

October 26, 2000

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 (3 pts) Water has a density of _____ g/cm^3 , rocks have a density of about _____ g/cm^3 and iron has a density of _____ g/cm^3 .

0 (4 pts) Write down the equation that describes the force of gravity between you and the Earth [be sure to say what your variables mean].

Four planets are orbiting a star that is identical to our Sun. From the Earth we observed these planets and collected the following data:

Planet	Mass	Diameter	Density [g/cm^3]		Average Distance from star [AU]
	[Earth = 1]	[Earth = 1]	Compressed	Uncompressed	
KENNY	0.20	0.50	8.0	8.0	0.5
KYLE	0.50	0.75	6.0	5.0	0.8
STAN	1.0	1.0	5.0	4.0	1.0
CARTMAN	4.0	2.0	2.5	1.0	3.0

1 (2 pts) Which of the planets takes the shortest time to orbit around the star?

2 (3 pts) How long does it take the planet STAN to orbit the star [show your work]?

3 (4 pts) If we assume that these planet are made of the same materials as our solar system (ice, rock and iron) what is the most likely compositions of the planet KENNY?

4 (4 pts) What is the most likely composition of the planet STAN?

5 (4 pts) Which of the planets is most likely the **least** geologically active? [Explain your answer].

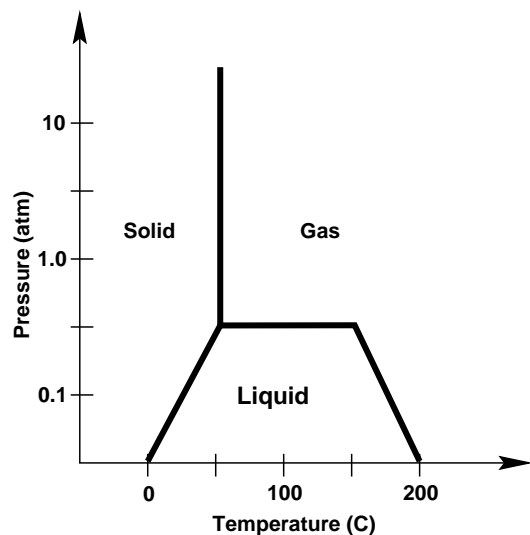
6 (5 pts) The planet CARTMAN is larger and more massive than the Earth. However, you would weigh the same on CARTMAN as you would on the Earth. Explain why this is [show your work].

You are part of the team of scientists that is sent to explore this planetary system. As you approach the system you measure the properties of the atmospheres the these planets.

Planet	Surface Pressure [atm]	Surface Temperature Range [°C]	Composition
KENNY	...	-100 – 300	No Atmosphere
KYLE	0.1	0 – 200	96% CO ₂ , 4% N ₂
STAN	1.0	10 – 50	95% CO ₂ , 5% N ₂
CARTMAN	10.0	90 – 110	98% CO ₂ , 2% N ₂

7 (6 pts) The planet CARTMAN is further away from the central star than STAN is, yet it has a higher surface temperature and a smaller range in temperatures. Explain how this can be.

8 (6 pts) Explain why it is unlikely than any of these planets have any Earth-like plant life on their surfaces even though some of the planets have warm, thick atmospheres.

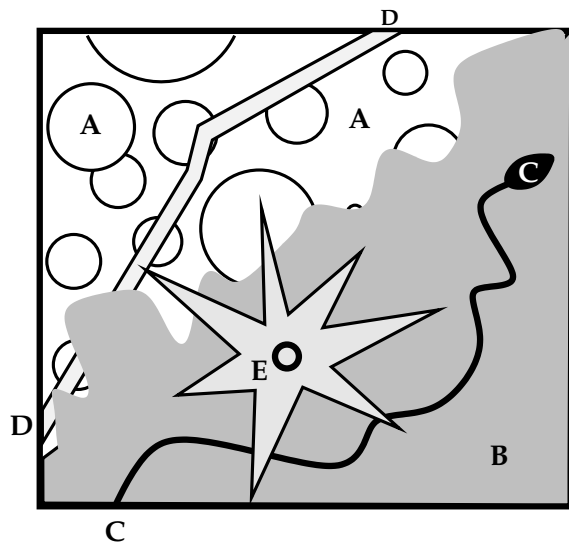


Scientists on the Earth have proposed that a substance called *GUNK* may be found on the surfaces of some of the planets. On the left is a phase diagram for *GUNK*.

