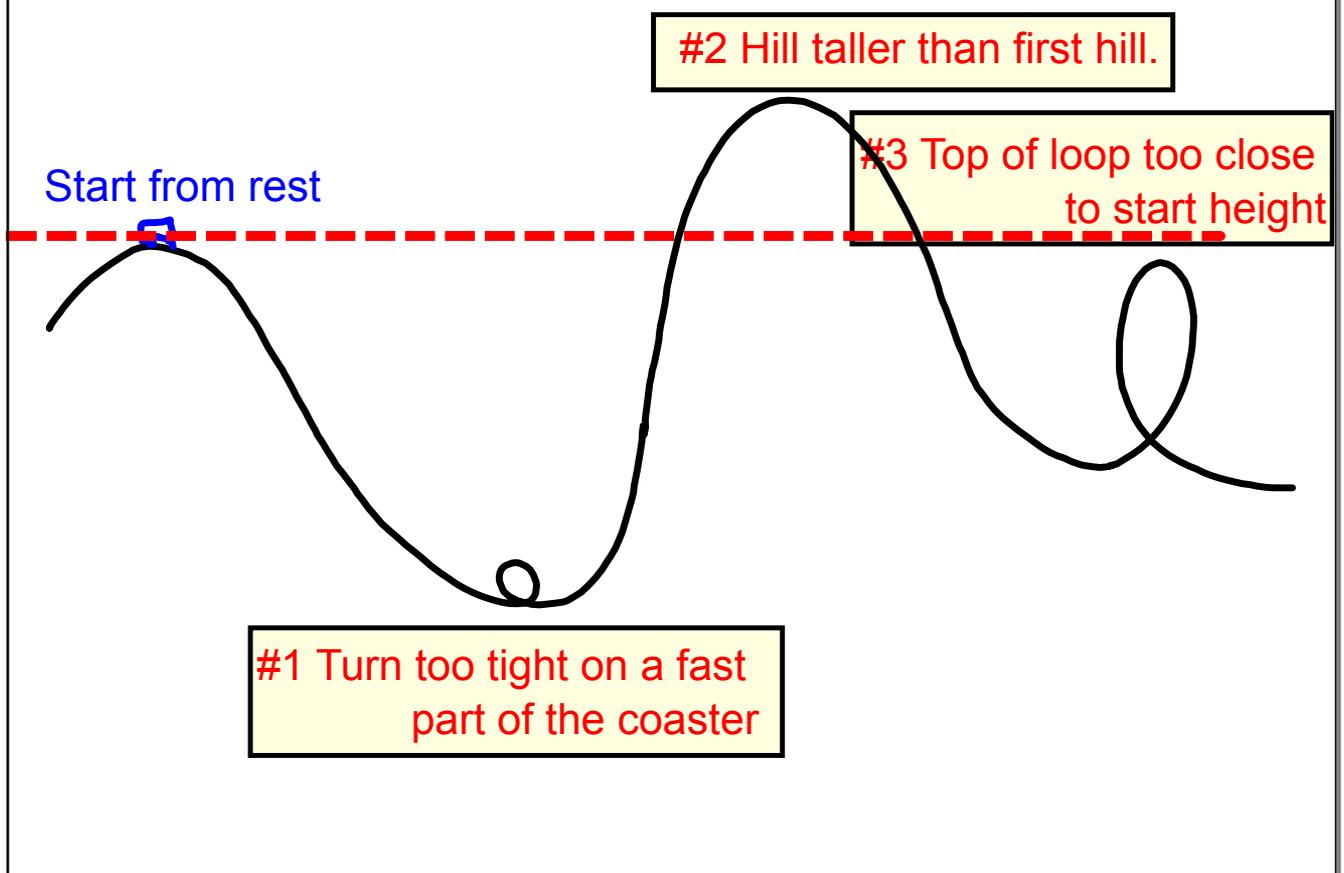
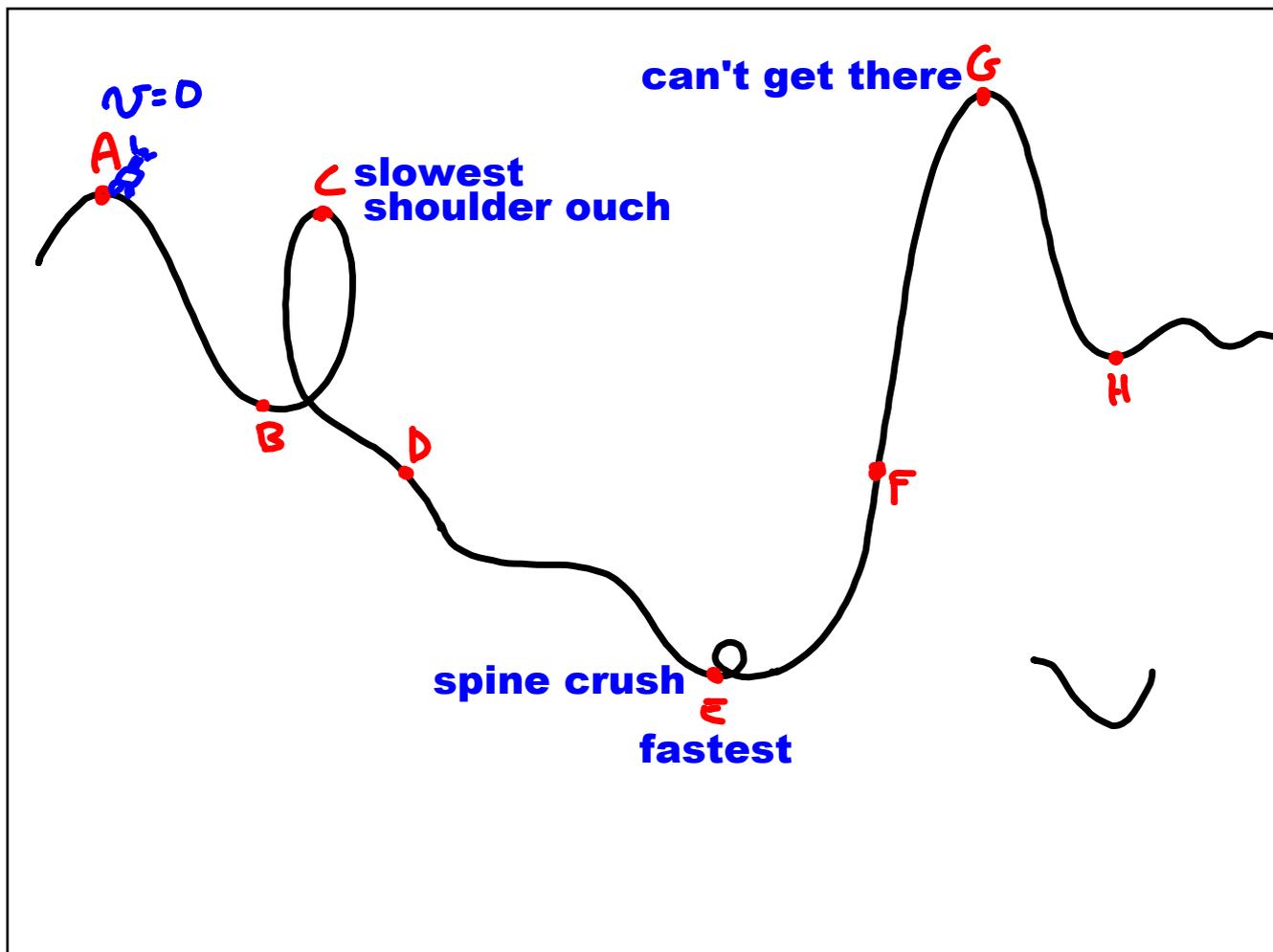


