

Saturnian System Lab

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Name: _____

Section: _____

1. Orbits

- a) Saturn is a gas giant located in the outer Solar System, with a semi-major axis of 9.58 AU. Using Kepler's Third Law, calculate how long it takes Saturn to revolve around the Sun (show work).

- b) **True or False:** Saturn's moons take roughly the same amount of time to orbit the Sun as Saturn. Explain your answer with 1-2 short sentences.

- c) What does it mean for a satellite to be in *synchronous rotation* around its planet?

- d) In a sentence or two, explain the reason for the synchronous rotation of many moons in the solar system.

- e) Some satellites orbit their planet in *retrograde* fashion, what does this mean?

2. Moons

- a) Saturn has over 60 moons, but most of these 'moons' are little more than large asteroids that can be classified into two broad camps: small moons that orbit within Saturn's ring system, and another cluster of small moons that orbit Saturn at large distances. Orbiting in between the two different populations of minor moons are Saturn's 9 major moons. List the 9 largest moons that orbit Saturn.

- b) Which one of the 9 major Saturnian moons (i.e. largest moons) has the highest density? Which of the major moons has the lowest density? What do these densities suggest about the composition of the two moons?

- c) One of the 9 major Saturnian moons displays a dramatic contrast in albedo between its trailing and leading hemispheres. Name the moon, and list the observed range in geometric albedo for its two hemispheres.

- d) The Cassini Orbiter, an observational satellite currently collecting data in the Saturnian System, zoomed through a plume of mostly water that erupted off the surface of which moon? State 2 reasons why finding liquid water in the Outer Solar System is important to scientists.

- e) Which of the 9 major Saturnian moons has a *retrograde* orbit?

- f) One of the 9 major moons of Saturn looks like the 'Death Star' from the movie *Star Wars*. Which moon is it? What features of the moon make it look like the 'Death Star?' (use terms you remember from the Lunar Features lab)

3. Moon Chemistry

- a) Titan, the largest moon of Saturn (radius of 2576 km), is surrounded by a dense atmosphere. Much like Earth, Titan's atmosphere has two major consistent gases, and numerous trace gases. What two *molecules* dominate the yellowish atmosphere of Titan?

- b) Lakes observed on Titan are probably filled with what broad group of molecules (hint: this group of substances is very profitable on Earth)?

- c) What is the mean temperature at the surface of Titan? Give your answer in both Kelvin and Fahrenheit. Show your work when you convert from one temperature scale to the other.

- d) Like many of the other moons in the Saturnian System, Titan's interior is comprised predominately of water ice; however, the surface of Titan is covered by a layer of particulates (photochemical products, dust, etc) that float down from the thick atmosphere. Some of the atmospheric particles settling on the surface of Titan are incorporated into surface features remarkably similar to landforms found in arid landscapes on Earth. List at least 3 different types of surface features that have been observed on Titan.