ROLLER COASTER PROJECT

Purpose: This project will be a culminating project of the concepts of physics we covered during the third quarter. It will allow you to demonstrate your knowledge of motion, energy, and forces, as well as other areas that may apply. It is meant to be a fun project to do in class as a group. No one student is responsible for all portions of this project. **All members of the group should perform work. All work should take place in class in groups of four people or fewer.**

Requirements:

1) The Roller Coaster. Using any of the following materials:
    a. Pipe insulation
    b. Masking tape
    c. Scissors
    d. Marbles
    e. Other (ask permission)
2) Presentation of roller coaster. This should be three minutes max, and should demonstrate the areas of physics as well as perform a run of the roller coaster.
3) Data table/calculations- see rubric for more information

Due Date: February 12th, 2015

I understand that my student is responsible for supplying materials, except for pipe insulation and basic tools. The final group project is due February 12th , 2015. The students will receive a grade for both class work and the final data table assessment. Grading will be based on the attached rubrics.

Please detach this portion and return, stating the above criteria are understood concerning the roller coaster project.

_____

Parent Signature

_____

Student Signature

Roller Coaster Project and Rules

Introduction: Six Flags Amusement Park has been hearing from its customers that their roller coasters are boring. The public is threatening that if the amusement park does not build a new, more exciting roller coaster they will stop going to the amusement park.

You are part of a team of engineers that has just been asked to submit a new roller coaster design to the amusement park. Using the concepts of forces, motion, and energy, design and build a model of a workable roller coaster that could be built in the Six Flags Amusement Park.

To appease the public, your roller coaster must have a "thrill factor." There must be at least one loop, at least one turn, and if possible, a "jump." Your roller coaster also needs to be safe for the public, so you will also need to calculate the speed, acceleration, PE and KE on various locations of your roller coaster.

You will need to be able to explain your roller coaster to the board of directors of Six Flags. You will need to include in your explanation why you think your roller coaster is the "best choice" and should be built in the amusement park. Keep in mind that the board of directors is made up of a team of scientists. You will want to impress them with your knowledge of how forces, motion and energy help your roller coaster work, why it is safe to ride, and why it is "thrilling."

Rules

1) Your roller coaster must fit within the confines of your "construction area." There is no height limit, and you may not intrude on another group's area without their permission.

2) You may NOT alter the pipe insulation from Ms. Grant if you choose to use it. Remember, you only have a certain amount of supplies. You may not have any replacement supplies if your idea doesn't work.

3) Your roller coaster must bring your marble safely to a stop. Drops and jumps are permitted, but the marble must be safely caught by the track without getting stuck.

4) Hills and loops must involve trading kinetic energy for potential energy. Horizontal loops are considered turns.

5) Hold on to your marble!!! You must pay for lost marbles, and many roller coasters will work best with one, specific marble. You may need to redesign your roller coaster if you lose your marble.

6) Do not mess around with another group's roller coaster. This will result in an automatic zero, and removal from the class for the rest of the project.

7) Extra time will not be permitted. Deadlines are absolute. Absences or unexpected school closures will not result in extra time. The tape changes shape as it dries out, and roller coasters stop working after a few days and are often unusable after awhile. You may come in at lunch if you need more time.

8) Your group is responsible for completely removing your roller coaster and cleaning the surrounding area after completion of the project. Any classroom equipment that is damaged must be paid for.

Calculations and Analysis

1. **LABEL the following points on your roller coaster:**
    a. Where the kinetic energy is the highest
    b. Where the kinetic energy is the lowest
    c. Where the potential energy is the highest
    d. Where the potential energy is the lowest
    e. Where there is positive acceleration
    f. Where there is negative acceleration
    g. Newton's 1st Law
    h. Newton's 2nd Law
    i. Newton's 3rd Law
    j. Two forces that might slow your marble down (what kinds of forces have we talked about in class?)

Measure and record the following measurements for your roller coaster.

