PHYS178 – Assignment 8 Rough Model Answers

Due: Monday 27 October 2008

This assignment contributes 2% to your final grade. Please write brief answers directly on the sheet in the spaces provided (and on the back if necessary). The assignment should be turned into the PHYS 178 assignment box on level 2 of E7B, just outside the doorway to E7A.

1. What are some of the constraints on a model of Solar System formation?

   Motional: nearly circular planetary orbits, in same direction; orbits in same plane; location of asteroids; location and motion of comets; rotation of planets …
   Composition: three broad types of planets (gas, ice, rock); composition of comets and asteroids; chemical abundances
   Age constraints: earliest fossils (3.5b); age of oldest rocks (3.8b); age of oldest meteorites (4.5b)

2. What is a Planetesimal and how do they form?

   Mountain sized lumps of rock / ice / metal from which the planets formed. First material condenses out of the solar nebula and accretes due to electrostatic forces, with gravitational attraction eventually taking over when large enough. These planetesimals continue to accrete material and collide to form proto planets.

3. Why is it overwhelmingly likely that a solar nebula would begin spinning?

   It's exceedingly unlikely that all the gas would move in a radial line to the centre of mass of a gas globule – very likely to be some small rotation about centre of mass. Conservation of angular momentum then means that as the radius shrinks the speed must pick up to compensate.

4. According to the solar nebula model of the formation of the Solar System, why is Jupiter and Saturn so much larger than Uranus and Neptune?

   Jupiter and Saturn formed much earlier and closer to the protosun. They picked up mass faster and where finally able to gravitationally trap gas. Around this time this sun entered its T-Tauri phase with a strong solar wind sweeping left over gas away. Uranus and Neptune where further out, hence grew too slowly. A case of too little too late.

5. Describe the likely stages of the death of our sun.

   Main sequence (with steadily increasing brightness); sub giant (runs out of H in core, contracts); red giant (begins fusing He, various shell burning stages, gradually blows out material); white dwarf (naked core left to cool)