

Rockets

YES I Can! Science Team

1 The Rocket Equation

In the late 1800's, early 1900's the Russian scientist and visionary Konstantin Eduardovich Tsiolkovsky formulated what has become to be known as the "Rocket Equation".

The unique feature of this equation is that allows one to calculate the amount of propellant P needed to achieve a predetermined velocity change Δv based on the rocket's mass M and the exhaust velocity V_e of the rocket engine.

Generally the equation is written as

$$\frac{(M + P)}{M} = e^{\Delta v / V_e} \quad (1)$$

rearranging equation 1 and solving for the propellant mass P gives

$$P = M e^{\Delta v / V_e} - M \quad (2)$$

Similarly, if the maximum Δv is to be calculated then equation 1 can be rearranged to give

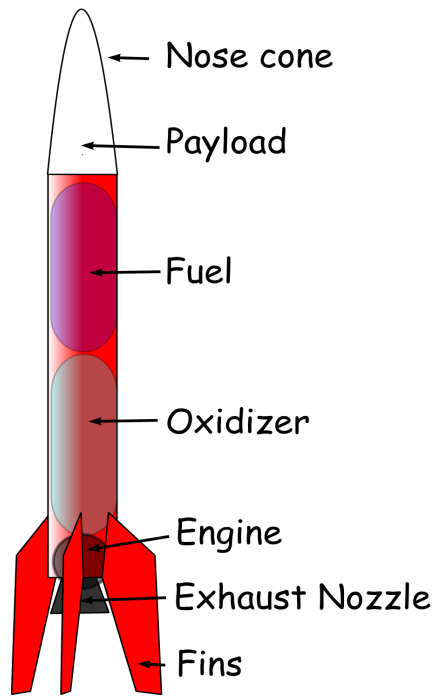
$$\Delta v = V_e \ln \left(\frac{M + P}{M} \right) \quad (3)$$

2 Nuclear Rocket

2.1

Figure 1: The structure of typical single stage, chemical rockets. Note that the major volume (and initial mass on the launch pad) of each rocket is to provide enough propellant

Liquid Propellant



Solid Propellant

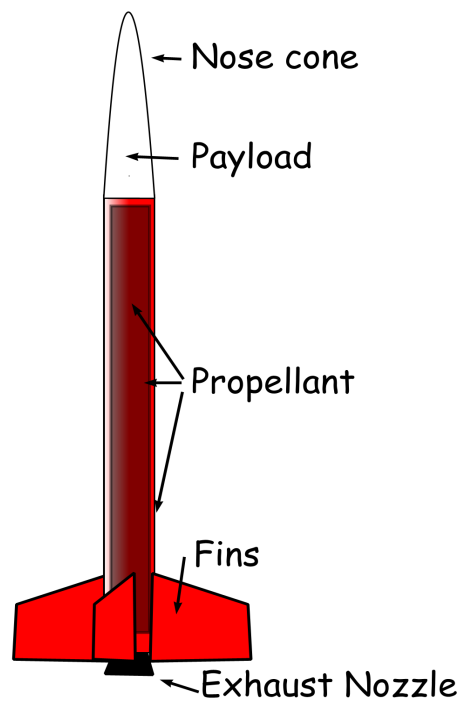


Figure 2: The structure of typical single stage, chemical rockets. Note that the major volume (and initial mass on the launch pad) of each rocket is to provide enough propellant

