What did Galileo See?

This activity involves:

- constructing a simple ‘galilean’ telescope
- making observations of a lunar image
- recording observations
- answering questions on validity of observations

Constructing the telescope is remarkably simple. Hold the convex lens at arms length and look through the concave lens. The system can be held in lab stands to give more stability or a mock up telescope can be easily made using cardboard tubes. Instructions for a more permanent telescope can be found at www.es.rice.edu/ES/humsoc/Galileo/Student_Work/Astronomy95/telescope_design

If the lenses are unavailable any ‘toy’ telescope will do, the cheaper the better.

Answer to Question 6

Stationary Moon, no atmospheric distortion. Lunar image less bright than real Moon.

Discussion could lead on to the idea that observations often require interpretation, they do not provide 'facts' accessible to the uninitiated. Students may be familiar with similar experiences in their first use of a microscope and there are modern examples in sciences from cosmology to microbiology.

References

Textbook
Chapter 15

Specification
10.6 The move away from an Earth-Centred View of the Universe

12.1c. 12.1k, 12.1l
12.2 b-c

Resources needed:

2 lenses (approximately 0.75 dioptre, -6.6 dioptre)
2 lab stands, boss and clamps
prepared moon pictures
drawing paper
pencils

What did Galileo See?

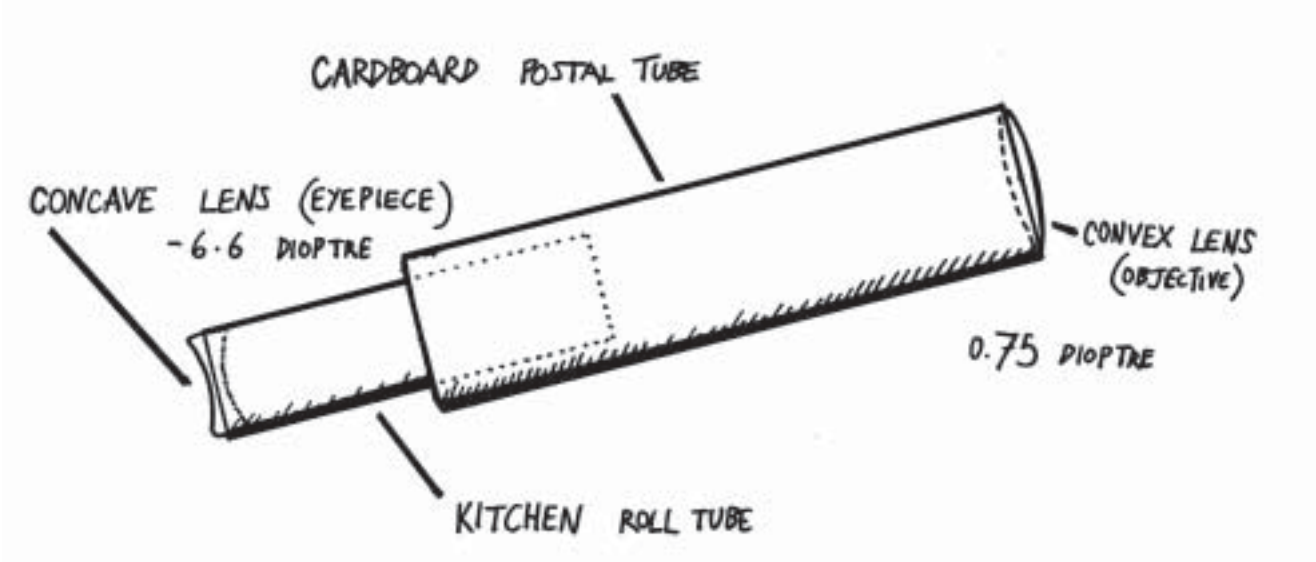
In 1609 Galileo wrote to the leader of Venetian republic about a new invention:

> *Galileo Galilei, a most humble servant of Your Serene Highness, being diligently attentive, with all his spirit, not only to discharging the duties pertaining to the lecturing of mathematics at the University of Padua, but also to bringing extraordinary benefit to Your Serene Highness with some useful and remarkable invention, now appear before you with a new contrivance of glasses, drawn from most recondite speculations of perspective, which render visible objects so close to the eye and represent them so distinctly that those are distant, for example, nine miles appear as though they were only one mile distant. This is a thing of inestimable benefit for all transactions and undertakings, maritime or terrestrial, allowing us at sea to discover at a much greater distance than usual the hulls and sails of the enemy, so that for two hours or more we can detect him before he detects us. . .*

Galileo's telescopic observations of the solar system were an important part of his evidence in favour of the heliocentric model and against the geocentric model. Not everyone agreed immediately with Galileo's interpretations of his observations. This activity should help you understand some of the difficulties faced by early astronomers.

In this activity you will construct and test your own telescope or test a toy telescope.

1 Construct your telescope as shown in the picture or use a toy telescope if you have one.



2 Choose from the two images of the Moon the correct one to observe from the end of the room. The images shown give the correct viewing distances below them. Fix one to a wall and look at it from the distance given.

The Moon covers about the same angle as a 10 p piece held at arm's length. You will probably be surprised how small an angle the Moon actually covers in the sky.

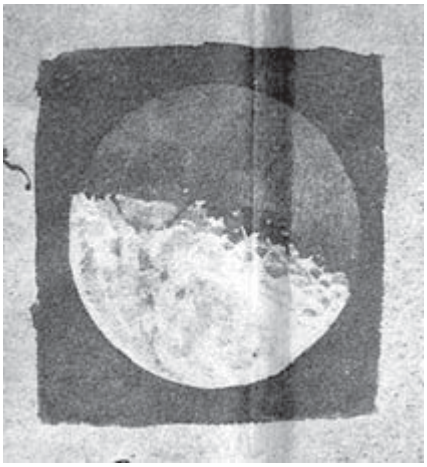
Smaller image for viewing from about 3m

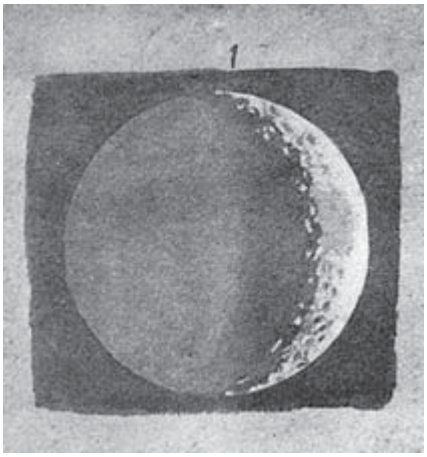
Larger image for viewing at about 6m

3 Using the telescope make as clear a sketch of the image as you can. Take your time. Try to get all the details you can.

4 Compare your drawing with the original image. How accurate have you been? Is this only because you lack drawing skill?

5 Compare the detail of your drawing to the ones made by Galileo. The phases of the Moon are different so you will only see some features on both sketches.





The glass used in the early telescopes was not of good quality. It had a greenish tinge and would often have small bubbles within it. When Galileo first turned his telescope to the skies no one knew what to expect. Some people simply did not accept that the newly – invented telescope showed the Moon and other objects as the really were. After all, telescopes often produced poor images of terrestrial objects like ships(whatever Galileo said in his letter) so why should the images of celestial bodies such as stars be any better?

Do you think this is a reasonable viewpoint? What does your attempt at drawing the Moon suggest?

6 Describe the ways in which your experiment with a telescope differs from Galileo's observations in 1609.

