Astronomy 105 Homework #1 Winter 2011

Part I

Planet	V_{escape} (km/s)
Earth	11.2
Moon	2.4
Mars	5.0
Sun	617.7

The table on the right shows the escape velocity for a few worlds in our solar system. The escape velocity is the ΔV a rocket needs to completely escape from a world. The rocket equation can be rewritten to find how much payload we can lift for a given 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 four worlds above, calculate what fraction of your rocket can be payload if you want to escape from that world. 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

1e6 = 1×10^6 = 1,000,000. 1e-6 = 1×10^{-6} = 0.000001

Part II

Take a look at the notes for last Friday's lecture:

http://www.astro.washington.edu/users/smith/Astro105/Lectures/Physics/Slide0.html

Determine how long it would take an astronaut to fall from a height of 1 meter on the Moon. Compare this time to the time it would take the astronaut to fall on the Earth. Make sure to show your work!

Due: Wed Jan 19 in class (−2% for every hour late)