

Einführung in die Physik I: Mechanik und Thermodynamik

Universität Basel

Herbstsemester 2022

Due to Friday 21.10.2022, 1 pm

Exercise Sheet 3

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 (2 points)

A ball is thrown downward at a speed of 20 m/s. Choosing the +y axis pointing up and neglecting air resistance, which of the following equations (more than one answer is possible) are correct? Briefly justify your answer.

- (a) $v = 20 - gt$
- (b) $y = y_0 - 20t - \frac{1}{2}gt^2$
- (c) $v^2 = 400 - 2g(y - y_0)$
- (d) $20 = \frac{v + v_0}{2}$
- (e) all of the above

Question 2 (2 points)

An object starts from rest and falls under the influence of gravity. Draw plots of

- (a) its velocity
- (b) the distance it has fallen

as function of time from $t = 0$ s to $t = 5$ s. Ignore air resistance.

Question 3 (3 points)

- (a) What is the acceleration of two falling sky divers (total mass = 132 kg including parachute) when the upward force of air resistance is equal to one-fourth of their weight?
- (b) After opening the parachute, the divers descend to the ground at constant speed. What now is the force of air resistance on the sky divers and their parachute?

Question 4 (3 points)

Evaluate the Coriolis acceleration of a rocket flying with velocity $v' = 10^3$ m/s along one of the Earth's parallels.

Problem 1 (10 points)

Two aircraft travel on the same plane with velocity $v_1 = 500$ km/h and $v_2 = 800$ km/h respectively. The directions of motion generate an angle $\theta = 30^\circ$ as the two aircraft move away from each other. Evaluate:

- (a) The magnitude of the relative velocity of the second aircraft with respect to the first one
- (b) The direction of the relative velocity of the second aircraft with respect to the first one

Problem 2 (10 points)

Three blocks on a frictionless horizontal surface are in contact with each other as shown in Figure 1.

A force is applied to block A.

- (a) Draw all the forces acting on each single block

Knowing that $m_A = m_B = m_C = 10$ kg, and $F = 96$ N, determine

- (b) the acceleration of the system
- (c) the net force on each block
- (d) the force of contact that each block exerts on its neighbor

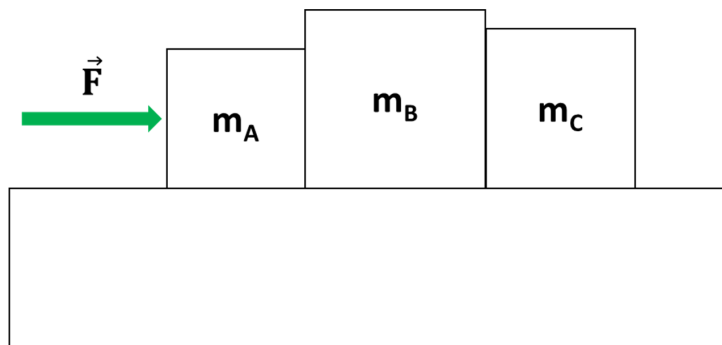


Figure 1