

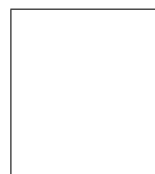
**Answer all questions in the space provided. If you have any questions, raise your hand.
100 points possible. No calculators.**

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

I have said a number of times in class that “**geological activity scales with size**”.

1 (4 pts) Explain what this means.

2 (6 pts) Explain why this is.



The table below shows the properties of three planets orbiting a star that is identical to our Sun. Use these data to answer the questions on this page.

Planet	Mass [Earth = 1]	Radius [Earth = 1]	Uncompressed Density [g/cm ³]	Moment-of-Inertia Factor [K]
FRODO	1/6	1/2	6.0	0.40
SAM	1/2	3/4	4.5	0.34
PIPPIN	6	2	3.5	0.30

For each of the three worlds, explain what the composition of the world is (2 pts), how the gravity compares to Earth’s gravity [show your work] (3 pts), and how the mass is distributed in the interior (2 pts).

3 (7 pts) FRODO

Composition:

Gravity:

Interior Mass Distribution:

4 (7 pts) SAM

Composition:

Gravity:

Interior Mass Distribution:

5 (7 pts) PIPPIN

Composition:

Gravity:

Interior Mass Distribution:

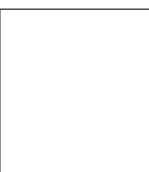


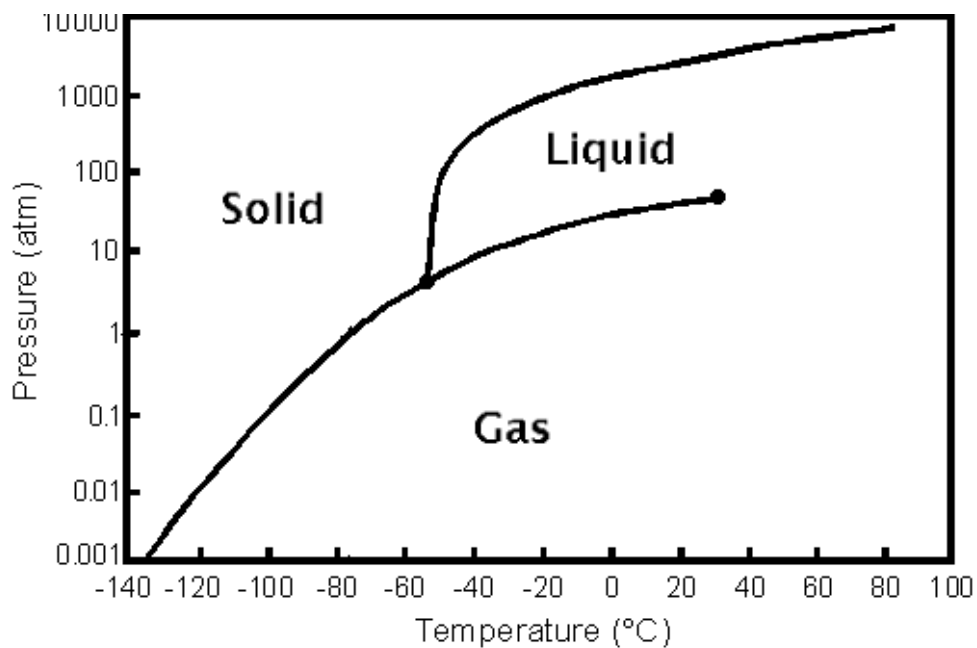
In class I showed this table of the history of the surface of Venus:

Time [Byr]	Event	Evidence
4.6	Origin	All Evidence Erased
4.4 - 4.0	Differentiation	All Evidence Erased
3.8	Late Heavy Bombardment	All Evidence Erased
3.8 - 0.5	Geological Activity	All Evidence Erased
0.5 - Now	Geological Activity	Measured Crater Density

6 (8 pts) Explain why we think we know what happened on the surface of Venus from 4.5 - 0.5 billion years ago even though there is **no direct evidence**.

7 (10 pts) Sketch a plot of the crater density of the surface of Venus (5 pts) and explain why it looks different from the crater density plot of the Mare surfaces on the Moon (5 pts). Make sure to label your axis, but do not worry about the numbers.



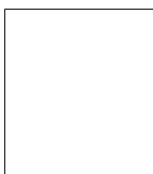


The graph above is the phase diagram for carbon dioxide (CO_2).

8 (4 pts) Plot and label the position on the phase diagram that shows what the phase of CO_2 would be in this room.

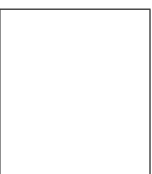
9 (4 pts) How cold would you have to make this room so that CO_2 would be a solid?

10 (8 pts) How would you change the conditions of this room so that CO_2 could exist as a liquid?



11 (8 pts) I said that the Earth-Moon system lacks **volatiles** compared to the average composition of the solar system. Explain what this means.

12 (8 pts) Explain why the Giant-Impact and Fission theory do a good job of explaining the lack of volatiles in the Earth-Moon system (The answer for both theories is the same).



13 (6 pts) The element Iridium (Ir) is very rare in the Earth's crust but more abundant in the core. Explain why this is.

14 (8 pts) Would you expect Ir to be abundant or rare on the **surface** of the Moon? Explain your answer. (Hint: there are good arguments on both sides; I am more interested in your reasoning.)

