



# UNAWE

Universe Awareness for Young Children

## The telescope: basics



Johannes Hevelius observing with one of his telescopes. (Source:Selenographia, 1647)

### What is a telescope?

A telescope is an instrument used for seeing things that are very far away. It is a tube with a lens at either end. Sometimes one of the lenses is replaced with a curved mirror.

This activity will show kids the fundamentals of how a telescope works.

Download the activity sheet here:  
[The telescope: basics PDF \(911.7Kb\)](#)

- **GOAL:** To explore the basic elements of what makes a telescope. Discover optics and observe how a lens works.

- **MATERIALS:** A magnifying glass, a sheet of stiff white paper, a cardboard box with a lid, a lamp, cardboard tube (from a paper towel roll), a magnifying lens, scissors, tape.
- **AGE GROUP:** Supervised, indoor/outdoor demonstration and group activity for 6 years and up.

## Part I: What makes a lens?



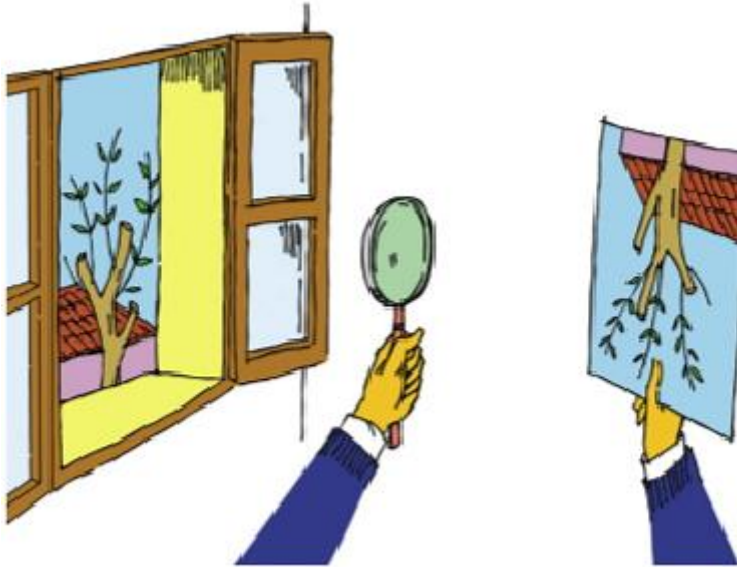
A lens is usually made from a piece of shaped glass.

We see lenses everyday in cameras, binoculars, eye spectacles and telescopes.

When light passes through the lens - depending on how the lens is curved - the rays of light can be brought closer together or spread further apart.

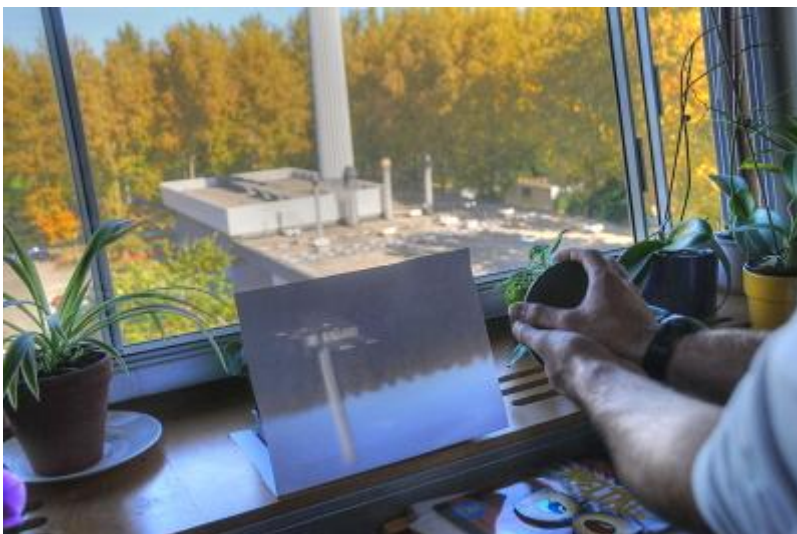
- **What to do**  
**Step 1.**  
 Choose a bright sunny day. Find a room that has a large window ~ 1 meter would be good. Ensure that the only light coming into the room comes from that window.
- **Step 2.**  
 Stand in the middle of the room. Hold a magnifying glass vertically with one hand, and a sheet of stiffened white paper in the other side.
- **Step 3.**  
 Move the paper slowly back and forth, until you see a picture of the objects that are on the outside

of the room, emerge on the paper.



