Name___________________________ **Section**_____________

Partner(s)_______________________ **Date**_____________

NIGHT SKY OBSERVATIONS

Working in a group, using the cross-staff you constructed (see p. 145), and star chart make the following observations:

On the eastern horizon observe the Moon just rising (Rising times are given in the *Washington Post* and other newspapers). Measure the altitude of the Moon compared to a reference point (at line of trees or a flat roof). Draw a sketch on a separate sheet of paper showing the reference horizon (trees, buildings, etc.). This could be done with the Moon setting in the western horizon if you want.

Determine the angular diameter of the Moon (best time is a full moon).

Low to the horizon ________ High in sky ________

Describe the Moon.

As the Moon rises record its altitude (vertical movement) and time over the next hour at 15 minute intervals. Add the Moon's position to your sketch above. Describe the motion of the Moon.

Time	Altitude

Using the first and last times and altitudes, calculate the vertical rise or the change in altitude that occurs in 60 minutes. To calculate the total movement degrees moved multiple your answer by 1.4 (works only at our latitude).

Since a day is 24 hours or 1440 minutes, over what fraction of a day did you observe? Multiply this fraction times 360° to get the number of degrees the Moon should have risen? Does this number agree with the values you got above?

On a moonless evening, make the measurements below:

angular width of Orion's belt_________

angular separation of two pointer stars in the Big Dipper (Merek and Dubhe) ________

Find the constellation Cassiopeia (looks like a W or Ó). Record the date and time of observation. Make a sketch of Cassiopeia in the night sky showing it in relationship to the north star, Polaris. Observe Cassiopeia a few hours later and record its position on your first sketch. Explain any difference in position.

Locate and identify what is at your zenith. Record the date and time.

Why did we make the above measurements on a moonless evening?

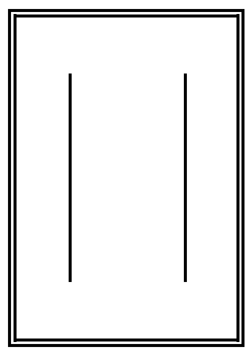
CONSTRUCTING THE CROSS-STAFF

Astronomers have adapted a common measuring device, the ruler, to measure curved surfaces by bending the ruler to match the curve. This curved device is called a **pentant** (if it measures one-fifth of a circle), a **sextant** (one-sixth of a circle) or a **cross-staff.** The sextant is used in celestial navigation when the only reference points you have are the stars.

Making the Cross-Staff

1. Carefully shave one end of a 1/4" wooden dowel so that it fits snugly in the center hole of a plastic ruler. Trim the length of the dowel so that it measures 57.3 cm from the ruler to the end (don't trim it before you fit it in the ruler). Be sure that the calibrated side of the ruler is facing the dowel.

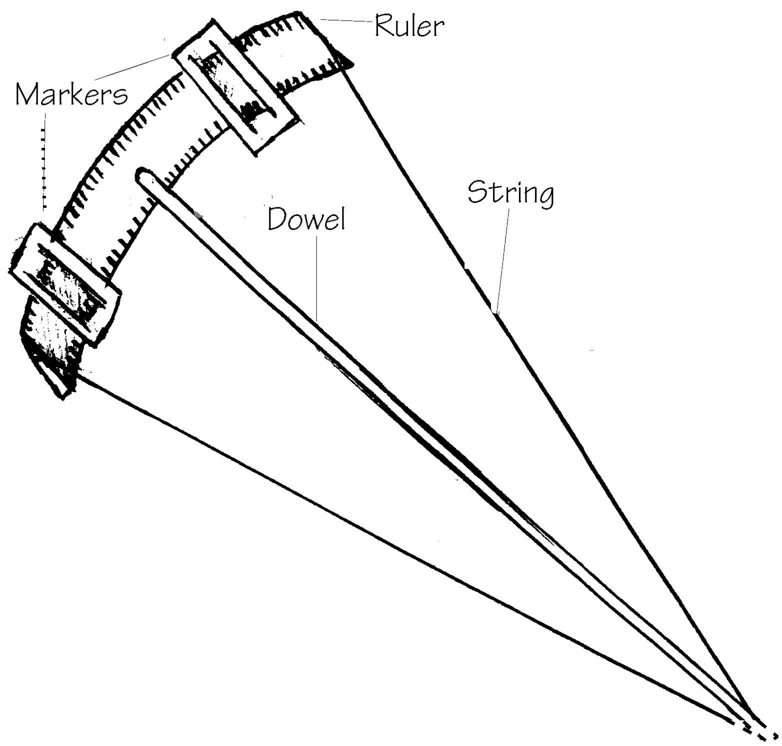
2. Cut two pieces of cardboard about 4 cm by 7 cm. Cut two slits in each marker so that they can be slipped onto the ruler. Slip them onto the ruler.



3. Cut a piece of string or strong thread approximately 160 cm long. Mark the thread with a marker so that the segments are as follows:

~10 cm 57.4 cm 30.5 cm 57.4 cm ~10 cm
______|______________________|_________________|_______________________|________

Pass the thread through the back of the markers and ruler. Tie the thread together at the 10 cm mark Carefully stretch the looped thread so that the knot is at the end of the dowel. You will have to bend the ruler to accomplish this. The thread should be 57.3 cm long on either side. If you are using thread, you can notch the end of the dowel and catch the thread in the notch. You may have to adjust the thread so that it is the same length on either side of the ruler. The marks for the 30.5 cm segment should be at the ends of the ruler. When you are finished the cross staff should look like the image below.



Using the Cross-Staff

1. Place the base of the cross-staff (dowel) against your cheek directly under one eye. Point the cross-staff at the objects you for which you are are measuring the separation Place one marker edge on one of the objects. Slide the second marker until the edge is on the second object. Record the number of centimeters between the two marker edges.

   Does the measurement mean anything in centimeters? Are the objects actually centimeters apart?

   ____

When measuring separations on a curved surface it makes more sense to express the measurement in degrees (recall that there are 360^{o} on a circle). The separation of two objects measured in degrees is called the **angular separation**.

2. The cross-staff you have made is designed so that each centimeter of separation is equal to 1^{o}. If two objects appear 12.5 cm apart, their angular separation is 12.5^{o}.

3. The cross-staff can be used at any angle and is good for measuring the altitude of objects, their distance from the horizon