

Optics (30 Minutes - Based on Team Schedule)

Description: Teams will participate in an activity involving the positioning of mirrors to direct a laser beam towards a target. The event has a written test on the geometric and physical concepts of optics.



Participants per team: 2 or 3

Spirit of the competition:

- It is a rules violation if coaches, parents, mentors, or spectators enter the competition area or communicate with the team members at any time during the competition. Violation of this rule will place the team below all other teams.

Safety Requirements:

- No AC power will be used.
- The Event Supervisor will operate the laser.
- Division A uses a Class 2 Laser Pointer: A Class 2 laser is safe because the blink reflex will limit the exposure to no more than 0.25 seconds. It only applies to visible-light lasers (400-700 nm). Class-2 lasers are limited to 1 mW continuous wave, or more if the emission time is less than 0.25 seconds or if the light is not spatially coherent. Intentional suppression of the blink reflex could lead to eye injury. Many laser pointers are class 2.

Teams must bring:

- Sharpened pencils (2-3), Protractor, and a Ruler. Optionally a four-function calculator.

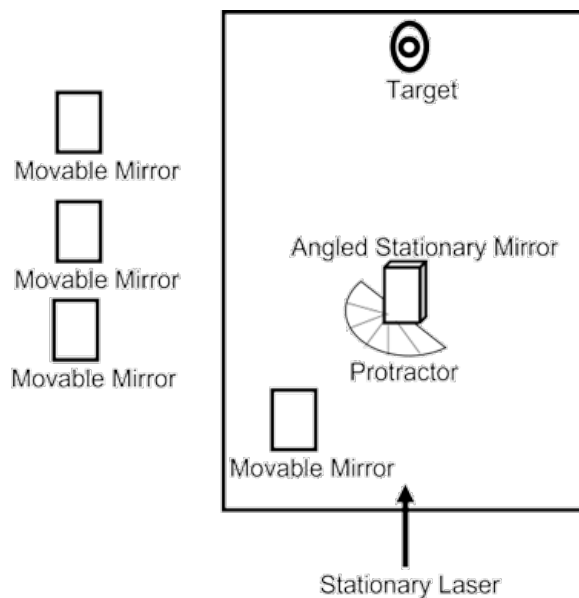
Materials provided at event:

- Event supervisors will provide mirrors, a class 2 laser, 1 stationary and 4 movable mirrors.
- Event supervisors will provide a paper exam based on the vocabulary listed below.
- Target size 2 cm diameter
- Mirror size \approx 6.5 cm by 7.5 cm

The Competition: *The practical application will take place during the knowledge test. Teams will be called one at a time for the practical application.*

Part 1 - Practical application:

- Teams will use up to 4 mirrors to direct a beam of light from a stationary laser pointer mounted inside 50 cm by 30cm device.
- The device will have a mounted laser pointer, a stationary target, and an angled stationary mirror.
- The angle of the stationary mirror will not be known until the day of the competition and will only be posted in the testing room.
- Teams will use one movable and the stationary mirror to bounce a light to the target within three minutes.
- Teams may not move the mirrors after they have been set or during the operation of the laser pointer.
- Teams receive a bonus, up to three, for each extra mirror used to reach the target.
- Teams will have 2 minutes to direct the beam of light



through as many mirrors as possible.

- Teams may move and adjust their mirrors after each laser pointing but may not exceed the three-minute total time limit.
- Teams must use a minimum of two mirrors to hit the target, one of them being the stationary mirror
- A protractor will be placed under the stationary mirror.
- Teams may use their own protractor when setting bonus mirrors.
- The Event Supervisor or designee will time the teams.

Part 2 - Knowledge Application:

Teams will demonstrate their understanding of basic optics, and light properties. Vocabulary is limited to the provided list.

absorb	amplitude	concave	convex
crest	electromagnetic	electromagnetic spectrum	energy
frequency	infrared	lens	mirror
opaque	radiation	rainbow	reflect
reflection	refract	refraction	solar radiation
spectrum	translucent	transmit	transparent
trough	ultraviolet	visible light	visible spectrum
wave	wave speed	wavelength	white light

Scoring:

Teams receive cumulative points:

- 1 point for each whole second under three minutes (time is rounded to the nearest second) used to complete the first mirror task.
- 5 points for each mirror used after the stationary and first mirror (maximum 15 points).
- 1 point for each correct response on the written test

Tiebreakers:

- 1st Tiebreaker – time
- 2nd Tiebreaker – targets hit
- 3rd Tiebreaker - the accuracy or quality of answers to selected questions chosen by the Event Supervisor prior to competition.

Possible Resources:

Division A will not release previous tests, or the exact resources used by the Event Supervisor or test writer for any events. The listed resources are meant as a starting point. It is up to the competitor to research further.

- [Optics | Science Olympiad](#)