Roller Coaster Physics
Assignment 1

Name: _____

Manipulation of General Roller Coaster Equations

You may refer to the Table *Variables and their Units*

1. Suppose that the PE at point one (PE_1) is equal to the Kinetic Energy at point 2 (KE_2) plus the PE at point two (PE_2): $PE_1 = (KE_2) + (PE_2)$

$$m_{mass} g h_1 = \frac{1}{2} m_{mass} v_2^{\,2} + m_{mass} g h_2$$

Solve for h_2.

$$\cancel{m_{mass}} g h_1 = \frac{1}{2} \cancel{m_{mass}} v_2^{\,2} + \cancel{m_{mass}} g h_2$$

$$g h_1 = \frac{1}{2} v_2^{\,2} + g h_2$$

$$2 g h_1 = v_2^{\,2} + 2 g h_2$$

$$2 g h_1 - v_2^{\,2} = 2 g h_2$$

$$\frac{2 g h_1 - v_2^{\,2}}{2g} = \frac{\cancel{2g}\, h_2}{\cancel{2g}}$$

$$h_2 = \frac{2 g h_1 - v_2^{\,2}}{2g}$$

2. In exercise 1 above, if the height if the first hill, h_1, is 65 feet, and the velocity of the roller coaster car at point 2 (v_2) is $20 \frac{m}{\text{sec}}$. What is the height of the roller coaster car at point 2 (h_2)?

$$h_2 = \frac{2 g h_1 - v_2^{\,2}}{2g}$$

$$= \frac{2\left(9.8 \frac{m}{\text{sec}^2}\right)\left(65\, ft \cdot \frac{0.914 m}{3\, ft}\right) - \left(20 \frac{m}{\text{sec}}\right)^2}{2\left(9.8 \frac{m}{\text{sec}^2}\right)}$$

$$= \frac{388.15 \frac{m^2}{\text{sec}^2} - 400 \frac{m^2}{\text{sec}^2}}{19.8 \frac{m}{\text{sec}^2}}$$

$$= \frac{-11.85}{19.8} m$$

$$h_2 = -0.6 m$$