

Unified Engineering Propulsion Bonus Quiz 1

Spring 2006

NAME _____ SOLUTIONS _____

- 1) Describe what happens to an airplane which is initially in a steady, constant altitude turn if it rolls to level and begins to fly straight at constant speed with no change in engine thrust setting. Why does this happen? Support your answer with an equation.

The airplane's altitude increases. Lift for turning flight is greater than in steady level flight since it must balance both weight and the centrifugal acceleration. Since drag is a function of lift, drag is higher in turning flight. When the airplane rolls to level, the drag is therefore reduced, but the thrust setting is constant so power available > power required, and the speed is constant (specified in the problem) so therefore the potential energy (altitude) must increase.

$$TV - DV = W \frac{dh}{dt} + W \frac{d}{dt} \left(\frac{V^2}{2g} \right)$$

- 2) Define Isp (using words).

Isp is the thrust per unit weight flow rate of propellant. It is a common measure of propulsion system performance for rockets.

$I_{sp} = \text{Thrust} / (\text{propellant mass flow rate} * \text{acceleration of gravity})$