Quiz 10

Names: _____

1. Explain what these three very similar equations are for. Explain a situation appropriate for each equation and show how it would be applied, what it represents and why in each case it's energy.

$$K = \tfrac{1}{2} m v^2 \qquad U_s = \tfrac{1}{2} k x^2 \qquad K_r = \tfrac{1}{2} I \omega^2$$

2. A 300 kg roller coaster starts from rest at the top of a hill 15.0 m high. After rolling unassisted to the bottom of the hill, its velocity is 10.0 m/s. Find the average force of friction that acted on the car if it traveled a total distance of 40.0 m while going down the hill.

3. The ballistic pendulum was invented in 1742 by English mathematician Benjamin Robins (1707–1751), and published in his book *New Principles of Gunnery*, which revolutionized the science of ballistics, as it provided the first way to accurately measure the velocity of a bullet. It consists of a heavy iron pendulum faced with wood to catch the bullet. Based on the height the pendulum swings, the speed of the bullet is determined.

   A musket ball of 1 oz (30 g), is fired into a ballistic pendulum of mass 10.0 kg. If the pendulum swings to a point 5.00 cm higher than its resting position, what was the velocity of the musket ball just before it was embedded in the pendulum. (Hint: The answer is ***not*** 18 m/s, it's much faster.)

$W = F\,\Delta x = \Delta E$ $\quad K = \frac{1}{2}\,m\,v^2$ $\quad U_g = mgh$ $\quad U_s = \frac{1}{2}\,k\,x^2$

$g = 9.8\ \text{m/s}^2$ $\quad K_r = \frac{1}{2}\,I\,\omega^2$ $\quad P = W/\Delta t = F\,v$

$\vec{p} = m\vec{v}$ $\quad \vec{F}\,\Delta t = \Delta\,\vec{p}$ $\quad \vec{p}_i = \vec{p_f}$ $\quad \Sigma\vec{F} = m\vec{a}$

$v_x = \frac{\Delta x}{\Delta t} = \frac{x_f - x_i}{\Delta t}$ $\quad a_x = \frac{\Delta v_x}{\Delta t} = \frac{v_{xf} - v_{xi}}{\Delta t}$

$x_f = x_i + v_{xi}\Delta t + \frac{1}{2}\,a_x(\Delta t)^2$ $\quad v_{xf} = v_{xi} + a_x\Delta t$ $\quad v_{xf}^2 = v_{xi}^2 + 2a_x\,(\Delta x)$

$\sin\theta$ = opp/hyp $\quad \cos\theta$ = adj/hyp $\quad \tan\theta$ = opp/adj

$a^2 + b^2 = c^2$