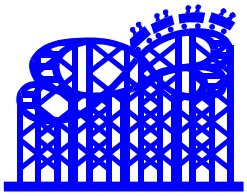


The Magnificent Marble Machine

Major Fun, Major Grade!

Objective: Using your knowledge of motion, forces, and energy, design and construct a "roller coaster" for a marble that meets all the requirements listed below and using the same materials as your classmates.

Materials:
Each group will receive the same amount of the following supplies and the same amount of time to work. You will not bring anything from home.

a. 1 sheet of poster board (Poster boards are 71.5cm x 56cm.)
b. 3 sentence strips (cut in half long ways, fold up sides to secure to poster)
c. tape
d. 1 marble for practice to be returned to the teacher daily

You should put your name on all supplies as they are given to you. You are responsible for keeping track of materials. They will NOT be replaced, and you may not bring any from home.

Roller Coaster Trick Requirements: (See details on back.)

- 1 vertical 360° loop
- a 5-cm jump
- a "stall" (with no stopper)
- a trap door / hole
- a 5-cm hill
- a trap or stopper at the end to stop the marble
- Speed will be calculated (cm/sec) and written on the front of the poster board. **Formula, equation, answer rounded to the tenths space and correct units should all be present.**

Planning Requirements:

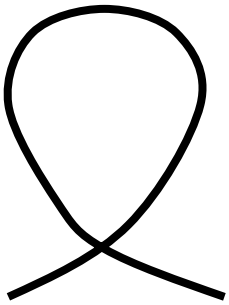
- Tonight you will do an individual design, complete with labels and following specific directions on that paper. This is due tomorrow.
- At our next class you will combine your design with your partner's design for your official blueprint and draw it on a new graph paper. The graph paper is scaled to the poster board and you will follow specific directions on that paper.

Working Requirements

- You must work and clean up with your partner for the 5 days at all times. This is 50% of your grade.
- Consult and edit your original blueprint as you build. It is part of your grade.
- Although neatness is not counted for your final product, the neater you are with your cuts and folds, the better your roller coaster will run.
- When you are finished building, calculate the speed of your marble by measuring the distance of the track and the time it takes your marble to run through the machine. (speed = distance / time)
- When you think you are finished, grade your marble machine with your own gradesheet before asking your teacher to grade it.

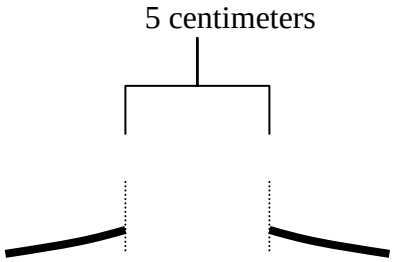
Other Information:

- If you are absent 2 or more days, you will be responsible for creating your own roller coaster.
- No student may "play with", "test out", "try out", "borrow from", or touch any project other than his/her own. If you are found doing this, your team will lose points.



Vertical 360° Loop

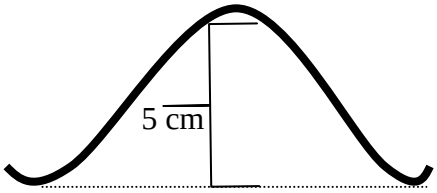
Make sure the marble goes all the way around and doesn't get to the top and just drop down. There is no height requirement.



5-centimeter Jump

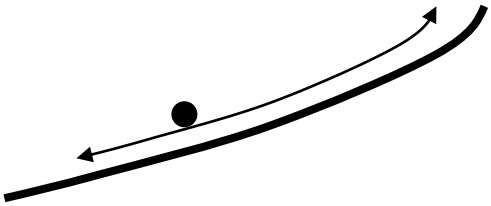
5-cm of empty space to another platform/runway. This is not a "drop."

The receiving strip should not be lower than the launching strip. This will be measured as shown here.



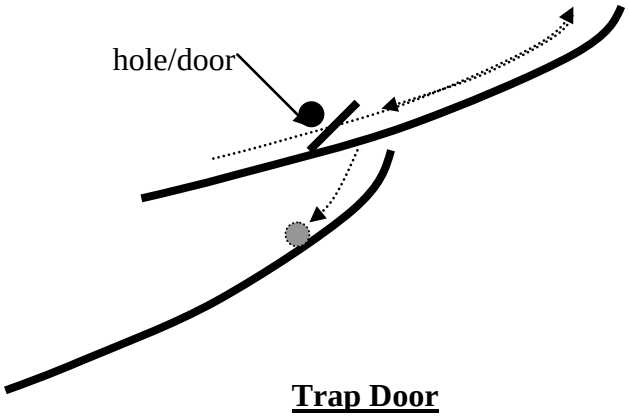
5-centimeter Hill

The marble must go up 5-centimeters and over. This will be measured as shown here.



Stall

The marble should go up a ramp, lose enough energy to make it turn around and go the other way. You should not put anything at the end of the ramp to make the marble turn around.



Trap Door

This is made from one strip of paper. The marble should have enough energy to roll over a door or hole you have cut in your runway, hit a wall or stall and change directions to come back and go through the hole and drop to another platform.

