ASTR 10, Vista College, Spring 2004

Instructor: Korpela

Homework #2 for Chapters 3-5

Due Feb 12, 2004

Explain all answers!

If you get stuck on the apparent motions of the Sun in the sky, or the phases of the moon, then try using an orange and a lamp to figure things out, as we did in class

Seasons (25 points)

1. **(10 points):** The planet Pong orbits its Sun with a very elliptical (oval) orbit (much more so than the Earth's orbit). Pong has no axial tilt, meaning that its rotational and orbital motion are in the same direction. To put it another way, Pong's rotation axis is perpendicular to the orbital plane, or parallel to its orbital axis. Remember that Earth's rotation axis is tilted 23.5 degrees from its orbital axis).
   a) Do the Pongians in the northern hemisphere experience seasons? Why or why not?
   b) Is the seasonal (or otherwise) experience of those in the northern and southern hemispheres of Pong the same (at the same time)? Why or why not?

   Explain your answer, but you should only need a short paragraph for each part.

2. **(15 points):** Consider the planet Pong from the previous question.
   a) Does the compass position of the rising (or setting) of their blue sun vary throughout the Pongian year? Explain why or why not.
   b) Does the Pongian period of daylight change during the year? Why or why not?
   c) Is the Pongian climate the same at its poles as its equator? Why or why not?

Phases of the Moon (20 points)

3. **(10 points)**: Identify the phase of the moon and sketch its appearance for an Earth-bound observer at sunset in the following circumstances. At sunset the moon is (a) near the eastern horizon, (b) in the southwest.

   To do this question, it might help you to first:
   - Locate an Earth-bound observer at sunset on the following diagram. [IMAGE]

   Briefly explain your answers for parts (a) and (b)

4. **(5 points)**: Suppose you were trying to see the moon on the day after a new moon. What time of day would you look? In which direction would you look?

5. **(5 points)**: It is sometimes possible to see the a faint glow from the dark portion of the moon on the day following the new moon. Why is that? (Hint: If you were on the moon at that time, what

phase would the Earth be in?)

Eclipses (15 points)

6. In October 2004, there will be both a partial solar eclipse, and a total lunar eclipse during the same month. The following questions should require only a sentence or two for your response. Assume there will be clear weather on the day/night in question.
   a) What phase will the moon be in during each eclipse?
   b) Will the partial solar eclipse be visible to all observers on the day side of the earth at the time of the solar eclipse? Why or why not?
   c) Will the lunar eclipse be visible to all observers on the night side of the earth at the time of the lunar eclipse? Why or why not?
   d) **Extra Credit:** Will the moon be visible during the lunar eclipse? Why or why not?

Choosing Between Models (20 points)

As we saw in class, the retrograde motion of the planets (such as Mars) can be equally well explained by two competing models for the Solar System: the Ptolemaic (Earth stationary at the center) model, and the Copernican (Sun-centered) model. Here we explore an observation that forces us to choose the Sun-centered model over the Earth-centered one!

7. Here is an enlarged view the Earth and Venus (at 4 different times) in the Ptolemaic (Earth stationary at center) model of the solar system.

[IMAGE]

   a) **(5 points)** Shade the portion of Venus **not** illuminated by the Sun (here or on a copy). Remember that the Sun is **very** far away! Can a "full" Venus **ever** be seen from the Earth in this model? Why?

      Galileo Galilei was the first person to use a telescope to observe Venus. Over time, he noted that Venus exhibited phases, as shown below:

      [IMAGE]

      Galileo knew of the Sun-centered, or heliocentric model developed by Nicolaus Copernicus. Galileo found that this model was able to completely explain the observed phases of Venus.

   b) Using the diagram below (or a copy), place Venus in the positions needed to produce the phases seen in panels a and e. Label these positions with a and e.

      [IMAGE]

   c) Briefly explain how the heliocentric model accounts for the observed **phases** of Venus.
   d) Briefly explain how the **sizes** of the images of Venus in panels a and e are explained by this model.

Orbits and Gravity (20 points)

8. **(10 points)**An object's weight is the force that Earth's gravity exerts on the object. Use Newton's law of gravity to predict how your weight would change in the following situations.
   a) You are on the planet Pong, which is the same size as the Earth, but has 2 times the mass.

b) You are on the planet Quing, which has the same mass as the Earth, but is only half as large.
c) **Extra Credit:** What is your mass in parts a-b (compared to your current mass)?

9. **(10 points)** The planet Quing orbits a star which is is twice the mass of the Sun. Quing lies 1 AU away from its star.
   a) Is a Quingan year longer or shorter than an Earth year (ie Does Quing have a longer or a shorter orbital period than the Earth)? Explain in terms of gravity. (**Hint:** Does Quing need to go faster or slower than the Earth in order to maintain its orbit? Why?)
   b) The Quingan people have discovered another planet (called Zampa) which orbits their star at a distance of 4 AU. Is a Zampan year longer or shorter than a Quingan year? Explain in terms of gravity.