Phys 2112, Spring 2011
Problem Set #5

1. a) The moon Ganymede of Jupiter orbits at a mean distance of 1.070×10^6 km (from Jupiter's center); its period of motion is 7.15 days. From this, find the mass of Jupiter.

b) From the fact that Jupiter has a radius of 7.15×10^4 km, find the mean density of Jupiter. Density of a spherical body is given by

$$\rho = \frac{M}{V} \qquad \text{where} \qquad V = \frac{4}{3}\pi R^3$$

Express the answer in units of $\frac{\text{g}}{\text{cm}^3}$ so that one compare with the density of water.

2. a) The moon Titan of Saturn orbits at a mean distance of 1.222×10^6 km (from Saturn's center); its period of orbit is 15.95 days. From this, find the mass of Saturn.

b) From the fact that Saturn has a radius of 6.0×10^4 km, find the mean density of Saturn.

3. a) The moon Triton of Neptune orbits at a mean distance of 3.55×10^5 km (from Neptune's center); its period of orbit is 5.88 days. From this, find the mass of Neptune.
b) From the fact that Neptune has a radius of 2.48×10^4 km, find the mean density of Neptune.

4. Find the value of g on the surfaces of the following celestial objects:

Celestial Body	**Mass**, kg	Radius, km
Earth's Moon	7.35×10^{22}	1738
Mercury	3.30×10^{23}	2439
Mars	6.42×10^{23}	3397
Venus	4.87×10^{24}	6052
Ganymede	1.49×10^{23}	2631
Titan	1.34×10^{23}	2575
White Dwarf	2.00×10^{30}	5740

5. Find the escape speeds for objects shot from the surfaces of the celestial bodies in the above table.

$$F = G\frac{m_1 m_2}{r^2} \qquad \text{where} \quad G = 6.67 \times 10^{-11}\ \tfrac{\text{N}\cdot\text{m}^2}{\text{kg}^2} \qquad F_c = \frac{mv^2}{r}$$

$$a^3 = \frac{GM}{4\pi^2}T^2$$