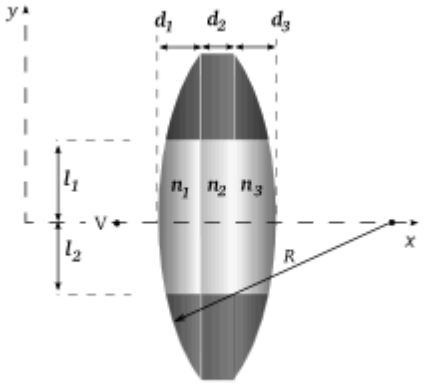
Biconvex Lens tool

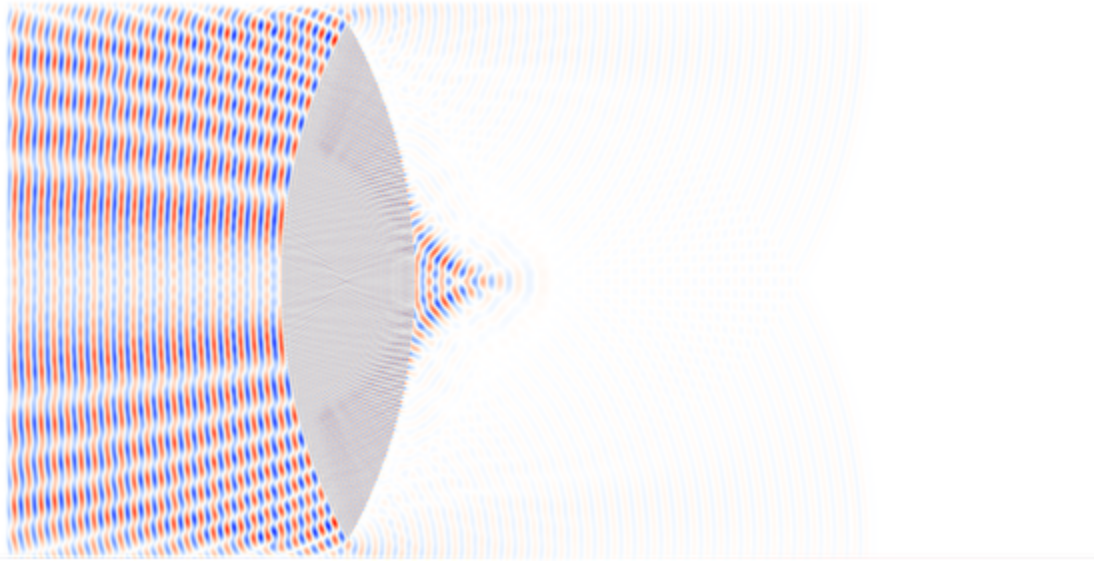
http://nanohub.org/resources/biconvex

Launch this tool and you will see that there is one lens with 10 parameters: the radius of curvature for the leftmost side of the lens labeled R, the width of the left part of the lens labeled d_1, the middle of the lens labeled d_2, the right hand part of the lens labeled d_3, the index of refraction of the left hand part of the lens labeled n_1, the index of refraction of the middle of the lens labeled n_2, the index of refraction of the righthand part of the lens labeled n_3, the y coordinate of the top of the aperture labeled l_1, the negative of the y coordinate of the bottom of the aperture labeled l_2, and the x coordinate of the leftmost part of the lens labeled V.



There are 3 other parameters to describe the properties of the wave source. S is the x coordinate of where the plane wave will propagate. The wavelength is the distance that the light covers to complete a full period. The Periods label marks how long you want the simulation to run. The more periods, the longer it runs.

As a trial, make R=8 mm, d_1=1 mm, d_2=0 mm, d_3=1 mm, n_1=1.5, n_2=1.5, n_3=1.5, l_1=4 mm, l_2=4 mm, Wavelength=200 um, V=-4 mm, S=-4.1 mm, and Periods=50. Run the simulation, and the last slide should look like:



Question 1.

- If you have a thin lens with $r_1=-r_2=8$ mm (R=8 mm, and $d_1=d_3=.5$ mm, while $d_2=0$ mm) and n=3, then how far away from the lens would light from a plane wave focus, in mm?

Question 2.

- If the lens above had n=2 instead of n=3, by what factor would the focal length increase.

Question 3.

- Now if you use the same lens from above with n=1, how far away from the lens would light from a plane wave focus, in mm.

Question 4.

- If you use n<1, the lensmaker's equation will give you a focal length. Why is this peculiar? http://en.wikipedia.org/wiki/Refractive_index

Question 5.

- We have a lens with $r_1=-r_2=8$. Assume that this lens is very thin. We have a second lens where r_2=infinity and r_1 is unknown. If we know that the second lens has the same index of refraction as the first lens, and the second lens has the same focal length as the first lens, then what is r_1 for the second lens (assume $d_1=.5$ mm).

Question 6. (For this one, use 1000um until you are very close, then use 300 um)

- Make a lens that inverts a plane wave that enters it (a plane wave comes in, and a plane wave comes out).

Question 7.

- Make a spherical lens of radius 4 mm and index of refraction 1.5 and investigate how light interacts with it.