May 03, 2016

General Instructions

1. The theoretical examination lasts for 5 hours and is worth a total of 60 points. It will be converted to 30 points in the final scores.

2. Dedicated APhO Answer Sheets are provided for writing your answers. Write your answers only on the Answer Sheets (marked **A**). Enter the final answers into the appropriate boxes in the Summary Table of Answer Sheets on the first (or two) page(s). There are extra Rough Sheets for carrying out detailed work/rough work (marked **B**). If you have written something on any sheet which you do not want to be graded, please cross it out.

3. Fill out all the entries in the header (Student Code and Page number).

4. You may answer the questions T1, T2 or T3 in any order. You may also be able to solve later parts of a question without having solved the previous ones.

5. You are not allowed to leave your working place without permission. If you need any assistance (malfunctioning calculator, need to visit a restroom, insufficient answer sheets or rough sheets, etc), please draw the attention of the invigilator using one of the two cards (red card for help and green card for toilet).

6. The beginning of the examination will be indicated by the sound signal of a gong. Also there will be sound signals every hour indicating the elapsed time. Additionally, there will be a sound signal, fifteen minutes before the end of the examination. At the end of the examination, there will be a long sound signal.

7. At the end of the examination you must stop writing immediately. Sort and number your Answer Sheets and Rough sheets, put it in the envelope provided, and leave it on your table. You are not allowed to take any sheet of paper out of the examination area.

8. Wait at your table till your envelope is collected. Once all envelopes are collected your student guide will escort you out of the examination area.

9. A list of physical constants is given on the next page.

General Data Sheet

Acceleration due to gravity on Earth	g	9.807 m s^{-2}
Atmospheric pressure	P_{atm}	$1.013 \times 10^5 \text{ Pa}$
Avogadro number	N_A	$6.022 \times 10^{23} \text{ mol}^{-1}$
Boltzmann Constant	k_B	$1.381 \times 10^{-23} \text{ J K}^{-1}$
Binding energy of hydrogen atom	$-$	13.606 eV
Magnitude of electron charge	e	$1.602 \times 10^{-19} \text{ C}$
Mass of electron	m_e	$9.109 \times 10^{-31} \text{ kg}$
Mass of proton	m_p	$1.673 \times 10^{-27} \text{ kg}$
Mass of neutron	m_n	$1.675 \times 10^{-27} \text{ kg}$
Permeability of free space	μ_0	$1.257 \times 10^{-6} \text{ H m}^{-1}$
Permittivity of free space	ϵ_0	$8.854 \times 10^{-12} \text{ F m}^{-1}$
Planck's constant	h	$6.626 \times 10^{-34} \text{ J s}$
Reduced Plank's constant	$\hbar$	$1.055 \times 10^{-34} \text{ J s}$
Speed of light in vacuum	c	$2.998 \times 10^8 \text{ m s}^{-1}$
Stefan-Boltzmann constant	σ	$5.670 \times 10^{-8} \text{ W m}^{-2} \text{ K}^{-1}$
Universal constant of Gravitation	G	$6.674 \times 10^{-11} \text{N m}^2 \text{ kg}^{-2}$
Universal gas constant	R	$8.314 \text{ J mol}^{-1} \text{ K}^{-1}$