

Moving Along the Straight and Narrow ... You Be Tripping or Dat's How'z Uz Roll'z

April 30th 1st car due. Rebuild / Improved car due by Tuesday 05/18, (required for everyone)

Purpose:

1. To design and build a racecar that will run farther, faster and straighter than any other in car in AP Physics 1.
2. To learn more about physics as an introduction to our unit on mechanics.

Rules o' the game are.....

1. The car must be all hand assembled and have at least **THREE** working wheels and a **frame**. The wheels must be round and be able to turn separate from the frame; they must touch the ground for the car's entire trip, although they do not have to turn. (No Coffee can cars...)
2. The car must start under its own power and run only on the flat surface of the floor. You are allowed to activate a trigger to start the car but you are not allowed to give it a push.
3. If a catapult or incline plane is used; the race begins when the car touches the floor and the catapult or incline plane must move with the car.
4. If using an incline plane, the car must first be propelled from the floor up the plane without interruption.
5. Trigger devices (e.g.; releasing a balloon) are acceptable IF they are permanently attached to the car AND require only the movement of a single switch or release to activate.
6. No electrical, ***animal***, nuclear, or commercially available motors.
7. No prefabricated wheels; cannot be a "kit" car (like from Boy Scouts) or K'NEX, wheels from other toys.
Can't use something that is designed as a wheel.
8. No tracks, guidewires, or strings used to maintain a straight path.
9. No Mentos & diet coke, CO₂ or NO₂ cartridges, or any rockets, Air Compressors / Pumps, combustion or any potentially dangerous vehicle that could jeopardize the safety of any student, teacher, or administrator (well, maybe an administrator) are allowed - if there's a question - ask!
10. The car must move as a whole unit, not part of the car being immobile and part being mobile, i.e. no rubber band launchers.
11. Two to four engineers per group. Each person needs to help with lab write-up/website and document their work. Format for lab write-ups is on the back of this handout. If more than 4 engineers are used then for each person over 4 the group has a new differently designed car must be made, and **group will be graded on the lowest performing car with no opportunity to earn bonus points, if no extra car the group grade will be a ZERO, no rebuild option will be available.** 5 engineers = 2 cars; 6 = 3 cars; 7 = 4 cars; ect. ***If only 1 person is in group then NO BONUS POINTS can be earned and a 0/10 points will be the grade for the group grade part and they must build 2 cars and be graded on the lowest performing car.***

VERY HELPFUL TO PICK PARTNERS THAT HAVE SKILLS YOU DO NOT....

GRADING FOR "Race Car Physics"

- 1) (Project1) Just for entering ON TIME.
- 2) (Project2) If the racecar moves 1 car length.
- 3) **Bonus for additional for every tile (foot) moved beyond one car length**, bonus applies to lowest standard you showed evidence in that standard.
- 4) (Project2) Fastest car over 5 feet (5 blocks)

fastest car next fastest car third fastest car fourth fastest fifth fastest sixth and so on

- 5) (Project3) Zee 'greatest and straightest' distance*. Specifically, the object is to maximize the value of Z, where $Z = [D - 3E]$. D is the distance traveled in feet, E is the lateral movement from the centerline.

greatest Z next highest Z third Z fourth Z fifth Z and so on

- 6) (Project3) (Mass)(speed) product as measured from start until car stops. (This is also known as momentum)
Largest product second third fourth fifth and so on

- 7) (Project4) Creativity. Hard to measure, we will come up with criteria in class. Use of premade kits will earn you less points.

First second third fourth fifth and so on

- 8) (Project 1, 2, & 5) Lab write-up (**WEBSITE**) (**TYPED UP**). Up to 30% total. (purpose; set-up, data, and calculations; analysis; Things that should be included → Pictures / Movies of different stages of lab, Works Cited).

- 9) (**Habits of Mind 6**) Group analysis Google Form (Done individually and shared with McChensey) – **10 points. Type up an explanation that grades how each person contributed to the group (Divide the 10 points among group members, explain why they get the grade they get. If 1 person builds the car they should receive more points than the other group members.) If there is no explanation of why the points are split the way they are then the grade will be a 0/10 points.**

- 10) (Project 5) Documentation of work – You need to create a google doc shared with McChesney, the document needs to list each group member and be a running record of what was done and when it was done. Document should have pictures of people working together in it. If document is not created at the start of project (when it is assigned) only half credit on this standard can be earned. Document should be updated every time you work on project and it should be more than once a week.

