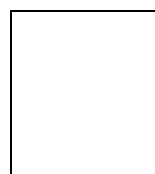


**Answer all questions in the space provided. If you have any questions, raise your hand.
100 points possible. NO CALCULATORS OR ANY ELECTRONIC DEVICES.**

1 (3 pts) Apollo 12 landed on a **Mare** surface of the Moon. What type(s) of rock is/are most common at this site?

2 (3 pts) Apollo 16 landed on a **Highland** surface of the Moon. What type(s) of rock is/are most common at this site?

3 (6 pts) Explain why you can **not** use the same radioactive isotopes to determine the age of Moon rocks as you would use to determine the age of rocks found around Seattle.



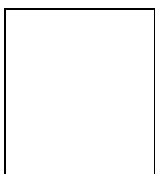
You have discovered a new planet orbiting the Sun at a distance of 0.3 AU. This planet is $(1/5)$ the size of the Earth, and is $(1/100)$ as massive. The planet has an uncompressed density of 5.0 g/cm^3 and a moment-of-inertia factor of 0.30. (Use this information to answer the question on the next two pages).

4 (6 pts) How does the gravity of this planet compare to the Earth's gravity? [Be quantitative; show your work.]

5 (4 pts) What is the most likely composition of this planet? [Remember to give a qualitative indication of the amount of each substance.]

6 (3 pts) Describe how the mass is distributed in the interior of this planet.

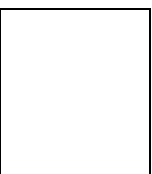
7 (6 pts) Would you expect the amount geological activity on this world to be greater or less than the Earth's? Explain your answer.



8 (8 pts) Explain why it is unlikely that this planet has a thick atmosphere **today**.

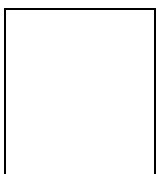
9 (8 pts) It is likely that 3 billion years ago this planet *did* have an atmosphere (for a short time). How did this atmosphere form and what was the most likely composition of this atmosphere.

10 (4 pts) Explain why the surface temperature of this world was probably higher 3 billion years ago, than is today.



11 (8 pts) The tilt of the Earth's spin (23.5°) is very similar to the current tilt of Mars (25.2°). Explain why this may not be the case in one million years.

12 (8 pts) What is the evidence that *Late Heavy Bombardment* happened on the surface of the Earth, and how do we know **when** it happened?



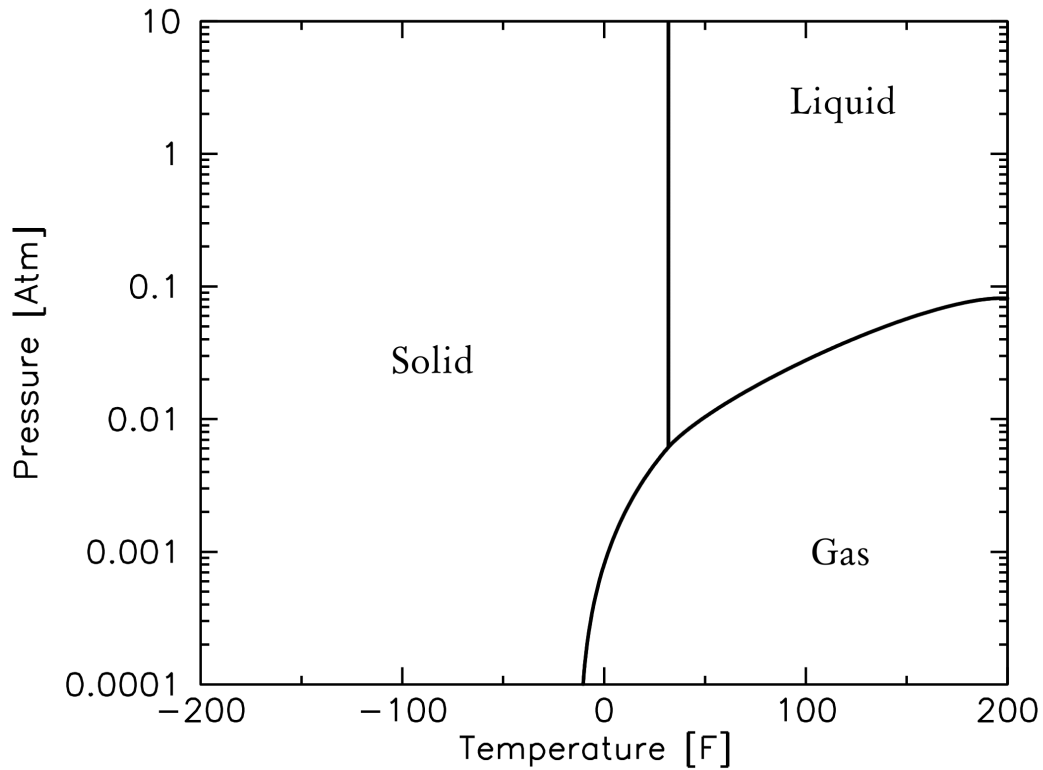
13 (9 pts) The graph below is the phase diagram for water. Plot and label the, very approximate, conditions (Temperature and Pressure) for:

A: The current conditions in this room.

B: The current conditions at the Opportunity Mars Rover site.

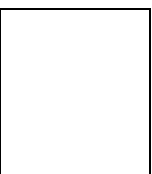
C: The conditions 3 Billion years ago when the Opportunity Mars Rover site was wet.

You should have three labeled points on the graph below.



14 (3 pts) Explain why you can not plot the conditions at the Apollo 15 landing site on the graph above.

15 (3 pts) Explain why you can not plot the conditions at the surface of Venus on the graph above.



16 (6 pts) Impact craters on the Earth are destroyed on very short timescales. Describe one way we can know if an impact had occurred in a particular location, even if the crater is long gone.

17 (10 pts) In the space below, sketch and label the **crater density plot** of the Highlands of Mars, the Mare on the Moon, and a typical surface of the Earth. Plot and label all three on the same axes. Make sure to provide a range and label for the axes. You should have one plot with three different lines.

