
Übungen zur Experimentalphysik I (Mechanik)

Aufgabenblatt 4 von 6

Abgabe im OLAT: Montag, 30.11.2020, 18:00 Uhr



1) Elastic collision

Two bodies with equal mass collide. One of the bodies is at rest before the collision. Make an experiment to show that the velocity or momentum vectors are orthonormal after a non-central collision.

Document your experiment with a video or with photos.

2) Free fall and a spring

A ball with a mass of $m = 3.2$ kg starts at rest and falls a distance of $h = 65$ cm. It then hits a vertical spring with no tension. The ball compresses the spring by $d = 10$ cm. Determine the velocity of the ball when touching the spring and the spring constant k . How high is the acceleration at the turning point?

3) Public transport

A bus with a total mass of 21 t accelerates from 0 to 50 km/h. Which energy (in J and kWh) is necessary? Where does the energy go when the bus breaks? Which final and which mean power does the engine provide if the final velocity was reached after a constant acceleration over a distance of 100 m?

4) Fly me to the Moon

a) The Earth and the Moon move around their center of mass. Determine the distance between the center of mass and the Earth's center. Use $m_{\text{Earth}} = 5.974 \cdot 10^{24}$ kg, $m_{\text{Moon}} = 7.349 \cdot 10^{22}$ kg, distance between Earth and Moon $d_{\text{EM}} = 384,400$ km.

b) Determine the angular velocity of Earth and Moon and their orbital period around the center of mass (= sidereal month).

c) Determine the point on the connecting line of Earth and Moon, where the gravitational forces of the Earth and the Moon cancel.

5) Hanging on a thread

Ellen is rock climbing. She wants to drop a 50 m long rope off a cliff. She holds the rope on one end, while the other end just touches the ground. On the ground, below the end of the rope, is a scale (numbers in kg). The rope has a total weight of 5 kg. Ellen drops the rope.

a) How long does it take the upper end of the rope to reach the scale?

b) What does the scale display before Ellen drops it? What does the scale display after the fall when the rope rests on the scale?

c) What does the scale display as a function of time between "Ellen letting the rope go" and "the rope resting on the scale"? (Split the process into three steps: 1) Which mass hits the scale per time unit? 2) At which velocity does the mass hit the scale? 3) What is the momentum transfer per time unit?)