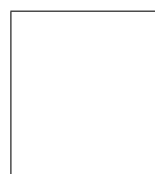


**Answer all questions in the space provided. If you have any questions, raise your hand.
100 points possible. No calculators.**

0 (3 pts) Rocks have a density of about _____ g/cm^3 , water has a density of _____ g/cm^3 , and iron has a density of about _____ g/cm^3 .

1 (6 pts) How do we determine the age of the lava flow from the Apollo 15 landing site?

2 (6 pts) How do we determine the age of the lava flow from the area surrounding Mt. Olympus on Mars?



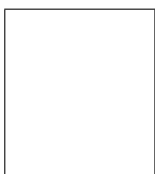
You have discovered a new planet orbiting the Sun at a distance of 0.9 AU. This planet is the same size as the Earth, but is 1.3 times more massive. The planet has an uncompressed density of 6.0 g/cm^3 and a moment-of-inertia factor of 0.33.

3 (5 pts) How does the gravity of this planet compare to the Earth's gravity? [Be quantitative; show your work.]

4 (4 pts) What is the most likely composition of this planet? [Remember to give a qualitative indication of the amount of each substance.]

5 (3 pts) How is the mass distributed in the interior?

6 (6 pts) Would you expect the geological activity on this world to be greater or less than the Earth's? Explain your answer.

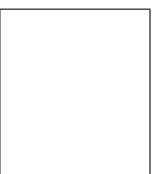


7 (8 pts) Explain how both human and robot missions to the planets sampled materials from deep under a surface without having to waste time digging.

8 (8 pts) The Moon is a **much** smaller target than the Earth, but has many large impact basins on its surface while the Earth has none. Explain why the Earth has no large impact basins on its surface.

9 (2 pts) The youngest rocks on the Moon are:

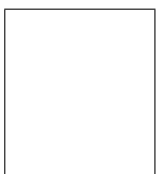
- (a) found primarily in the highlands.
- (b) older than most every rock on the Earth.
- (c) composed primarily of iron.
- (d) less than about 1 million years old.
- (e) really made of green cheese.



10 (5 pts) Recent data from the Mars Explorer Rovers suggests that **liquid** water existed on at least one part of the surface of Mars in the past. Explain why liquid water **cannot** exist on the surface of Mars today.

11 (3 pts) Where is one place on Mars where we **can** find liquid water today?

12 (8 pts) Explain how we can determine what substances are on the surface of Mars without bringing a sample back to Earth.



13 (4 pts) Fill in the blanks with the appropriate atmospheric gas.

A secondary atmosphere is composed primarily of: _____ and _____.

The Earth's atmosphere is composed primarily of: _____ and _____.

14 (8 pts) Explain **why** the Earth's atmosphere is different from a "typical" secondary atmosphere.

15 (3 pts) Explain why you **cannot** use an Earth-based telescope to observe in the Ultraviolet part of the spectrum.



I have argued in class that life on Earth has been greatly affected by two impact events: the giant impact that formed the Moon, and the much smaller impact that ended the reign of the dinosaurs.

16 (8 pts) Pick one of these two events and explain how the Earth would have been different had this impact **not** occurred.

17 (8 pts) The mineral Olivine appears to the eye as bright green crystals. In the space below, sketch the reflectance spectrum of Olivine. Make sure to provide a range and label for the axes.

