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Exercises and Complements for the Introduction to Physics I for Students of Biology, Pharmacy and Geoscience

Sheet 5 / September 30, 2019 Discussion of the Exercises: **22.10.2019/23.10.2019**

Exercise 21. A bullet gets shot vertically up. At a height of $h = 2000$ m the potential and the kinetic energy are equal($E_P = 0$ at $h = 0$). What is the velocity at $h = 2000$ m and what was the initial velocity v_0?

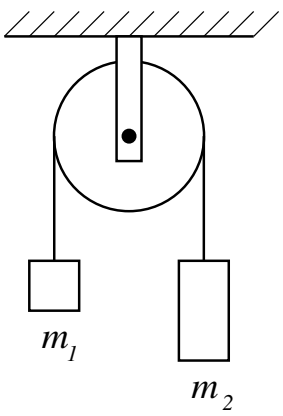
Exercise 22. A concrete slab (density $\rho = 2.2 \cdot 10^3$ kg/m^3), with the dimensions $2.0 \times 1.0 \times 0.2$ m^3, is pulled out from a 5 m deep construction pit above a 30° inclined plane. The coefficient of sliding friction is $\mu = 0.25$. Calculate the needed work.

Exercise 23. An object with the mass $m = 10$ kg gets accelerated by a spring on a horizontal slideway. Initially the spring got compressed by $\Delta s = 5$ cm and has a spring constant of $k = 2450$ Ncm^{-1}. After detaching from the spring the object is sliding for 2 m on a horizontal surface. Afterwards it is sliding up an inclined surface which has an angle of $\alpha = 30°$. The coefficient of sliding friction on the entire surface is $\mu = 0.3$.

(a) Sketch the situation.
(b) Calculate the height Δh at which the object stops moving on the inclined surface.

Exercise 24. A homogeneous block made of oak wood with $m_Z = 600$ g is hanging from a cord, which has a length of $l = 50$ cm. A bullet, with $m_B = 5$ g and a velocity of $v = 320$ m/s, enters in the resting block (The shot goes through the center of mass). Calculate the angle of deflection of the oak block!

Exercise 25.
Two masses m_1 and m_2 are connected through a thin rope. The rope goes above a rotatable wheel which moves without friction, see figure (neglect the mass of the wheel and of the rope).



(a) What happens if $m_1 = m_2$?
(b) Calculate by using the law of conservation of energy the acceleration if $m_1 \neq m_2$.

Solutions:

Exercise 21. 198 m/s and 280 m/s

Exercise 22. 61.85 kJ

Exercise 23. 1.65 m

Exercise 24. 73°