Constant 'V' Solution Problems

Problem No. 01

Consider a rocket with following **specifications**.

m_0 = 80 Tons, $\mathbf{m_p = 60}$ **Tons**, I_{sp} = 240s, $g_0 = 9.81 m/s^2$, $\theta_0 = 2^o$, V_0 = 300 m/s, $\boldsymbol{\theta_b = 90^o}$**.**

Determine **burnout** conditions**.**

Solution No. 01

The **burnout** solution is as follows.

$$\Delta t = \frac{V_0}{g}\ln\left(\frac{\tan\dfrac{\theta_b}{2}}{\tan\dfrac{\theta_0}{2}}\right) \rightarrow \Delta t = \frac{300}{9.81}\ln\left(\frac{\tan 45^o}{\tan 1^o}\right) = 123.8s$$

$$\frac{m_b}{m_0} = \left(\frac{\sin\theta_b}{\sin\theta_0}\right)^{-\frac{\tilde{g}V_0}{g_0^2 I_{sp}}} \rightarrow m_b = 80\times\left(\frac{1.0}{0.0349}\right)^{-0.1274} = 52.17T$$

$$\Delta h_b = \frac{V_0^2}{\tilde{g}}\ln\frac{\sin\theta_b}{\sin\theta_0} \rightarrow \Delta h = \frac{300\times 300}{9.81}(3.355) = 30780m$$

$$\Delta x_b = \frac{V_0^2}{\tilde{g}}\Delta\theta_b = \frac{300\times 300}{9.81}(1.5709 - 0.0349) = 14091m$$