13 Work, Power, and Energy

Name______________________________________

Worksheet B: Roller Coaster Physics Video

AP Physics B

1. At the beginning of the video you saw the Mantis coaster at Cedar Point, Ohio. This fast stand-up coaster was constructed in 1996 for $12 million. It begins with a first drop of 42.0 m, followed by a 36 m vertical loop, 31 m dive loop, 360° banked curve, and then a 25 m loop angled at 45°. Use energy concepts to explain why each part of the ride is **lower** than the previous part.

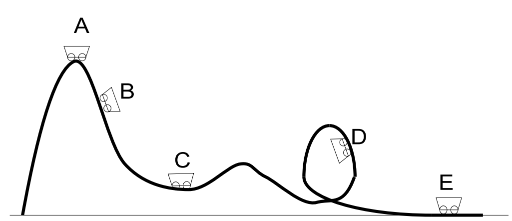
2. Calculate the potential energy (in joules) of a 3,000 kg coaster train when it is at the top of the first drop.

3. That potential energy is converted into kinetic energy when the coaster reaches the bottom of the drop. Use your answer from question 2 and the formula for kinetic energy to calculate the theoretical maximum speed of the coaster.

4. The Mantis actually has a top speed of 26.8 m/s (60 mph). Use this and the answer to question 3 to determine the heat flow (Q) from a 3000 kg train.

5. Use your answers to questions 2 and 4 to determine the efficiency of the coaster on its first drop. ($e = W_{out} / W_{in}$ or the "useful energy output" divided by the input energy)

6. The film mentioned several physics concepts that are illustrated by the different segments of a roller coaster ride. Match the description with the most appropriate car location in the diagram. (No answer is used more than once.)



______ Here the coaster's potential energy has been entirely converted to heat and kinetic energy.

______ Here the centripetal force is more downward than upward, but still holds the rider against the seat.

______ Here the coaster achieves maximum potential energy.

______ Here the rider will experience a sensation of free-fall (partial weightlessness).