**Paper Roller Coaster Challenge**

**Introduction and Objective:**

Thinking like a scientist means using the knowledge and experience you have acquired, planning and predicting, considering potential outcomes, solving problems and adapting to new situations as they present themselves. With this in mind, you will be applying what you know in the construction of a Paper Roller Coaster which accommodates marbles. You will apply and utilize the basic concepts of motion and energy in this project. Construction material will be provided. Class time will be provided. You may work individually or in groups of 2 or 3. NO GROUPS OF MORE THAN 3.

**Equipment Needed:**

\*Paper Roller Coaster Templates

\*Scissors

\*Tape

\*Cardboard Base

\*Marbles

\*Ruler

**Minimum Construction Requirements to Receive 70%:**

The following are the minimum standards to implement:

\*Cardboard/Foam Board Base = 12” wide x 21-30” Long

\*At least 1 Loop

\*At least 1 Funnel

\*At least 1 Corkscrew/Helix

\*At least 1 Up Hill Section

\*At least 5 turns not counting Corkscrew

\*At least 150 cm Long

\*Catch area at the end for the marble

**Tips/Suggestions:**

* Do some planning before you randomly start building. Decide on dimensions and a basic framework. Sketch out a basic design. Decide approximately how many of each piece you will need to use.
* Divide and Conquer if you are working together. Decide who is doing what.
* Build frame first and secure it well to your base. Make sure it is structurally sound.
* Use beams and braces effectively – avoid long areas of open space that will weaken.
* Refer to the references linked on the website in regard to folding and attaching the various elements of your roller coaster. Follow directions and put it together correctly.
* Use the links on my website and also do some of your own searches on Google or on Youtube – there are lots of great ideas and resources available

**Related Calculations:**

Complete the two worksheets:

* Calculating Potential and Kinetic Energy of a Rolling Marble
  + You ONLY need to do Part “A” of this work sheet.
* Calculating Average Speed of a Rolling Marble
  + Complete all of this work sheet.

**Summary of Project:**

Each group must write a summary of their project construction/performance. This summary probably only needs to be 1-2 good paragraphs long. It needs to include the following terms – used correctly as they relate to your project construction and performance:

Acceleration Force Friction Gravity

Kinetic Energy Mass Potential Energy Velocity

Motion Inertia

**Extra Credit:**

Extra Credit will be awarded in 3 categories. Only one project will be chosen from the entire freshman class in each of the 3 categories….. NOT one project per period. The 3 categories will be as follows and each is worth 5 extra credit points.

Category 1 – Most Complex Design – 5pts to the project that incorporates the greatest number of different design elements, as well as unique combinations of elements. They must be functional and work.

Category 2 – Longest descent – 5 pts to the group with a roller coaster that has the longest average time of descent from beginning to end. This does NOT include the marble getting stuck. The marble must still maintain motion the entire time.

Category 3 – Most Creative/Scenic – 5 pts to the group whose roller coaster incorporates the most creative design, scenery, theme, etc.

**Final Testing/Grading:**

The final grade will include an average of 3 attempts for the marble to travel through the roller coaster.

* Cardboard/Foam Board Base = 12” wide x 21-30” High 0 – 3 pts.
* At least 1 Loop 0 – 7 pts.
* At least 1 Funnel 0 – 7 pts.
* At least 1 Corkscrew/Helix 0 – 10 pts.
* At least 1 Up Hill Section 0 – 5 pts.
* At least 5 turns not counting Corkscrew 0 – 10 pts.
* At least 150 cm Long 0 – 5 pts.
* Catch area at the end for the marble 0 – 3 pts.
* Solid, Quality Construction 0 - 10 pts.
* Marble does not stop, fall off, or need help 0 - 10 pts.
* Coaster is visually appealing, creative and interesting 0 - 10 pts.
* Summary Paragraph(s) of the project 0 - 10 pts.
* Related Calculations 0 - 10 pts.
* Extra Credit 0-5pts