AUS-S-2 T-0 C
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A123

Theory
General Instructions
Cover sheet

Please return this cover sheet together with all the related question sheets.

General instructions: Theoretical Examination (30 points)

July 14, 2016 The theoretical examination lasts for 5 hours and is worth a total of 30 points.

Before the exam

- You must not open the envelopes containing the problems before the sound signal indicating the beginning of the examination.
- The beginning and end of the examination will be indicated by a sound signal. There will be announcements every hour indicating the elapsed time, as well as fifteen minutes before the end of the examination (before the final sound signal).

During the exam

- Dedicated answer sheets are provided for writing your answers. Enter the final answers into the appropriate boxes in the corresponding answer sheet (marked A). For every problem, there are extra blank work sheets for carrying out detailed work (marked W). Always use the work sheets that belong to the problem you are currently working on (check the problem number in the header). If you have written something on any sheet which you do not want to be graded, cross it out. Only use the front side of every page.
- In your answers, try to be as concise as possible: use equations, logical operators and sketches to illustrate your thoughts whenever possible. Avoid the use of long sentences.
- Please give an appropriate number of significant digits when stating numbers.
- You may often be able to solve later parts of a problem without having solved the previous ones.
- A list of physical constants is given on the next page.
- You are not allowed to leave your working place without permission. If you need any assistance (need to refill your drinking water bottle, broken calculator, need to visit a restroom, etc), please draw the attention of a team guide by putting one of the three flags into the holder attached to your cubicle ("Refill my water bottle, please", "I need to go to the toilet, please", or "I need help, please" in all other cases).

At the end of the exam

- At the end of the examination you must stop writing immediately.
- For every problem, sort the corresponding sheets in the following order: cover sheet (C), questions (Q), answer sheets (A), work sheets (W).
- Put all the sheets belonging to one problem into the same envelope. Also put the general instructions (G) into the remaining separate envelope. Make sure your student code is visible in the viewing window of each envelope. Also hand in empty sheets. You are not allowed to take any sheets of paper out of the examination area.
- Leave the blue calculator provided by the organizers on the table.
- Take the writing equipment (2 ball point pens, 1 felt tip pen, 1 pencil, 1 pair of scissors, 1 ruler, 2 pairs of earplugs) as well your personal calculator (if applicable) with you. Also take your water bottle with you.
- Wait at your table until your envelopes are collected. Once all envelopes are collected your guide will escort you out of the examination area.

General Data Sheet

Speed of light in vacuum	c	$=$	$299\,792\,458\ \mathrm{m\cdot s^{-1}}$
Vacuum permeability (magnetic constant)	μ_0	$=$	$4\pi\times10^{-7}\ \mathrm{kg\cdot m\cdot A^{-2}\cdot s^{-2}}$
Vacuum permittivity (electrical constant)	ε_0	$=$	$8.854\,187\,817\times10^{-12}\ \mathrm{A^2\cdot s^4\cdot kg^{-1}\cdot m^{-3}}$
Elementary charge	e	$=$	$1.602\,176\,620\,8(98)\times10^{-19}\ \mathrm{A\cdot s}$
Mass of the electron	m_e	$=$	$9.109\,383\,56(11)\times10^{-31}\ \mathrm{kg}$
		$=$	$0.510\,998\,946\,1(31)\ \frac{\mathrm{MeV}}{\mathrm{c^2}}$
Mass of the proton	m_p	$=$	$1.672\,621\,898(21)\times10^{-27}\ \mathrm{kg}$
		$=$	$938.272\,081\,3(58)\ \frac{\mathrm{MeV}}{\mathrm{c^2}}$
Mass of the neutron	m_n	$=$	$1.674\,927\,471(21)\times10^{-27}\ \mathrm{kg}$
		$=$	$939.565\,413\,3(58)\ \frac{\mathrm{MeV}}{\mathrm{c^2}}$
Unified atomic mass unit	u	$=$	$1.660\,539\,040(20)\times10^{-27}\ \mathrm{kg}$
Rydberg constant	R_∞	$=$	$10\,973\,731.568\,508(65)\ \mathrm{m^{-1}}$
Universal constant of gravitation	G	$=$	$6.674\,08(31)\times10^{-11}\ \mathrm{m^3\cdot kg^{-1}\cdot s^{-2}}$
Acceleration due to gravity (in Zurich)	g	$=$	$9.81\ \mathrm{m\cdot s^{-2}}$
Planck's constant	h	$=$	$6.626\,070\,040\ (81)\times10^{-34}\ \mathrm{kg\cdot m^2\cdot s^{-1}}$
Avogadro number	N_A	$=$	$6.022\,140\,857\ (74)\times10^{23}\ \mathrm{mol^{-1}}$
Molar gas constant	R	$=$	$8.314\,4598(48)\ \mathrm{kg\cdot m^2\cdot s^{-2}\cdot mol^{-1}\cdot K^{-1}}$
Molar mass constant	M_u	$=$	$1\times10^{-3}\ \mathrm{kg\cdot mol^{-1}}$
Boltzmann constant	k_B	$=$	$1.380\,648\,52(79)\times10^{-23}\ \mathrm{kg\cdot m^2\cdot s^{-2}\cdot K^{-1}}$
Stefan-Boltzmann constant	σ	$=$	$5.670\,367\ (13)\times10^{-8}\ \mathrm{kg\cdot s^{-3}\cdot K^{-4}}$

Translation AUS

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