ASTRONOMY 150 - EXAM #3 Name: _____

December 10, 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) I have said many times that the "Sun is the top 99 objects in the Solar system". Obviously, the Sun is only one object. Explain what I meant by this statement.

2 (6 pts) We have never seen the deep interior of Jupiter, nor could probes survive a trip there. Explain how we know what the deep interior of Jupiter is like.

3 (4 pts) I said that Neptune's moon Triton has surface that is about 300 million years old. This age determination was based on a lot of assumptions. If you *really* wanted to know the age of Triton's surface, how would you determine it?

Astronomers have discovered about 30 planetary systems around other nearby stars. The main characteristic of these systems are Jupiter sized planets orbiting very close to the parent star.

4 (8 pts) Explain why we believe that these large planets did **not** form at their present location.

5 (8 pts) Explain why these types of planetary systems are the easiest to detect.

6 (5 pts) The Earth is geologically active today. Explain how the Earth generates its internal heat to drive this geological activity.

7 (5 pts) Rocks brought back by the Apollo mission showed that the Moon had a magnetic field 3.3 billion years ago. What was different about the Moon 3.3 billion year ago that allowed it to have a magnetic field?

8 (6 pts) One component you need to generate a magnetic field is a conducting medium. Match the world to its conducting medium. You can use a conducting medium for more than one answer.

____ Earth	
____ Neptune	A. "Metallic" Hydrogen
____ Jupiter	B. Water/Rock "Ocean"
____ Mercury	C. Iron
____ Saturn	D. Copper
____ Uranus	

Read the following excerpt from the December 3, 1999 issue of *Science*:

> Oceans seem to be popping up everywhere among the satellites of Jupiter. First it was Europa's 100-kilometer-deep, ice-encrusted ocean, which might even harbor some life ... now it may be fiery Io's turn. But there are no tantalizing prospects for life in Io's proposed ocean. At something like 2000 Kelvin ... this ocean would consist of molten rock. ... If Io's magma ocean is really there, it may be fueling geologic processes we don't see on Earth and that haven't been seen in billions of years ... The magma ocean that roiled Earth in the earliest days of the solar system left no geologic record ... This mushy magma ocean must be global, the researchers conclude, to feed the volcanic hot spots that seem to be uniformly distributed over Io's surface ... The early Earth or moon may have looked this way ... before [they] cooled enough to solidify.

9 (2 pts) What is magma?

10 (6 pts) The excerpt states that the Earth has no geological record of a magma ocean. What happened to the rocks that were formed when the Earth's magma ocean cooled?

11 (6 pts) Earth and the Moon have cooled enough to loose their magma oceans but Io has not. Why has Io not cooled?

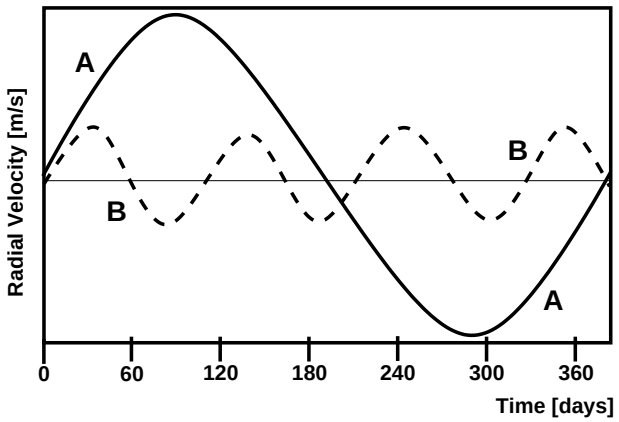
We have seen that Jupiter has had a profound influence on our Solar system. For each of the following facts about our Solar system, explain how Jupiter contributed in bring about that fact.

12 (6 pts) The Earth was hit by a 10 km asteroid 65 million years ago that may have helped clear the way for mammals (that's us).

13 (6 pts) The area around Io is one of the most dangerous region of the Solar system for humans (or robots) to explore.

14 (8 pts) The asteroid belt has asteroids composed of carbonaceous chondrite material.

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.



15 (2 pts) What is the period of the planet orbiting star A? _____ [days]

16 (2 pts) What is the period of the planet orbiting star B? _____ [days]

17 (4 pts) Which star has the more massive planet? Explain how you determined this.

18 (4 pts) Which star has the planet with the orbit closest to the star? Explain how you determined this.

19 (6 pts) Approximately how far away does the planet around star A orbit? [Hint: You should not have to do any calculations]