ASTRONOMY 150 – FINAL Name: _____

Dec 13, 2010 – Autumn 2010 TA's Name & Section: _____

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

1 (2 pts) Jupiter takes about 12 years to go around the Sun. An asteroid in a 4:1 resonance with Jupiter would take how many years to go around the Sun?

(a) 4 years
(b) 3 years
(c) 12 years
(d) 48 years
(e) 15 years

2 (2 pts) How do meteorites get from the asteroid belt to the Earth?

(a) An impact breaks pieces off sending them flying to the Earth
(b) An asteroid explodes, sending pieces to the Earth
(c) An interaction with Jupiter sends pieces to the Earth
(d) Alien spacecraft inadvertently pick them up and deliver them during their frequent visits to Earth

3 (2 pts) Saturn's small moon Mimas is saturated with impact craters. What does saturated mean in this context?

(a) There are no large impact craters
(b) The addition of more craters would not change the crater density
(c) Volcanic activity has covered most of the craters
(d) Impacts have released water that has saturated the surface

4 (2 pts) Small worlds in the outer solar system can have levels of geological activity similar to much larger worlds in the inner solar system because:

(a) their surfaces have stronger solar heating
(b) they are made primarily of ice
(c) they have higher impact rates from the asteroid belt
(d) they have more radioactive elements

5 (2 pts) Why do we think the water on the Earth had to come from the outer solar system

(a) Water is not dense enough to form in the inner solar system
(b) Water molecules move too fast close to the Sun to be in Earth's atmosphere
(c) Water cannot exist as a solid inside the snowline
(d) Comets do not come into the inner solar system

6 (2 pts) The **Kuiper belt** never formed into a single object because

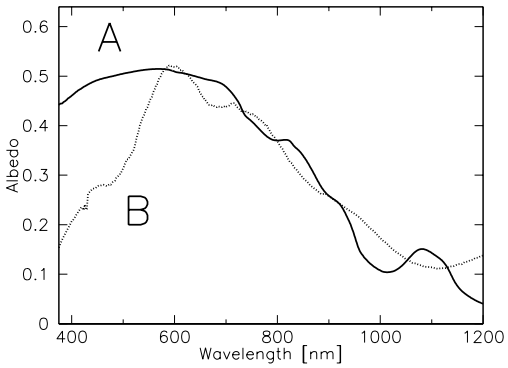
(a) of capture by Neptune
(b) of the influence of Jupiter
(c) there is not enough rocky material
(d) accretion times are longer that 4 Byrs
(e) tidal forces are greater than gravitational forces

7 (2 pts) The **asteroid belt** never formed into a single object because

(a) of capture by Neptune
(b) of the influence of Jupiter
(c) there is not enough rocky material
(d) accretion times are longer that 4 Byrs
(e) tidal forces are greater than gravitational forces

8 (2 pts) The **rings of Saturn** never formed into a single object because

(a) of capture by Neptune
(b) of the influence of Jupiter
(c) there is not enough rocky material
(d) accretion times are longer that 4 Byrs
(e) tidal forces are greater than gravitational forces



The plot on the left shows the reflectance spectra of two samples, Sample **A** (solid line), and Sample **B** (dotted line). Both are commonly found here in the Pacific Northwest. Remember that you can see wavelengths in a range of 380 to 700 nm. Wavelengths longer than 750 nm are in the infrared.

9 (4 pts) Describe the **visible** appearance of sample **A**.

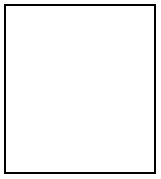
10 (4 pts) Describe the **visible** appearance of sample **B**.

11 (2 pts) At what wavelength would a filter be best able to distinguish the two samples?

12 (8 pts) Explain why we **cannot** use crater counting to determine the absolute age of the surfaces of the **dead** moons of Saturn.

