

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 (3 pts) Jupiter takes about 12 years to orbit the sun. An asteroid in 4:1 resonance with Jupiter would orbit the sun in how many years?

- (a) 3 years
- (b) 48 years
- (c) 12 years
- (d) 16 years
- (e) 1/4 year

2 (3 pts) A small (< 200 km) object formed at a distance of 0.5 AU from the sun would have a density of about

- (a) 1 g/cm³
- (b) 3 g/cm³
- (c) 8 g/cm³

3 (3 pts) A small (< 200 km) object formed at a distance of 15 AU from the sun would have a density of about

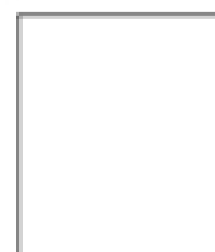
- (a) 1 g/cm³
- (b) 3 g/cm³
- (c) 8 g/cm³

4 (3 pts) A planet with a mass of 10 times that of Jupiter will have a size

- (a) 10 times greater than Jupiter
- (b) 10 times less than Jupiter
- (c) about the same as Jupiter
- (d) that can have any value

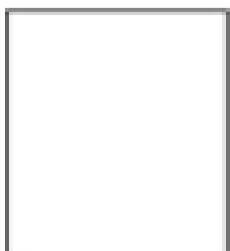
5 (3 pts) Which of the following atmospheric gasses would be a strong indicator of a potentially biologically rich world?

- (a) Carbon Dioxide (CO₂)
- (b) Ozone (O₃)
- (c) Nitrogen (N₂)
- (d) Methane (CH₄)



6 (8 pts) Describe how you can determine the composition of the surface of an asteroid *without* having a sample.

7 (8 pts) Explain how we can determine how far an extrasolar planet is from its star, even though we cannot see the planet.



8 (8 pts) I have said that we **cannot** use crater counting to determine the ages of the worlds in the outer solar system. Describe what the evidence is that supports this statement.

9 (8 pts) Venus, Earth, Mars, and Titan are terrestrial worlds with **secondary** atmospheres. Explain why the composition of Titan's atmosphere is very different from the composition of Venus' atmosphere.

