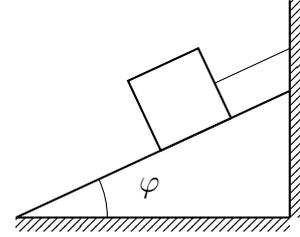1. A block with mass $m = 5\,\text{kg}$ rests on a slope ($\varphi = 25°$) and is attached to the wall with a light string, as shown in the figure. The coefficients of static and dynamic friction between the block and the slope are $k_{\text{tr}} = k_{\text{l}} = 0.2$.

   a) Calculate the force exerted on the string.

   b) The string is cut. Calculate the acceleration of the block and how much distance it travels in two seconds.

2. Ca^+ ions are accelerated by an electron gun with an unknown voltage U and directed into a homogeneous magnetic field with density $1.37\,\text{T}$. The magnetic field is pointing out of the page, as indicated in the sketch.

   a) What accelerating voltage U is required so that the radius of the circular motion in the magnetic field is $R = 7.3\,\text{cm}$? The mass of Ca^+ ions is $m_{\text{Ca}} = 6.65 \cdot 10^{-23}\,\text{g}$.

   b) With what velocity do the ions enter the region with the magnetic field?
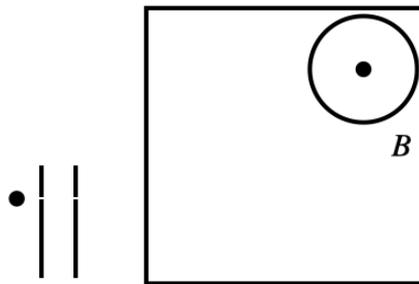
3. In the circuit shown in the sketch we have $R_1 = 1.2\,\Omega$, $R_2 = 3.4\,\Omega$ and $U = 5.6\,\text{V}$.

   a) Find the voltage between points **A** and **B**!

   b) What is the power dissipated on resistor R_2 in the middle of the circuit?
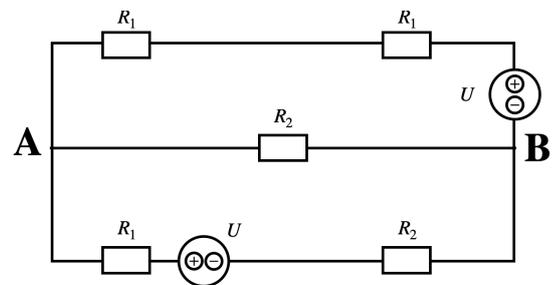
4. Inside a closet we have a rod ($m_\mathrm{p} = 0.7\,\mathrm{kg}$, $L = 1.1\,\mathrm{m}$). At the left end it is attached to the wall so that it can pivot around this point, and at the right end it is connected to the ceiling by a spring (see the sketch). A rolled up towel is hanging from the rod, which we treat as a rod with mass $m_\mathrm{b} = 500\,\mathrm{g}$ and lenght $b = 0.6\,\mathrm{m}$. All distances ($a = 0.4\,\mathrm{m}$, $c = 0.1\,\mathrm{m}$) are indicated in the sketch. In the equilibrium position, the rod is horizontal. The coefficient of the spring is $k = 300\,\mathrm{N/m}$.

a) With how much force is the spring stretched when the system is at rest in the equilibrium position?

b) With what oscillation time (t_0) does the system oscillate if it is sligtly displaced from the equilibrium position?
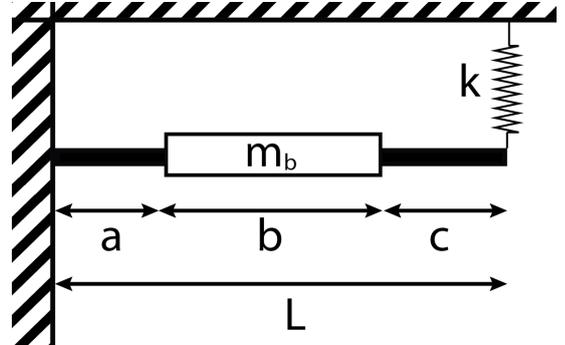
5. A capacitor consists of two parallel conductive plates with width $b = 5\,\mathrm{cm}$, height $c = 8\,\mathrm{cm}$ (separated by $a = 0.5\,\mathrm{cm}$) and an insulating base and side walls. Oil with permittivity $\varepsilon = 5$ is poured between the plates. The capacitance of the capacitor is then $C_0 = \varepsilon\varepsilon_0 S/a$, where $S = bc$ is the area of the conductive plates, and ε_0 the vacuum permittivity.

We then tilt the capacitor so that some oil spills out, as shown in the sketch (the oil now fills the space below the diagonal of the rectangle). Calculate the capacitance of the tilted capacitor.