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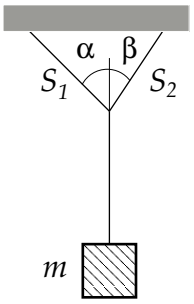
Exercises and Complements for the Introduction to Physics I for Students of Biology, Pharmacy and Geoscience

Sheet 3 / September 26, 2017 Discussion of the Exercises: **10.10.2017/11.10.2017**

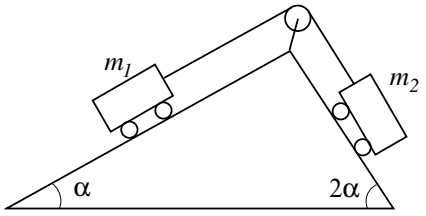
Exercise 10.



A mass $m = 0.5$ kg is hanging on thin wires, see figure. The angle α is 45° and $\beta = 60°$. How big are the absolute values of the forces F_1 and F_2 in the different parts of the wire S_1 and S_2?

Exercise 11.

Two wagons are connected via a rope and they should move without friction. $m_1 = m_2 = 100$ kg, $\alpha = 20°$ and assume that the rope has no mass. Calculate:



(a) the acceleration of the wagons.
(b) the velocity v after 10 s (the initial velocity is 0).

Exercise 12.

In a cave deep under the Earth's surface, the gravitational force is:

(a) bigger
(b) smaller
(c) equal

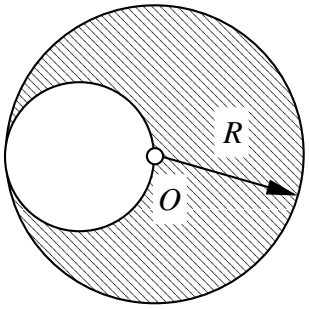
than at the Earth's surface. Justify your answer qualitatively. Furthermore, sketch the absolute value

of the gravitational force as a function of the distance from the Earth's center.

Exercise 13.

A communication satellite without an engine should be placed always at the same position above the Earth's surface.

(a) How big does the distance to the Earth's surface has to be?
(b) Is it possible that this satellite is always positioned, for example, above Basel? Explain!



Additional Exercise (the additional exercise is not relevant to the exam. It is for the students which are looking for a challenge.)
A uniform circular disk with a radius $R = 20$ cm has a circular opening, see figure. The mass of the shaded area is $m = 7.3$ kg. This circular disk is rotating around an axis which goes through the center of mass and the axis is perpendicular to the plane of the disk. Calculate the moment of inertia of this system.

Hint: Use Steiner's Theorem (Parallel axis Theorem).

Solutions:

Exercise 10. 4.4 N and 3.6 N

Exercise 11. (a) 1.476 m/s^2, (b) 14.76 m/s

Exercise 13. 36000 km

Additional Exercise 0.15 kg m^2