Einführung in die Physik I: Mechanik und Thermodynamik
Universität Basel
Herbstsemester 2022
Due to Friday 14.10.2022, 1 pm

Exercise Sheet 2

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 (1 point)

If an object is moving, is it possible for the net force acting on it to be zero? Explain.

Question 2 (1 point)

If the acceleration of an object is zero, are no forces acting on it? Explain.

Question 3 (3 points)

A point mass moves along a straight path. Its initial velocity is $v_0 = 10$ m/s, oriented along the positive direction of the axis. The acceleration is constant and negative, with magnitude $a_0 = 4$ m/s^2. Provide the expression for the space travelled before the point mass stops.

Question 4 (5 points)

A point mass moves with acceleration a following the representation

$$\begin{cases} \mathrm{a}_x = 2\mathrm{t} \\ \mathrm{a}_y = 3 \\ \mathrm{a}_z = 0 \end{cases}$$

At time t = 5, the velocity of the point mass is

$$\begin{aligned} v_x(5) &= 30 \\ v_y(5) &= 10 \\ v_z(5) &= 12 \end{aligned}$$

Evaluate the velocity variation as function of time.

Problem 1 (10 points)

Consider a circular platform of radius R = 2 m. At the time instant t = 0 it is at rest. When it starts moving, it has a constant angular acceleration $d\omega/dt = \dot{\omega} = 0.2$ rad/s^2. Evaluate:

(a) The angular velocity after 2 s (2.5 points)

(b) The magnitude of the acceleration experienced by a particle placed at the edge of the platform (at a distance corresponding to R) (2.5 points)

If at t = 3 s, the acceleration of the particle is 1.05 m/s^2 in a direction that makes an angle of 25° to its direction of motion, evaluate:

(c) The speed of the particle at t = 3 s (2.5 points)

(d) The speed of the particle at t = 5 s (2.5 points)

Problem 2 (10 points)

A point mass is launched with velocity v_0 = 12 m/s out of a window placed at 8 m from ground level. The angle α that the initial velocity forms with the horizontal is 30° (see Figure 1). Evaluate:

(a) The law of motion (4 points)

(b) The distance y_c from the window at which the point mass lands (2 points)

(c) The time instant at which the point mass lands (2 points)

(d) The maximum height z_m reached by the point mass (2 points)

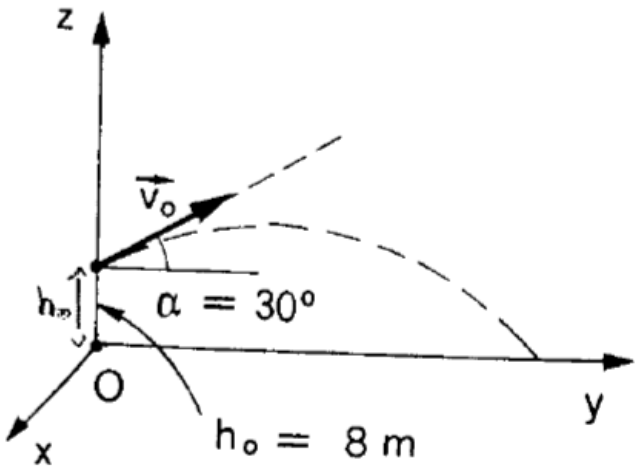

Figure 1: Motion of the point mass