

Astro 2000 Homework 4 Due THURS OCT 6th NAME: _____

1. It is four (4) days BEFORE the full Moon in mid-November on an unspecified year here in Boulder. You are standing in Norlin Quadrangle looking due south at the Moon as it crosses the local meridian.

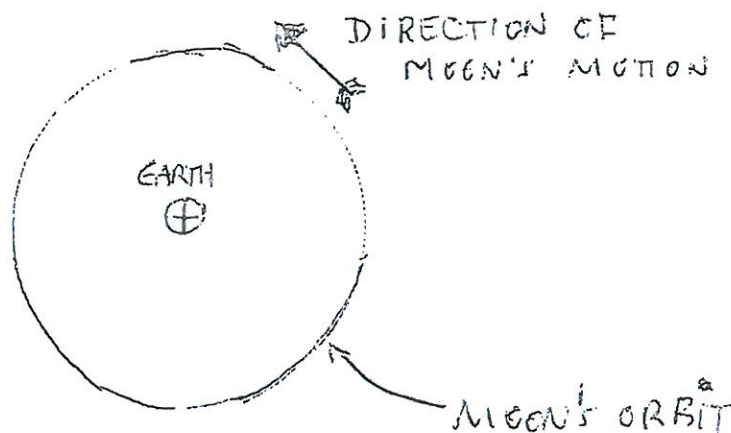
a. Sketch the appearance of the Moon at the time above. Shade the dark portion so there is no ambiguity as to the phase. What is this phase of the Moon called?

b. How many days is it until the next New Moon?

c. Two weeks after the observation you made in part (a) you return to Norlin Quad and again observe the Moon as it crosses the local meridian. Sketch the appearance of the Moon. What do we call this phase?

d. On the sketch of the orbit of the Moon shown below {NOT TO SCALE!}, place these two moon phases at their approximate correct locations in the lunar orbit. Use the letters (a) and (c) to indicate the Moon's location in parts (a) and (c).

SKETCH LOOKING DOWN
ON MOON'S ORBIT
FROM ABOVE THE
ECLIPTIC PLANE
*NOT TO
SCALE*



e. Use your two sketches from parts (a) and (c) to explain the difference between the "back-side" of the Moon and the "dark-side" of the Moon.

2. When does the **waxing half Moon** (also called first quarter moon) rise? You could look up the answer in the notes but, by going through the step-by-step process suggested below, you will both answer this question and learn how to answer similar questions.

a. It's a half Moon, so how far from the source of light (the Sun) is the Moon in the sky? (How many degrees or what fraction of a full circle of 360 degrees is this angle approximately?). A glance at the sketch of the lunar orbit in Question 1 part (d) may help you answer this question.

b. Now how many hours of Earth's rotation does this many degrees (or this many fractions of a full circle) correspond to? That is, ___ degrees (from above) is to 360 degrees as ___ hours is to 24 hours. Fill in the blanks.

Now you know by how many hours the Moon leads or follows the Sun in the sky when it is at this phase.

c. It's a waxing Moon, so does it lead (i.e., is it to the right of) or follow (i.e., to the left of) the Sun? Circle one of these options and explain your answer.

d. So, now you are done. Just put all your answers together and answer the first question relative to Sunrise. {For example, if your answer to part (c) is "leads" and your answer to part (b) is 10 hours, then Moonrise precedes Sunrise by 10 hours. Ten hours before Sunrise is also about 2 hours after Sunset the previous day or approximately 8pm}. So, using your answers to parts (b) and (c), at approximately what time does the waxing half Moon rise?

e. Go through this same logic again to estimate the approximate time the waning half Moon (third quarter Moon) sets.

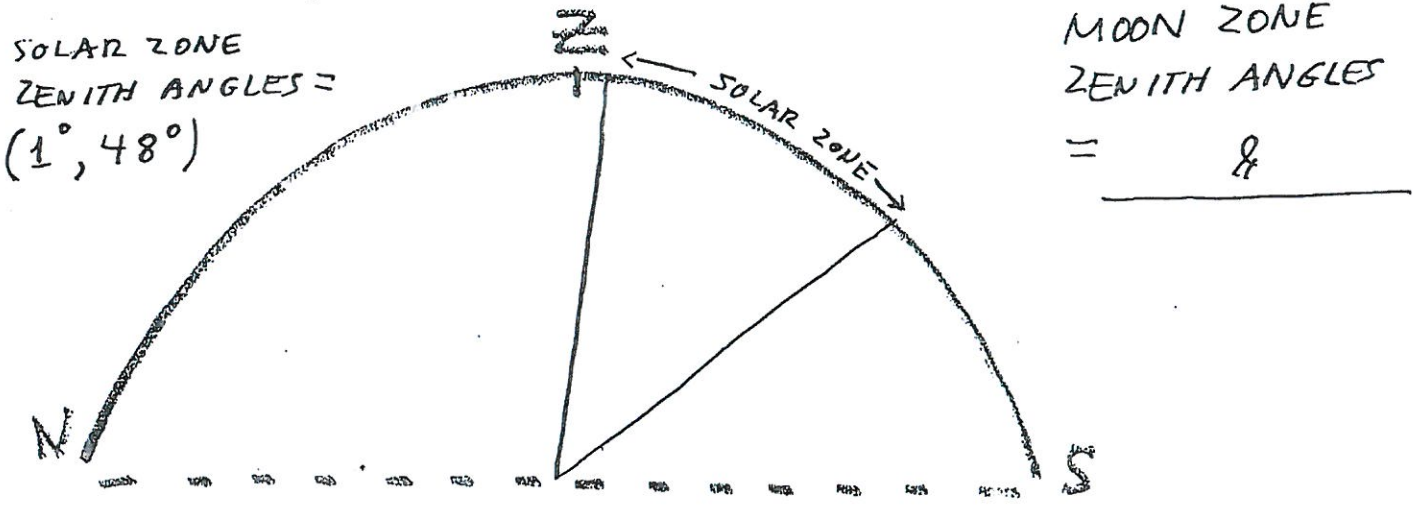
3. The Moon's orbit around the Earth is tilted by 5° from the ecliptic plane (the plane of the Solar System and of the Sun's orbit around the Earth from the perspective of the ancients). This tilt has several observational consequences.

- a. Explain with a sketch and words why this tilt prevents either a Solar Eclipse or a Lunar Eclipse from occurring every month.

GO TO NEXT PAGE for PARTS b. and c.

- b. The 5° tilt also increases the full range of Celestial Latitudes (Declinations) that the Moon can have. In comparison with the Sun's range of 47° (twice 23.5°), the Moon has a full range of $47^\circ + 10^\circ = 57^\circ$. The sketch below is a meridian slice for Key West, FL (latitude = 24.5° N) showing the "Solar Zone" for that location. On this slice show the range of angles along the meridian that the Moon can have, a range that we might call the "Moon Zone". Compute the zenith angles for the extreme locations of the Moon within its "Zone". Specifically for the Full Moon what are these extremes called?

MERIDIAN SLICE FOR: KEY WEST, FL.



- c. In observing the Moon what can happen in Key West, FL that cannot happen ever here in Boulder? Explain your answer. {Presumably lots of things can happen in Key West that don't happen here but have nothing to do with the Moon!}