

Einführung in die Physik I: Mechanik und Thermodynamik

Universität Basel

Herbstsemester 2022

Due to Friday 28.10.2022, 1 pm

Exercise Sheet 4

Remember to specify your name, the number of your group and the name of the assistants in your group on the sheet that you hand in.

Question 1 (4 points)

A body having mass $m = 10 \text{ kg}$ is moving along a horizontal path with velocity $v_0 = 3 \text{ m/s}$, when a constant force f starts to oppose to the movement until the body is brought to rest within 10 s.

- (a) Evaluate the impulse during the 10 s interval
- (b) Evaluate the magnitude of the force

Question 2 (3 points)

Consider the 2.0 m long uniform beam shown in Fig.(1) (all the forces acting on it are shown). Determine the net torque about:

- (a) point C (exactly in the middle of the beam)
- (b) point P at one end of the beam

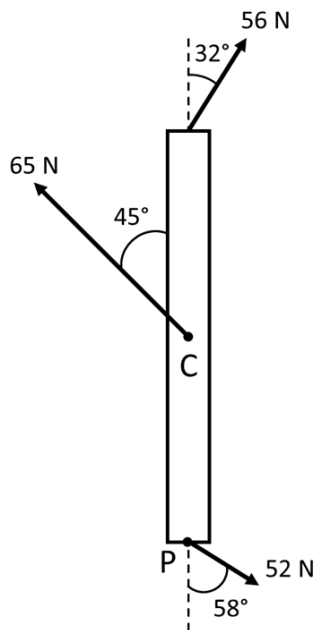


Figure 1: Forces applied on the beam.

Question 3 (3 points)

A simple pendulum is constituted by a point mass $m = 30$ g suspended by an inextensible flexible wire of length $l = 50$ cm (the mass of the wire is negligible).

- (a) Evaluate the period of oscillation of the pendulum
- (b) Knowing that the pendulum is brought to an initial angle $\theta = 4^\circ$ with respect to its vertical equilibrium position, and then it's released with an initial velocity equal to zero, write down the equation of motion ($\theta(t)$)

Problem 1 (10 points)

A 265 kg load is lifted 18 m vertically with an acceleration $a = 0.160g$ by a single cable. The force that the cable applies on the load to lift it up is 3×10^3 N. Determine:

- (a) the net work done on the load
- (b) the work done by the cable on the load
- (c) the work done by gravity on the load
- (d) the final speed of the load assuming it started from rest

Problem 2 (10 points)

A ball having mass $m = 0.48$ kg is thrown with a speed of 8.8 m/s at an upward angle of 36° . If we neglect the effect of air resistance

- (a) What is its speed at its highest point?
- (b) Which is the maximum height reached by the ball?
- (c) At what point does the ball have the highest energy?

If the ball is now thrown straight up, neglecting air resistance, indicate which of the following statements are true/false regarding the energy of the ball. Briefly justify your answers.

- i. The potential energy decreases while the ball is going up
- ii. The kinetic energy decreases while the ball is going up
- iii. The sum of the kinetic energy and potential energy is constant
- iv. The potential energy decreases when the ball is coming down
- v. The kinetic energy increases when the ball is coming down