

# Paper Plate Education

*"Serving the Universe on a Paper Plate"*

## Activity: Altitude Measurer



This and several other activities from the *Paper Plate Astronomy* videotape and DVD are now available online as [free streaming video!](#)

The following text was written as part of a series of in-planetarium lesson plans to be done in Westlake, Ohio. Used with permission. Read Paper Plate Ed's [tip](#) for a variation below.

6. ALTITUDE-MEASURER: Half of a paper plate, printed protractor, scissors, tape about a foot of string, nail, one or two washers (weights), widest straw possible. Cut out protractor and tape it to half of a paper plate, so the flat edges line up. Punch out the vertex dot with a nail. Attach the string to the hole and tie it firmly. Tie the washers firmly to the other end. Tape the straw to the flat edge of the protractor. Show how the protractor measures a height angle of 0 degrees. Demonstrate how to measure height with a sphere near the ceiling of one wall. "Clamp the string with your thumb and forefinger while looking through or right beside the straw. Now we will all do it." Note how the measured angles are smaller for people sitting farthest from the wall. Explain that outside, the angles of objects above the ground (horizon) will be measured the same for everyone in Westlake, because the sky objects are so far away. Explain that Columbus and other explorers used an angle-measurer to find out where they were on the earth since the angles of sky objects change if you go to places that are different distances north or south of the equator. "Take your angle-measurer home and find out: How high is the North Star above north in Westlake? Tell us what you find next time we meet "

1. (Start in planetarium) WRAP UP THE ALTITUDE OF THE NORTH STAR: Ask what values the participants measured. Write them on the chalkboard. Darken the sky to current autumn evening. Find the Big Dipper and North Star. Notice that it is less than half way to overhead (the zenith). Turn on the meridian. See that the altitude is 41 degrees, the value that they should have measured. Explain that this is our latitude and that Columbus and other explorers aimed their angle-measurers at the North Star in order to find their latitude. Show the meaning of latitude on a lighted globe. Move the planetarium latitude to other places (Miami, San Salvador, the equator). Have participants tell the latitude, and the angle of the North Star they would measure at these places, by noting the altitude of the North Star. Move back to our home location.

Contributed by Jeanne Bishop.



Paper Plate Ed says...



A favorite tip of Paper Plate Education pertains to certain brands of *foam* plates. Some brands of foam plates, such as Hefty®, have decorative scallops or fluting around the perimeter. The edging is conveniently divided into 36 sections, so each scallop equals 10 degrees. If you use a foam plate for your Altitude Measurer, you can eliminate the need for a protractor and simply interpolate between the ten degree increments.



Putting "gun sights" across the top of the plate will help you align the device with a star in the dark. Draw a line parallel to and above the line bisecting the plate. Cut off the top part of the plate here. Cut in a short way across the diameter of the plate and fold the tabs in opposite directions.



Poke a small hole at the center of the plate (which is across the diameter and is below the sight line) and from there suspend the weighted string.



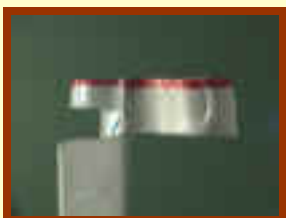
For clarity and daytime practice, color the tops edges of the tabs red. Your astrolabe is ready for use.



If you look down the "gun sight" and it appears as shown (with the foreground sight lower than the background sight), the astrolabe is aimed above the target star.



If you look down the "gun sight" and it appears as shown (with the foreground sight higher than the background sight), the astrolabe is aimed below the target star.



If you look down the "gun sight" and it appears as shown (with the foreground sight even with the background sight), the astrolabe is directly at the target star.

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