

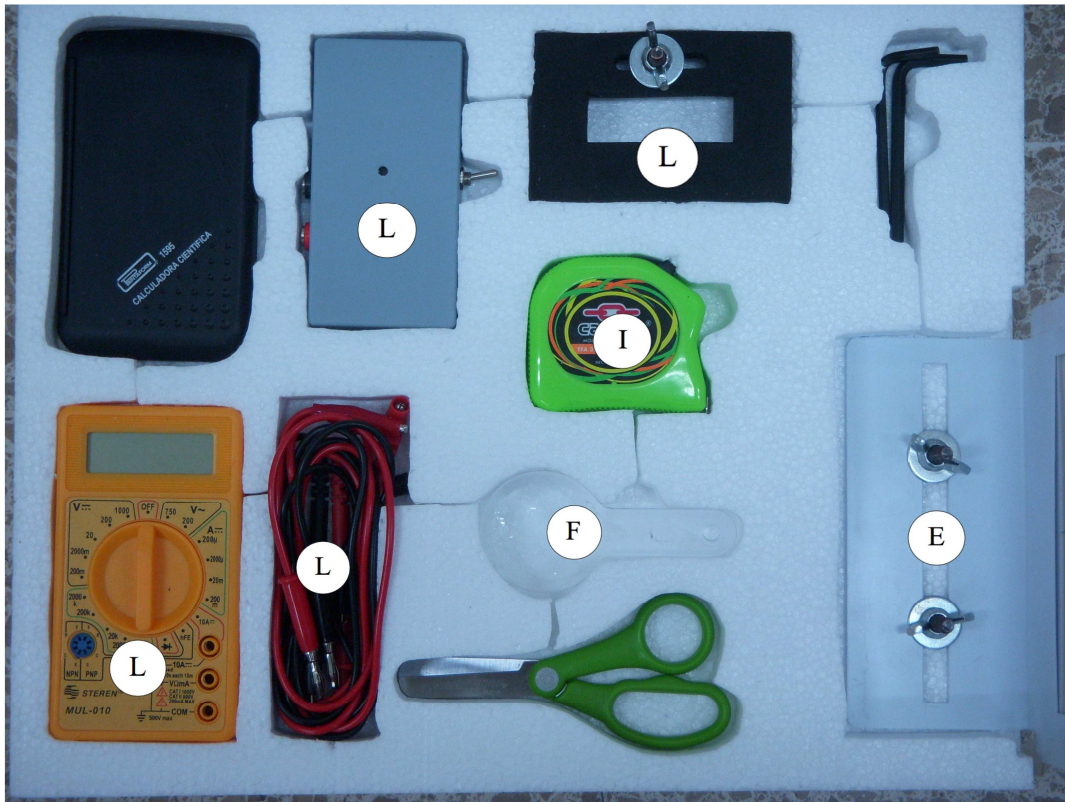
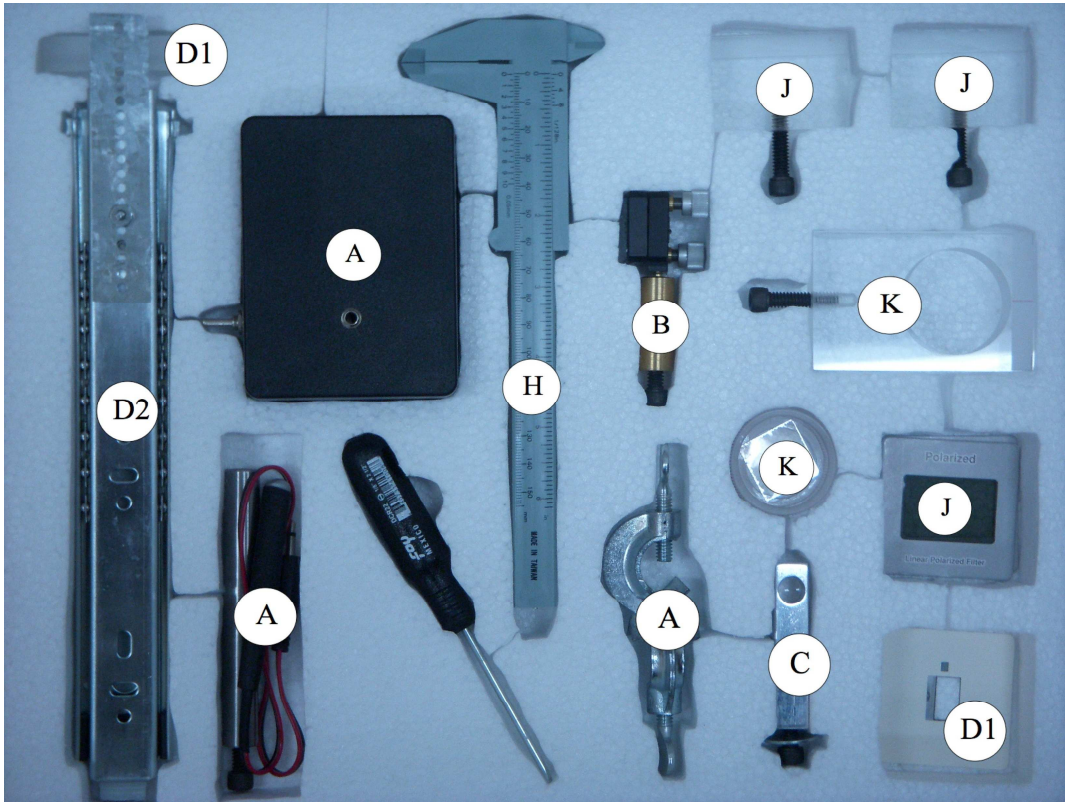
IPhO2009

