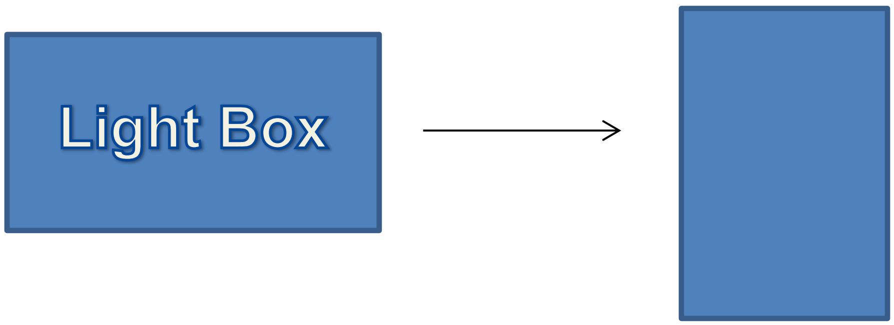
Refraction / Total Internal Reflection/ Thin Lenses Lab

Place the rectangular slab with the long side perpendicular to a single beam.

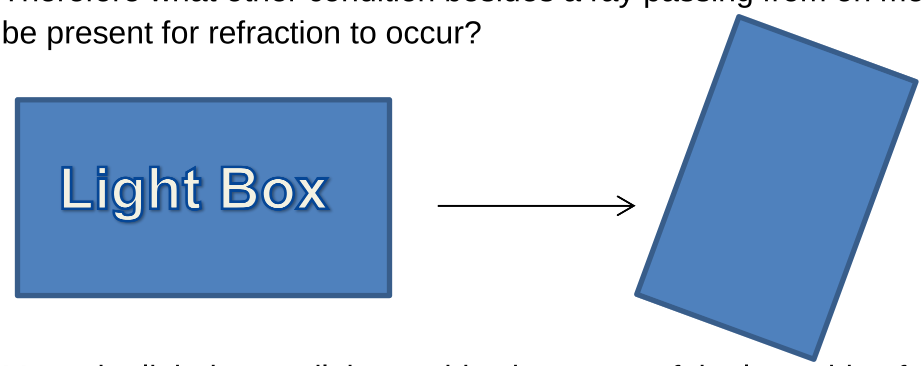


Is there any refraction at either incident or emergent faces?

If not, why not?

The ray passes from one medium (air) into a second medium (acrylic plastic) at the first interface, and vice versa at the second interface.

Therefore what other condition besides a ray passing from on medium to another must be present for refraction to occur?



Move the light box until the ray hits the center of the long side of the slab at an angle of incidence of 45°. Record the incident and emergent paths.

Remove the slab and draw (a) the ray path through the slab. (b) The theoretical ray path which would have been followed had no slab been in position.

Is the emergent ray parallel to the incident ray and its extension?

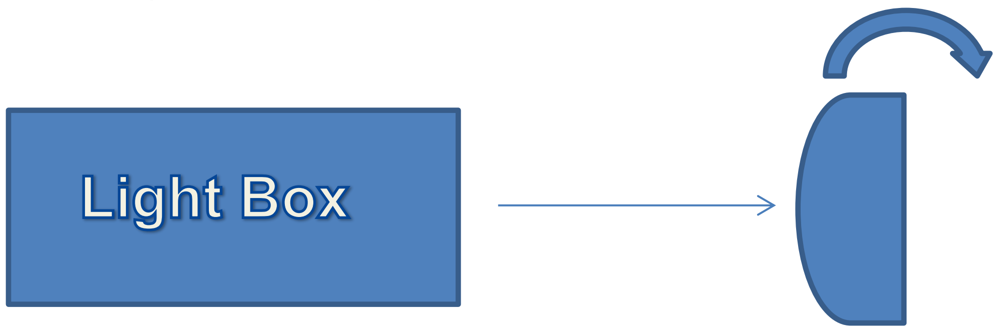
Draw the normal to the interface where the rays entered and emerged from the slab.

Total Internal Reflection

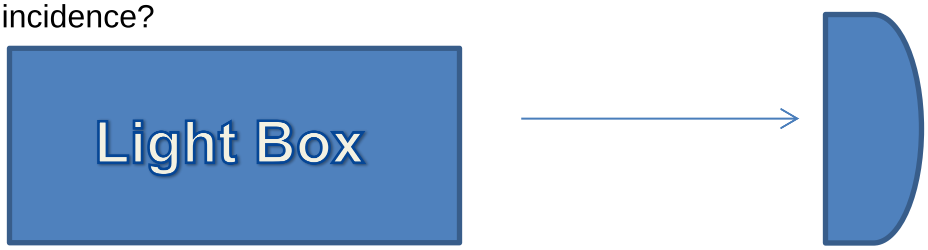
Arrange the semi-circular slab so that a single light ray strikes the curved surface at its normal mid-point and passes through the center of the flat side.

Is there any refraction at either interface? If not, why not?

Mark the position of the center of the straight side of slab and rotate the slab slightly about this point until the ray inside the slab meets the flat side at an angle.



Is the ray at this flat face refracted towards or away the normal at the point of incidence?



Again rotate the slab about the center point of the flat side and observe and record the emergent ray at the new position.

