Astronomy 2020 – Space Astronomy & Exploration **Fall 2020**
Homework #6 Due: Nov. 20, 2020

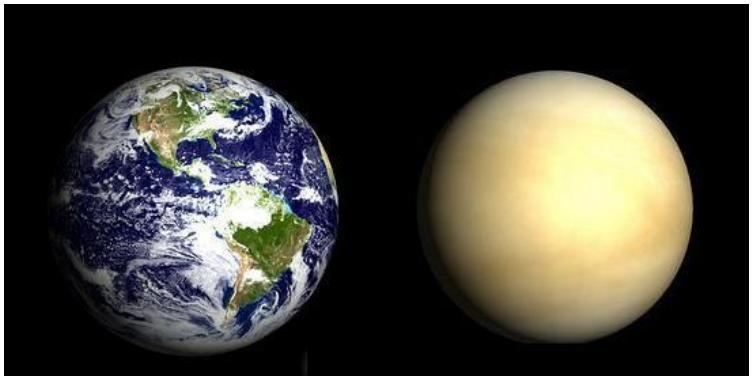
In questions 1-3 below, choose the best answer. Then explain your reasoning in a few complete sentences. Each question is worth 2 pts.

1. Why does Neptune appear blue and Jupiter appear red?
    a. Neptune is hotter, which produces bluer thermal emission.
    b. Methane in Neptune's atmosphere absorbs red light.
    c. Neptune's atmosphere scatters blue light, much as Earth's atmosphere does.
    d. Jupiter has an intense Greenhouse Effect causing it to trap red light.

2. Why is Saturn almost as big as Jupiter, despite its smaller mass?
    a. Jupiter's greater mass compresses it more, thus increasing its density.
    b. Saturn's rings make the planet look bigger.
    c. Saturn is further from the Sun, thus cooler, and therefore less compact.
    d. Saturn has a larger proportion of hydrogen and helium than Jupiter, and is therefore less dense.
    e. Jupiter's strong magnetic field constrains its size.

3. Did a large terrestrial planet ever form in the region of the asteroid belt?
    a. No, because there was never enough mass there.
    b. No, because Jupiter prevented one from accreting.
    c. Yes, but it was shattered by a giant impact.
    d. Yes, but it migrated to beyond the orbit of Pluto as a result of a gravitational resonance.

4. (3 pts). Of Mercury, Venus, the Moon, and Mars, which world has the greatest erosion? Explain why. In your answer, include the potential sources of erosion and discuss their effect on each planet.



5. (3 pts). Suppose you could choose any one moon (other than Earth's Moon) to visit in the solar system with a human mission.
   a. Which one would you pick, and why?
   b. What dangers would you face in your visit to this moon?
   c. What kinds of scientific instruments would you want to bring along for your studies?

6. (3 pts). Each ring particle in the densest part of Saturn's rings collides with another about every 5 hours. If a ring particle survived for the age of the solar system (4.5 billion years), how many collisions would it undergo?

7. (3 pts). A number of planetary scientists strongly suspect that Europa has a subsurface ocean, even though we cannot see through the surface ice. Explain why scientists think the ocean exists. What is the evidence for such an ocean?

8. (4 pts). A relatively small impact crater 20 kilometers (km) in diameter could be made by an asteroid 2 km in diameter traveling at 30 km/sec (30,000 m/sec).
   a. Assume that the asteroid has a mass of 4×10^{12} kilograms (kg). What is the total kinetic energy of this asteroid? (If you use mass in kg and velocity in m/sec, kinetic energy will have units of joules.)
   b. By doing a little web research, convert your answer above to an equivalent in megatons of TNT, the unit used for nuclear bombs. Comment on the degree of devastation the impact of such an asteroid could cause if it struck a populated region on Earth.