AP PHYSICS

Name: _____

Period: _____ Date: _____

DEVIL PHYSICS

BADDEST CLASS ON CAMPUS

SUPPLEMENTAL READING ACTIVITY

The Physics of Rollercoasters

1. Read the article *The Physics of Rollercoasters* (Sections G through J) and answer the following questions:
   a. Acceleration occurs as a result of a change in either of what two things? _____

      _____
   b. "Forces are a direct result of _____"

      (or vice versa).
   c. When forces are balanced, i.e. the net force is zero, acceleration is _____
   d. What is the equation that relates force to acceleration (Hint: it is also Newton's First Law)?

      _____
   e. "Potential energy is _____

      _____"
   f. Potential energy is often called _____

      _____
   g. What formula is used to calculate potential energy? _____

      _____
   h. "As a coaster starts moving, potential energy is converted into _____

      _____"
   i. What formula is used to calculate kinetic energy? _____
   j. "Kinetic Energy, when added to Potential Energy equals _____

      _____"
   k. If it weren't for friction and other dissipative forces, Total Energy _____

      _____
   l. When a pendulum is at the ***top*** of its swing:

      Potential Energy is _____

      Kinetic Energy is _____
   m. When a pendulum is at the ***bottom*** of its swing:

      Potential Energy is _____

Kinetic Energy is _____

2. Read the PIB Physics Day Data Guide, Principles of Physics, pages 10-14 and look over the graphs on pages 15-21. Really read this because it will help you to understand the next section.
3. Read the PIB Physics Day Data Guide starting on page 6, Problems, and ending at the bottom of page 8. Then answer the following questions:
   a. What is the equation used for centripetal force? _____
   b. Centripetal force is felt when turning or changing direction. Acceleration occurs any time we change velocity or direction. Knowing this and that Newton's First Law is F = ma, what do you think is the equation for centripetal acceleration? _____
   c. Weight is a force and is often called the force due to gravity (F_g). What is the equation for weight or F_g? _____

Note: "G-force" is a term used for multiples of the earth's acceleration due to gravity, 9.81 m/s^2. So 7-g's would be 7 x 9.81 = 68.7 m/s^2. Just standing around doing nothing, we experience 1-g.

   d. At the bottom of a hill or loop, the track must support the weight of the coaster and the additional force due to centripetal acceleration. What are the equations for the supporting force of the track and for the G-Forces felt at the bottom of a hill or loop? _____

   _____

   e. At the ***top*** of a loop, the track must only support the force due to centripetal acceleration minus the weight of the coaster. What are the equations for the supporting force of the track and for the G-Forces felt at the top of a loop? _____

   _____

   f. At the ***top*** of a hill when right side up, the centripetal acceleration decreases the amount of weight the track must support. What are the equations for the supporting force of the track and for the G-Forces felt at the ***top*** of a hill when right side up? _____

   _____

   g. You already know how to find horizontal acceleration using the kinematic equations. What is the equation used to convert this acceleration into G-force? _____

   _____

   h. What is the equation used to show convervation of kinetic and potential energy at the bottom and top of a ride? _____

   _____

Note: For the next two questions, the "N" in the equations stands for the 'normal force' which is the same as the supporting force of the track.

i. In a banked turn, the centripetal force will provide the horizontal component of the force that the track must support. What is the equation used to show the relationship between the normal force ***N*** and the centripetal force for a bank angle of ***a***? _____

j. In a banked turn, weight provides the vertical component of the force that the track must support. What is the equation used to show the relationship between the normal force ***N*** and the weight for a bank angle of ***a***? _____

k. Since G-force = ma/mg, we can find the g-force in a banked turn by dividing the equation for the centripetal force by the equation for the weight. What is the equation for G-force that can be derived from this process? _____

4. Answers may be typed or neatly printed. If you submit this assignment electronically, the filename must be in the following format, "LastnameFirstinitialPerXReadActX-X".