13 (8 pts) Explain why we have meteor showers when we pass through the orbit of a **comet**, but not when we pass through the orbit of an **asteroid**.

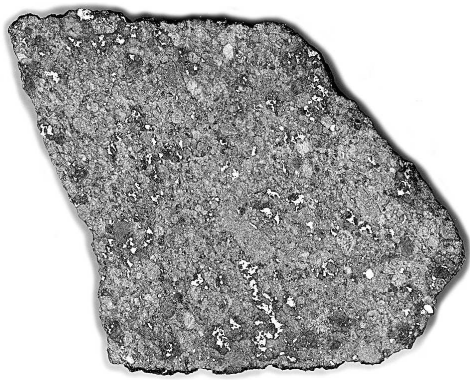
14 (8 pts) The main property of the *Nice Model* of planetary formation is that Uranus and Neptune formed at a much closer proximity to the Sun than they are currently at. Explain why it was advantageous for these planets to have formed closer to the Sun.



15 (8 pts) Explain why the atmospheric composition of Titan (Saturn's moon) is different from the atmospheric composition of Venus.

16 (8 pts) How do the **Mass**, **Size**, and **Orbital Distance** of the PLANET around the star *51 Peg* compare to Jupiter?

On the right is an image of a slice of an **Ordinary Chondrite** meteorite.



17 (4 pts) Is this sample *primitive*? Explain.

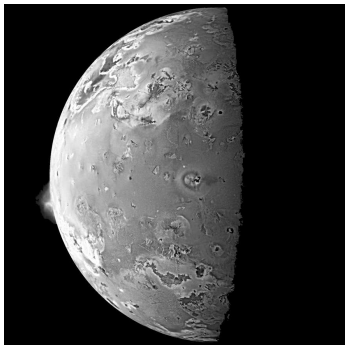
18 (10 pts) Describe the approximate **size** (in km), **shape**, **density** (in g/cm^3), and **moment-of-inertia** of the *parent body* of this sample.

19 (2 pts) What is the *most likely* age of this meteorite?

(a) Age $>$ 4 Billion years
(b) 3.8 Billion years $>$ Age $>$ 1 Billion years
(c) Age $<$ 1 Billion years

You have a way to travel in time and space. Assume that you have landed on each of the following surfaces *TODAY*. Tell me the types of rocks you would find at your feet, and how old they would be. Now assume you jump ahead in time and visit each surface *1 BILLION YEARS* from now. Answer the same questions for now + 1Byrs.

20 (6 pts) **Jupiter's satellite Io**



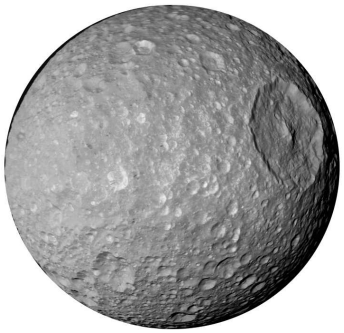
Sample Type (Today): _____

Surface Age (Today): _____

Sample Type (+1 Byrs): _____

Surface Age (+1 Byrs): _____

21 (6 pts) **Saturn's satellite Mimas**

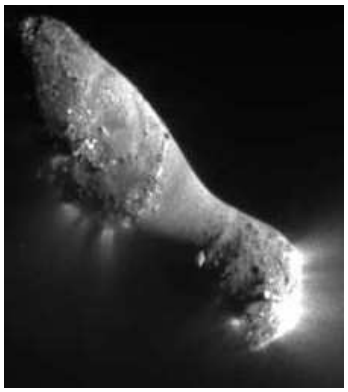


Sample Type (Today): _____

Surface Age (Today): _____

Sample Type (+1 Byrs): _____

Surface Age (+1 Byrs): _____



22 (6 pts) **Short Period Comet**

Sample Type (Today): _____

Surface Age (Today): _____

Sample Type (+1 Byrs): _____

Surface Age (+1 Byrs): _____