# Ay 10 - Problem Set #5
# Due: October 11, 11am

Please write your full name, section number, and GSI's name at the top of your homework. Also, be sure to put your homework in the correct box in the basement of Campbell Hall. There is a 20% penalty per day for the late submission of assignments, however you do get one "freebie" (see course syllabus for more info).

Remember to always show your work; no credit will be given for just a final answer. However, if you get most of the question right but get the final answer wrong, you will get most of the points. Use a calculator where necessary and dont forget units if the answer requires them.

If you use any resource besides the textbook, lecture, or section (*e.g.* a web site), be sure to include proper attribution for the reference. Feel free to work with other students in the class, but remember that all work turned in must be your own (*i.e.* don't just copy the work of another student).

1. **(5 points) Phases of the.. Planets!**

   (a) Venus has been called both the **morning star** and the **evening star**. Why is Venus only visible at these times?

   We can deduce the arrangement of the solar system by the phases of the various planets as seen from Earth.

   (b) Does Venus go through an entire set of phases like the Moon, as observed from the Earth? If so, draw how you could have a **full Venus**, **new Venus**, and **half Venus** (on your diagram be sure to include Venus, the Sun, and the Earth.)

   (c) Venus' orbit is interior to the Earth's (i.e. Venus is closer to the Sun). Does an outer planet, say Saturn, have an entire set of phases as observed from the Earth? If so, draw how you could have a **full Saturn**, **new Saturn**, and **half Saturn**.

2. **(4 points) Meteo..what?**

   We didn't cover the distinctions between meteors, meteorites, meteoroids, and asteroids in lecture. Use whatever resources are available to you (your textbook, the internet, a library) and explain what the differences between the four objects are.

3. **(4 points) Kepler's Laws**

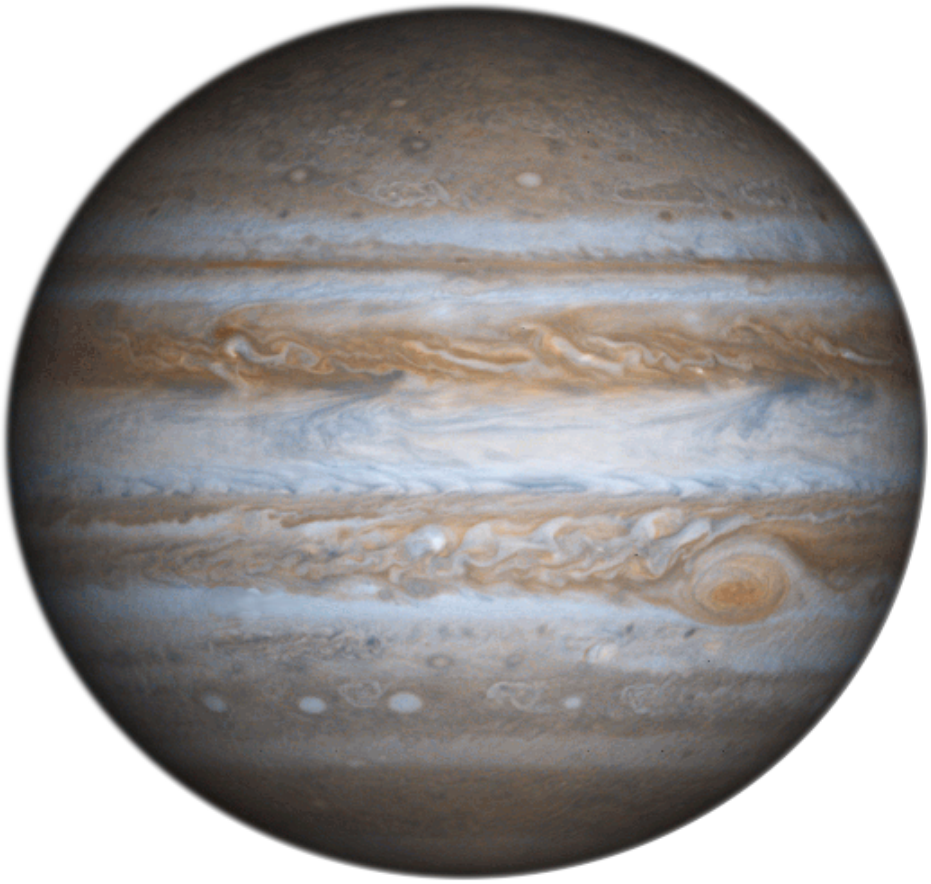
   (a) Eris (a distant object in our solar system that used to be nicknamed Xena) is at an average distance of 68 AU from the Sun. How long is a year on Eris?

   (b) A year on Mercury lasts about 88 Earth days. What is Mercury's average distance from the Sun?

4. **(3 points) Modified Kepler's Laws** After developing the laws of gravity Newton modified Kepler's laws. Use the modified Kepler's laws to answer the following question.

   If the Sun had twice as much mass, how long would a year on Earth be? Assume that the mass of the Earth and the Earth-Sun distance is unchanged.

5. **(4 points) Jupiter**



   (a) Look up the radius of Jupiter in your book or online. Use Jupiter's radius along with figure 1 to determine the size of the Great Red Spot.

   (b) How many Earth diameters would span the Great Red Spot?

6. **(6 points) Are Shooting Stars Really Shooting Stars?** [1]

"Shooting stars" are relatively bright points of light that suddenly appear in the night sky, streak across part of the sky, and then disappear. Let's say that a "shooting star" traverses 5 degrees on the sky in 0.5 seconds (this is actually *waaaaay* slower than most "shooting stars", but we're trying to make a point here).

(a) Assuming that the star is about 10 pc away from Earth, how far did the "shooting star" actually travel in meters. Remember that there are about $3 \times 10^{16}$ m in 1 pc.

(b) What was the "shooting star's" velocity in m/s?

(c) Compare the "shooting star's" velocity to the speed of light.

(d) Why do we keep using quotes around the term "shooting star"? (*i.e.* is a "shooting star" really a shooting star?)

(e) What **is** a "shooting star"?

[1] This question was originally inspired by a conversation between Jeff and his girlfriend.