Wanted: New Super Coaster at Great America

Six Flags is looking for the next new coaster design. Your design submission will is thrilling yet safe. Klothoid loops are used and g-forces are between -0.5 g's and +3 g's. Dips and hill tops are too brief to be included in the g-force limitation. Also, in order to avoid costly whiplash lawsuits, your design must keep stopping accelerations at no more than 15 m/s^2. Remember, you must create a model coaster that will "wow" evaluators from Six Flags and get their attention.

Your coaster wheels are efficient and nearly frictionless. You may assume they are frictionless for all computations except for braking force and related computations (see rubric).

Look at the rubric to make sure you have thought through carefully all important considerations, but consider the following check list to help you in this process with your design team:

1. What scale will I use?
2. What will be my theme? My coaster's name?
3. When will we make up a good jingle to help sell the design?
4. What will the coaster model use as a bottom base and where do we get it?
5. How can we make sure all team members contribute fairly and also make sure we have redundancy in case someone gets sick or forgets to do something on time? (Supervisor who checks up on everyone, etc.)
6. Since part of the evaluation is using time wisely (in class), what can we do to make sure that we don't lose points for doing all our wok outside of class?
7. Do we have a means of double-checking our computations to make sure there are no errors?
8. Is every paper turned in double-checked by someone?
9. List anything else you can plan to do to make sure you have an awesome coaster model!

Coaster Requirements:

1. Coaster has at least 7 features (hills, turns, and loops), including at least one (klothoid) loop
2. Feature number, speed, radius elevation and g force are labeled for each of 7 features (exactly 7 labels! important!)
3. Calculations (see summary sheet, label (1-15 & F1 - F7) all 18 calculations; neat and easy to follow!)
4. For your required loop
    a. Check g-force at the top of the loop
    b. Check g-force at the bottom of the loop
    c. Report the most dangerous g-force

Roller Coaster Project Rubric

	Points earned/ Points possible	Excellent	Good	Fair	Poor
Coaster design/model 1. Ride is "thrilling" but SAFE! 2. Coaster g's range from -0.5 to +3.0 (except for brief hills and dips) 3. Model is realistic looking & is not a Single Rail (NO Monorails) 4. Roller coaster has visual appeal 5. Quality of work is high relative to competition 6. Contains 7 labeled features (loops, hills/dips, turns) 7. Name is on coaster itself and paperwork turned in on presentation day	**20**	All of the elements are present and high quality.	Elements present and some are of high quality.	Most elements are present. Quality needs work for some.	Elements missing and/or of low quality.
Calculations & documents For **each feature**, 1. All 7 **labels** included on coaster itself and appear correct. Labels include feature number, speed, elevation, radius and g-force. 2. Features summary sheet and makes sense 3. Detailed Calculations for 15 summary items and for 7 features is turned in and are neat and easy to follow 4. G-force for BOTH top of loop and bottom of loop done. Loop elevation at top and bottom recorded. 5. Braking distance calculated including KE at bottom and Braking force required 6. Power for first hill climb including climb time, first hill height and units for hp are used 7. Cost of energy and required horsepower correct	**20**	All of the elements are present and high quality.	Elements present and some are of high quality.	Most elements are present. Quality needs work for some.	Elements missing and/or of low quality.
Presentation 1. Sales pitch is at least 1 minute, no more than 3 minutes 2. Sales pitch is enthusiastic and appears sincere 3. Large colorful visuals (easy for executive board to see) 4. Entertaining name or jingle 5. Audience in involved, educated & entertained 6. All members of group are also polite audience members 7. All group members worked well during class time given	**10**	All of the elements are present and high quality.	Elements present and some are of high quality.	Most elements are present. Quality needs work for some.	Elements missing and/or of low quality.
Total points earned					

Features summary sheet:

1. Scale used (example: 100:1) _____
2. (Actual) Height of first hill on model (m): _____
3. Climb time for first hill (s): _____
4. Coaster mass including passengers (kg) _____
5. 1st hill motor (hp) : _____ energy consumed by 1st hill (J, 100% eff.): _____
6. (Actual) Track length (m) : _____
7. Frictional energy "losses"* (J): _____
8. Average ride elevation (m): _____
9. Average ride speed (mph):_____
10. Average ride speed (m/s):_____
11. Amount of time to load & unload riders (s) :_____
12. Rides per day: _____
13. Monthly(**) energy cost to operate lift motor: $_____
14. KE left at ride's end* (J) _____ Momentum at ride's end* _____
15. Braking distance (m) /force (N)**/acceleration: _____ _____ _____

Feature number	**Feature type** (loop top, loop bottom, turn, hill top, dip)	**IF loop: Is loop inside or outside?**	**Radius of curvature (m)**	**Elevation above ground level (m)**	**Show: circular g's + orientation g's = total g's (loop only, show g-force at loop top and loop bottom)**
F1					
F2					
F3					
F4					
F5					
F6					
F7					

* $\mu = 0.0135$, source: http://www.coaster101.com/2011/10/24/coasters-101-wheel-design/; only take friction into account for questions 7 and 14-15; ride's end means immediately prior to initial brake application
** Assume 30 day month, park open from 10:00 AM until 7:00 PM and ride is never down for maintenance, etc: