

ASTR 121: Homework 7

Due Thursday, October 22nd, 2009

For problems of a mathematical nature, show all work for full credit (including multiple choice responses).

1. (10 pts) Which of the following is a reason that the Jovian planets have lighter elements in their atmospheres compared to the terrestrial planets?
 - (a) The temperatures on the Jovian planets are lower compared to the atmospheric temperatures of the terrestrial planets.
 - (b) The Jovian planets are the only ones with magnetic fields.
 - (c) Jovian planets have higher escape velocities due in part to their larger masses.
 - (d) Jovian planets have lower escape velocities due in part to their larger radii.
 - (e) Both (a) and (c)
 - (f) Both (a) and (d)

2. (10 pts) Why does the Moon have more craters than the Earth?
 - (a) The Moon gets hit by more debris.
 - (b) The Earth has an active geology which wipes away craters after a period of time.
 - (c) The Earth's magnetic field deflects meteors.
 - (d) The Moon has an active geology which creates more craters overtime.

3. (20 pts) **True or False:**
 - i The Jovian planets have higher average densities than the terrestrial planets?
 - ii Spectroscopy of planets that have atmospheres reveals bright emission lines.
 - iii Craters are always circular in shape, regardless of angle of impact.
 - iv Larger planets have molten cores because it takes them longer to cool than smaller planets.
 - v The Jovian planets (also called *gas giants*) are only made of gas.

4. (15 pts) Mercury rotates once on its axis every 58.646 days, compared to 1 day for the Earth. Based on this information alone, does Mercury have a smaller or larger magnetic field? Explain in 2-3 sentences.

5. **(15 pts)** The absorption lines in the spectrum of a planet or satellite do not necessarily indicate the composition of the planet or satellite's atmosphere. Why not?
6. **(30 pts)** A spherical planet Alpha has a radius $R_\alpha = 8,000$ km.
 - (a) What is Alpha's volume in m^3 ?
 - (b) If Alpha has a mass $m_\alpha = 3.5 \times 10^{25}$ kg, what is its average density?
 - (c) What is the escape speed of Alpha?
 - (d) If the planet has an atmospheric temperature of $T = 300$ K, what is the average velocity of a hydrogen molecule in its atmosphere? Note that the mass of one hydrogen molecule is $m_H = 3.28 \times 10^{-27}$ kg.
 - (e) Will hydrogen molecules be abundant in Alpha's atmosphere? Explain.