Problem Set 2

Due Jan 24 by class time

Work on each problem for at least 15 minutes on your own before discussing it with other students or with me. In writing up your solution, show your work (the steps in your thinking) to enable the grader to give partial credit. You are encouraged to use suitable diagrams, state any assumptions explicitly, and to translate the problem's wording into symbolic form. The problem is not necessarily self-contained, and you might need to consult the book or class notes to look up some information. Turn in your solution on a separate sheet, making sure to put your name on the separate sheet. You do not have to turn in this sheet.

Going to Mars

Rocket Science

I found out about the Mars One mission (http://www.mars-one.com/) too late. Did you know they were looking for applicants to go to Mars in 2022, and that now they've already picked the people who would go? I probably wouldn't qualify, but it would have been nice to try to apply. This is a major expedition in all respects. For one, it won't be possible to send everything in one rocket; they will need too much food and equipment, some assembly has to be done in Earth's orbit. Suppose you do get involved, but (only!) as a rocket scientist (you can tell them you took PHY112). One of the rockets to be launched has a mass of 1.50×10^6 kg, your team is supposed to figure out how much fuel will be roughly needed to launch this rocket, assuming that each kilogram of fuel delivers 10 MJ of energy, and that the rocket has just enough energy to reach a space station in orbit at a height of 400.0 km above ground. *Hint: If you assume the rocket's mass is constant throughout the trip, would you be overestimating or underestimating the amount of fuel needed?*

How did the first few module of the station get in orbit? Describe roughly how a spacecraft launched with the vertical velocity you've just found above could get in orbit.

If the velocity needed to reach the station doesn't depend on the mass of the rocket, why not send the entire station, with supplies and all, in one go (pre-assembled or packed in pieces inside one rocket)?