Coaster Kingdom

(Extra Credit in Exactly 12 Seconds)

For honors and advanced physics

Purpose:

To build a roller coaster to allow a sphere to travel a student designed and student built course in **exactly** 12 seconds.

Rules/Procedures:

1) Entries may be designed and built by a either an individual or a team of 2 students.

2) Any material is ok to use. Multiple mediums for the track are encouraged with extra points. **NO prefab marble tracks can be used for the roller coaster. You must build it yourself.**

Materials: Look for tubing that you can easily reshape. Go to a hardware store and look around in the plumbing section.

- Soft copper tubing
- Clear tygon tubing
- PVC pipe (?)
- Foam pipe insulation
- Garden hose

3) You must **try** to include at least vertical **one loop** on the track. Massive points will be given for successfully completing a loop. More loops, more points. If you are not able to build with a loop, at least build the track! (You just won't get the maximum amount of points)

4) Track must have at least **1 hill** for the marble to go up. Massive points will be given for this hill. More hills, more points.
Hills must be a minimum of 10 cm above the tracks lowest point.

5) You must be able to see the marble on the track for AT LEAST **1/2 of the total trip**. Looking through clear tubing does not count.

6) You must name your roller coaster and have a theme. Tunnels and scenery are a must--you will get points for decorations such as small signs, mountains, trees, random people, miniature models etc..... Think about the Matterhorn or Thunder Mountain, or the Pirates of Caribbean at Disneyland.

7) The roller coaster's height is only limited by the ceiling in the class room and the vehicle you are using to get it here. **Hint**: The taller it is, the more energy you have to start out with!

8) A marble may be obtained from the teacher. Or the student may supply a ball of any size.

9) The roller coaster is to be on 1 sheet of wood whose **maximum** size is 1m x 0.5m

10) The roller coaster MUST be stable. You must mount it to the sheet of plywood. Use good strong supports and nails & wood screws to make it stable at the base. You must be able to transport it to school w/o damage. Don't use hot glue or duct tape to tack to board. **WOOD SCREWS!!!**

11) The marble must go through the roller coaster and be done by exactly 12 seconds. +/- 0.10 second increments will cause deduction in points.

12) Timing will be done by stopwatch by the teacher

13) Timing will start when the student releases the ball.

14) Timing will stop when the ball reaches the end of the track at the diagonally opposite corner.

15) If the ball flips off of the track, the timing will stop.

16) **You may not touch the device at any time**, once the ball is let loose and is going down the track or you will lose 2 points each time.

17) The roller coaster may be as long as you wish in length.

18) You must have **at least 2 curved turns greater than 135°**. Other turns are ok:

Drops (through a funnel)
zig zag sections
90 degree angle turns

19) The marble must only go through the track via the force of gravity.

20) You will get 2 tries to make it work. The best score of 2 will be used.

21) Bring tools on the day of the contest to FIX your roller coaster. (It will need to be fixed. It will probably break en route to school.)

22) You will need to arrange to have the roller coaster transported to school via van, SUV, or pickup truck. Make friends now!!

23) The roller coaster's track **MUST** end at the diagonally opposite corner from where it began.

Due Date:

Tuesday, October 23, during long lunch

Points and Grading:

Grade: 50 point extra test grade

The entry with the maximum number of points wins the contest.

1. Building a feasible marble track on the board that takes a marble a minimum of **6 seconds** to go through.....15 points

2. Decorations, scenery, painted/colorful, with trees etc.....4 points
(subjective score--judged by the teacher **-Impress the teacher.**)

3. 1 loop **with success**.....4 points.
(extra loops with success.....2 points each)

4. 1 hill **with success** (Minimum of 10 cm tall).....4 points
(extra hills with success.....2 points each)

5. Time for completion---12 sec (when flag is raised or ball stops).....15 points
*minus 1 point for every 0.10 sec above or below 12 sec.