The rays of light passing through the lens are focused on one point and then continue straight onward forming an image that is given back. Note that the image is upside down!

\*NB: You can also do this with a concave mirror like the ones you use in your bathroom. In this case, the mirror collects the light and reflects it back onto the screen, like the one shown below.



## Part II: Making a 'Home TV'

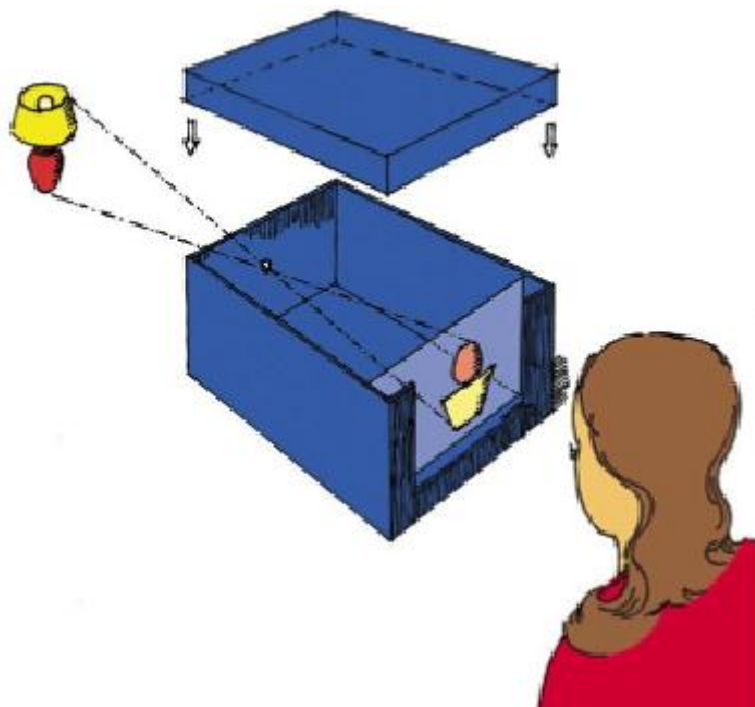
To make a telescope we would need a kind of tube. Remember, light- rays travel in straight lines.

- **What to do**

- Step 1.**

- Take a large cardboard box and pierce one end in the middle with a small hole ~ half a centimeter in diameter.

- **Step 2.** Cut out a small window on the opposite side of the cardboard box.  
The window should not be very big, just large enough so that if you look through the hole you can see its outline clearly.
- **Step 3** Take your piece of stiffened white paper and measure a piece that will fit the end of the box. This will be the screen. Bend the bottom 2cm of the cardboard at a right angle so that it stands up right. Tape the screen inside the box about 3 cm from the window you've cut.
- **Step 4.** Shut the box tightly and then place the side of the box with the hole in front of a bright



object, i.e. a lamp.

- **Step 5.** See how the light rays pass through the hole, and form a sharp image on the screen that is upside down.
- **Step 6.** Take your TV box out into the street and look around you for objects illuminated by the Sun. If you point your box at these, you should see them upside down on the viewing screen. However, as very few rays of light are actually reaching the screen, the image will not be very bright.

- **Step 7.** Make the hole bigger, and observe how more light comes in. The picture becomes brighter but it also becomes more blurred. The best results can be achieved if more light is focused on the screen, with something like our magnifying glass.
- **Step 8.** Find a simple magnifying lens (without a handle) at a pharmacy.
- **Step 9.** Stick the lens on to a cardboard tube with adhesive tape and place the tube inside the hole of the box. To do this you will have to make the hole much bigger, so that the tube with the lens fits.
- **Step 10.** Slide the tube back and forth, so that you can focus the image on the screen, which should now be quite bright.

With the lens, the image would look clearer and would be larger. Telescopes are based on a similar idea to this. A lens forms an image, and another second lens expands the image.

**Source:** Ricardo Moreno, UNawe en español  
Astronomy Workshop, Editorial Akal, Madrid, 1998  
Experiments for all Ages, Ed. Rialp, Madrid, 2008