Saathi

Date ___/___/___

(1) $\Delta v = I_{sp} g_0 \ln M_0/M_f$

$7600 = 400 \times 9.8 \ln M_0/M_f$

$6.944 = M_0/M_f = \dfrac{M_{prop} + M_{payload}(+)}{M_{payload}(+)\ (extra)}$

$6.944 M_{prop} = 5.944 M_{payload}(+)$

$=$

$\dfrac{M_{prop}}{M_0} = 5.944/_{12.8} \approx 23/50$

(2) $n = \dfrac{c\dot{m}}{m_0 g}$ $\qquad dm/dt = -\dot{m}$

a)

$F_{net} = c\dot{m}/m_0 g - mg$

$m\,dv/dt = c\dot{m} - mg = n m_0 g - mg$

$\int_0^v dv = \dfrac{n m_0 g}{\dot{m}} \ln(M/M_0) - g/\dot{m}\,(m - M_0)$

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b.) $$\frac{dx(t)}{dt} = -gt - \frac{m_0 g}{\dot{m}} \ln\left(\frac{m_0 - \dot{m}t}{m_0}\right)$$

$$x = -gt^2/2 - \frac{m_0 g t}{\dot{m}} + \frac{m_0 g}{\dot{m}^2} (m_0 - \dot{m}t) \ln(u)$$

d.) Signifies abt the ~~Earth~~ thrust & speed of Exhaust, provided to rocket (by ejected gases)

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(3) $\Delta v = 8000\, m/s$

$v_e = 4500\, m/s$

$\Delta v = -v_e\, x \ln\left(\frac{M_f}{M_o}\right)$

$8000 = 4500 \ln\left(\frac{M_o}{M_f}\right)$

$1.78 = \ln M_o/M_f$

$M_o = e^{1.78} M_f \approx 5.93 M_f$

$M_{prop} + M_{pay} + M_{rocket} = 5.93\,(M_{pay} + M_{rocket})$

$4.93\,(\underbrace{M_{pay} + M_{rocket}}_{x}) = M_{prop}$

$4.93x = M_o - x$

$x = M_o/5.93$