Kungl Tekniska Högskolan
Institutionen för Mekanik

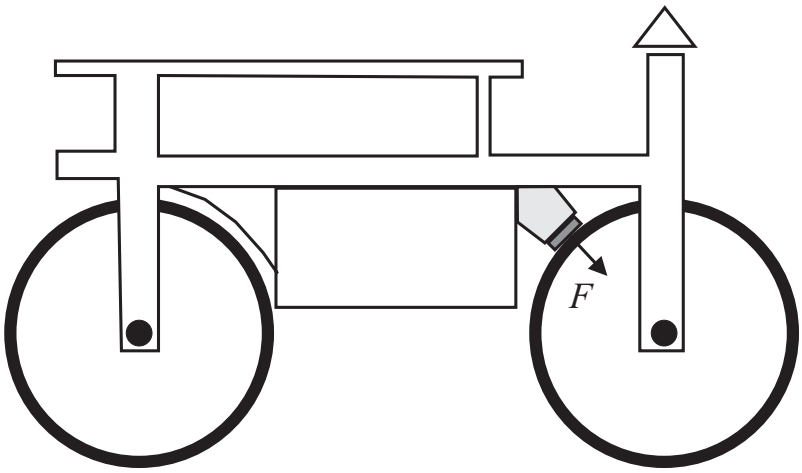
2004 09 24

Mekanik II M2, 5C1140

Hand in assignment 3, HT 2004

In order to reduce the transport weight and braking distance of the steam roller shown in the figure it is suggested that the wheels are made as hollow cylindrical shells. These are then filled with water before the steam roller is used.

Assume that such a steam roller with empty wheels, has a braking distance of 2 m at a speed of 5 km/h. The brake consists of a chock which is pressed against the front wheel with a force of $F = (125\,\mathrm{kg})g$, the coefficient of (sliding) friction being 0.8 between wheel and chock. The wheels have a diameter of 1 m and a width of 2 m. Calculate the braking distance when the wheels are filled with
a) liquid water, and
b) ice.



The solutions, which must have explanative *text* in English, are intended to start from general laws and definitions. All essential steps in the calculations must be included.

Mark the solutions with your *name* and number as well as *my name* (Hanno Essén). They must be *tidy* and easy to read, as well as correct.

The last day for handing in this assignment is Friday, October 1.

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See also next page!

Note that $g = 9.8\ \text{m/s}^2$.
Hint: the following notation should be useful:

$$
\begin{aligned}
m_0 &= \text{mass of steam roller without wheels,} \\
m_e &= \text{mass of one empty wheel,} \\
m_w &= \text{mass of water in one wheel,} \\
J_e &= \text{moment of inertia of one empty wheel,} \\
J_w &= \frac{1}{2} m_w r^2, \ \text{moment of inertia of water in one wheel,} \\
\ell_e &= 2\,\text{m, empty braking distance,} \\
v &= 5\,\text{km/h, initial speed of steam roller,} \\
r &= 0.5\,\text{m, radius of wheel,} \\
\mu &= 0.8 \text{ coefficient of sliding friction.}
\end{aligned}
$$

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