COASTER DESIGN PRINCIPLES

- 1. Which hill must be the highest?**
- 2. Which spots are the fastest? Which are the slowest?**
- 3. What will tight turns at fast spots do to riders?**
- 4. What will going slow at the tops of loops do to rider's shoulders?**

What's wrong with this coaster?





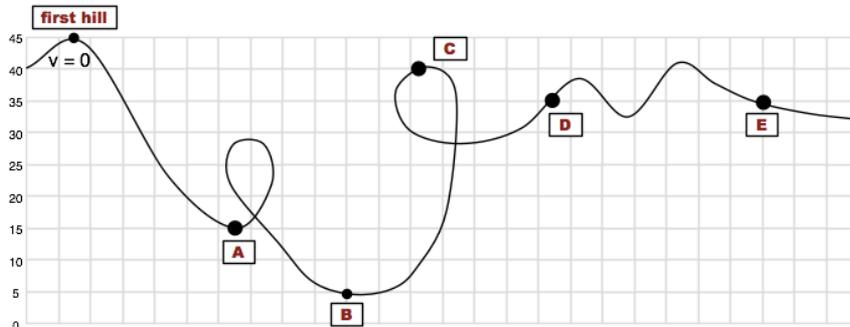
Wk 28 Roller Coaster

D1: Coaster Calculation

$$KE = \frac{m}{2}(v^2)$$

$$GPE = mgh = (kg)(10)(meters)$$

name: _____



Mass of coaster: 100 kg

- _____ 1. Which spot is the fastest spot?
- _____ 2. Which spot is the slowest spot?
- _____ 3. Which two spots will have the same speed?
- _____ 4. Which spot is most likely to crush spines?
- _____ 5. Which spot is most likely to hurt the shoulders?

