June 6, 2011 – Spring 2011

Name: _____

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.

billion years old?

- (a) The oldest Earth rocks are 4.5 billion years old
- (b) Martian meteorites are 4.5 billion years old
- (c) Samples from the Lunar surface are 4.5 billion years old
- (d) Carbonaceous chondrites are 4.5 billion years old
- (e) Samples from the Solar surface are 4.5 billion years old

2 (2 pts) What is the common characteristic of exoplanets discovered by the **radial velocity** method?

- (a) The planets are generally very small and orbit very close to the central star.
- (b) The planets are generally very large and orbit very far from the central star.
- (c) The planets are generally very small and orbit very far from the central star.
- (d) The planets are generally very large and orbit very close to the central star.

3 (2 pts) Which following list of meteorite types is arranged from **most** primitive to **least** primitive?

- (a) ordinary chondrite, carbonaceous chondrite, iron
- (b) ordinary chondrite, iron, carbonaceous chondrite
- (c) iron, carbonaceous chondrite, ordinary chondrite
- (d) carbonaceous chondrite, ordinary chondrite, iron

4 (2 pts) What process is responsible for the heat generated in the interior of Jupiter?

- (a) tidal heating
- (b) radioactive heating
- (c) solar heating
- (d) gravitational contraction

1 (2 pts) How do we know the solar system is 4.5 5 (2 pts) In studying the surfaces of solid worlds in the solar system, we have learned that the number of craters (per unit area)

- (a) is greater as you get close to the Sun
- (b) is roughly proportional to the age of the surface
- (c) is about the same on every world
- (d) is greater as you get farther and farther from the Sun
- (e) follows no discernible rules or relationships

6 (2 pts) Which of the following atmospheric gasses would be a strong indicator of a potentially biologically rich world?

- (a) Carbon Dioxide (CO_2)
- (b) Ozone (O_3)
- (c) Nitrogen (N_2)
- (d) Methane (CH_4)

7 (2 pts) Which of the following would most affect the level of geological activity on Jupiter's moon Io?

- (a) Slow down Jupiter's rotation.
- (b) Remove Europa from orbit around Jupiter.
- (c) Double the mass of the Asteroid Belt.
- (d) Move the Jupiter system twice a far from the Sun.
- (e) Turn off the magnetic field of Jupiter.

8 (2 pts) Why do spacecraft not suffer a collision with an asteroid when they travel through the asteroid belt?

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

Above is the visible light reflectance spectra and physical data for the Kuiper belt object Fallere



9 (6 pts) Describe the color and brightness of Fallere

10 (8 pts) Describe the shape of Fallere and explain why it would have this shape

11 (4 pts) What is the surface of Fallere most likely composed of?

12 (4 pts) Explain what the process of accretion is.

13 (6 pts) Explain why accretion is very inefficient within the Roche limit of Saturn.

14 (6 pts) Explain why accretion is very slow far away from the Sun.

 ${\bf 15}~(6~{\rm pts})$ Explain why magnetic fields were probably ${\bf much}$ more common on many worlds 3.5 billion years ago.

16 (10 pts) Explain what the *snow-line* is in our solar system, and why there is more solid material outside the *snow-line* than inside.

The next two statements are **False**. For each of these statements, explain what is wrong with the argument.

17 (8 pts) A single meteor entered the Earth's atmosphere and broke into 10 pieces. These 10 meteorites were collected on the ground. Eight of them where iron meteorites and two where carbonaceous chondrites.

18 (8 pts) Jupiter has very little effect on the orbit of asteroids in the asteroid belt since asteroids never get closer than about 1 AU to Jupiter.

For each of the following surfaces, tell me: (1) the most likely composition of the surface, (2) the most probable age of the surface (I want a number with units), and (3) what processes are modifying the surface TODAY.



19 $(6~{\rm pts})$ Io - Ra Patera Volcano

Surface Composition: _____

Surface Age: _____

Processes modifying surface today:



20 (6 pts) Mimas - highland surface

Surface Composition: _____

Surface Age: _____

Processes modifying surface today:



21 (6 pts) Titan - North Pole

Surface Composition: _____

Surface Age: _____

Processes modifying surface today: