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Optical Bench
4-66000

Warning:

- **Not a toy; use only in a laboratory or educational setting.**
- **California Proposition 65 Warning: This product can expose you to chemicals including lead, nickel, and chromium which are known to the State of California to cause cancer, birth defects, or other reproductive harm. For more information go to www.P65Warnings.ca.gov.**

Introduction

The Optical Bench is used to demonstrate image formation using lenses and mirrors. This is an apparatus that is fitted for the convenient location and adjustment of light sources and optical devices and that is used for the observation and measurement of optical phenomena.

What is a Lens and How Does It Work?

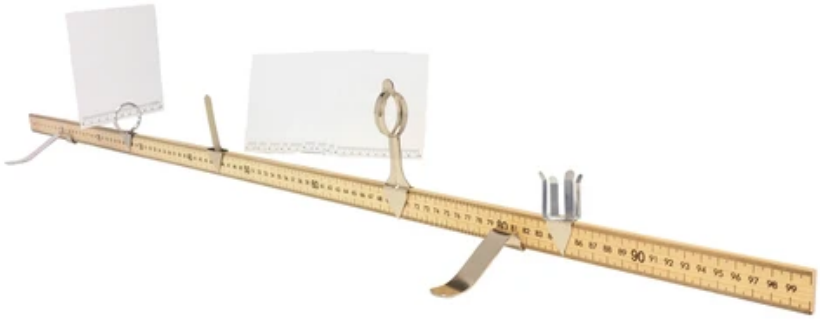
A lens is a transparent piece of glass or plastic with at least one curved surface. A lens works by refraction: it bends light rays as they pass through it so they change direction. That means the rays seem to come from a point that's closer or further away from where they actually originate and that's what makes objects seen through a lens seem either bigger or smaller than they really are.

There are two main types of lenses, known as convex (or converging) and concave (or diverging). In a convex lens the glass (or plastic) surfaces bulge outwards in the center. A convex lens is also called a converging lens because it makes parallel light rays passing through it bend inward and meet (converge) at a spot just beyond the lens known as the focal point. Convex lenses are used in things like telescopes and binoculars to bring distant light rays to a focus in your eyes.

A concave lens is exactly the opposite with the outer surfaces curving inward, so it makes parallel light rays curve outward or diverge. That's why concave lenses are sometimes called diverging lenses. Concave lenses are used in things like TV projectors to make light rays spread out into the distance.

What your kit includes:

- Meter Stick (100 cm)
- 2 Meter Stick Supports
- Candle Holder
- 10 Object Screens with mm Scale
- Screen Support
- Lens Support for a 38 mm Lens or Mirror
- Object Marker



The Optical Bench parts are designed to fit onto a standard size meter stick and to hold the items in a straight line on the meter stick. The meter stick supports will hold a meter on its narrow edge and the v-shaped bottom of the optical bench parts will sit snugly on the meter stick.

Determining Focal Length Using the Optical Bench

Place a lens in the lens holder and an object screen with scale in the screen support and mount both on the meter stick of the optical bench. The lens should be between the object you would like to view and the object screen with scale. It may be helpful to dim the lighting in the room. Move the lens and lens holder on the meter stick until a clear image appears on the object. The lens is now in focus with the object. The distance from the object to the center of the lens is the focal length of the lens, Fi.

Focal Length From Object- Image Distance

Keep the same arrangement as listed above and place the object marker on the meter stick as far away as possible from the lens and object. If the image of the marker is to be brought into focus on the object, the lens may need to be moved slightly. Record the distance from the object to the lens; this is the image distance, Li. Record the distance from the marker to the lens; this is the object distance, Lo. Repeat this procedure using different positions at least two more times, recording values for Li and Lo. The focal length of the lens may then be calculated by the relationship: Fi = Li + Lo

- The ray of light (1), which is parallel to the axis, passes through the point on the axis which corresponds to the lenses focal length.
- The ray of light (2) will pass through the center of the lens unrefracted.
- The ray of light (3), which is passing through a point one focal length in front of the lens, will emerge from the lens parallel to the axis.

* Each of these rays leaving Point A will intersect at Point A^1 which is the image distance, Li.