Physics I Test Exam for Students of Biology, Pharmacy and Geosciences

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

Name:	
Matriculation number:	

Exercise	1	2	3	4	5	total
maximal points	10	6	8	8	4	36
achieved 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.
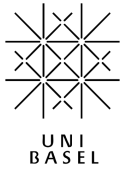
Allowed Aids:

- 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).

In case it is not possible to solve an exercise this way, estimate the previous result and note this in your solution.

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
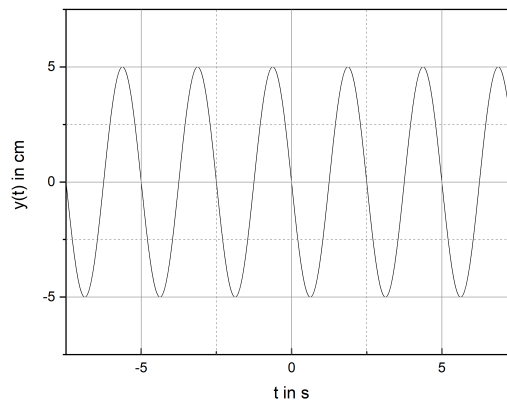
of Biology, Pharmacy and Geoscience

Tuesday, 17.12.2019 and Wednesday, 18.12.2019

Absolute terms:

- Gravity acceleration $g = 9.81 \, \frac{\text{m}}{\text{s}^2}$
- Density of seawater $\rho_{\text{MW}} = 1.03 \, \frac{\text{g}}{\text{cm}^3}$
- Density of fresh water $\rho_{\text{SW}} = 1.00 \, \frac{\text{g}}{\text{cm}^3}$
- Specific heat of water $c_{\text{water}} = 4182 \, \frac{\text{J}}{\text{kg}\cdot\text{K}}$
- Specific heat of quartz $c_{\text{quartz}} = 710 \, \frac{\text{J}}{\text{kg}\cdot\text{K}}$

1 Oscillation (10 Points)

The following graph shows an oscillation:

Determine from the graph or calculate:

(a) the period T **(1 point)**
(b) the angular frequency ω **(2 points)**
(c) the amplitude A **(1 point)**
(d) the position $y(t)$ of the oscillation as a function of time **(2 points)**
(e) the velocity $v(t)$ of the oscillation as a function of time **(2 points)**
(f) the maximum value of the velocity v_{max} **(2 points)**

2 Velocity (6 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. (**4 Points**)

3 Gymnastics hoop (8 points)

A Gymnastics hoop ($J_{hoop} = mr^2$) with a mass $m = 500$ g and a diameter $d = 80$ cm rolls with a velocity of 6 m/s. The thickness of the hoop is much less than its diameter and neglectable.

(a) Determine the kinetic energy (not due to rotation) of the hoop. (**2 points**)

(b) Determine the rotational energy of the hoop. (**2 points**)

(c) How far can the hoop roll uphill a slope with an inclination of $\alpha = 10°$? (**3 points**)

4 Mixed (8 Points)

(a) In seawater a ship has a penetration depth of d_{sea}. It travels in a river mouth with fresh water, where it has a penetration depth of d_{fresh}.
   (i) Where is the penetration depth larger? In seawater or in fresh water? (**1 Point**)
  (ii) At the port inland (in fresh water), the cargo of 600 t is unloaded. By chance, the new penetration depth in fresh water is exactly the same as before in the seawater d_{sea}. Calculate the total mass of the ship after unloading, assuming that the side surfaces are perpendicular to the water surface. (**4 Points**)

(b) On a 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**)

5 Warming up water (4 points)

(a) How much energy is necessary, to heat up 200 ml of water and a cup of quartz glass weighing 200 g from $30°$C to $100°$C? (**2 Points**)
(b) How long does this process last inside a microwave oven with a power of 1.2 kW, if 50% of this power goes directly to warming up the water and the cup? (**2 Points**)

total 36 Points