

PHYS 178 – Assignment 1 Rough Model Answers

Due: Monday 18th August 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. Calculate the density of the Sun. (Yes, you need its mass and radius to answer this!)

Mass $M = 1.99 \times 10^{30}$ kg; radius $R = 6.96 \times 10^8$ m. Then compute the volume $\frac{4}{3}\pi R^3$ and compute density as mass/volume = 1400 kg m^{-3}

2. What are the implications of the crater record in the solar system?

Collisions throughout the early solar system (before about 3.5 Gyr ago) were very common. This implies that terrestrial planets formed from the aggregation of many much smaller bodies.

Cratering can also be used to estimate the relative ages of the surfaces of different bodies, or regions on the surface of a single body.

3. Describe the process of “differentiation” that occurs in the history of the terrestrial planets.

The terrestrial planets were molten after their formation due to heating during the accretion of smaller bodies and radioactive decay. Denser materials sank towards their centres under the action of gravity to create their cores. The lighter materials form the crusts.

4. Describe what is meant by a “subduction zone”.

A region where one tectonic plate is overriding another as they are forced together by convective motions in the Earth's mantle.

5. The temperature of the atmosphere declines with height above the Earth's surface and then starts increasing at high altitude. Why is this?

The lower atmosphere is heated by reradiation of sunlight by the surface at infrared wavelengths. The air is mixed by vertical motions and as the air wells up it expands and cools (the opposite is true for sinking air). This leads to the decline in temperature with height near the surface. At high altitudes the atmosphere is directly heated by the Sun's radiation. Its ability to cool declines with decreasing density and so the temperature in this region increases with height.