8. Minimum of two curved turns.....4 points
(Unlike hills and loops, extra curves do not add extra points.)

9. Track ends at the diagonally opposite corner to the starting point.....4 points

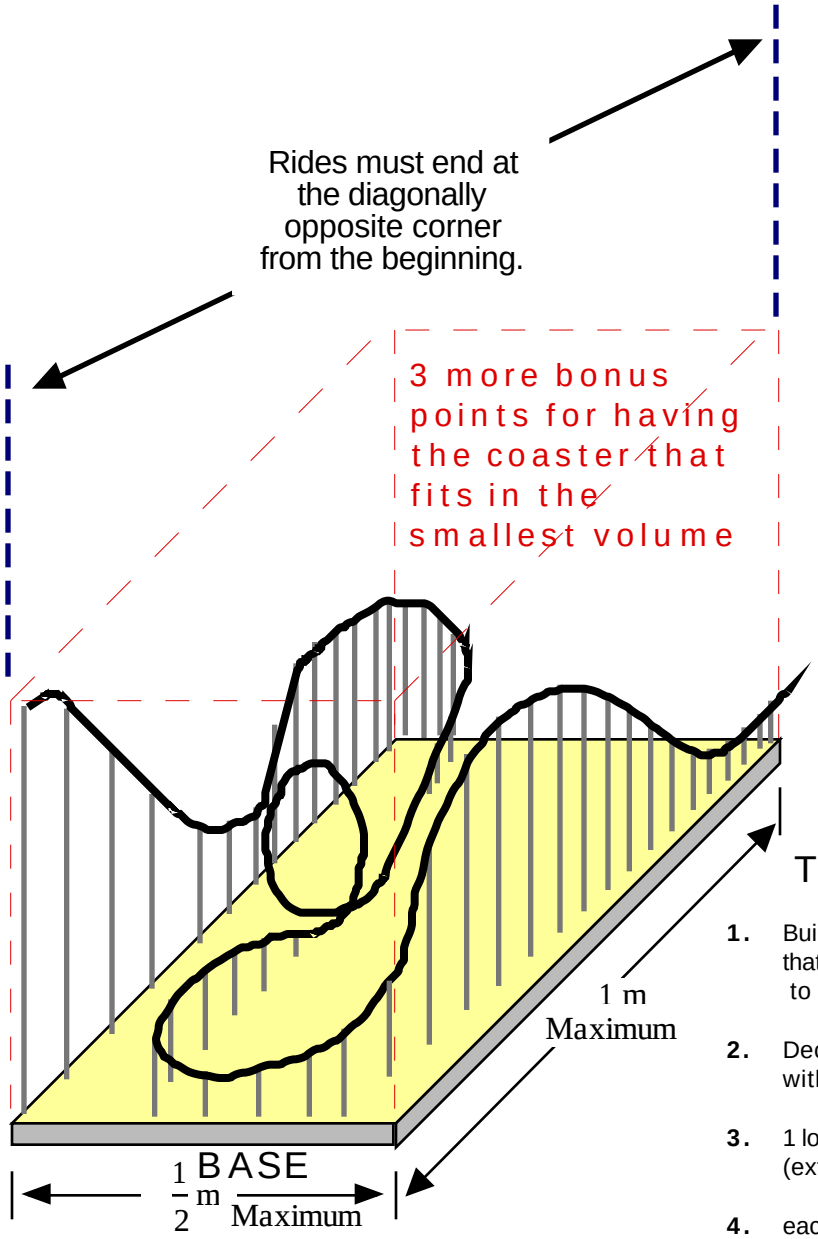
10. Not being able to see the marble for 1/2 of the total time
(example: marble is inside of PVC pipe the whole trip)..... **-** 8 points
Clear tygon flex tubing doesn't count for seeing the marble.

With multiple hills and loops, an entry can earn up to 10 more points above the 50 listed above.

2 Points if you make your track solely out of flexible copper or aluminum tubing. (A difficult and time consuming task.)

3 Bonus points for winning.

3 Bonus points for having built a coaster that can fit in the smallest rectangular volume.



This coaster's grade.

1. Building a feasible marble track on the board that takes a marble a minimum of **6 secs** to go through..... ✓ 15 pts
2. Decorations, scenary, painted/colorful, with trees ect..... ✗ 4 pts
3. 1 loop **with success**..... ✓ 4 pts. (extra loops with success.....2 pts each)
4. each hilll **with success** (Minimum of 10cm tall)..... ✓✓✓ 2 pts
5. Time for completion---12 sec ..... 15 pts
   *minus 1 point for every 05 sec above or below 12 sec.
   11 sec
   1 second away from "12": 13 points
8. Minimum of <u>two</u> curved turns..... ✓ 4 pts (<u>Unlike</u> hills and loops, extra curves do not add extra points.)
9. Track ends at the diagonally opposite corner to the starting pount..... ✓ 4 pts
10. Not being able to see the marble for <u>1/2 of the total time</u>..... - 8 pts

Score = 15 + 4 + (2 x 3) + 13 + 4 + 4 = $^{46}/_{50}$