Time of ride = _____ (seconds)

Mass of the marble=_____ (kg)
Go weigh your marble (you may have to weigh it in a cup, then weigh the cup, and subtract to get just the weight of the marble).

Length of the track = _____ (meters)

Using the measurements above, calculate the following items for your roller coaster. Please show all of your work and label all of your answers with the correct units!!!!

2. Average speed of the ride (remember your speed equation???)

3. Acceleration of marble at one location on your roller coaster (remember your acceleration equation???)

4. The Force at one location on your roller coaster. Remember your force equation? (Use your acceleration from above)

5. Gravitational Potential Energy at the beginning of your ride.

6. Kinetic Energy at one location on your roller coaster.

ROLLER COASTER PROJECT RUBRICS

Criteria for Calculations and Analysis:

Where the kinetic energy is the highest	2	
Where the kinetic energy is the lowest	2	
Where the potential energy is the highest	2	
Where the potential energy is the lowest	2	
Where there is positive acceleration (speeding up)	2	
Where there is negative acceleration (slowing down)	2	
Newton's 1st Law	2	
Newton's 2nd Law	2	
Newton's 3rd Law	2	
Two other forces present on your roller coaster	2	
Time of Ride (in seconds)	2	
Length of Track (in meters)	2	
Average Velocity of the ride	2	
Acceleration at one location	2	
Gravitational P.E at beginning of ride	2	
Force at one location of roller coaster	2	
Kinetic Energy at one location	2	
Total Points	**34**	

Criteria for Presentation

	Possible Points	Points Earned
Presentation was appropriate length (2-3 minutes)	**5**	
Information was organized	**5**	
Presentation was understandable	**5**	
Total Points	**15**	

Criterion for The Actual Roller Coaster

	Possible points	Points Earned
Appearance: Does the roller coaster look good? Is it neat? Does it have a name?	**5**	
Safety: Does the marble stay on the track? Does the marble complete the entire track without getting stuck or stopping? Is it brought to a stop?	**5**	
Number of loops/Hills: Does the roller coaster have one or more loops or hills?	**5**	
Building: Does your marble go off the track? Does it touch anything other than the track before the end? Did you follow the rules?	**5**	
Thrill: Is the track open for all/part of the ride? Can the passengers "see" out? How abrupt are any changes in motion? Are there any jumps?	**5**	
Total Points	**25**	

Student Evaluation

Roller Coaster # _____
Roller Coaster Name _____

Criterion	Points Possible	Points Earned/ Comments
Appearance: Does the roller coaster look good? Is it neat? Is it decorated?	**3**	
Number of Loops/Hills: Does the roller coaster have one or more loops or hills? How does it compare with others?	**3**	
Number of Turns: How many turns does the roller coaster have? How does it compare with others?	**3**	
Thrill: Is the track open for all/part of the loops? Can the passengers "see" out? How abrupt are any changes in motion? Are there any jumps?	**3**	
Creativity: Does the roller coaster have a name? Is there anything unique about this roller coaster?	**3**	
Total Points	**15**	

For an evaluation to be counted, you must give a comment explaining the score to the designers. You may not give something a score of zero unless that feature is missing completely. You must give at least two positive comments for your scores to count. Any overly negative comments will be thrown out.

Self Evaluation

Student Name: _____
Roller Coaster Name: _____
Group Member Names: _____

Criterion	Points Possible	Points Earned/ Reasons	
Teamwork: Did you help each other? Did you work together, or did everyone try to do their own thing?	**2.5**		
Individual participation; Did you do your fair share of the work? Did you help with every step, or just do one part?	**2.5**		
Group Participation: Did everyone contribute equally? Was everyone involved in each step (building, analysis, clean up, etc.)? Give each person in your group up to 2.5 points for their participation.	**2.5**	Name	Points and Reasons
Respecting each other: Did you listen to each other? Did everyone get to share their ideas? Were any group members put down?	**2.5**		
Total points	**10**		

Total Possible Points for Project: 100