# Einführung in die Physik I: Mechanik und Thermodynamik 

Universität Basel
Herbstsemester 2022
Due to Friday 7.10.2022, 1 pm

## Exercise Sheet 1

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 (3 points)

An angstrom $(\AA)$ is a unit of length, defined as $10^{-10} \mathrm{~m}$, which is the order of the diameter of an atom. Indicate which conversion is correct (more than one answer is possible).
$1.0 \AA$ is equivalent to:
(a) 10 nm
(b) $10^{5} \mathrm{fm}$
(c) $10^{-1} \mathrm{~nm}$
(d) $10^{-5} \mathrm{fm}$
(e) $10^{-4} \mu \mathrm{~m}$
(f) $10^{3} \mu \mathrm{~m}$

## Question 2 (4 points)

The speed of an object is given by the equation $v=A t^{3}-B t$ where t refers to time.
(a) What are the dimensions of A and B ?
(b) What are the SI units for the constants A and B?

## Question 3 (3 points)

When an object moves with constant velocity, does its average velocity during any time interval differ from its instantaneous velocity at any instant? Explain.

## Problem 1 (10 points)

A point mass moves as a function of time following the representation

$$
\left\{\begin{array}{l}
x=2 \mathrm{t}^{2} \\
y=2 t+1 \\
z=4
\end{array}\right.
$$

Evaluate:
(a) The average velocity within the time interval $t_{1}=0 \mathrm{~s}$ and $t_{2}=5 \mathrm{~s}$ specifying the components and the magnitude of the vector (4 points)
(b) The momentary velocity specifying the components and the magnitude of the vector (3 points)
(c) The momentary acceleration specifying the components and the magnitude of the vector (3 points)

## Problem 2 (10 points)

The position of a car moving along a straight path as a function time is plotted in Figure 1.
(a) What is the instantaneous velocity at $\mathrm{t}=10 \mathrm{~s}$ and at $\mathrm{t}=30 \mathrm{~s}$ ? (3 points)
(b) What is the average velocity between $t_{1}=0 \mathrm{~s}$ and $t_{2}=5 \mathrm{~s}$ and between $t_{1}=40 \mathrm{~s}$ and $t_{2}=50 \mathrm{~s}$ ? (3 points)
(c) During which time interval is the velocity constant? (1 point)
(d) At what time is the velocity greatest? (1 point)
(e) At what time is the velocity zero? (1 point)
(f) Is the car moving in one direction or in both directions during the time shown? (1 point)


Figure 1: Position of a car as function of time

