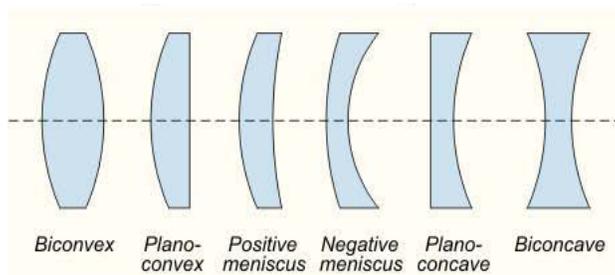


(b) Activity with Lenses, Eyeglasses and Mirrors

Today, I am exploring the convex lenses. When I place the convex lens close to the object (approximately 3 inches or less), the image formed on the convex lens is magnify and virtual. However, the image becomes less sharp when I move the lens further away from the object (more than 3 inches but less than 9 inches). A real image is formed on the convex lens when the lens is place at further distance from the object (approximately 9 inches or more). But the image is become smaller and smaller as the convex lens moves away from the object.

After that, I play the lenses with my torch light (made up of 9 LEDs). I discovered that when I hold and turn on my torch light directly onto the lenses, some images of the 9 LEDs are formed on the lenses. This experiment must be carry out in a dark room.

Apparatus:

Ruler, torch light (made up of 9 LEDs), a biconvex lens, a biconcave lens, a negative meniscus lens and a flat mirror.

Procedures:

- 1) Place all the lenses on a flat non-reflective surface table.
- 2) Direct the torch light onto the top surface of the biconvex lens from point A, 30cm above the table.
- 3) Observe the images formed in/on the lenses. Record your observations with some sketches.
- 4) Direct the torch light onto the top surface of the biconvex lens from point C, 30cm above the table.
- 5) Observe the images formed in/on the lenses. Record your observations with some sketches.
- 6) Repeat steps (2) to (5) for the following lenses:
 - (a) negative meniscus lens
 - (b) biconcave lens
 - (c) combination of a **negative meniscus lens** place at the bottom (the curved surface face down) and a biconvex lens **on top of the negative meniscus lens**
 - (d) combination of a **negative meniscus lens** place at the bottom (the curved surface face down) and a biconcave lens **on top of the negative meniscus lens**
 - (e) combination of a biconcave lens place at the bottom and a **negative meniscus lens** (the curved surface face up) **on top of the biconcave lens**
 - (f) combination of a biconcave lens place at the bottom and a biconvex lens
 - (g) combination of a biconcave lens place at the bottom, a biconvex lens place at the middle and a **negative meniscus lens** place **on top of the biconvex lens** (the curved surface face up)
 - (h) combination of a **negative meniscus lens** (the curved surface face up) place at the bottom, a biconvex lens place at the middle and a biconcave lens place **on top of the biconvex lens**
 - (i) combination of a biconcave lens place at the bottom, a biconvex lens place at the middle and a **negative meniscus lens** (the curved surface face up) place at **on top of the biconvex**

lens; a piece of flat mirror is place at the bottom of this model

7) Observe the images formed in/on the lenses. Record your observations with some sketches.

I have sketch out all the images I have seen during this experiment on my journal. The following are the summary of my observations:

Type of Lenses	Total No. of Images Appeared on the Lenses
single biconvex lens	2 sharp bright images - one of the images is slightly bigger than the other one
single negative meniscus lens	2 sharp bright images - one of the images is bigger than the other one
single biconcave lens	2 sharp bright images - one of the images is much more bigger than the other one
combination of a negative meniscus lens place at the bottom (the curved surface face down) and a biconvex lens on top of the negative meniscus lens	4 sharp bright images and 2 less sharp images (in between the lenses) - two of the sharp bright images are slightly bigger than the other two at the middle.
combination of a negative meniscus lens place at the bottom (the curved surface face down) and a biconcave lens on top of the negative meniscus lens	4 sharp bright images and 2 less sharp images (in between the lenses) - four sharp bright images have different sizes.
combination of a biconcave lens place at the bottom and a negative meniscus lens (the curved surface face up) on top of the biconcave lens	4 sharp bright images - first top two images are smaller than the bottom one
combination of a biconcave lens place at the bottom and a biconvex lens	4 sharp bright images and 2 less sharp images - first top two images are smaller than the bottom one
combination of a biconcave lens place at the bottom, a biconvex lens place at the middle and a negative meniscus lens place on top of the biconvex lens (the curved surface face up)	6 sharp bright images - the bottom two images are larger than the other four images above; the two images at the middle are the smallest in size among the six images.
combination of a negative meniscus lens (the curved surface face up) place at the bottom, a biconvex lens place at the middle and a biconcave lens place on top of the biconvex lens	5 sharp bright images - the first top image is the largest; the three images at the middle are the smallest in size among the five images; the image at the bottom is slightly larger than the three images formed at the middle.
combination of a biconcave lens place at the bottom, a biconvex lens place at the middle and a negative meniscus lens (the curved surface face up) place at on top of the biconvex lens ; a piece of flat mirror is place at the bottom of this model	6 sharp bright images, 4 less bright images and 6 less sharp and bright images - For the bright sharp images: the bottom two images are larger than the other four images above; the two images at the middle are the smallest in size among the six images. - For the less bright images: four images have the same size

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