- 11) (Project 4) Efficiency – Distance travelled in feet / Mass in grams, higher the number the better. Must move at least 5 feet.

First second third fourth fifth and so on

- 12) (**Habits of Mind 7**) Rebuild / Improve the car.

First second third fourth fifth and so on

You must have a working car in order to score the minimum score. If you are having trouble / an issue make sure you are making regular check ins with McChesney and documenting it in the Google Document you created on day 1.

Make sure you include your data, sample calculations, and use units (acceleration might be in feet per second per second) in your documentation.

Thus..... this project is will be graded out of 7 Standards with some standards being graded twice. Note the bonus can be used to raise a standard to a 10 if you scored at least a 5 in the standard. but there will be a 'cap' on how many standards the bonus applies to for this project.

You may test your car early (and you are strongly encouraged to do so) if you schedule a testing time with McChesney, if on the official test day, you have a video recorded test in the presence of McChesney you may count that run as an official run done before the test day you may include that run in your official test runs.

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Lab write up (WEBSITE) format. Please make sure to title each page of the website and write the name of the person(s) who worked on the page and date on each webpage was updated.

1. Purpose/Introduction of group:

- Put in your OWN words!! The intended purpose will not always be the same as what is in the lab(s). This should be to the point.
- Introduce the physics used in this project
- Each group member should have a short bio / video introducing themselves along with descriptions of what they did for the project.

2. Set Up:

- Use drawings/schematics to aid in making your procedures brief. "Synthesize" elements from the lab and make sure another group could understand well enough to repeat what you do. You need to take pictures of the car at each step in the build and record movies of the trial runs. **HINT: TAKE LOTS OF PICTURES AND MOVIES** of the process!

3. Data:

- Use tables, and include data from practice runs done while building car. Label the measurements and what units you used thoroughly.

4. Pictures and Movies:

- Take **multiple** pictures and video of the build progress and testing of your car. ← **Important**

5. Calculations:

- Use three steps.
A) Formula
B) Actual data replacing the variables
C) The answers with correct units

6. Analysis and Results:

- Write a conclusion based on your findings. You should address the physics involved in the project and what part of the project used what physics. The conclusion should be a number of paragraphs long. Be sure to include relationships and references to your data and calculations. You may want to include reasons for experimental error, possible improvements to the experiment, etc. here. The *analysis* of what went right, what went wrong, and how your lab could be improved are important. The amount of analysis is the most important part of your lab write-up.
- This is also where you should write your proposal of what you are going to change on your car (has to address an area of weakness) and why are you changing it. What is the physics behind the issue you are addressing. You should be specific in this section. Make sure your change is approved by McChesney.

7. Credits and References:

- Include links to videos watched, links to websites used, and any other resources you used to help you build your car.

8. Documentation:

- Your documentation of the process, updated whenever your group or you worked on the project.

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Data to record for website / lab write-up:

At a minimum you should be recording the following data: Car **mass** (in g), **Total distance** (D), **Lateral movement** (E), **Time** (0 to 5 feet- if car goes that far), The **average velocity for 5 ft**, **Time** until car stops, **distance** car traveled, and **average velocity** of for entire trip. (Mass)(Speed) product in (gram)(feet)/sec.-----
-> Very funky and non-Physics-like units, but OK for now... and finally find “**Z value**” (**straight line distance**) = [D - 3E]. **Not a bad idea to record other data! Make sure you record videos of the test trials done outside of school.**

* NOTE* If the car does not go 5 feet, determine the average velocity for the distance travelled until the car comes to a stop.

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During the week of April 26th you may schedule a time before school, after school, or during one of my free mods to do an official test run. If you get an official test run recorded in front of me and on test day your car experiences a failure the test run can be used in place of the April 30th data.

Rebuilds are required for everyone in class: Due the last week of school.

After the official test day, you will write up a proposal (included on your website) on what was the lowest performance aspect of your car. Propose a way to make a new car that improves in that category, design the car, then test the car. For the rebuilds it is important you document the progress.

If you have questions ask.

If you have an issue or problem make sure McChesney is aware of it before the project is due.

Pick your partners wisely, do research on the types of cars possible and the physics behind them.

Waiting to the last minute is something that is not helpful.

Make multiple prototypes is usually the most successful method.

Record lots of videos / take lots of pictures of the process.