TeachEngineering

Telescope Building Notebook

Building a Telescope

And taking images of the moon!

Ask

Overview: Telescopes and similar instruments allow us to explore the night sky and see what lies beyond. With different types and sizes, telescopes can capture images of the moon, planets, galaxies, nebulae, and more. In this activity, you will become an astronomical instrument engineer and:

- Design and build a telescope.
- Capture images through the telescope using your smartphone.
- Collaborate with classmates to identify which telescope features produce the best images.

Refracting Telescope Introduction

1. Watch the video below:

2. In the space provided on the right, respond to the following questions:

    - What does long-distance viewing rely on? What part of the telescope can do this?
    - What is the focal point of a lens?
    - What two types of lens does a telescope use?

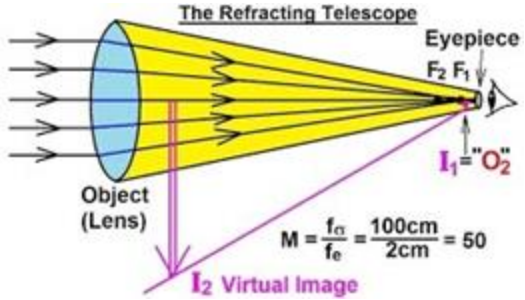
Type your responses here:

Long-distance viewing relies on gathering as much light as possible and increasing the apparent size of the distance object. The lenses of the telescope can help us do this.

A telescope has an objective lens and an eyepiece lens. The focal point is where the light rays from a lens meet before diverging out again.

Refracting Telescope Introduction

1. Watch the video below:



2. In the space provided on the right, respond to the following questions:

   - How can you make sure the focal lengths overlap?
   - Why do we need to take pictures from the refracting telescope and turn them 180 degrees?
   - How can you determine the magnification of an image from your telescope?

Type your responses here:

You can make the focal lengths overlap by moving the eyepiece lens back and forth until it is focused correctly.
We need to take pictures from the refracting telescope and turn them 180 degrees because they'll be upside down; the virtual image created by the objective lens is upside down, so the one seen by the eyepiece will be too.

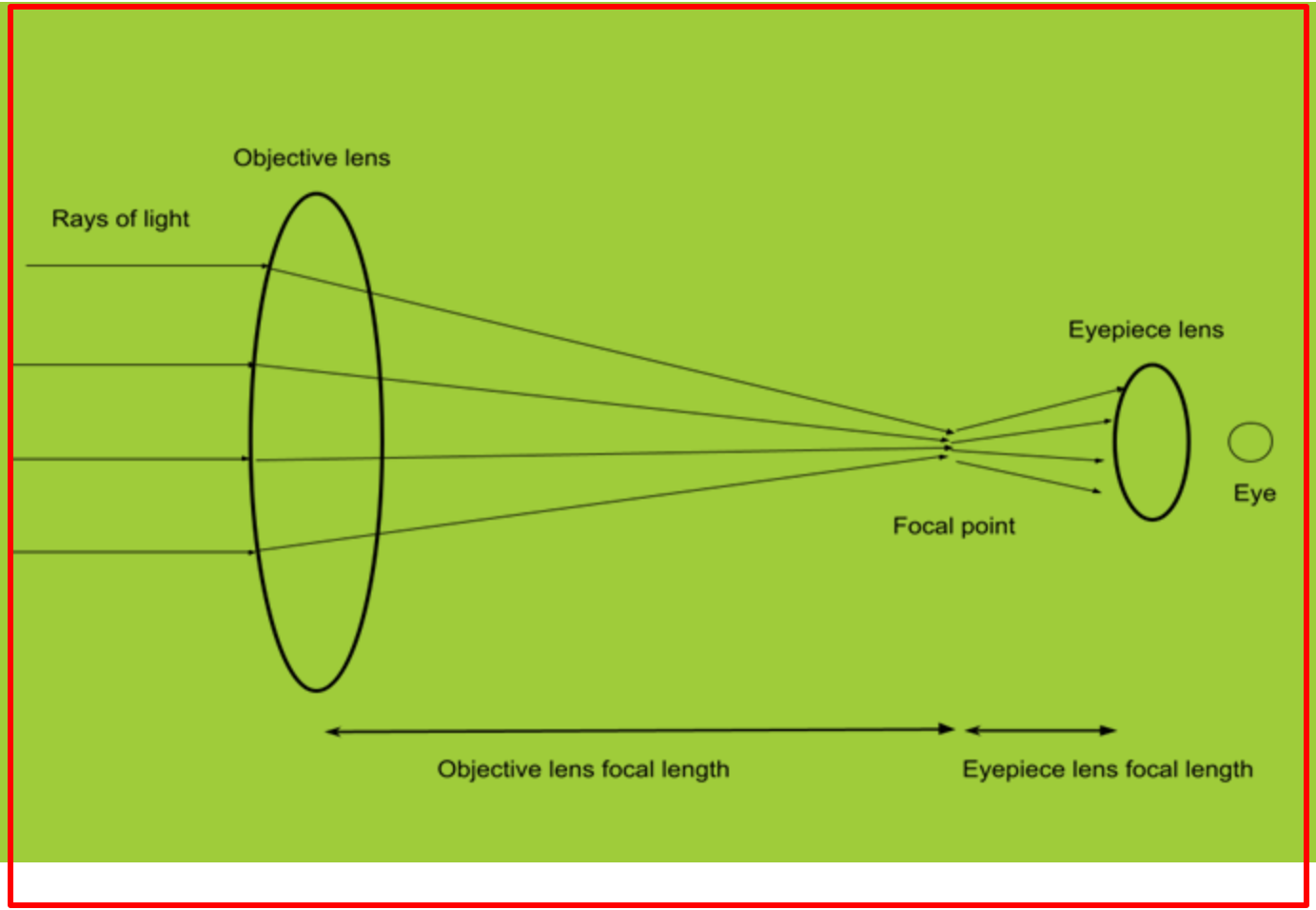
To determine the magnification of an image from your telescope, you can use the ratio of the focal length of the objective lens divided by the focal length of the eyepiece lens.

