Module 4: Astronomy – The Solar System
Topic 2 Application: Pinhole Viewer Scientific Investigation

Before you begin the scientific investigation below, make sure to download the *Pinhole Viewer Scientific Investigation Report*. As you complete this scientific investigation, fill in any needed information on the report template. If you need more information about each section of the report, please visit the Developmental Module.

Introduction

A pinhole viewer is a simple device that has no lens and includes a small hole through which light can travel. As light passes through the hole, it projects an image which can be viewed by the human eye. Simple versions of pinhole viewers have been used for thousands of years, and historians have found evidence that they were used in Ancient Greece. Since it is dangerous to look directly at the Sun, these devices allow people to observe the behavior of the Sun without looking directly at it. In this scientific investigation you will create your own pinhole viewer and use this viewer to observe the Sun.

CAUTION: It is extremely dangerous to look directly at the Sun. Looking directly at the Sun can cause permanent eye damage and even blindness. Do not ever attempt to view the Sun or Sun-related phenomena without the use of specialized equipment.

Objectives

In this scientific investigation, you will:

- create a pinhole viewer using one of two methods; and
- demonstrate the use of the pinhole viewer by observing the Sun on a sunny day.

Hypothesis

Using the Procedure and Data Collection section below, read through the procedural information for this scientific investigation. Based on your understanding of the procedure, develop you own hypothesis which describe your expected results. When developing your hypothesis you may want to consider the following question: Specifically, what do you think you will observe when you use the pinhole viewer? Record these hypotheses in the Hypothesis section of your *Pinhole Viewer Scientific Investigation Report*.

Equipment and Materials

Pinhole viewers can be constructed using two different sets of materials. View the equipment and materials below, and select one of the methods to construct your pinhole viewer. Both methods will allow you to observe the Sun, so you may choose either method.

Method A: Paper	Method B: Box
• 2 pieces of white paper • 1 pin or thumbtack	• 1 cardboard box • Aluminum foil • 1 pin or thumbtack • Tape • Scissors

Procedure and Data Collection

Based on the materials that you selected to construct your pinhole viewer, follow the appropriate procedures below. Please note, this scientific investigation must be conducted on a sunny day. As part of this assignment, you should record your construction and use of the pinhole viewer. You may use a camera, phone, or video recorder to create a set of images or a short movie for submission to the assignment's dropbox.

Method A: Paper

1. After you have gathered your materials, use the pin or thumbtack to punch a small hole in the center of one of your pieces of paper.
2. Once you are outside, hold the paper up and aim the hole at the Sun. Remember, you should not look directly at the Sun.
3. Now, using the other piece of paper, move it around until you find the image of the Sun that comes through the hole of the first sheet of paper.
4. Adjust your pieces of paper until you can view a clear dot on the piece of paper. What you are seeing is not just a dot of light coming through the hole, but an actual image of the Sun.
5. In the Data section of your *Pinhole Viewer Scientific Investigation Report*, describe the construction of your pinhole viewer, create an illustration of your observations, and record what you see.

Method B: Box

1. After you have gathered your materials, use the scissors to cut a hole in the center of one end of the box.
2. Cover the newly created hole with aluminum foil, and tape the foil in place.
3. Using the pin or thumbtack, make a tiny hole in the foil.
4. Go outside and aim the side of the box with the foil and the hole toward the Sun. Remember, you should not look directly at the Sun.
5. The Sun should appear as a tiny dot on the side of the box opposite the aluminum foil.
6. In the Data section of your *Pinhole Viewer Scientific Investigation Report*, describe the construction of your pinhole viewer, create an illustration of your observations, and record what you see.

Data

Using the blank space provided in the Data section of the *Pinhole Viewer Scientific Investigation Report*, describe the construction of your pinhole viewer, create an illustration of your observations, and record what you see. Also, you may want to include any other items of importance that you encounter during the scientific investigation. Make sure to be thorough in your descriptions so that someone who has never constructed a pinhole viewer would understand what you are documenting.

Data Analysis

In the Data Analysis section of your *Pinhole Viewer Scientific Investigation Report*, provide responses to the following questions:

1. Why did you choose the either paper method or box method to complete your pinhole viewer?
2. Describe the appearance of the Sun when using the pinhole viewer.
3. Were you able to see any of the different parts of the Sun in the pinhole viewer? Which parts?
4. Why was the Sun inverted on the pinhole viewer?
5. What do you think would happen if you made the pinhole larger?
6. What could you do to make your viewer more effective?

Conclusion

Using the Conclusion section of your *Pinhole Viewer Scientific Investigation Report*, compose a three to four sentences describing your overall conclusion based on your data. Were your hypotheses true or false, and how do you know? Use the observations and notes that you collected from your investigation to form your conclusion. Make sure that you include your information that you gained from data analysis to support your conclusion.

Experimental Sources of Error

On your *Pinhole Viewer Scientific Investigation Report*, provide reasons to the following questions: Are there any sources of error? If so, what are they, and what could be done to minimize error?

Once you have constructed your pinhole viewer and documented its use, please submit your *Pinhole Viewer Scientific Investigation Report* along with your video/pictures to the dropbox.