University Karlruhe - International Department

Pre-Semester Physics - Exercises Summer 2009

Holger Schmidt
hschmidt@tkm.uni-karlsruhe.de

Sheet 2
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1. Exercise

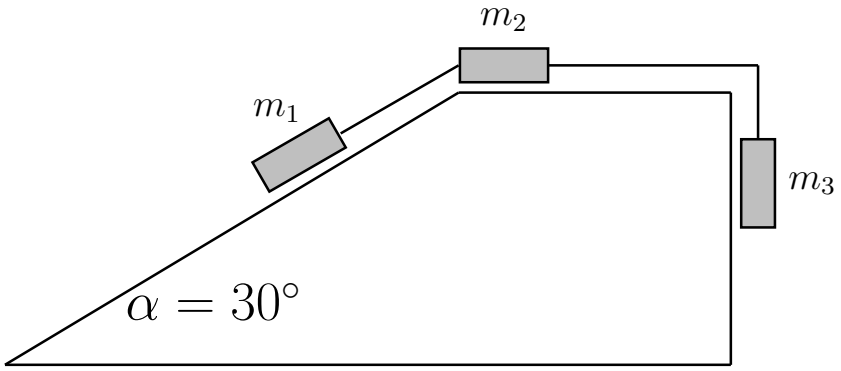
An object with mass $m = 6\,\text{kg}$ is pulled along a frictionless horizontal surface by a horizontal force $F = 10\,N$.

(i) If the object is at rest at $t = 0$ how fast is it moving at $t = 3\,s$.

(ii) How far does it travel during these $3\,s$.

2. Exercise

Three masses $m_1 = m_3$ and $m_2 = 10\,m_1$ are arranged as shown in the figure below. They are all exposed to the gravitational force ($g = 10\frac{m}{s^2}$). The mass m_3 is positioned at a height of $h = 0.5m$. Neglect friction!



(i) Determine the acceleration a of the system in terms of g.

(ii) Find the time t, the mass m_3 needs to hit the ground.

(iii) Find the tension force in the two ropes.

(iv) What ratio of m_1 and m_3 is needed, such that m_2 stays at rest?

3. Exercise

A civil engineer is asked to design a curved section of a roadway that meets the following conditions: With ice on the road, when the coefficient of static friction between the road and rubber is 0.08, a car at rest must not slide into the ditch and a car traveling less than $60\frac{km}{h}$ must not skid to the outside of the curve.

(i) At what angle should the road be banked?

(ii) What is the minimum radius of the curve?

4. Exercise (more advanced)

We will analyse the motion of a falling object, like a skydiver. There is friction induced by moving through the air.

(i) Explain, why the equation of motion takes the form

$$m\dot{v}(t) = mg - \gamma v(t)\,.$$

(ii) Solve the equation of motion for $v(t)$ with the initial condition $v(0) = 0$.