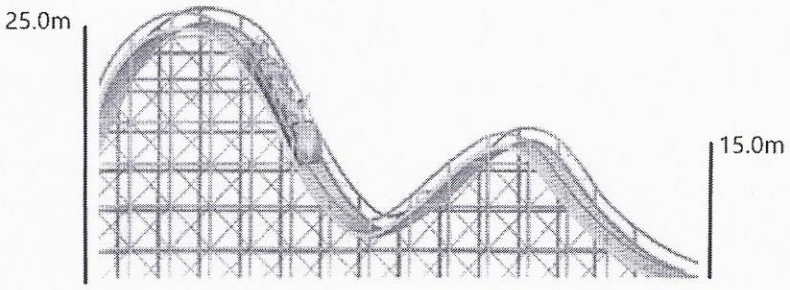
EST4

Roller Coaster Energy

Use the following image to answer the questions. Assume your roller coaster is a single car coaster that runs on a frictionless track. It has a mass of 800.0 kg. The car is at a standstill before it starts moving down the first hill.



1. In which situation would the potential energy of the car be highest
   a) Top of big hill
   b) Bottom of big hill
   c) Top of small hill
   d) Bottom of small hill

2. What happens to the mechanical energy of the car as potential energy decreases?
   a) Increases
   b) Decreases
   c) Stays the same
   d) Mechanical energy does not depend on potential energy

3. Which statement is true?
   a) Kinetic energy is stored in the car as it moves down the big hill.
   b) Potential energy is transformed into kinetic energy and other forms of energy as the car moves down the big hill.
   c) The potential energy of the car is equal to the kinetic energy of the car at the top of the small hill.
   d) Some energy is destroyed as the car moves down the small hill.

4. Calculate the maximum amount of energy the car possesses as it travels along the track of the roller coaster?

P = M same here

full pot = M

P = mgh

800.0 x 9.8 x 25.0

= 196 000 J

5. Calculate the potential energy of the car when it is at the top of the small hill.

$P = mgh$

$800.0 * 9.8 * 15.0$

$118\,000\,J$

6. At what speed is the car travelling when it reaches the top of the small hill?

Full pot. $196\,000\,J$

pot small hill $- 118\,000\,J$

$78\,000\,J$ = kinetic energy

$v^2 = \frac{k}{.5m}$ $\quad \frac{78000}{.5 \times 800.0} = 14\ m/s$

7. How high above the ground is the car when it is travelling at travelling at 70.0 km/h?

③ $h = \frac{P}{mg}$ $\quad \frac{45000}{(800.0 \times 9.8)} = 5.7\ m$

① $K = .5mv^2 = .5 \times 800.0 \times 19.4^2$ $\quad 151\,000\,J$ $\quad \frac{70.0 \times 1000}{3600} = 19.4$

② $P = M - K$

$196\,000 - 151\,000$

$\leftarrow 45\,000\,J$

8. One of the passengers dropped a baseball with a mass of 145g from the roller coaster just before the car started to roll down the first hill. At what speed (in km/h) will the ~~apple~~ baseball hit the ground? use full p

$v^2 = \frac{k}{.5m}$ $\quad v^2 = \frac{mgh}{.5m}$ $\quad \frac{.145 \times 9.8 \times 25.0}{(.5 \times .145)} = 22.1\ m/s$