Due: Wed Jan 15 in class. Name:_____

Astronomy 105 Homework #1 Winter 2014

Part I

Take a look at the notes from Wednesday's lecture:
http://www.astro.washington.edu/users/smith/Astro105/Lectures/Physics/Slide0.html

1 (5 pts) Determine how long it would take an astronaut to fall from a height of 2 meters on the Moon.

2 (5 pts) Determine how long it would take an astronaut to fall from a height of 2 meters on the Earth.

3 (5 pts) Determine how long it would take an astronaut to fall from a height of 2 meters on the asteroid Vesta ($g = 0.22$ m/s^2).

Part II

The rocket equation can be rewritten to find how much payload we can lift if we are given a value for ΔV and u:

$$\frac{M}{M_0} = e^{-\Delta V/u} = \exp(-\Delta V/u)$$

M/M_0 is the fraction of the total rocket mass that is payload. For example, if $M/M_0 = 0.05$ that means that 5% of the rocket's mass can be payload.

For each of the problems below, calculate what fraction of your rocket can be payload. Assume that $u =$ 3 km/s. Express your answers in percentages (*i.e.* 5%). Show your work! **Hint**: Try typing exp(-1.1/2.0) into Google.

4 (3 pts) Surface of the Earth to low Earth orbit: $\Delta V = 9.4$ km/s

5 (3 pts) Surface of the Earth to surface of the Moon: $\Delta V = 15$ km/s

6 (3 pts) Place a Direct-TV satellite in geostationary orbit: $\Delta V = 13.3$ km/s

7 (3 pts) Surface of the Earth to escape solar system: $\Delta V = 18.2$ km/s

8 (3 pts) Surface of the Earth to surface of the Mars: $\Delta V = 18.9$ km/s