24.2: Case I- Constant force parallel to the direction of motion

Suppose that the applied force is constant and parallel to the direction of motion. Then the work W done by the force F acting through a distance x is simply

$$W = Fx \tag{24.2.1}$$

Example 24.2.1

Suppose you have a box sitting on the floor. You apply a force of $50\ \mathrm{N}$ to the box over a distance of 4 meters, causing it to accelerate. What is the work done by you on the box

Solution

The work done by you on the box is $W = (50\ \mathrm{N})(4\ \mathrm{m}) = 200\ \mathrm{J}$

Example 24.2.2

Suppose a mass m is sitting on the floor; you pick it up and lift it a height h. How much work have you done?

Solution

You have done work $W = mgh$ on the mass against gravity. Another way to think of this is to say the gravitational force has done work $-mgh$ on the mass against you. If you now lower the mass down to the ground, you're doing negative work $-mgh$ on the mass against gravity, and gravity is doing work $+mgh$ on the mass against you. It's important to keep the signs straight when computing work: be sure you're clear about what force is doing the work.

Note that the physics sense of "work" is a bit different from the everyday sense. If you're standing with a 100-lb mass in your arms, your muscles are exerting quite a bit of effort to hold up the heavy mass. But in the physics sense of the word, you're doing zero work against gravity. Only if you lift the mass are you doing work.