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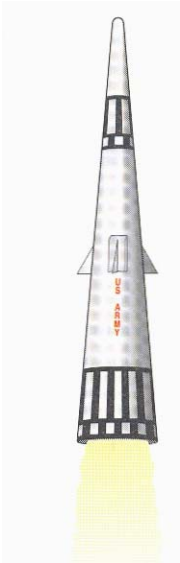
سایت آموزش مهندسی مکانیک ایران

Example 2.2

Missiles designed for defense against ballistic missiles achieve accelerations in excess of 100g or 100 times the acceleration due to gravity. If a missile has a constant acceleration of 100g how long does it take to go from rest to 60 mi/hr? What is its displacement during that time?



Solution:

Assume that the target velocity of $v = 60$ mi/hr $= 88$ ft/s occurs at $t = t_1$. Then in the first of Eqs. (2.17) we have $v_0 = 0$ (missile starts from rest) and $a = 100g - g = 99(32.2)$ ft/s^2 including the effect of gravity. This results in the relation:

$$88 = 0 + 99(32.2)t_1$$

or

$$t_1 = 0.0276 \text{ s}$$

To determine the distance traveled during this time, s_1, we use the second of Eqs. (2.17):

$$s_1 = s_0 + v_0 t_1 + \frac{1}{2} a t_1^2 = 0 + 0 + \frac{1}{2}(99)(32.2)(0.0276)^2$$
$$= 1.215 \text{ ft}$$

Click to see plots for the motion of the rocket