

Laser Shoot Briefing for Coaches' Workshop

November 17, 2023

James Luis and Cole Mason
Event Supervisors

Structure of the Event

Total Event Time: approx 50 mins

- Part I - Written Test: approx 40 mins
- Part II - Laser Shoot: approx 10 mins

Part I - Written Test

Format: Around 20 questions consisting of approximately equal parts:

- Multiple Choice Questions
- True-False Questions
- Work-Out Math Questions
- Completion Questions

All answers must be in metric units.

The written test will also comprise approximately equal parts of the following topics shown on the next slide.

Topics that Might Appear on the Written Test

Division B

1. Structure and Function of Optical Systems:
 - a. Microscopes
 - b. Telescopes
 - c. Cameras
 - d. Glasses
 - e. Retro reflectors
 - f. Periscopes
2. Absorption Spectra in:
 - a. Films
 - b. Chemicals
 - c. Dyes

Division C

1. All Division B topics, plus...
2. Lasers
 - a. Structure and Function
 - b. Coherent light

Required Math Skills

Division B

- Simple algebra manipulations, including solving one equation for one variable
- Simple trigonometric relations (inc. calculator use)
- No angles in radians

Division C

- Same as Division B, plus...
- More sophisticated algebra (e.g solving systems of equations for multiple variables)

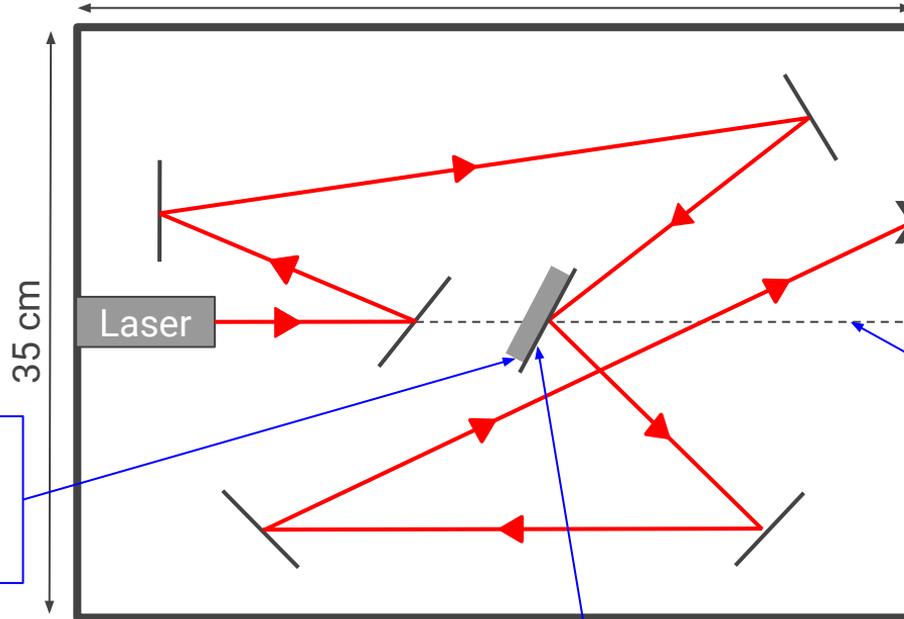
Part II - Laser Shoot

- Objective: Place mirrors to reflect a laser beam around barrier(s) towards a “Target Point” located on the wall opposite the laser.
- Time Limit: 4 minutes (teams take it in turns)
- Basic Rules:
 - The laser is not turned on until after the 4 minutes are up
 - Mirrors are covered until laser is switched on
 - Before each team starts, the five relocatable mirrors are reset to a “home” position
 - Relocatable mirrors can be moved to anywhere in the Laser Shoot Setup
 - Teams cannot adjust the orientation or position of the laser
 - Teams cannot move the “barrier mirror”

Laser Shoot Setup: Division B

- 5 relocatable mirrors
- 1 "barrier mirror"
- Mirror widths: 5.0-8.0 cm
- Barrier widths: 2.0-8.0 cm

56 cm



35 cm

Laser

"Target point"

