NAME _____ DATE _____

Scenario

A student is given the following set of orbital data for some of Jupiter's moons and is asked to use the data to determine the mass M_J of Jupiter. Assume that the orbits of these moons are circular.

Orbital Period **T** *(seconds)*	***Orbital Radius*** **R** *(meters)*	*(s^2)*	*(m^3)*
2.08×10^7	1.12×10^{10}		
2.49×10^7	1.26×10^{10}		
4.05×10^7	1.71×10^{10}		
5.03×10^7	2.02×10^{10}		

Create an Equation

PART A: Write an algebraic expression for the gravitational force between Jupiter and one of its moons.

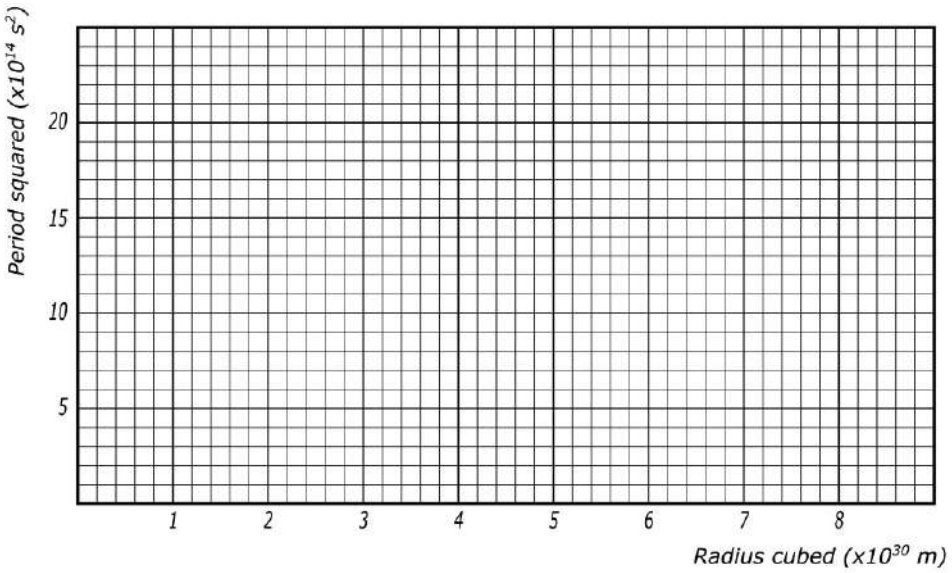
PART B: Use your expression from Part A and the assumption of circular orbits to derive an equation for the orbital period T of a moon as a function of its orbital radius R.

Data Analysis

PART C: Which quantities should be graphed to yield a straight line whose slope could be used to determine the mass of Jupiter?

PART D: Complete the table by calculating the two quantities to be graphed. Label the top of each column, including units.

PART E: Plot the graph on the axes below. Label the axis with the variables used and appropriate numbers to indicate the scale.



PART F: Two identical probes are sent to study one of Jupiter's moons. Probe A is in geosynchronous orbit around the moon while probe B rests on the surface of the moon and rotates with the moon.

Rank the magnitudes of the following gravitational forces from greatest to least. If two or more quantities are the same, say so clearly.

a. The force of the moon on probe A

b. The force of the moon on probe B

c. The force of probe A on the moon

d. The force of probe B on the moon

e. The force of probe A on probe B

f. The force of probe B on probe A

Greatest _____ _____ _____ _____ _____ _____ Least

Justify your ranking.