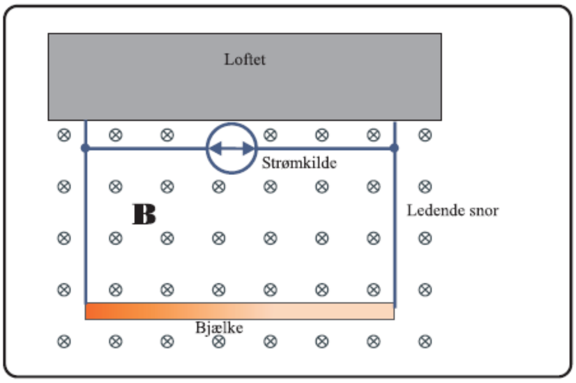
Exercise 5.1

A beam hangs from the ceiling by some conductive strings. There is a magnetic field present as shown in the drawing below. By sending a current through the beam, we can get it to try to lift itself. The beam has a weight of 400 g/m. The B-field is at 3.6 Wb/m².

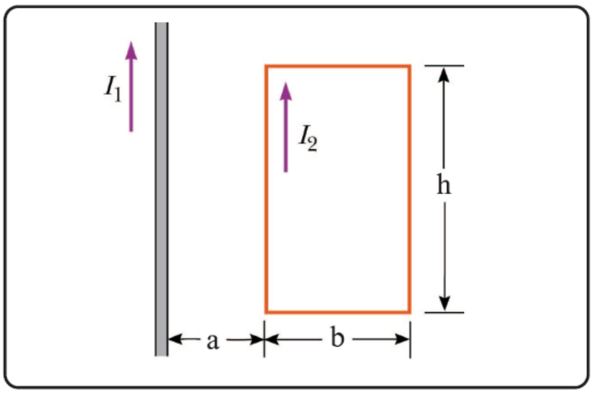


a. What current is needed for the tension in the strings to become 0?

b. Which way should the current flow?

Exercise 5.2

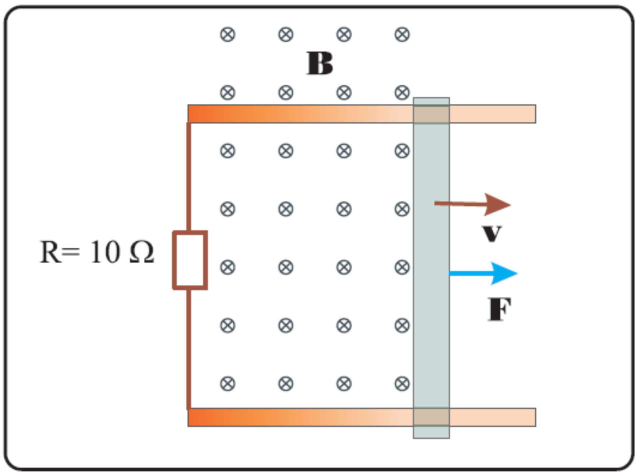
We have I1= 5 A and I2= 10 A. The dimensions of the loop are a = 10 cm, b = 15 cm, h = 45 cm.



a. Find the total force on the loop.

Exercise 5.3

The figure shows a beam that can move along the two rails using ball bearings or similar without any friction, such that there is constantly an electrical current path through the rails and the beam. The beam is considered massless. It has a length of 7 cm. The magnetic field has a strength of 1.3 Wb/m², and the beam moves in the direction of the arrow at 50 cm/s.



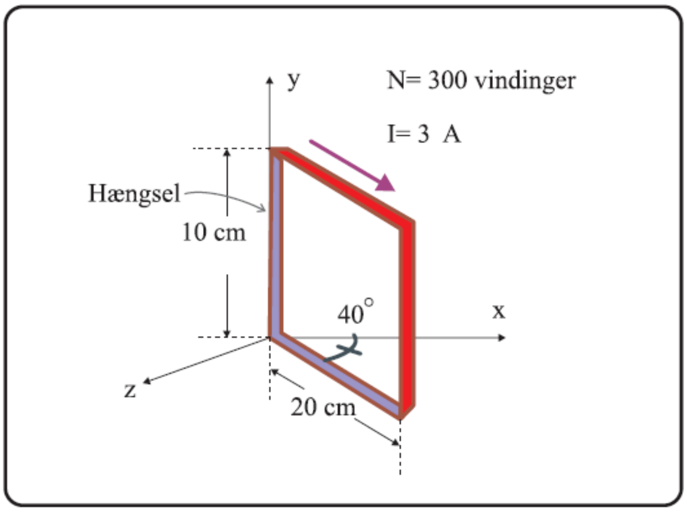
a. Determine the voltage across the resistance R, which is 10 Ω.

b. Calculate the force that must act on the beam to maintain the speed of 50 cm/s, based on the power dissipated in the resistance.

Exercise 5.4

The coil in the figure is acting as a hinge so that it can rotate around the y-axis. There are 300 turns of wire in the coil, and the current through it is 3 A. There is a magnetic field in the area, given by:

$$\bar{B} = \begin{bmatrix} 2 \\ 1 \\ 0 \end{bmatrix} \quad \text{Wb/m}^2$$



a. Calculate the magnetic dipole moment for the loop.

b. Calculate the torque the loop is subjected to.

c. Will the hinge rotate around the y-axis?