

NEWTON'S 2ND LAW

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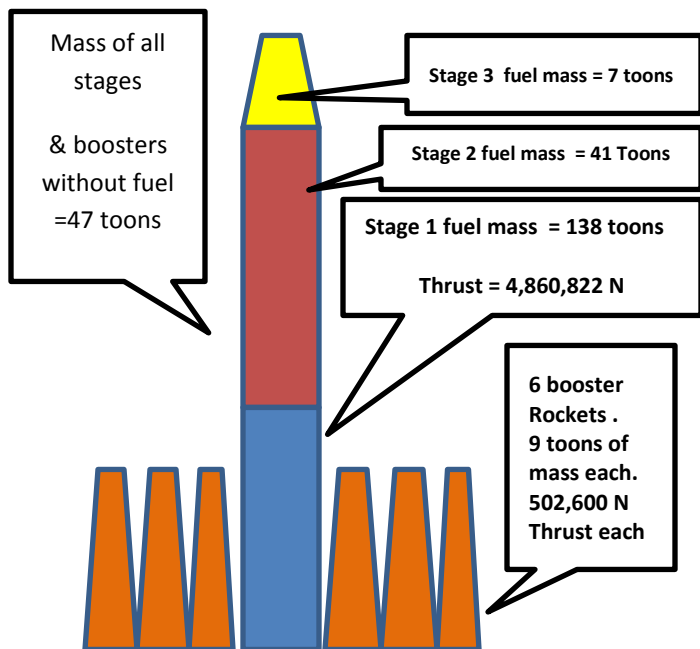
Grande St., Austin Tx 78701 jpcise@austinctc.edu & NYTimes Nov. 6, 2013 by Hartosh Singh Bal

Indian Craft Is Lofted Toward Mars, Trailed by Pride and Questions



India Launches Rocket to Mars: The Mangalyaan must travel 780 million kilometers (485 million miles) over 300 days to reach an orbit around the red planet next September.

The launch is only the first step, however, in a perilous 300-day journey that has ended in failure for about a third of all previous efforts. Only the United States, Russia and the European Space Agency have reached Mars, and none of them managed it on the first try. Because India's attempts to develop a more powerful launcher had failed, the spacecraft could not be sent directly on its way. Instead, it will have to orbit Earth for nearly a month as a series of small bursts by its thrusters slowly nudges it into space. If all goes well, it will reach Mars on Sept. 24.



INTRODUCTION: Consider fuel mass of stage 1 and Boosters to have a average mass of $\frac{1}{2}$ of initial mass for the first 113 seconds before stage 1 and boosters are ejected when empty of fuel. **HINT:** toon = 2200 kg., $g = 9.8 \text{ m/s}^2$
 $1.6 \text{ km} = 1 \text{ mile}$, $F_{\text{net}} = ma$, $y = V_0 t + \frac{1}{2} at^2$
QUESTIONS: (a) Find $\frac{1}{2}$ mass & weight of stage 1 + boosters? (b) Find total mass $M_{\text{total}} = \text{mass of Stages 2 \& 3} + \text{Mass of all empty stages \& boosters} + (a)$? Also, find the weight of this total Mass? (c) Find the total thrust during the first 113 seconds due to Stage 1 + boosters prior to stage 1 + 6 boosters released(ejected)? (d) Find net force on rocket(Net force on rocket = Thrust – weight)? (e) Find acceleration “a” during the first 113 seconds? (f) Find distance traveled(in km and miles) in the first 113 seconds of flight prior to ejection of 6 boosters + stage 1?

Answers: (a) 207,900 kg., 2,037,420 N, (b) 416,900 Kg., 4,085,620 N., (c) 7,875,600 N, (d) 3,789,980 N, (e) 9.09 m/s^2 (f) 58 km , 36.3 miles