



*Drexel-SDP GK-12 ACTIVITY*

## Activity Template

**Subject Area(s)** Earth & Space, Measurement

**Associated Unit:** Astronomy

**Associated Lesson:** Astrolabe

**Activity Title:** Classroom Gazing

**Grade Level** 6 (6-7)

**Time Required:** 35 Minutes

**Group Size:** 1

**Expendable Cost per Group** US \$ .50

### Summary

In this activity the students build a modern version of a historical astronomical instrument, the astrolabe. The astrolabe was a device used in medieval times for astrology, navigation, surveying, and timekeeping. Students build an astrolabe using a protractor, a straw, a piece of string, a small bead, and some tape. Students then use the astrolabe to measure the altitude angle of objects around the classroom.

### Engineering Connection

Engineers need to know how to make accurate measurements and construct tools needed to make those measurements. This activity allows students to create a measurement tool and use it to make measurements. Civil engineers can also use surveying equipment that performs a similar function to the astrolabe. In addition, students learn about navigation techniques that engineers developed before the time of GPS or Mapquest.

### Keywords

angle, astrolabe, astronomy, measurement, protractor

### Educational Standards

- Science: 3.4D

- Math: 2.3

### **Pre-Requisite Knowledge**

Familiarity with a protractor is helpful.

### **Learning Objectives**

After this lesson, students should be able to:

- Measure angles of altitude using their astrolabe
- Explain what an astrolabe is and what it can be used for

### **Materials List**

Each group needs:

- A protractor
- A small piece of string
- A straw
- A small bead or paperclip
- Some scotch tape

To share with the entire class:

- 

### **Introduction / Motivation**

Have you ever looked at the sky on a clear night and seen just how many stars there are? How could anyone try to catalog them and know which star is which from night to night? In medieval times, astronomers used a tool called an astrolabe to measure how high in the sky a particular star was. Using the astrolabe they were able to create star charts that mapped the night sky. This information was so valuable it could be used for navigation and time keeping before there were technologies such as GPS and digital watches. In this activity we will create an astrolabe that was very similar to the ones used in medieval times and use it measure the angle of altitude of different objects around the room. The astrolabe is a useful device because it allows you to measure the altitude of something very far away or that cannot reach. All you need to be able to do is see the object you wish to measure and the astrolabe will tell you the angle of altitude. Surveyors even use this technology today to map out different types of areas.

### **Vocabulary / Definitions**

Word	Definition
Angle of altitude	Angle formed between the intersection of a horizontal line and a line from the observation point to the target object.
Astrolabe	Historical astronomical instrument which measure angle of altitude.

### **Procedure**

#### **Background**

You may want to make an astrolabe for yourself before you begin to work out common problems and to have an example to show the students.

#### **Before the Activity**

- Make copy of the worksheet.
- Prepare the pieces of string, straws, beads, and tape.

#### **With the Students**

1. Have a discussion with the class and ask them how they would describe the position of a star to someone else so they could see the same one. Introduce angle of altitude.
2. Hand out the materials.
3. Explain how to make an astrolabe. First tie the bead or paperclip around one end of the string and the other end of the string around the middle of the protractor. Then tape the straw to the flat edge of the protractor.
4. Now explain how to use the astrolabe. Look at the target object through the straw and hold the string down once it has stopped swinging. Subtract the angle that the string is resting on from 90 and that is the angle of altitude.
5. Have the students fill out the worksheet by measuring the angle of altitude of different objects in the classroom.

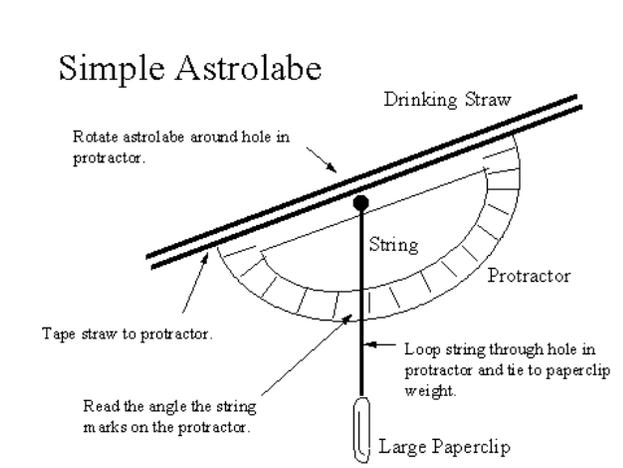
### Image

Figure 1

Diagram shows the construction of a simple astrolabe.

Source:

<http://www.efg2.com/Lab/ScienceAndEngineering/Fireworks/>



### Attachments

classroom\_gazing\_worksheet.doc

### Assessment

#### Pre-Activity Assessment

*Class Discussion:* Ask the class what they know about stars and how they would describe their position in the sky to see what they know about angle of altitude.

#### Activity Embedded Assessment

*Worksheet:* The worksheet will let you assess if the students learned how to measure angle of altitude correctly and what implications the angle has for navigational purposes.

#### Post-Activity Assessment

None

**Activity Extensions**

The students can take their astrolabes home to measure the angle of altitude of buildings, the stars and the moon.

**References**

Efg's Computer Lab. Updated July 4 2002. Accessed December 15 2008.  
<http://www.efg2.com/Lab/ScienceAndEngineering/Fireworks/>

Winterburn, Emily. Using an Astrolabe. Posted August 2005. Accessed December 15 2008.  
<http://www.muslimheritage.com/topics/default.cfm?ArticleID=529>

**Owner**

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Name: \_\_\_\_\_

## Classroom Gazing

Once you have constructed your astrolabe, use it to find the altitude angle of objects around the classroom. For the blank objects you can pick an object you like. The angle of altitude is ( $90^\circ -$  Angle read on protractor).

Object	Angle on Protractor	Angle of Altitude
Wall clock	_____	_____
Top of the chalkboard	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____

Compare the angles you measured for the wall clock and the chalkboard with someone sitting on the other side of the room. Were your angles the same or different than theirs? Do you think that the stars we see look the same if you were looking from somewhere far away, like California or Australia?