

## **Homework #3**

(Due Monday, January 25<sup>th</sup>)

*Please write up your answers neatly on another sheet of paper. Show all of your work since I care more about your process than whether you got the right number or not. Similarly, if you don't understand what I'm asking, think about it. If it's still really unclear please ask me asap or go ahead and answer as best you can and explain what you thought I meant.*

*You are welcome to work in groups, but each individual must write up their own solutions. Do not copy! If you can't write it up under your own power, chances are you don't quite understand it yet – so please have the courage to admit that and ask your group to go over it again.*

### 1.) **Weighing Jupiter**

Jupiter's largest moon, Ganymede, (also the largest moon in our solar system) is about 2.7 times farther away from Jupiter than our Moon is from Earth. In other words, Ganymede is 2.7 Earth-Moon distances away from Jupiter's center. We can also measure its orbital period around Jupiter, which we find to be about 7 days.

- a. Can we determine Jupiter's mass from these quantities, and if so, what is the name of the law that allows us to find the mass?
- b. Write the law down, explain what each quantity represents, and state what units each quantity is expressed in.
- c. Using this law, find Jupiter's mass. First express it in solar masses, i.e. Jupiter is what fraction of the mass of the Sun? (Note: the Sun is 400 times farther from Earth than the Earth-Moon distance)
- d. Now convert Jupiter's mass into Earth-masses, i.e. Jupiter is how many times the mass of Earth? (Note: the Sun is 333,333 times as massive as the Earth)
- e. Finally, express Jupiter's mass in kilograms, i.e. Jupiter is how many kilograms? (Note: the Earth is  $6 \times 10^{24}$  kg)