Physics I Mock Exam for Students of Biology, Pharmacy and Geoscience

The student card will be checked at the end of the exam; please have the student card ready when you hand in the exam!

Name:	
Matriculation number:	

Exercise	1	2	3	4	total
maximum number of points	5	10	8	3	26
achieved number of points					

Important

Please number consecutively all your sheets und **label each sheet with your name!** Pay attention to give always first the general result and afterwards replace with the numerical values. Note down all the steps to the solution. If the result is numerical, you include the units. **Please give the results with a maximum precision of two positions after the decimal point.**

We insist on that you solve the exercises independently. Whoever copies from somebody else, is risks obtaining 0 points for the exam.

Allowed Aids:

- A (technical- scientific) calculator (no computer, i.e. graphics calculator), programmable calculators have to be reset by the student before the exam, which will be controlled randomly (spot tests).

- A **handwritten** summary of **one A4 page**, no photocopies of exercise sheets and solutions

- A formulary

- Non-natives can use a dictionary

- The use of wireless devices is strictly forbidden

- **Other aids are not allowed**

- Whoever is caught violating the rules during the exam, is excluded from the exam.

You can solve the exercises in arbitrary order. Work calmly and with focus. **Not all** exercises need to be solved to reach the top grade. Do not waste your time if you do not get ahead with an exercise; just proceed to the next one.

If a subtask is based on a previous subtask, which you could not solve, use for the unknown value the corresponding symbol and solve this exercise generally (without numerical result).

Check that you have not overlooked any exercises!
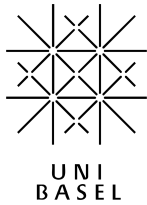
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U N I
B A S E L

Mock Exam to the Lecture Introduction to Physics I

for Students

of Biology, Pharmacy and Geoscience

Tuesday, 19.12.2017 and Wednesday, 20.12.2017

Absolute terms:

- Gravity acceleration $g = 9.81 \frac{m}{s^2}$
- Density of seawater $\rho_{MW} = 1.03 \frac{g}{cm^3}$
- Density of fresh water $\rho_{SW} = 1.00 \frac{g}{cm^3}$
- Coefficient of linear expansion for iron $\alpha_{Fe} = 12.1 \cdot 10^{-6} \frac{1}{°C}$

1 Velocity (5 Points)

A car drives with a slightly to fast but constant velocity of 108 km/h. It drives in a straight line on a flat street with heavy opposing traffic. Suddenly the driver realizes a damaged truck standing in front of him at a distance of 90 m. The car driver starts to break after a reaction time of 0.8 s.

(a) How far away is the car from the truck as it starts to break? **(2 Points)**
(b) The breaking deceleration of the car is constant and it is $-6.2 \, ms^{-2}$. Calculate if the car manages to stop before hitting the parking truck. **(3 Points)**

2 Acoustic wave (10 Points)

A flat acoustic wave in air is described by the following equation:

$$y(x,t) = 5 \cdot 10^{-5} m \cdot \sin(1980 s^{-1} \cdot t - 6 m^{-1} \cdot x)$$

Determine for this wave:

(a) the frequency f **(2 Points)**
(b) the wavelength λ **(2 Points)**
(c) the propagation velocity c **(2 Points)**
(d) the velocity-time-law $v(t)$ **(2 Points)**
(e) the maximum value of the velocity v_{max} **(2 Points)**

3 Mixed (8 Points)

(a) A ship has a penetration depth in seawater of d_{MW}. It travels in a river mouth with fresh water, where it has a penetration depth of d_{SW}.

    (i) Which penetration depth is larger? (**1 Point**)

    (ii) The shipload of 600000 kg gets unloaded (still in fresh water). The new penetration depth is now d_{MW}. Calculate the total mass of the ship under the assumption that the side surfaces are perpendicular to the water surface. (**4 Points**)

(b) On a 2 m long clothesline, a dripping wet towel (mass m = 5 kg) is hung exactly in the middle. The clothesline is fixed with hooks in the wall. The angle between line and wall is on both sides 85°. What is the force with which the line pulls on each hook? (**3 Points**)

4 Temperature (3 Points)
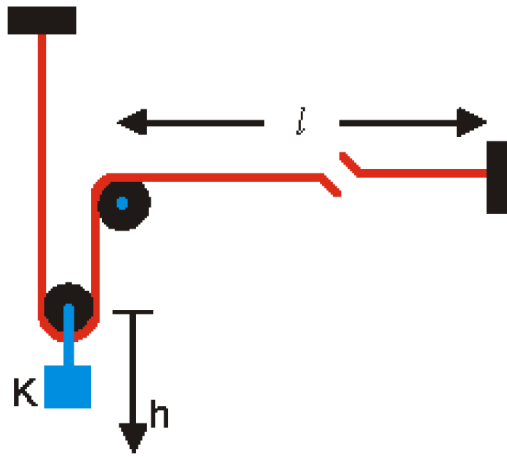
In order to have a constant sagging independent of temperature in the overhead contact line with a length of $l_0 = 30$ m, the national railways has built a special tension device, see figure above. The body sinks by $h = 9.0$ mm. By how many degrees Celsius has the line warmed up? For the calculation neglect the warming-up of the line in the tension device. (**3 Points**)

total overall 26 Points