Telescope Diagram

On the slide that follows, draw an accurate diagram of how a refracting telescope works, including the path that rays of light take from one end of the telescope to the other.

You can either draw on paper and upload the image to your Google Drive to post on this presentation OR take the following steps to draw it on the slideshow that follows:

1. Go to Google Drawings.
2. Create your drawing and save it by clicking File->Download->PNG image.
3. Go back to this slideshow and click Insert->Image->Upload from computer and select your saved PNG image.


Objective lens
Rays of light
Eyepiece lens
Eye
Focal point
Objective lens focal length
Eyepiece lens focal length

Imagine

Sketch your telescope design in the space below. Make sure to label what materials you will be using.

Answers will vary.

Plan

Before you build your telescope, you need to find the ideal distance between the two lenses to maximize magnification. To do this, follow the directions below:

1. Gather the following materials from the materials table: 1 double convex lens, 1 double concave lens, several sheets of black paper, & 1 meter stick
2. Hold the double concave lens (the thick one) in front of your eye, and the double convex lens (the thin one) further out while focusing on the red lightbulb source.
3. Move the double convex lens back and forth until the light source is as big as possible.
4. Have your partner use a meter stick to measure the distance between both lenses.
5. Note the focal length of each lens, as well as the distance measured in the space to the right.

LENS SPECIFICATIONS

Double Concave Lens Focal Length (mm): 150 mm

Double Convex Lens Focal Length (mm): 500 mm

Distance Between Lenses (mm): Varies, typically 250 mm - 500 mm

Design and Plan Your Telescope

Draw your telescope design in the space below incorporating the necessary focal length. Make sure to label what materials you will be using.

Answers will vary.

Create

With your partner, spend the remainder of today building your telescope based on your design drawing!

Test

Once built, coordinate with your partner to take the telescope home and take two types of images of the moon:

1. One image with only your smartphone
2. One image with your smartphone aided by the telescope

Insert your images on the next slide.

Insert Your Pictures On This Slide:

Without Telescope Aid:

With Telescope Aid:

Testing

Write your procedure for capturing your images below and note any specific details about your captured images.

Answers will vary.

Improve

1. What worked?

Answers will vary.

1. What didn’t work?

Answers will vary.

Building Your Telescope! Part 4

For this last part, we are going to be comparing our images class-wide. As we do this, think about the following questions and write your responses, after our discussion, on the right hand side of this slide:

1. Who took the best images?
2. How does their telescope differ from yours, or—if this is yours —why did you design it the way that you did?
3. If you were to continue refining your telescope design, what might be your next steps for a clearer image of the moon?

Type your responses here:

Answers will vary.

Telescope Project Rubric

Content Skill:	**Data**: Students develop skills in accurate observation, data collection, analysis, and interpretation of celestial phenomena, utilizing various astronomical instruments and applying statistical and mathematical techniques.	
Not Yet	**Proficient**	**Exceeding Proficiency**
	❏ Demonstrates a solid understanding of telescope components and their assembly.	
	❏ Aligns the telescope accurately for moon observation, consistently achieving clear views.	
	❏ Captures high-quality pictures of the moon, showcasing good clarity, composition, and detail.	
Overall Rating:		