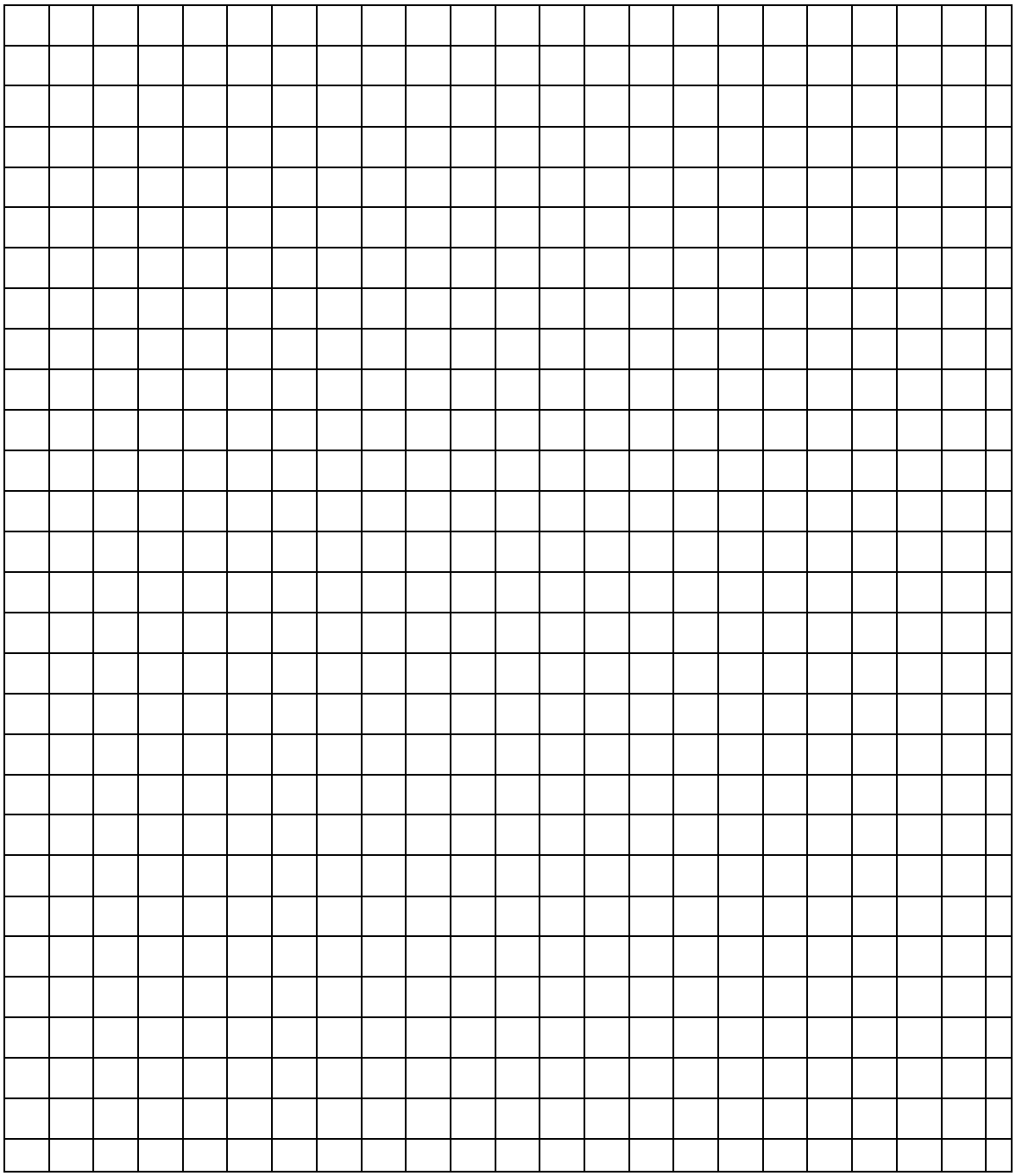
Extra credit is available for **only** the following tricks **if they are successful**:

- longer jump (7.5 cm or longer) You will receive points for the required jump and extra credit points too!
- higher hill (7.5 cm or higher) You will receive points for the required hill and extra credit points too!
- extra 360 loops
- extra 5-cm jumps
- extra 5-cm hills

Individual Idea Blueprint Paper

1. Tonight you will do an individual design, complete with labels. This is due tomorrow. The back is an extra diagram.
2. The graph paper is scaled to the poster board. 1 square = 2.5-cm on poster (Poster boards are 71.5cm x 56cm).
3. If you draw your roller coaster in only a small section of this graph, then you will be building your roller coaster in only a small section of your poster! Spread out your design!
4. Label:

□first and last names on blueprint
□all six obstacles labeled and spelled correctly
□extra tricks also labeled
□potential and kinetic energy labeled where both are at their maximum



Grade Sheet for Marble Machines

_____ Day 1 (10 points) Working together and clean up, follow directions for building permit

_____ Day 2 (10 points) Working together and clean up

_____ Day 3 (10 points) Working together and clean up

_____ Day 4 (10 points) Working together and clean up

_____ Day 5 (10 points) Working together and clean up

Each of the following is worth five points.

_____Did the approved drawing (with corrections if necessary) and the actual marble machine match? (yes/no)

_____Were the names of everyone in the group on the poster and the design sheet? (yes/no)

_____Was the marble able to go through the entire machine on the graded attempt? (yes/no)

_____Did the 360 vertical loop work as described in the directions? (yes/no)

_____Did the stall work as described in the directions? (yes/no)

_____Was there a 5-cm jump as described in the directions and was it successful? (yes/no)

_____Was there a trap door that allowed the marble to cross over it and then fall through it?(yes/no)

_____Was there a 5-cm hill as described in the directions and was it successful? (yes/no)

_____Was there a trap/stopper at the end? (yes/no)

_____Was speed calculated correctly with formula, equation, answer rounded to the tenths space and units? (yes/no)

_____Extra points for_____