Q1 CP Design Project - Grand Prix Racers

Purpose: To design a car powered only by gravity that will have the largest displacement (Δx) and/or average velocity (v_{ave}).

B2. Skills and Traits of Technological Design

Students use a systematic process, tools and techniques, and a variety of materials to design and produce a solution or product that meets new needs or improves existing designs.

c. Select the design that best meets established criteria.
e. Implement the proposed design solution.
f. Evaluate the solution to a design problem and the consequences of that solution.

Racing your car:

- The front of your car will be placed at a green line 1 meter from the bottom of a ramp inclined at 30º.
- The car will be released from rest and timed with a stopwatch from the bottom of the ramp to where it stops.
- You will measure the displacement of your car from the middle of the bottom of the ramp in a straight line to the front of your car when it comes to a stop.

Building your car and writing your journal:

- Build a car using the Physics Pro Kit. Your car can be no bigger than 30cm X 30cm.
- After you have built your first car, try it out on the ramp. Record the displacement and time for your car (from the bottom of the ramp to where it stops). Also record any observations about how it moves (i.e., "curves to right," "curves to left," "doesn't roll well," etc.).
- Go back to your Physics Pro Kit and improve your design. Describe in your journal what changes you make to your original design.
- Repeat the steps above until you are satisfied with your car.
- Draw a picture of your final design in your journal.
- Write your name on a piece of paper to include with your car and ask your teacher where you should store it until the race next class.
- On race day:
  - Record your total displacement and time on your data sheet.
  - Calculate your average velocity.
  - Staple your picture to this packet and pass it in.

$$\text{Average Velocity} = \frac{\Delta \text{position}}{\text{time}} = \frac{\text{displacement}}{\text{time}}$$

Journal

Stage 1:

Data: (from the end of the ramp to the stopping position:

displacement: $\Delta x =$ _____

time: $t =$ _____

Observations about performance of car:

Discussion and documentation of how car was rebuilt to improve performance:

Stage 2:

Data: (from the end of the ramp to the stopping position:

displacement: $\Delta x =$ _____

time: $t =$ _____

Observations about performance of car:

Discussion and documentation of how car was rebuilt to improve performance:

Journal (cont.)

Stage 3:

Data: (from the end of the ramp to the stopping position:

displacement: $\Delta x =$ _____

time: $t =$ _____

Observations about performance of car:

Discussion and documentation of how car was rebuilt to improve performance:

Stage 4:

Data: (from the end of the ramp to the stopping position:

displacement: $\Delta x =$ _____

time: $t =$ _____

Observations about performance of car:

Discussion and documentation of how car was rebuilt to improve performance:

Journal (cont.)

Detailed picture of final design. Label the parts of your car.

Grading Rubric:

	5 points	**10 points**	**15 points**	**20 points**
performance highest of your Δx & v_{ave} rank among all students	0-25%	26-50%	51-75%	76-100%
	20 points	**40 points**	**60 points**	**80 points**
journal	More than two parts of journal requirements are missing	Documentation of design process is incomplete or vague and picture, data or calculations are missing	Includes documentation and discussion of each step of design process, data & calculations	Docmentation of design process is thorough and in complete sentences, includes detailed picture of final design, data & correct calculations

Data: (from the end of the ramp to the stopping position:

displacement: $\Delta x =$ _____

time: $t =$ _____

Calculations (show work!):

average velocity: $V_{ave} =$ _____

rank for Δx: _____ **rank for V_{ave}:** _____ **Final Grade:** _____