

# HOMEWORK C

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Due: September 28, 2017

HW 1: A roller coaster in an amusement park starts from 35 m height above the ground level. During the ride, the ride goes through a few ups and downs and twists and ends at a level higher than the ground, similar to the one shown in Fig. 1. Answer the following questions along with your physical reasoning.

(1) If the coaster naturally falls at the start without any additional force applied, can you reach a higher point than the start during the ride?

(2) If the ride starts as described in (1), and there is no friction on the track, the coaster will arrive at the end with a high speed. Consider a full coaster and an empty coaster. Which one arrives at the finish at a higher speed?

(3) Which one in (2) would arrive at the finish faster?

(4) In reality there is always friction. With this in mind, if you were to design a ride, what should you consider to decide the height of the finishing point. Why do you want to put the finish at a higher level than the lowest ground level? How high can the finish be?

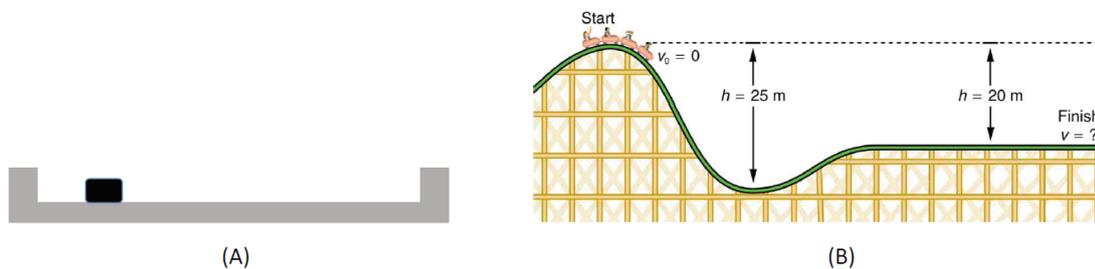


FIG. 1:

Figure 1(A) shows a horizontal track bound by two walls. When a block moves on the track and collide into a wall, the block will bounce backwards at the same speed as its incident speed. Figure 1(B) shows a roller coaster track. The start point is 25 m above the lowest point of the track, and the finish is at 5 m above the lowest point of the track. Answer the following questions.

HW 2: For (A), while the block moves on the track, is there any change in gravitational potential energy? Is there a energy loss due to collision with a wall? *Compare the mechanical energy right before and after the collision.*

HW 3: Suppose the block (2 kg) is initially moving to the right at a constant speed of

0.1 m/s. Describe the motion of the block assuming there is no friction.

HW 4: But when the actual experiment was performed, the block eventually stopped after moving 10 m. Can you estimate the frictional force between the block and the track?

HW 5: For the roller coaster in (B), what is the speed of the coaster at the lowest point ignoring the friction?

HW 6: What is the speed of the coaster when it reached the same height as the finish during the initial fall. Compare it with the speed at the finish.

HW 7: In an actual ride, the coaster approached the finish at 1 m/s. How much of energy is lost through friction in this ride?