Week 3

This week, your students will look for other changes in the sun's daily path. At this half-way point in the Moon-watching, they will learn some interesting Moon vocabulary, and discuss the Moon data accumulated so far. Finally, they will learn to recognize the zodiac constellations.

Continue the activities started in the previous weeks:

* Daily: .Moon Calendar

.Moon position records (in relation to the Sun and/or stars or planets)

* Once this week: .Sunset

* If your students have not yet found all the bright objects (stars and planets) in the Zodiac, continue working on that, using the Moon as a guide. In either case, if planets are in the sky, have your students find them and indicate their positions on the star chart.

* Research topics: planets, moons, rings, asteroids, the Viking and Voyager missions.

Lesson 7

MIDDAY

OBJECTIVES:

* To understand the midday shadow.
* To start looking for seasonal changes in it.

GRADES: 4 and up.

SCHEDULING:

This lesson will require one class period on a sunny morning, and a few minutes around midday for some shadow observations. It will be followed up with a weekly noon shadow observation.

PREPARATION:

Use the ALMANAC to find out the times of sunrise and sunset on the day of the lesson, and on the day that you performed the gnomon experiment.

STUDENT SHEETS:

* Midday
* Noon Shadow Record Sheet

MATERIALS:

* The record sheet from the gnomon experiment.
* The whole gnomon setup. (See Lesson 2.)

DISCUSSION:

Put the gnomon shadow record sheet where all can see it. Ask the class:

* What would happen if we repeated the gnomon experiment today?
* Would the shadows point in the same direction?

* What time would the shortest shadow be? Where would the Sun be, then?

ACTIVITY:

Tell the students that you will not repeat the whole gnomon experiment, but that you will investigate the day's shortest shadow. It happens when the Sun is highest. It is reasonable to assume that the highest point is halfway between sunrise and sunset. That time is called midday.

Hand out the Midday sheets. Tell the students the times of sunrise and sunset on the day of the gnomon experiment, and show them on the chalkboard how to calculate midday for that day. On the gnomon record sheet, look for the shadow closest to midday, measure it, and note the general direction it is pointing to. (Use the "magnetic North" arrow as a reference.) Note the shadow closest to noon, measure it, and see which direction it is pointing to. Compare the results with the Midday shadow.

Give them today's times of sunrise and sunset. Ask them to calculate the time of midday. (Allow them to do the calculations "their own way" if they want.)

Once the time has been calculated, assign some students to set up the gnomon and compass, so that two shadow observation can be made: one at midday, and one at noon (or as close to noon as practical, e.g. five minutes before lunch recess). Compare the length of the two shadows. (Midday should be shorter.) Compare the direction of the midday shadow with magnetic North. Tell the students that the midday shadow points

to the North pole, while the compass points to the magnetic North pole. (If you have access to a globe, show them the North Pole and the magnetic North pole on it.) In other words, gnomon North is true North, while compass North is only an approximation.

From now on, make a weekly measurement of the noon shadow, and enter it on the Noon Shadow Record Sheet. If you miss it on one day, do it the next, as a difference of a day or two is not significant, because changes are slow.

To keep students interested in this weekly activity, ask for predicitions: will the shadow be shorter today? longer? can you predict its length?

CONCLUSIONS:

* Midday is not usually at clock noon.
* The midday shadow points North. In other words, the midday Sun is due South.
* The midday shadow is the shortest shadow of the day.

After a few weeks, it should be apparent that:

* The length of the noon shadow changes from week to week.

COMMENTS:

* If you or your students are interested in the outcome, you can repeat the whole gnomon experiment. You will observe more obvious changes around the Equinoxes (late September or March) than around the Solstices (late December or June).
* Tell the students they can find "gnomon North" at home and compare it to "North Star" North. They should match. If any students want to do this, they will need the time of midday on

a week-end day. Provide them with the times of sunrise and sunset so they can make the calculation.

* In this lesson, your students will learn that calculations are essential to astronomy. Astronomers do use a lot of mathematics, and most of it is beyond the reach of your students. This kit will teach them much of what can be learned without accurate measurements and complex calculations.

MIDDAY

At midday, the Sun is halfway across the sky, on its path from sunrise to sunset. Many people think midday is at noon. You will find out what time midday is today.

To do that, you will need to find the time that is exactly half way between sunrise and sunset. In other words, the time at midday is the average of the time at sunrise and the time at sunset (their sum divided by 2).

HOW TO CALCULATE IT:

The following example is worked out for San Francisco, October 14, 1984. Read it, then use the same method to find midday today in your town. Or, work out your own method for finding midday.

1. Time at sunrise: 7:18 (am)
2. Time at sunset: 18:34 (i.e. 6:34 pm).
3. Average of the hours: (7 + 18) / 2 = 12.5 or 12 1/2. In other words, 12:30 .
4. Average of the minutes: (18 + 34) / 2 = 26
5. Time at midday: 12:30 + :26 = 12:56. The answer is 12:56 pm

* Be sure to use a 24-hour clock! (In other words, if the time you have for sunset is less than 12, add 12 hours to it.)
* Remember that half an hour is 30 minutes (see #3 in the example above).
* If you get an answer like 11:71, with a number of minutes greater than 60, subtract 60 from the minutes, and add 1 to the hours. (In the case of 11:71, you get 12:11.)

Noon shadow record sheet

~~week~~	Date	Time	Length of shadow

Try to measure the gnomon's shadow ~~at~~ at the same time every day.