

April 23, 1999

TA's Name & Section (2 pts): \_\_\_\_\_

**Answer all questions in the space provided. If you have any questions, raise your hand. 100 points possible.**

**1** (5 pts) You have discovered a planet that is twice the radius of the Moon and four times as massive. How does the gravity on the surface of this planet compare to the Moon? [show your work]

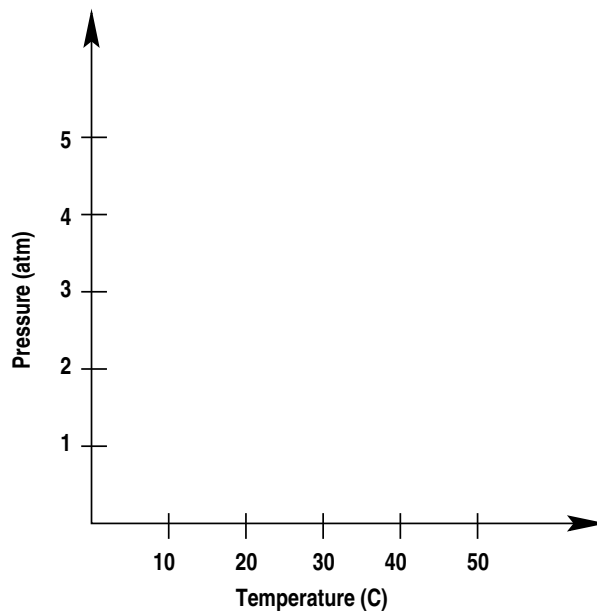
**2** (4 pts) You measure the **uncompressed** density of your newly discovered world to be  $4.0 \text{ g/cm}^3$ . What is the most likely composition of the planet?

**3** (6 pts) Your new world orbits a star **exactly** like our Sun. If your world is the same distance from its star as the Earth is from the Sun would you expect it to have an atmosphere? Explain why or why not.

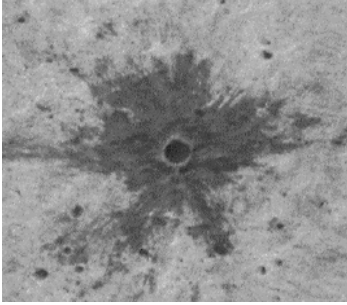
**4** (7 pts) Would you expect the geological activity on your newly discovered world to be more, less, or about equal to that on the Moon? Explain the reasoning behind your answer.

**5** (10 pts) On your long trip to your new world your food supply is a substance called *Soylent Green*. You have collected data (shown in the table below) about its phase at different temperatures and pressures. In the blank graph below **plot your data** and construct a phase diagram for *Soylent Green* that is consistent with your data.

Temperature (° C)	Pressure (atm)	Phase
10	1	Solid
10	2	Liquid
10	5	Gas
20	3	Liquid
30	4	Gas
50	3	Solid



**6** (2 pts) If the temperature in this room is 20 °C. What phase would *Soylent Green* be in?



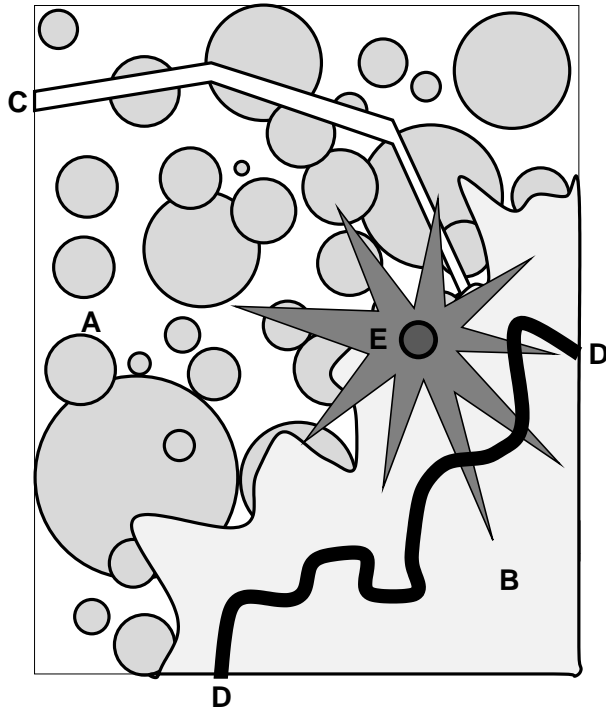
**7** (6 pts) As you orbit your world you image an impact crater on the surface (image on left). As you can see low albedo material has been exposed underneath a layer of high albedo material. The impact crater has a diameter of 36 meters. What is the **maximum** thickness of overlying high albedo material? [show your work]



**8** (4 pts) Landing on your newly discovered world you pick up a rock at your feet. On the left is an image on a thin section you made of the rock. Based on the lunar samples you looked at in lab what type of rock is it? (check one)

- ☐ Basalt
- ☐ Impact Breccia
- ☐ Orange Soil
- ☐ Regolith
- ☐ Pristine Highland Rock

**9** (6 pts) What are the characteristics of the thin-section that you used to determine the rock type?



**10** (5 pts) After several days of exploring your new world you have created the geological map on the left. Indicate the **relative** ages of the various landforms from oldest (1, formed first) to youngest (5, formed last).

A - Cratered Terrain \_\_\_\_\_

B - Lava Flow \_\_\_\_\_

C - Straight Rille (Fault) \_\_\_\_\_

D - Sinuous Rille \_\_\_\_\_

E - Crater and Ejecta \_\_\_\_\_

**11** (2 pts) What is the most probable location for the origin of the rock you made a thin-section of?

☐ A                      ☐ B                      ☐ C                      ☐ D                      ☐ E

**12** (8 pts) You measure the crater density on the “Cratered Terrain” to be about the same as that on the Lunar Highlands. Based on the crater density alone, why may it be wrong to conclude that the age of the “Cratered Terrain” is the same as the Lunar Highlands?

From your world you observe three planets that are all orbiting the central star all at the same distance [yes, I know this is really contrived]. You measure the composition of a **few** gases in their atmospheres (see table below).

	Hydrogen (H <sub>2</sub> )	Oxygen (O <sub>2</sub> )	Carbon Dioxide (CO <sub>2</sub> )
Planet A	0%	25%	1%
Planet B	75%	0%	0%
Planet C	0%	0%	98%

**13** (6 pts) Which planet is the most massive? Explain how you determined that based only on the measured atmospheric gases.

**14** (6 pts) Which planet is most likely to have life on it (at least life like we have on Earth)? Explain how you determined that based only on the measured atmospheric gases.

**15** (6 pts) Which planet would most likely have the highest surface temperature? Explain how you determined that based only on the measured atmospheric gases.

After a long investigation you find the **surface** of your world to be lifeless. However, you remember the surfaces of planets may not be the best place to get life going.

**16** (5 pts) I said that it could be difficult to form life on the **surface** of the Earth 3.8 billion years ago. What was happening to the surface of the Earth (and all of the other terrestrial planets) at this time to make the formation of life difficult?

**17** (10 pts) Most of the Earth's surface from 3.8 billion years ago is long gone. We have no rocks or features whose ages we can determine. How do we know this event happened 3.8 billion years ago and not at another time?