

PROJECT 2: OBSERVING THE PLANETS

1 Your Solar System

Now that you've carefully observed the motion of the Sun across the sky of your new planet, you are ready to make some nighttime observations. First you observe the stars, noting that they move east to west across the sky just like the Sun. Or, rather, almost like the Sun. The Sun drifts eastward relative to the stars over the course of a year. Since you have already measured the tropical year and the solar day, you know that you can calculate the sidereal day without having to measure it directly.

But the Sun is not the only thing that doesn't move in lock-step with the stars. You notice a few other things up there that look like stars but seem to drift relative to the "fixed" stars. You set out to make careful measurements of the motions of these other objects relative to the stars. These motions are depicted in your personalized Solar System simulation.

2 What You Need To Do

For this project you need to complete the following tasks:

Sidereal Year Determine the length of the sidereal year in days (to the nearest tenth of a day). Explain in detail how you determined this value. Compare to the length of the tropical year you determined earlier. What can you say about the precession of the equinoxes for your new planet?

Sidereal Day Calculate the length of the sidereal day, in hours (to the nearest hundredth of an hour), using data you have already gathered. Explain how you performed the calculation.

Number of Planets Determine the number of planets that are visible in your night sky. Explain how you can tell that these things are planets, not stars.

Inferior/Superior For each planet you find, determine whether that planet is an inferior or superior planet. Explain how you know. Describe *all* of the characteristics that identify each planet as either inferior or superior.

Planet Names Name each planet you find. Also give a name to your new home world. Use a common theme for your names (for example, in our real solar system all of the planets have been named after Roman gods). Make sure to explain the theme and how each name relates to that theme. You can give a new name to your Sun if you like, or you can just refer to it as the Sun or as Barnard's Star.

Synodic Periods Measure the synodic period of each planet in days (to the nearest tenth of a day). Explain in detail how you made these measurements.

Zodiacal Periods Measure the zodiacal period of each planet in days (to the nearest tenth of a day). Explain in detail how you made these measurements.

Maximum Elongation Measure the maximum elongation from the Sun for all inferior planets (to the nearest tenth of a degree). Explain in detail how you made these measurements.

Time from Opposition to Quadrature Measure the time from opposition to quadrature, in days (to the nearest tenth of a day), for any superior planets. Explain in detail how you made these measurements.

3 Hint

When measuring the zodiacal period, please measure multiple times (I suggest 20) and use the average result. You may make your multiple measurements in one continuous sequence by, for example, letting the object complete 20 full zodiacal periods and then dividing the total time by 20. Averaging in this way is important because the zodiacal period is *defined* as an average period over many cycles, *not* as the time for a single cycle (which changes from one cycle to the next). Even for those quantities that are genuinely periodic, and thus should give you the same value every time you measure, averaging can help reduce the uncertainty of your measurement. It is very important that you get accurate measurement results because you will be using your results later in the semester to do other things. Note: if you make a significant error that will prevent you from accomplishing your later work, then you will need to redo your measurements.

Also, note that this project is all about things we can directly observe in the night sky. You should *not* discuss things that we cannot directly observe, like planetary orbits or distances to a planet. Please stick to speaking in observational terms for this project.

4 What You Need to Turn In

You must turn in a typed report that includes the following:

- One grammatically correct paragraph addressing *each* of the items in the previous section. Please give each paragraph its own section heading, using the headings given above.

Please submit this project by October 1, 2013.