ASTRONOMY 150 – FINAL Name: _____

March 16, 2005 – Winter 2005 TA's Name & Section: _____

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

1 (5 pts) In class I called a lot of extraterrestrial samples examples of "primitive" materials. Describe what is meant by "primitive" materials.

2 (8 pts) Which of Jupiter's moons – Io, Europa, Ganymede or Callisto – would you expect to find the most primitive material on its surface? Explain your answer.

3 (3 pts) Why did the *Cassini* spacecraft not suffer a collision with an asteroid when it went through the asteroid belt?

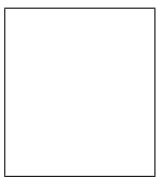
(a) The spacecraft was coated with asteroid repellent
(b) The separation between asteroids is very large
(c) Iron asteroids are very rare
(d) The large asteroids have been ejected by Jupiter
(e) The average asteroid is much smaller than the spacecraft

We have seen many examples of the effects of *orbital resonances* in this class. For each of the three phenomena listed, explain the role orbital resonances play.

4 (6 pts) Tidal heating of Io.

5 (6 pts) Delivery of meteorites to the surface of the Earth.

6 (6 pts) The fact that Pluto's orbit is stable over the age of the solar system, despite the fact that it crosses the orbit of Neptune.



In *Star Wars*, the Earth-sized planet Alderaan was blown to pieces by the Death Star.

7 (9 pts) If you were to collect pieces of this destroyed planet, what three different types of meteorites would they represent? Explain your answer.

8 (8 pts) In the space below, sketch the reflectance spectrum of a surface of the Earth that is rich in vegetation. Make sure to label the axes.

9 (2 pts) What is the energy source that drove the geological activity on the surface of the asteroid *Vesta* (or any formerly active asteroid)?

(a) Tidal heating by Jupiter
(b) Solar radiation
(c) Radioactive decay
(d) Contraction from formation
(e) Differentiation

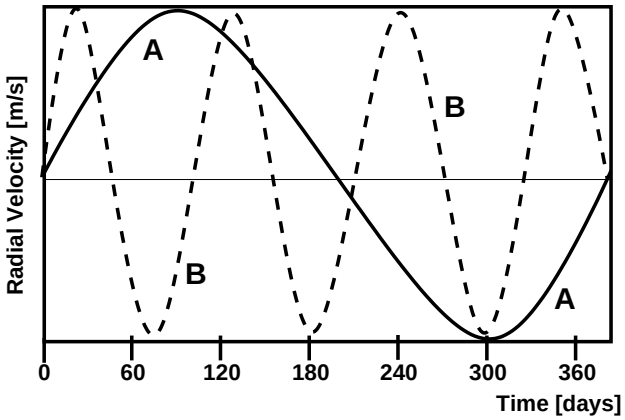
10 (10 pts) The planet Venus lacks a magnetic field and its atmosphere lacks the complex belt and zone structure seen on Jupiter (and the Earth). Explain how Venus' slow rotation (243 days) contributes to both of these phenomena.

11 (5 pts) Explain why the amount of volatile material in a short-period comet **decreases** with time.

12 (6 pts) Describe why secondary atmospheres in the outer parts of the solar system (*i.e.,* Titan) are different from secondary atmospheres in the inner solar system (*i.e.,* Venus).

13 (10 pts) You have discovered a new moon of Saturn located far from the planet in a retrograde orbit. You determined its size to be about 100 km (2% the size of the Earth's Moon). Describe the most probable shape of this new world and the types of geological features you would expect to see on its surface.

On the right is a plot of the Radial Velocity vs. time for two different stars *exactly* like our Sun. A single planet orbits each star. Assume that the orbits of the planets are circular and that we are viewing the system nearly edge-on. Star **A** is represented by the solid line, Star **B** by the dashed line.



14 (4 pts) Which star has the planet with the orbit closest to the star? Explain how you determined this.

15 (4 pts) Which star has the more massive planet? Explain how you determined this.

16 (6 pts) Explain why it is more difficult to determine the mass and period of the planet around star **A** than star **B**.

17 (2 pts) And finally, list the top 100 objects in the solar system.