First Hill

Total Mech E:		
KE	+	GPE

A

Total Mech E:		
KE	+	GPE

B

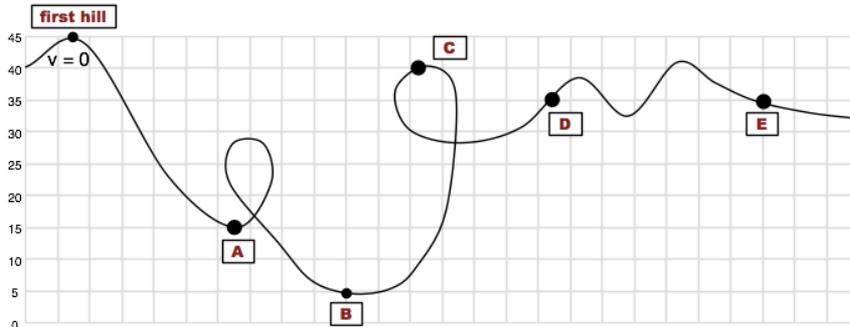
Total Mech E:		
KE	+	GPE

Wk 28 Roller Coaster
D1: Coaster Calculation

$$KE = \left(\frac{m}{2}\right)(v^2)$$

$$GPE = mgh = (kg)(10)(meters)$$

name: _____



- _____ 1. Which spot is the fastest spot?
- _____ 2. Which spot is the slowest spot?
- _____ 3. Which two spots will have the same speed?
- _____ 4. Which spot is most likely to crush spines?
- _____ 5. Which spot is most likely to hurt the shoulders?

Mass of coaster: 100 kg

First Hill

Total Mech E: 45,000 J	
KE	+ GPE
0	45,000 J

$$GPE = mgh$$

$$= (100kg)(10)(45m)$$

$$= 45,000 J$$

Total Mech E: 45,000 J	
KE	+ GPE
30,000 J	15,000 J

$$GPE = mgh$$

$$= (100kg)(10)(15m)$$

$$= 15,000 J$$

$$KE = \left(\frac{m}{2}\right)(v^2)$$

$$30,000 J = \left(\frac{100}{2}\right)v^2$$

$$\frac{30,000}{50} = \frac{50v^2}{50}$$

$$600 = v^2$$

$$\sqrt{600} = \sqrt{v^2}$$

$$24.5 m/s = v$$

Total Mech E: 45,000 J	
KE	+ GPE
40,000 J	5,000 J

$$GPE = mgh$$

$$= (100kg)(10)(5m)$$

$$= 5,000 J$$

$$KE = \left(\frac{m}{2}\right)(v^2)$$

$$40,000 = \left(\frac{100}{2}\right)v^2$$

$$\frac{40,000}{50} = \frac{50v^2}{50}$$

$$800 = v^2$$

$$\sqrt{800} = \sqrt{v^2}$$

$$28.3 m/s = v$$

1. Which hill should be the highest?

2. Do you want to cause spinal injury?
 - If yes, what should you put into your design?
 - If no, what should you not put into your design?

3. Do you want to hurt their shoulders?
 - If yes, what should you put into your design?
 - If no, what should you not put into your design?

STEPS	COMMENTS
1. Set a scale: 1 box = ?? meters.	The height controls the speed. Choosing a scale essentially puts a limit on the speed of your coaster.
2. Sketch with pencil.	You only get one piece of large graph paper. Pencil can be erased.
3. Get your sketch approved.	I am checking to make sure you understand the physics, so I may ask you questions about it.
4. On your paper, label: <ol style="list-style-type: none"> a) The height of the first hill. (label it A) b) The height of the fastest spot. (label it B) c) The height of the slowest spot. (label it C) d) The height of one other spot (label it D) 	Count boxes and use your scale to convert.
5. Calculate the velocity of (B), (C), and (D) on scrap paper first.	Get Mr. Mont to check them. They will be graded!
6. Transfer calculations to your paper near the spot.	Neatly!
7. Name the coaster, color & decorate. Label hazards!	Neatly!

