Student:_____

How Things Work

Homework 4 – Due Sunday, July 8 (in class)

1) A rock is dropped from a great height. Ignore air resistance. If the acceleration due to gravity is 10 m/s^2, determine the following:

a) The *distance* the rock has fallen after 3.0 seconds.

b) The *speed* of the rock after 3.0 seconds.

c) The *acceleration* of the rock after 3.0 seconds.

2) Re-read sections on "Energy, Work, and Gravitational Potential Energy" in the Textbook (Pages 26-32) and write a summary explaining the concept of Gravitational Potential Energy and its relationship to other forms of energy. (1-page maximum). **(NOTE: This should be very helpful in the preparation for your Lab. Report on Roller Coaster Experiment)**

3) Answer the following "Check your understanding" questions from the textbook.

(IMPORTANT LEARNING OPPORTUNITY: For your benefit, **FIRST** answer the question, and **THEN** check answers in book. If your answer does not agree with the book's answer, re-think your answer and repeat the process until you understand the concept. This is a great way to really learn. If you simply copy the answer from the book, there will be no learning benefit.)

a. Check Your Understanding #6: Mountain Biking (**Textbook p. 30**)

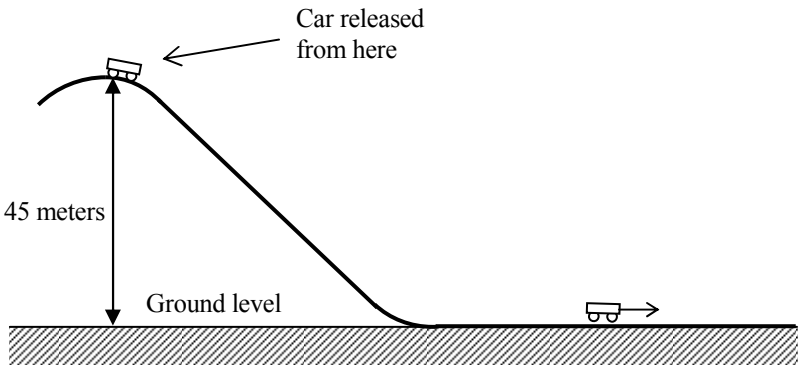
b. Check Your Figures #2: Watch out Below (**Textbook p. 30**)

Work the following "Problems" from the textbook p 39.

4) Problem #17

5) Problem #18

6) In a roller coaster, a car with a mass of **200 kilograms (kg)** is released from the top of a hill as shown in the illustration below. The height of the hill is **45 meters (m)** and the car is released from rest (initial speed = 0).



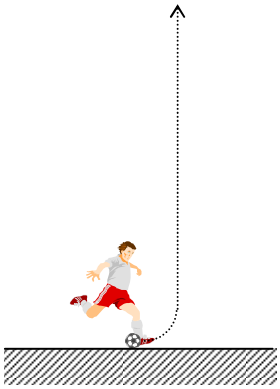
a. Find the Gravitational Potential Energy of the car at the time it is released (top of the hill).

b. Find the Kinetic Energy of the car at the time it is released (top of the hill).

c. Find the Total Energy of the car at the time it is released (top of the hill).

7) Still considering the roller coaster of the previous question, assume that the tracks and wheels are frictionless and use the principle of conservation of energy to find the speed of the car when it reaches ground level.

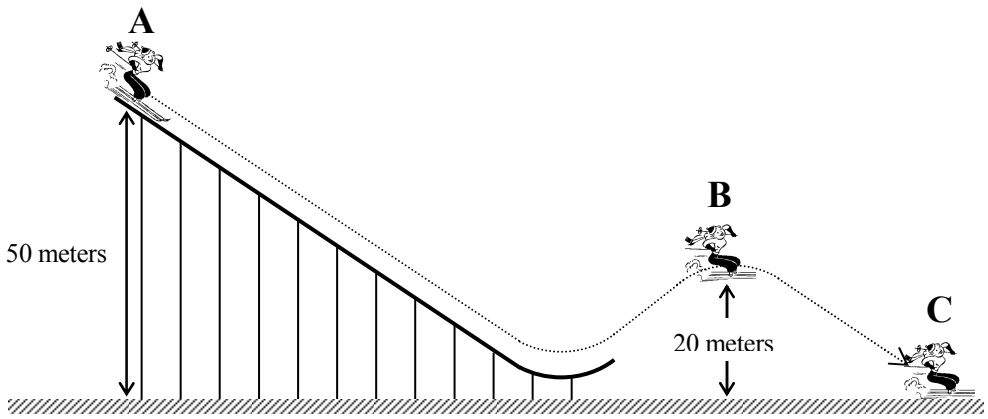
8) In a soccer game a defender player kicks the ball vertically upward as shown in the illustration below. The powerful kick imparts on the ball an initial speed of **25 m/s** (meters/second). The mass of the ball is **0.4 kg**.



a. Find the kinetic energy of the ball right after it has been kicked by the player.

b. Find the maximum height the ball can reach.

9) A skier with a mass of **60 kg** performs the long jump illustrated in the figure below. She starts from rest at a height of **50 meters** (point **A**). She slides down the ramp, takes off, reaches a maximum height of **20 meters** at point **B**, and lands safely at point **C**.



Assuming that the ramp is frictionless, use the principle of conservation of energy to find the speed of the skier at point **B**. (This is the point where she reaches the maximum height in flight).