Test#1

Equation Sheet

Thermo efficiency, η_T

$$\eta_T = \frac{\dot{W}_{out}}{\dot{Q}_{in}}$$

where

$\dot{W}_{out}$: net power out of engine

$$\dot{W}_{out} = \frac{1}{2g_c}[(\dot{m}_0 + \dot{m}_f)V_e^2 - \dot{m}_0 V_0^2]$$

$\dot{Q}_{in}$: rate of thermal energy (fuel) released

$$\dot{Q}_{in} = \dot{m}_f h_{PR}$$

Propulsive efficiency, η_p

$$\eta_p = \frac{TV_o}{\dot{W}_{out}}$$

Overall efficiency, η_o

$$\eta_o = \eta_p \ \eta_T$$

Thrust Specific Fuel Consumption, S or TSFC:

$$S = \frac{\dot{m}_f}{F}$$

$$TSFC = \frac{\dot{m}_f}{T}$$

$$d'Q \quad = \quad dE \quad + \quad d'W$$

$$h = u + pv$$

$$c_p = c_v + R$$

$$\gamma = \frac{c_p}{c_v}$$

$$u_2 - u_1 = c_v(T_2 - T_1)$$

$$h_2 - h_1 = c_p(T_2 - T_1)$$

$$\frac{T_2}{T_1} = (\frac{p_2}{p_1})^{(\gamma-1/\gamma)}\exp[(s_2 - s_1)/c_p]$$

$$\frac{T_2}{T_1} = (\frac{p_2}{p_1})^{(\gamma-1/\gamma)}$$

$$q - w_x = (h + \frac{V^2}{2g_c})_o - (h + \frac{V^2}{2g_c})_i$$

$$h_t \equiv h + \frac{V^2}{2g_c}$$

For a CPG, where $h = c_p T$,

$$\frac{T_t}{T} = 1 + \frac{\gamma - 1}{2}M^2$$

$$P_t = P(\frac{T_t}{T})^{\frac{\gamma}{(\gamma-1)}}$$

$$s_2 - s_1 = cp\ln\frac{T_2}{T_1} - R\ln\frac{P_2}{P_1}$$

$$\frac{p_t}{p} = [1 + \frac{\gamma - 1}{2}M^2]^{\frac{\gamma}{\gamma-1}}$$