Physics 132

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Lens and Geometric Optics

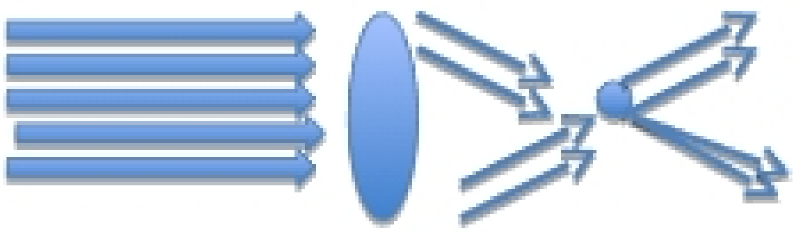
Abstract: In this experiment we tested both concave and convex lenses and tests how they projected different images at different focal lengths. The purpose of that is to be able to compare different focal points with different equations. We also used the law of refraction to test the angles of different beams of light.

Questions:

1. I calculated the refractive index for water by using Snell's Law which states that nair sin θ 1 =nwater sin θ 3. The refractive index for water that I got was 1.233. This was very close to the actual refractive index of water, which was 1.33. The equation that I used was 1sin45=x sin 35. The measurement of θ 1 was 45 degrees and the measurement of θ 3 was 35 degrees. Then I just solved for the refractive index of the water and got 1.233.
2. The focal length of this lens that I measured is 105mm. The measurement in the manual was 100mm. This is an example of a converging lens. You can see a real image on a converging lens.
3. The focal length can be calculated by the formula $h \; (¿¿'/h) \; -\left(\frac{s'}{s}\right)=¿$. The ratios listed in the chart below were fairly close. There was a small amount of error between the numbers.

Trial 1	-(s"/s)=(h'/h) -(136/366)=(200/400)	-.37=.5	F=99.15
Trial 2	-(s"/s)=(h'/h)	-.26=.35	F=95.38

	-(120/465)=(140/400)		
Trial 3	-(s"/s)=(h'/h) -(145/285)=(290/400)	-.51=.72	F=96.105



Ray Diagram

4. By using the parallax method to find the focal length of the lens we measured the length that we had to move the pin away from the lens so that we could see a parallax. This measurement was then placed in the equation $\frac{1}{s}+\frac{1}{s'}=\frac{1}{f}$. The s' was the distance that the pin was away from the lens. S=281 s'=239 and f=129.5. This focal point is much higher that of found with out the parallax.
5. The virtual image that is seen in section 1.3 is seen through a converging lens. This lens will make the object bigger and it would also be upside down because the lens flips the image.
6. By using the formula $\frac{1}{s}+\frac{1}{s'}=\frac{1}{f}$, and filling in 15cm for s and -10cm for f we can conclude that s' would equal -6.0 cm. This could not be possible because it's a negative number as a length.
7. Using the formula 1/f combined=1/fc+1/fd. The combined length we got was 155.54mm. The fc is 105.When putting these numbers into the equation we get 1/155.54=1/105+1/fd. Solving for fd we get it to be -323.14. This number seems really small it should be around -50. This could have been caused by a incorrect measurement.
8. The focal length of the lens of the second lens that I need to combine with the 10cm lens to get a focal length of 40 cm would be -13.33cm. I used the

formula 1/40=1/10+1/x to solve for x which would be the missing focal length.

Conclusion:

After conducting the experiment we can see that the focal point found in different ways are proportional to each other. This shows that there is more than one way to find focal points. We have also proved Snell's Law by using the equation and measuring out the angels that were refracted by the water. The numbers were slightly different but you have to take into account human error.