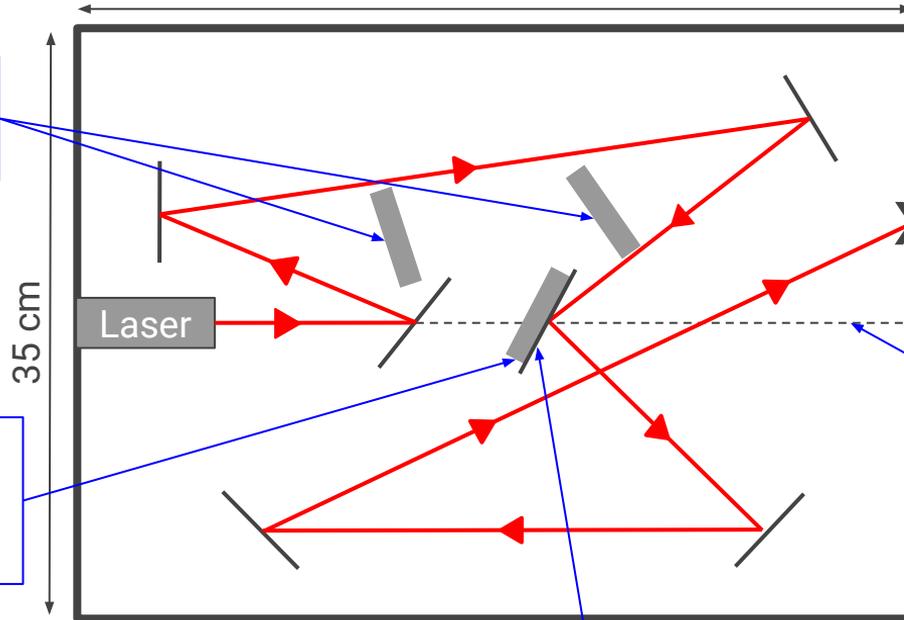
"Midline" to opposite wall marking laser's optical axis

Fixed "Barrier" anywhere along midline

"Barrier" mirror on back of barrier

Laser Shoot Setup: Division C

56 cm



Extra two
barriers

35 cm

Laser

Fixed "Barrier"
anywhere along
midline

"Barrier" mirror on
back of barrier

"Target
point"

"Midline" to opposite
wall marking laser's
optical axis

- 5 relocatable mirrors
- 1 "barrier mirror"
 - (Division C: **any barrier may have barrier mirror**)
- Mirror widths: 5.0-8.0 cm
- Barrier widths: 2.0-8.0 cm

Detailed Rules for Event Supervisors

- The event supervisor must select a Target Point location that is the same for all teams
 - Teams must not be informed of the location until it is their turn to compete in Part II (Laser Shoot) of the event
- The Event Supervisor must test the beam's alignment before each team is permitted to see the Laser Shoot Setup
- All mirrors must be placed in a home position designated by the event supervisor before each team is permitted to see the Laser Shoot Setup
- When a team is ready to begin, the event supervisor must give a countdown of "3, 2, 1 start" and start a timer
 - Event Supervisors must give teams a warning when 3 minutes have elapsed

Detailed Rules for Competitors

- Competitors must make all measurements, calculations, and mirror placement/alignment within a 4-minute time period.
 - Competitors may choose to use between 1 and 5 relocatable mirrors.
- Timing stops when 4 minutes have elapsed or the competitors uncover the face of one mirror
 - Competitors must not make any additional adjustments to the mirrors at that point other than to remove the mirror coverings.
 - The Event Supervisor must not remove the coverings.
- Competitors must not mark on or modify the LSS.
- Competitors must not touch the laser or change its orientation and/or position.
- The laser must not be turned on until timing stops.
 - Once turned on, the Event Supervisor must mark on the paper mounted above the metric scale where the laser strikes it to record the results
 - Participant tools/ templates may remain on the LSS during this process

Scoring

- Final Score = Exam Score + Mirrors Score + Accuracy Score + Barrier Score
 - Exam Score = (Written Exam Score / Highest Written Exam Score of All Teams) x 50
 - Mirrors Score = Number of **Relocatable** Mirrors Used x 5 (Max 20)
 - Accuracy Score = 25 – (distance from target in mm/10) (Min 0)
 - Barrier Score = 5 if the laser reflects off the barrier mirror
- Tie breaks based on designated questions on the Written Exam
 - These will be identified prior to the written exam
- **Rule violations will result in penalties**
 - The Accuracy Score, Mirrors Score, and Barrier Score will be multiplied by 0.9 when calculating the Final Score if the team violates any of the rules on the previous slide
- **Unsafe behaviors will result in disqualification (i.e. 0 points)**

What to bring to the event (per team)

- One three-ring binder of any size containing information in any form and from any source, attached using the available rings. Sheet protectors, lamination, tabs and labels are permitted. (Participants may remove information or pages for their use during any part of the event).
- Tools, premade templates, supplies, writing utensils
- Up to two stand-alone calculators of any type

What **not** to bring to the event

- Lasers
- Mirrors
- Barriers
- Timers

Safety

- Laser will be eye-safe (no safety goggles required)
 - Still, do not stare at laser beam
- Safe practices will be enforced:
 - Don't direct laser beam at people
 - Do not touch laser at all
 - ***“Any operation of a device focused toward another person’s head may be considered unsafe operation and result in disqualification.” - <https://www.soinc.org/lasers>***
 - Remove reflective jewelry on hands or wrists
- Laser will be operated under supervision of event supervisors

Hints for Success

- Pay attention to the clock
 - Four minutes will pass quickly, do not spend too much time on one mirror
- Errors build up
 - More mirrors means a higher chance to severely miss the target point
 - But, more mirrors also means more points
- Useful tools
 - Protractor
 - Metal ruler (or straight edge)
 - Pre-made templates



Good luck!