Astronomy 150
Winter 08
Sullivan

Homework #2 Due Wednesday Jan 23rd

1. **Meteorite - Asteroid Belt Connection**
   Please give one good piece of evidence from the meteorites that we have collected that justifies the following claims, be sure to explain your answers.

   (a) The Asteroid belt was never one, large monolithic object (a planet that exploded for example)

   (b) Some meteorites came from asteroids that were very large

2. **Killer Asteroids**
   There are currently several projects designed to search for Near Earth Objects (NEOs), asteroids or comets whose orbits cross the Earth's. The information from these searches is made available publicly, and every few months the media grabs hold of one, and blows it into a "doomsday impactor" scare article. In all of these cases, analysis of follow-up observations has indicated that the NEO will in fact miss the Earth. Unfortunately these scares tend to lend the public a false impression of the importance of looking for NEOs. A series of very short articles was written about the whole affair in 2003, please read about it at:

   `http://nai.arc.nasa.gov/impact/news_detail.cfm?ID=128`

   The Minor Planet Center (MPC) maintains a list of upcoming close encounters at

   `http://cfa-www.harvard.edu/iau/lists/CloseApp.html`

   Find an approach date near your birthday in the next few years. Convert the close approach distance from AU to kilometers and comment on our best estimate as to how close this object will come to Earth. Based on some of the arguments presented in the article, should we be significantly concerned with this approach? Make sure to check with your TA if you are having trouble reading the table.

(OVER)

3. **Carbonaceous Chondrites** Why do we use the age of carbonaceous chondrite meteorites to date the age of the solar system? Why are these objects better at telling us what the early solar system was like than plants such as the Earth?

4. **Lifetime of Comets**
   A comet loses (very roughly) 0.1% of its mass everytime it orbits the sun. Some comets, however, have been seen many times over the course of human history, for example Comet Halley was potentially observed as early as 467BC by the Chinese. Please show your work for the following questions (Hint - it is perfectly OK to round numbers in order to make the math quick and easy - remember we are dealing with estimates!).

   (a) Does it make sense that we still see Comet Halley, with a 76 year orbital, even though it is loosing mass every orbit? Compare how long Comet Halley has been observed with how long it could survive.

   (b) Comet Wild-2 (the Stardust mission target) has an orbital period of 6.4 years. How long could this comet survive in its present orbit?

   (c) The sublimation of material from these comets gives rise to two types of tail and a coma. Please explain how these features are produced, and where they are with respect to the comet and the Sun.

5. **How do we Know The Density of the Moon**
   Using all the information below (not in order), weave an argument that explains how we can estimate the average density (total mass divided by volume) of the Moon. These items represent well established measurements, mathematics, or scientific laws. Piece them together in a logical path. You don't need to use any numbers, just construct the argument.

   - The distance from the Earth to the Moon (found by timing a laser beam bouncing off its surface)
   - The mass of the Earth
   - Given the agnular diameter of an object and its distnace, we can calculate its linear, or true, diameter (see pp 40-42 of the text).
   - The Moon's orbital period about the Earth (27.3 days).
   - The volume of a sphere is $\frac{4}{3}\pi r^3$, where r is the radius of the sphere.
   - The angular diameter of the Moon (by looking and measuring it)
   - Newton's gravity relates the (1) orbital period, (2) masses, and (3) distance between one object orbiting another (Hint: given any two of these quantities one can calculate the third)