled down by the Earth's gravity.

Gravity force is equal to

$$F_g = mg$$

in terms of the object's mass m and free fall acceleration $g = 9.8 \text{ m/s}^2$.

Units of force are called Newtons, N: $1 \text{ N} = 1 \frac{\text{m} \cdot \text{kg}}{\text{s}^2}$

When an object is at rest, all forces acting on it are balanced. For instance, when an apple lies on a table, gravity force pulling it down is balanced by the force of the table pushing up on the apple (this kind of force is called normal force).

Homework

Problem 1.

Santa Claus wants to make sure that his reindeer will keep up with the gift delivery this Christmas. His sleigh (without any gifts) and himself combined have mass 600 kg. Santa needs to be able to carry 1000 gifts at a time. The average mass of a Christmas gift this season is 400 grams. One Santa's reindeer can provide a lifting force of 1000 N (on top of their own weight, so a reindeer can lift itself plus 1000N). How many reindeer Santa needs to take with him from Lapland to be able to fly in his sleigh?

You can approximate free fall acceleration as 10 m/s^2 when solving this problem.

Problem 2.

A group of workers uses a bucket with a rope tied to it to lift bricks to higher floors of a building they construct. The bucket has mass 2 kilograms; each brick is rectangular with length 20 cm, width 10 cm and height 5 cm. Density of a brick is 1.8 g/cm^3 . How many bricks can be transported in the bucket at once if the rope withstands force up to 100 N?