ASTRONOMY 150 - FINAL Name: _____

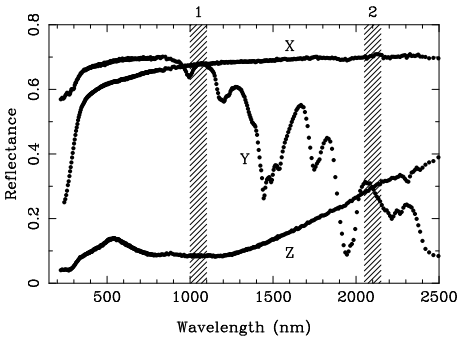
December 18, 2001 TA's Name & Section: _____

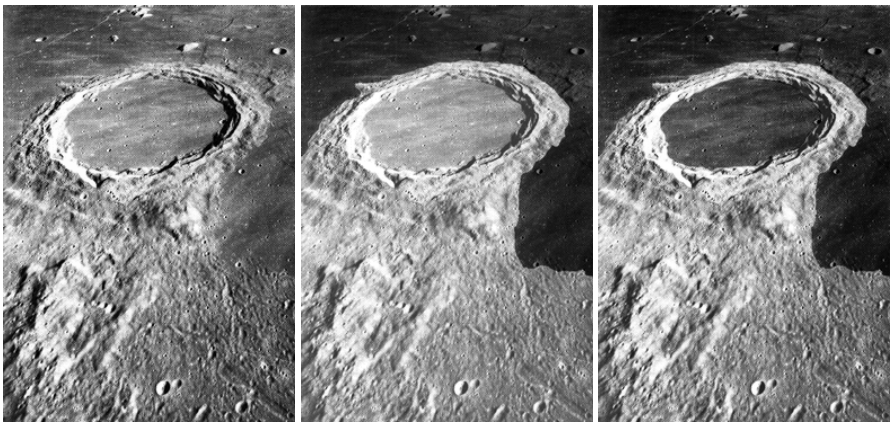
**Answer all questions in the space provided. If you have any questions, raise your hand. 100 points possible.**

**1** (5 pts) Astronomers estimate that there may be a trillion cometary nuclei in the Kuiper Belt. Despite the large numbers of cometary nuclei, they have only been discovered in the last decade. Explain why this is.

**2** (5 pts) Halley's comet takes about 76 years to orbit the Sun. Why do we believe that Halley's comet was not in its present orbit 4 billion years ago?

**3** (5 pts) Explain why we believe that Jupiter-sized planets orbiting solar-type stars must have formed at a distance of at least 3 AUs.



LAYOUT FILTER 1 FILTER 2

On the left is a plot of the reflectance spectra of three different rock types (X, Y, AND Z) and the bandpasses of two different filters; FILTER 1 and FILTER 2 (cross-hatched regions). On the right are three images of a site on the Moon. The first image shows the layout of the region, the second image is taken through FILTER 1, and the third through FILTER 2. Use this data to answer the next three questions.

**4** (6 pts) Name the geological features shown in this image and describe how they were formed.

**5** (9 pts) Describe the distribution of the three different rock types X, Y, AND Z in the region imaged.

**6** (6 pts) Human eyes are generally sensitive to light of wavelengths between 400 nm (Blue) and 800 nm (Red). Describe how each of the three different rock samples X, Y, AND Z would look to the astronauts picking up the samples. Make sure you comment on the samples color and relative brightness.

**7** (5 pts) We have seen in class that, except for tidally heated worlds, larger worlds are more geologically active then smaller worlds. Explain why larger worlds are more geologically active then smaller worlds.

**8** (4 pts) Explain why the inner terrestrial worlds (*e.g.* Mercury, Venus, Earth *etc.*) are composed of higher density material than the outer terrestrial worlds (*e.g.* Europa, Titan, Triton *etc.*).

On the following two pages are a series of facts that we learned about the solar system this quarter. For each of the facts, list **what data** we used to determine the fact [2pts] and **how this data was used** to determine the fact [5pts]. The data may be a sample, an image, a comparison with another world, or a theoretical model. *Make sure that you are* **specific** *about what sample, image, world, theory you are using.*

**9** (7 pts) *Fact #1*: The Earth was hit by a 10 km asteroid 65 million years ago.

Data used:

**10** (7 pts) *Fact #2*: Some asteroids are highly differentiated.

Data used:

**11** (7 pts) *Fact #3*: The very deep interior of Jupiter is composed of liquid metallic hydrogen.

Data used:

**12** (7 pts) *Fact #4*: The surfaces of the inner terrestrial worlds were heavily bombarded 3.8 billion years ago.
Data used:

**13** (7 pts) *Fact #5*: The Sun formed 4.5 billion years ago.
Data used:

**14** (7 pts) *Fact #6*: Jupiter's moon Io is the most geologically active world in the solar system.
Data used:

"Now that the idea of an ocean on Jupiter's satellite Europa is generally accepted, the debate has shifted to how far below the icy surface it lies. If it's too far, even the most tenacious ocean life could be cut off from its best energy source-the sun . . . posing a great obstacle for life in Europa's ocean . . . "

**15** (8 pts) The quote above comes from the November 9th 2001 issue of *Science*. Contrary to this quote, I have proposed in class that sunlight is not necessary for life on Europa, and that Europa may be a great place for life. Describe where the energy for life on Europa may come from, where on Europa life might be common, and what kind of life this might be.

**16** (3 pts) The total number of asteroids known to this day, counting those the size of small cars, exceeds 100,000. Explain why the Galileo spacecraft survived its trip through the asteroid belt undamaged.

**17** (2 pts) List the top 100 objects in the solar system.