



Minor Challenge Set 1

STEM Field: Astronomy

Level: Junior

Challenge Name: Make Your Own Telescope

Project cost: 0-20 USD

Materials required:

- 2 magnifying glasses with handles (more are optional) - perhaps 1-1.5 inches (2.5-3 cm) diameter (it works best if one is larger than the other)
 - Larger lenses will allow for better images but don't pick lenses that are too large to handle
- 1 cardboard tube - paper towel roll or gift-wrapping paper roll (it helps if it is long)
- Duct tape
- Scissors
- A ruler, yard stick, or tape measure
- Sheet of printed paper - newspaper or magazine will do
- Paper and pens/pencils

Safety:

- Some adult supervision is advised with the scissors

Duration:

- This challenge will take about 2 hours

Introduction:

In this project you will investigate lenses and how they are able to magnify an image.

Your eyes are unable to see far away objects because their lenses are too small to capture enough light. A telescope is a series of lenses that allow you to focus more light. As a result, far away objects appear closer.

Our telescopes will have two (or more lenses) in series. The lens closest to the far away object (the larger lens in the figure 1 below) collects the light reflecting off the object and focuses it. The lens closest to your eye (the smaller lens in the figure 1) spreads the light back out (magnifying it) and focusing it (making it clear). You will notice that the rays in Figure 1 cross over each other, this will result in an upside down image. All lenses work like this! Even the lenses in your eyes flip images upside down, your brain flips the images so that you see the world around you right side up.

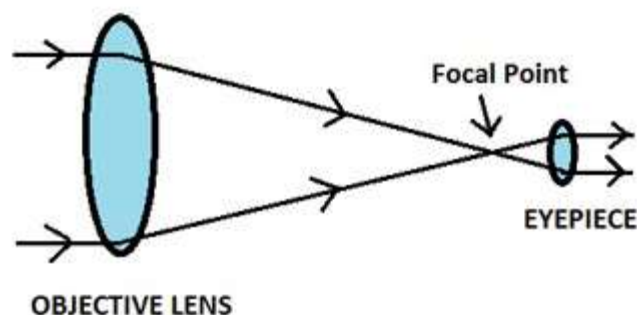


Figure 1. This is a ray diagram that shows how light is directed by lenses to make a far away object appear closer

Instructions:

1. Hold one magnifying glass (the larger one) between your eye and the paper at a distance where the print on the piece of paper looks blurry.



Figure 2. This shows how a single magnifying glass make make the print on your paper appear blurry

2. Hold the second magnifying glass between your eye and the first magnifying glass and move it forward or backward until the print comes into sharp focus.



Figure 3. This is an example of how two magnifying glasses together can make a far away object appear closer and clearer. You will notice that the

print appears larger and upside down. An explanation for this is in the introduction.

3. Have a friend or parent measure the distance between the two magnifying glasses. Write the distance down so you don't forget it.
4. Cut a slot or hole in the cardboard tube near the front opening about an inch (2.5cm) away. The handle of the large magnifying glass should be able to slide into the slot without the rest of the magnifying glass falling through.
5. Cut a slot for the small magnifying glass in the tube. This second slot should be the same distance from the first slot as you wrote down in step 3.
6. Insert the two magnifying glasses into their slots (the big one at the front, the smaller one at the back) and tape them in with the duct tape.
7. If you have more than about 1 or 2cm (0.5-1inch) of cardboard tube sticking out past the small magnifying glass, trim it down.
8. Check to see that it works by looking at the printed page. You may have to play slightly to get the exact distances between the two glasses right so that the image comes to a focus.
9. Now take your telescope outside and see how it changes what you are seeing!

Extension:

If you have another magnifying glass try adding it to your telescope. How does your image change if you add it between the other two magnifying glasses? What if you hold it in front of your telescope? What happens to the image you see?

Reflection Questions:

- Are there any improvements you would make to this challenge?
- What real world application/s can you apply this challenge to?
- What are the key science and engineering concepts that relate to this challenge?
- Based on the ray diagram in Figure 1. What do you think happens when you add in another lens? Do you think the image will get bigger or smaller? Will the image flip again?
- Why do you think bigger lenses are better? What would happen if you had more light to focus?

Submission Guidelines:

- Submit a photo of your telescope setup. Include a short summary that addresses the reflection questions.

Note: Remember, if you want to upload pictures of your Minor Challenge that also include you, please check if it is OK with your parent or guardian first.

- The submission form is on the Minor Challenges page:
<https://sciencechallenge.org.au/index.php/minor-challenges/>
Fill out the details and make sure you upload your submission.

Learn More! Resources:

- To learn more about the physics that makes this project work check out the link below!
<https://thebackyardgnome.com/how-does-a-refracting-telescope-work/>
- To learn more about the history of telescopes and what they are used for check out this link!
<https://www.britannica.com/science/optical-telescope>

Bibliography:

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