Roller Coasters

1. Shown below is a roller coaster. At points A, B and C find the potential energy, kinetic energy and speed of a passenger whose mass is 60 kg.

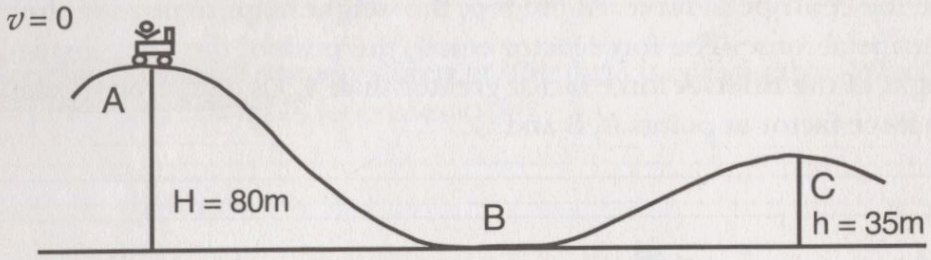

Figure 1: Roller Coaster

A	B	C	
PE = _____	PE = _____	PE = _____	Total =
KE = _____	KE = _____	KE = _____	
v = _____	v = _____	v = _____	

2. Using the same roller coaster with a different passenger, find the energies and speeds for a passenger whose mass is 120 kg. Compare with the answers to problem #1.

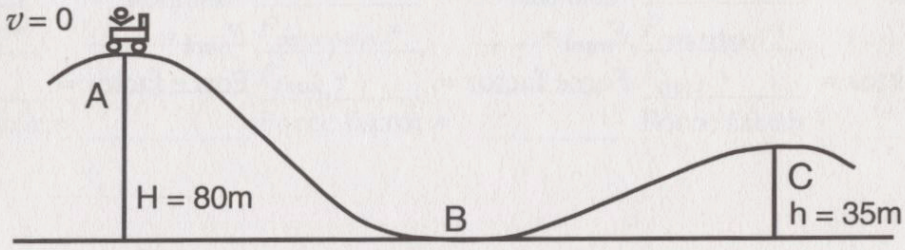

Figure 2: Roller Coaster with different passenger

A	B	C	
PE = _____	PE = _____	PE = _____	Total =
KE = _____	KE = _____	KE = _____	
v = _____	v = _____	v = _____	

3. Let the car start from rest at point A in the looping coaster shown below. Find the potential energy, the kinetic energy and the speed of the rider at points A, B and C. What is the net force (centripetal force) at each point? How much of this force must be provided by the track? Remember that at the bottom of the loop the track must both balance the weight of the car and provide the centripetal force. At the top, the weight helps to provide the centripetal force. The force factor equals the push of the track divided by the weight of the rider. A force factor greater than 4.5 is dangerous. Calculate the force factor at points A, B and C.

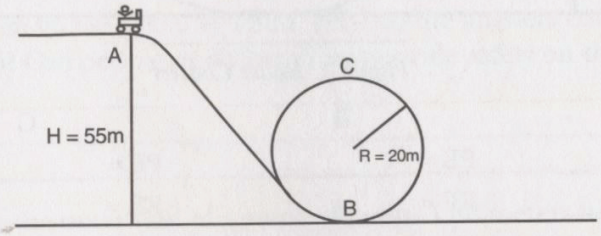

Figure 3: Catapulted Coaster (circular loop)

	A		B		C
PE =	_____	PE =	_____	PE =	_____
KE =	_____	KE =	_____	KE =	_____
v =	_____	v =	_____	v =	_____
$F_{centripetal}$ =	_____	$F_{centripetal}$ =	_____	$F_{centripetal}$ =	_____
F_{track} =	_____	F_{track} =	_____	F_{track} =	_____
Force factor =	_____	Force factor =	_____	Force factor =	_____

4. This looping coaster has a clothoid loop instead of a circular loop. The top of this loop has a smaller radius than the bottom. At points A, B and C, find the potential energy, the kinetic energy, the speed, the centripetal force, the push of the track and the force factor. How does the force factor at the fastest point on the clothoid loop compare with the force factor at the fastest point on the circular loop?

_____

_____

Since the speeds are not very different, the thrill is comparable. Why then do parks only build clothoid loop coasters?

_____

_____

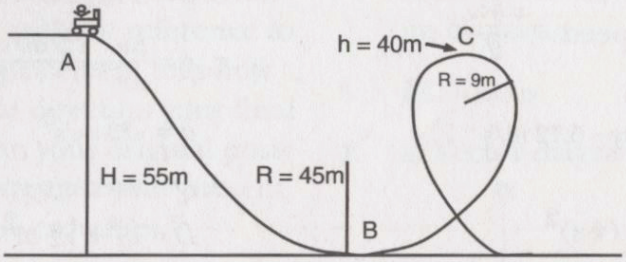

Figure 4: Catapulted Coaster (clothoid loop)

	A	B	C
PE =	_____	_____	_____
KE =	_____	_____	_____
v =	_____	_____	_____
$F_{centripetal}$ =	_____	_____	_____
F_{track} =	_____	_____	_____
Force factor =	_____	_____	_____