Experimental Competition
Wednesday, July 15, 2009

The experimental part of this Olympiad consists of two problems. In Problem 1 the aim is to measure the wavelength of a diode laser, and in Problem 2 the goal is to measure the birefringence of a material called mica.

Please read this first:

1. The total time available is 5 hours for the experimental competition.
2. Use only the pencils provided.
3. Use only the front side of the paper sheets.
4. Each problem is presented in the *question form*, marked with a **Q** in the upper left corner.
5. You *must* summarize the answers you have obtained in the *answer form*, marked with an **A** in the upper left corner.
6. In addition, there is a set of *working sheets*, marked with a **W** in the upper left corner, where you may write your calculations.
7. In addition, write down the *Problem Number* (1 or 2) on the top of the *answer forms* and *working sheets*.
8. Write on the working sheets of paper whatever you consider is required for the solution of the problem. Please use *as little text as possible*; express yourself primarily in equations, numbers, figures, and plots.
9. For each problem and each of the forms (question form, answer form and working sheets), fill in the boxes at the top of each sheet of paper used by writing your student number (*Student Number*), the progressive page number (*Page No.*) and the total number of pages used (*Total No. of Pages*). If you use some working sheets of paper for notes that you do not wish to be marked, do **not** destroy it. Instead, mark it with a large X across the entire working sheet and do **not** include it in your numbering.
10. At the end of the exam, arrange all sheets for each problem *in the following order*:
 - answer form (including graph paper for your plots).
 - used working sheets in order
 - the working sheets that you do not wish to be considered (marked with the large X)
 - unused working sheets
 - printed question form.Place the papers of each problem set inside the folder and leave everything on your desk. You are not allowed to take *any* sheets of paper out of the room nor any device of the experimental kit.
11. The devices and materials for the experiments are contained in **two** separate packing layers within the box. The photographs of the sets are in the next page. Some devices are LABELED. For each experiment check that all the material is in the box. **If during the experiments you find that any of the devices is not working properly, please ask for a replacement.**



DIODE LASER EQUIPMENT AND MOVABLE MIRROR.

In both experimental setups you should need a diode laser, with its holder and power supply, and a mirror on a mechanical movable mount.

Before you decide on which problem to work first, we suggest that you mount the laser and the mirror, as indicated in Figure 0. Use the following material:

- 1) Wooden optical table.
- 2) Diode laser equipment. Includes the diode laser, support post, "S" clamp and power supply box (LABEL A). See photograph for mounting instructions. **DO NOT LOOK DIRECTLY INTO THE LASER BEAM.**
- 3) A mirror on a movable mount with two adjusting knobs and support post (LABEL B). See photograph for mounting instructions. **CAUTION: mount the support post to the optical table without touching the mirror. Take off the paper cover after you have mounted the mirror.**

Mount the above devices as indicated in Figure 0. The alignment of the laser beam will be done later on. NOTE: Although we have provided you with optional Allen wrenches, everything can be left fingertight.

