



Experimental Examination

July 07, 2015

General Instructions

- The experimental examination lasts for 5 hours and is worth a total of 20 marks.
- You must neither open the envelope with the problems nor touch the experimental equipment before the sound signal indicating the beginning of the competition.
- Dedicated IPhO Answer Sheets are provided for writing your answers. Enter the observations into the appropriate tables/boxes in the corresponding Answer Sheet. All graphs must be drawn only on the IPhO Graph Papers provided. Blank pages are also provided (marked **B**). If you have written something on any sheet which you do not want to be graded, cross it out.
- Fill out all the entries in the header (Contestant Code, Page number etc.).
- You are not allowed to leave your working place without permission. If you need any assistance (broken calculator, need to visit a restroom, etc), please draw the attention of the invigilator using one of the two cards (red card for help and green card for toilet).
- The beginning and end of the examination will be indicated by a sound signal. Additionally there will be sound signals every hour indicating the elapsed time. Additionally there will be a buzzer sound, fifteen minutes before the end of the examination (before the final sound signal).
- At the end of the examination you must stop writing immediately. Sort and number your Answer Sheets and Graph Papers. Put them in the envelope provided, and leave the envelope on your table. You are not allowed to take any sheet of paper out of the examination area.
- 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.



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10:00 – 15:00

2015 is being celebrated as the International Year of Light. Optical techniques play an important role in experimental physics. Diffraction is an amazingly powerful tool used across the sciences, and has helped unravel the structure of complex molecules like DNA and study the properties of matter in great detail. Today you will perform experiments using diffraction of laser light.

Experiment E-I: **Diffraction due to helical structures** 10 marks

Experiment E-II: **Diffraction due to surface tension waves** 10 marks

Experiments E-I and E-II use the same optical bench, but with different apparatus and settings. You must begin with experiment E-I and then go on to E-II.

Important Precautions

- Do not look into the laser beam directly or through any optical device.
- The experiments use low-power visible lasers. However, you are advised to wear laser goggles while performing optical alignments.
- Do not place highly reflective objects (such as rings, watches etc.) in the path of the laser beam.
- The stand on your right hand side has a pre-adjusted setup for E-II. Do not disturb it before you start working on E-II.
- The mirrors are front-coated, avoid touching the surface of the mirrors.
- Do not use the DC regulated power supply for the tablet computer.
- Avoid unnecessary movements during the experimental examination. Do not shake the walls of your cubicle. Laser experiments require stability.