Continue this rotation of the slab until no refracted ray emerges from the flat face.

What is the angle of incidence at the flat face when this occurs?

Rotate the slab a little further.

What happens to the ray that was previously refracted?

Rotate it back again until the ray ceases to be internally reflected and is again refracted.

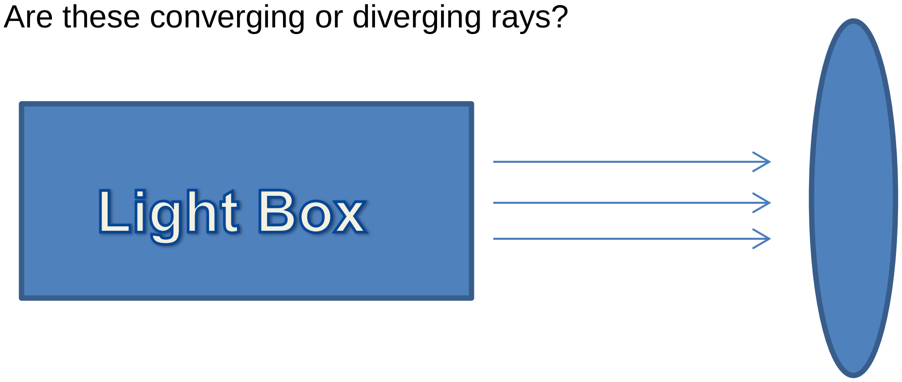
Once again find the angle of incidence at which refraction ceases and Internal Reflection commences.

Focal Line of a Bi-Convex Lens and Bi- Concave Lens

Place one of the bi-convex lenses on a sheet of paper and trace its outline.

Without altering the lens position, arrange the light box to project three parallel rays and trace the path of the rays using dots on your sheet of paper. Label the focal point of the bi-convex mirror.

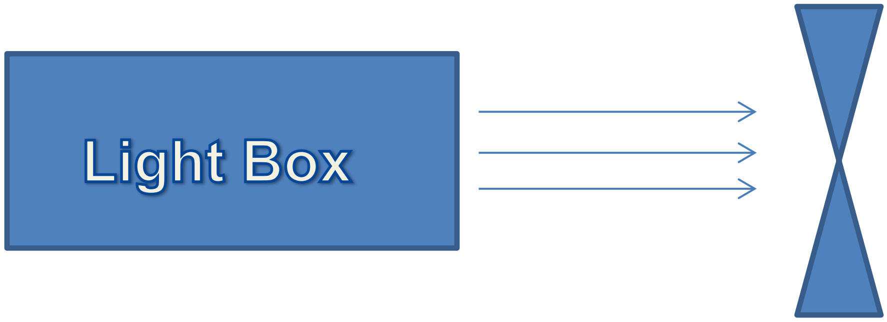
Are these converging or diverging rays?



Now select the lens which has two hollow sides curving towards each other, making it thinner at the center than at the sides – bi-concave.

Aim three parallel rays of light at the lens, parallel to its axis of symmetry.

Trace the lens position and both the entrant and emergent rays. Remove the lens and extend the emergent rays back through the lens position towards the light box.



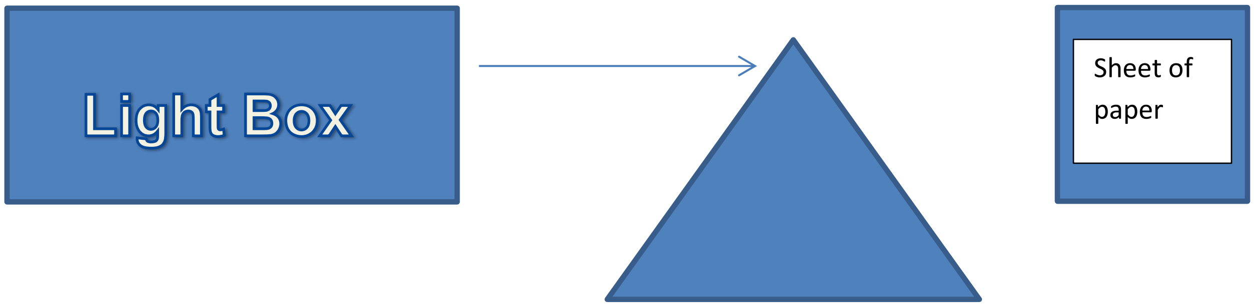
Do they appear to radiate from one point, or from several?

Is a bi-concave lens is a diverging or converging lens? Does it have a positive or a negative focal length?

How is this used in your daily life? People who suffer from short-sightedness use such lenses. This is a condition in which the image formed by the lens of the eye falls short of the light sensitive retina.

<u>Dispersion by Triangle Lens</u>

Pass a single ray through the outer edge of a triangle lens onto a white piece of paper held perpendicular to your lab table. Observe that they have colored edges after refraction.



What has happened to the white light?

What you are now seeing is a phenomenon known as ***dispersion***. The refractive index of the triangle varies with the wavelength or color of light used. This causes colors to be refracted differently and leave the prism at different angles, creating an effect similar to a rainbow.

Why do you think we see the rainbow when a sprinkler is on or after it has finished raining?