

## Astronomy 1F03: Assignment 2

Due Date: Tuesday 25<sup>th</sup> Oct, 2016 hand in to **ABB241 by 2pm** (10% per day late penalty)

Write your answers on a separate sheet showing your working and explaining any formulae you use.

1. What is the maximum possible aphelion distance for a Kuiper-belt comet (short-period comet) with an orbital period of 216 years? What is the eccentricity of this orbit? What prevents a periodic comet from following this precise orbit?
2. Impact energetics
  - a. Estimate the kinetic energy ( $\frac{1}{2} m v^2$ ) of a comet striking the Earth. Assume that the comet is a sphere 8 km in diameter, with the density of water and is travelling at  $30 \text{ km s}^{-1}$  when it hits the Earth. Use SI units throughout.
  - b. 1 Megaton of TNT has an explosive yield of  $4 \times 10^{15}$  Joules. The entire nuclear arsenal of the world has been estimated at 5,000 Megatons. Estimate the diameter of a comet with a destructive power of 5,000 Megatons (with the same density and velocity as above).
3. Calculate the total mass of water needed to cover the entire surface of Mars to a depth of 30 meters. How many comets of average size (say, 2 km diameter) would it take to bring in this much water? What is the average time between impacts, if this number of comets struck Mars in the first billion years of the solar system? How does this average impact time compare with that given in the figure on page 30 of the Lecture04 notes?
4. What is the radius of an asteroid for which the escape velocity ( $= \sqrt{2GM/R}$ ) is 8 meters/sec? Assume the density of the asteroid is  $3000 \text{ kg/m}^3$ . (At this low escape speed, a person could "run" off the asteroid.)
5. From Wien's law, at what wavelength does Neptune's thermal emission peak? In what part of the electromagnetic spectrum does this wavelength lie?