

May 21, 1999

TA's Name & Section: _____

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

1 (6 pts) Meteorites are just as likely to fall in Western Washington as anywhere else on the Earth. However, if we were to search around Western Washington we would be much less likely to find a meteorite than if we searched the same amount of land in the Australian desert. Explain why this is. [2 reasons]

2 (6 pts) Even if we had a “piece” of the Sun we could not determine its age (it would just be a handful of gas). So, how do we know the Sun is 4.5 billion years old?

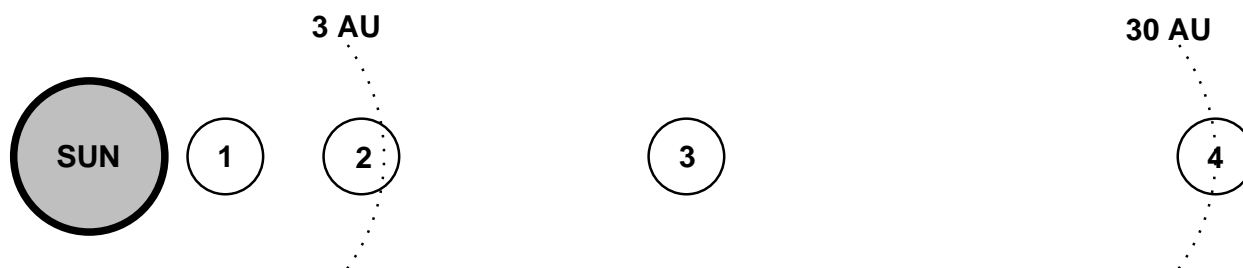
3 (4 pts) How do we know that comets did not form in the inner solar system?

4 (6 pts) The Earth has only a few impact craters visible on its surface. Yet we believe that in the past the Earth was bombarded by impactors. Why do we believe the Earth was **heavily** bombarded in the past?



5 (5 pts) To the left is an image of an impact crater on the icy surface of Europa. The impact crater has a diameter of 26 kilometers. If we assume that the dark material came from underneath the ice, what is the **maximum** thickness the ice can have? [show your work]

6 (6 pts) The Earth's Moon and Saturn's moon Titan are about the same size and have about the same gravity. Titan has a thick atmosphere while the Moon has none. Explain why this is.



7 (8 pts) The four numbered circles in the diagram above represent the locations but *NOT* the sizes of four different **solid** worlds in our Solar system. Assume that each of those worlds formed from materials at their indicated locations. Describe the approximate bulk composition and density of each of the worlds.

8 (8 pts) Answer the same question as above but assume that the system formed around a star twice as hot as the Sun.

You have discovered three airless moons around another planet. The planet has a **radius of 10,000 km** and a mass about the same as Jupiter's. You determine the distance from the planet and the period for each moon (table on right). Based only on this data answer the next three questions:

Name	Distance (km)	Period (hours)
A	20,000	0.4
B	100,000	5.0
C	160,000	10.0

9 (6 pts) Which of the moons would you deduce is the **smallest** moon? (check one)

☐ A ☐ B ☐ C

Explain your reasoning:

10 (6 pts) Which of the moons would you deduce is being **tidally heated**? (check one)

☐ A ☐ B ☐ C

Explain your reasoning:

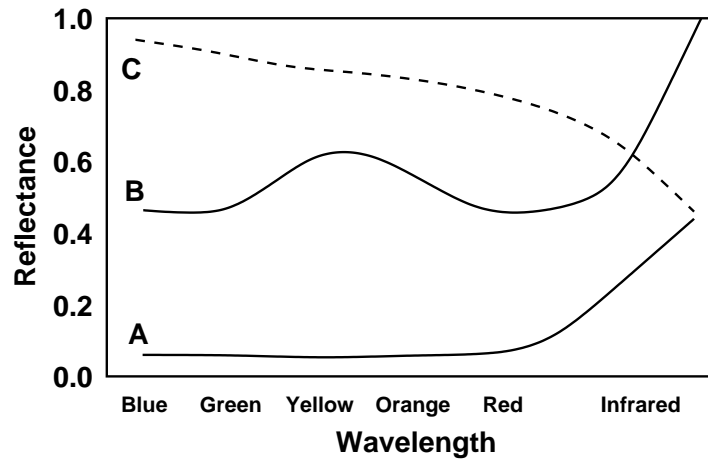
11 (6 pts) Which of the moons would you deduce is the most **cratered**? (check one)

☐ A ☐ B ☐ C

Explain your reasoning:

12 (10 pts) One of the moons in the system from the previous page is being tidally heated. Describe how tidal heating works and draw a diagram using this system as an example.

13 (5 pts) Explain why the other moons in the system are **not** tidally heated.



From the Earth you measure the reflectance spectra of the three moons (A, B, and C) in the system (see graph on left). Use these spectra to answer the remaining questions.

14 (9 pts) Describe the colors and relative brightnesses of the moons if you were to observe them visually.

15 (3 pts) Describe the relative brightnesses of the moons if you observed them in the infrared.

16 (6 pts) Speculate what materials might make up the surfaces of each of the moons.