9 (4 pts) On the surface of KYLE, *GUNK* can exist in all three states. On KYLE the boiling point of *GUNK* is _____ [°C] and the freezing point is _____ [°C].

10 (4 pts) Before you arrived in the planetary system, it was theorized that large seas of *GUNK* may exist on the surface of the planet STAN. Based on the data you collected so far, explain if this is possible?

11 (5 pts) On the surface of CARTMAN, *GUNK* can only exist as a gas. However, clouds of liquid *GUNK* were detected in the atmosphere. Explain how this can be.



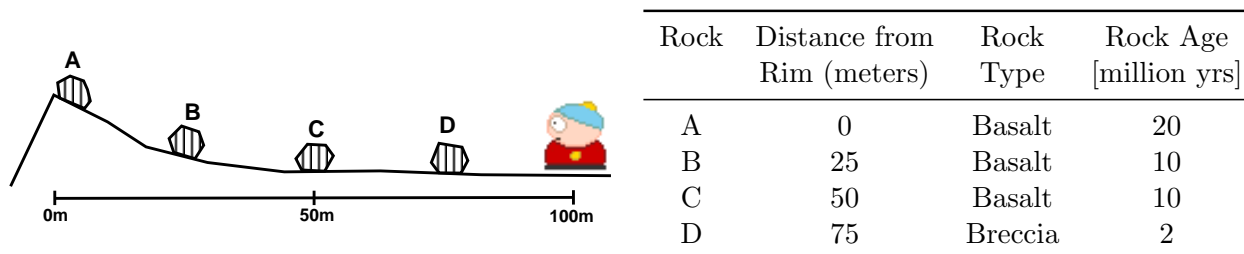
12 (5 pts) From orbit around CARTMAN you create the geological map of a possible landing site. Indicate the **relative** ages of the various landforms from oldest (1, formed first) to youngest (5, formed last).

- A - Cratered Terrain _____
- B - Lava Flow _____
- C - Sinuous Rille _____
- D - Straight Rille (Fault) _____
- E - Crater and Ejecta _____

13 (5 pts) You notice from your mapping that even on the cratered terrain there are no craters smaller than about 10 km. Explain why this may be.

14 (5 pts) How would you determine the absolute age of the Cratered Terrain?

After landing on the surface of CARTMAN the first thing you is walk to the rim of the crater [E] collecting rocks. Back in the lab you determine what type of rocks you found. Your results are shown in the table on the below.



15 (6 pts) Most of the rocks you found around the crater were basalts. We have seen basalt or basalt-like rocks on every world so far. Describe what basalt looks like and how it is formed.

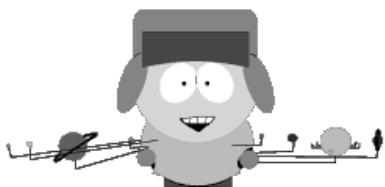
16 (2 pts) Look at the geological map on the previous page. What landform is the most likely origin of the basalts you found?

17 (5 pts) I said that an impact crater evacuates material from a maximum depth of about 1/10 the crater diameter. Assume that crater [E] is 1000 meters in diameter. Is the lava flow that crater [E] fell on greater or less than 100 meters thick? [Explain your answer]

18 (6 pts) Look at the age of the rocks you collected. Explain why they get older as you get closer to the rim.

19 (6 pts) You analyze the rocks at your landing site and find that they are rich in heavy elements like platinum and iridium. Why should such heavy elements be rare in the crust of the planet CARTMAN.

20 (4 pts) What is the most likely origin of these heavy elements?



If you drop your keys in molten lava just let 'em go 'cause man, they're gone.

– *Deep Thoughts by Jack Handey [SNL]*