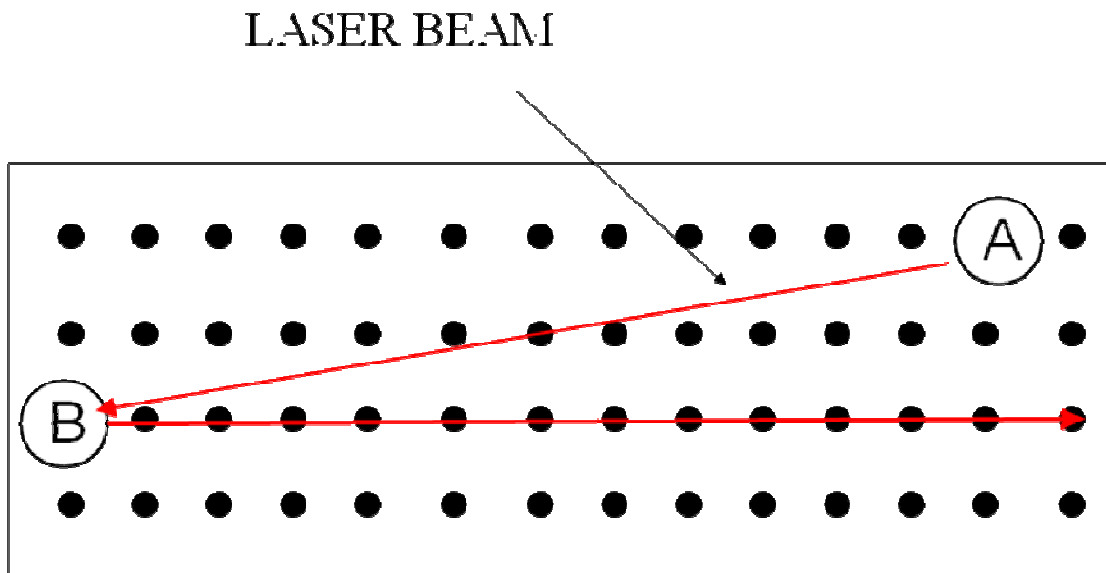
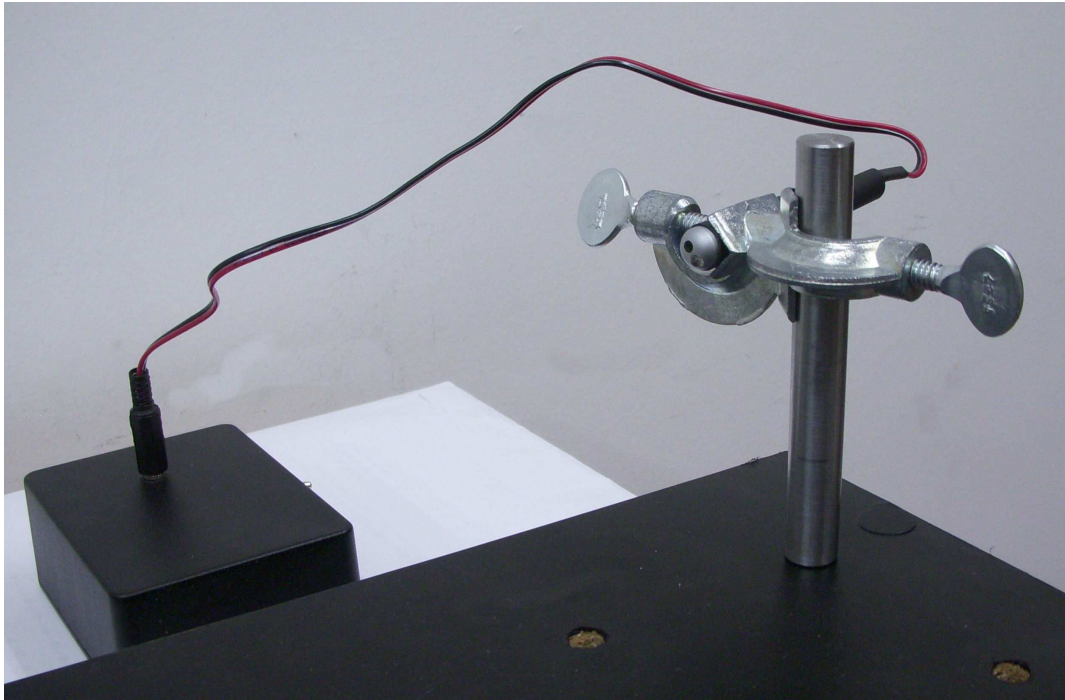
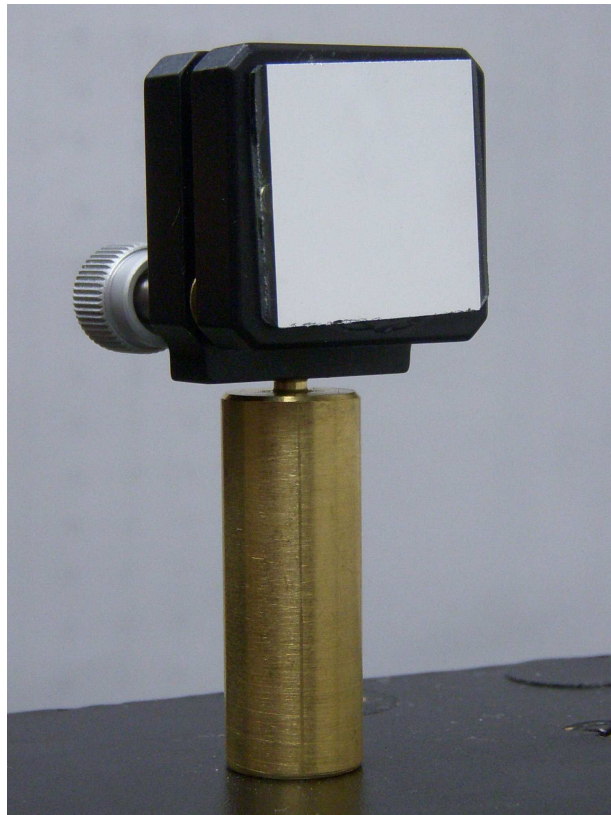


Figure 0. Mounting the laser and the mirror.



Diode laser, support post, "S" clamp and power supply box (LABEL A).



Mirror on a movable mount with two adjusting knobs and support post (LABEL B).