NAME

Standard
STEM-FET
1,6

FET 6.2
CO_2 Dragster

In this assignment, you are going to design and build a CO_2 powered mini-dragster. You will work with a team, and at the end you will race your car against other teams' cars.

Procedure

- Follow the 8-step design process to create your car, logging everything in your design notebook.
- At some point, print you inventory sheet, put your team # at the top right, and show it to me to receive your parts.
- Complete steps 1-5A of the process and present it for approval. You cannot continue until this is complete.
- Complete steps 5B-8 of the process. This mainly includes building your car following your design.
- After building your cars, we will have a racing tournament and a car show (time permitting).
- We will finish with class presentations where you present your designs to the class.

Design Notebook Requirements

Your notebook must include documentation of how you completed each of the 8 steps of the design process.

1. Identify the need, problem, or want – state the problem.
2. Research, determine criteria and constraints – show evidence of research; list criteria and constraints.
3. Develop possible solutions – include sketches of at least 3 different possible designs.
4. Select the best possible solution – advantages/disadvantages listed for each design; why you picked the one you did.
5. Part A, Final design – detailed design drawings.
5. Part B, Build model – bill of materials, description of build process.
6. Test, evaluate, refine/redesign – what tests you did and the results; adjustments you made.
7. Create final product – describe changes or differences between original design and final design; race results.
8. Communicate the design – organize; add title, table of contents, and sign-off pages (on my web page); turn it in.

Components and Parts Kit

Print the inventory signoff sheet from my webpage. Here is what your team will be provided.

Components	Parts Kit
1 balsa wood car body block	5 axle pieces – 1 155mm aluminum, 2 65mm steel, 2 45mm steel
1 piece of sand paper	1 plastic axle sleeve
4 wide wheels	4 wheel locks
4 narrow wheels	8 washers/spacers – 4 brass, 4 plastic
	2 screw eyes

When you receive your components and parts, check everything off on the inventory sheet, sign it, and turn it in. You are responsible for everything you are given, and you must account for everything at the end of the project except for scrap wood. Do not throw anything else away. You will also be provided other non-inventory items (tools, glue, etc).

Car Specs

Structural

- You must use only the approved materials and parts provided to you as part of the project.
- It must conform to the measurement dimensions and limits on the 'CO_2 Car Spec Chart' (you'll be given this).

Cosmetic

- All external surfaces except wheels and axles must be sanded and painted. You must use at least 2 colors.
- It must include at least one part designed using CAD and printed on the 3D printer (details below).
- It must be a creative design, not just wheels slapped on the original block of wood.
- It must be given a name that is visible on the car.

Design Requirements

Your overall design must meet the following requirements:

- Research ideas using the Internet or other sources, but you must create the design.
- Your initial drawings can be simple and hand-drawn. Your selected final design drawings must be DETAILED, including the front, right, and top views and ALL dimensions. Views can be on one or multiple pages/drawings. You have 3 options for drawing:
    - Hand-drawn – must look professional and neat (use a ruler to ensure straight lines)
    - Graphics software (like Paint or Word drawing tools) – make them look good, then print the required views.
    - CAD (SolidWorks, TinkerCAD) - print the required views.
- You must design at least one part using CAD, which will be printed on the 3D printer.
- Your design must include a bill of materials listing everything you require to design and build the car.

CAD/3D Printing Requirements
The part(s) you design and print must meet the following requirements:

- Must be an original design started from scratch, not downloaded off the Internet.
- Cannot be used to replace a functional part (like a wheel or axle).
- Must have multiple 'features' – tapers, extrusions, text, etc. It cannot just be a plain block or something like that.
- Cannot extend wider than the wheels or longer than the car body, and cannot be mounted on the bottom.
- Must require no more than a total of 1 cubic inch of 3D material (you won't be able to tell this, but just be aware that I might have to shrink it if it's too big).

Other Requirements and Restrictions

- Any unauthorized CO_2 firings or mishandling of loaded cartridges will result in a zero grade for this project and a write-up. This is a potential safety hazard that could injure you and others. Do not touch a charged CO_2 cartridge or load one into a car unless authorized by the teacher. Empty CO_2 cartridges may be used anytime for testing.
- Cars that do not meet ALL of the Car Specs will not be allowed to race.
- Make sure at least one person on your team knows how to use the drawing software you choose.
- Your team must provide your own paint and brushes. Small bottles of cheap craft paint and cheap foam or bristle brushes are perfect. NO SPRAY PAINT.

Racing and Car Show

- Assuming the launcher and timer work, we will have a tournament to determine whose car is the fastest. The tournament format will be determined later depending on the number of qualifying teams.
- If we have the time, we will also have a car show to show off your car designs. We will have a contest to let the classes (and maybe others) vote for their favorite design.
- Awards will be presented to both the race winner and the design winner.

Presentation Requirements
You must present your finished project to the class at the end. All team members must participate. It must include:

- Description of your design, including drawings, reasons for designing it the way you did, etc.
- Description of your construction and testing process
- Your race results and why you think your car performed like it did.
- Description and showing of the car itself
- Multimedia visual aids (PowerPoint, Prezi, videos, posters, etc.)

Grading Rubric
You will receive 6 separate grades for this project (4 summative, 2 formative). I will be very picky with my grading on this, so you must be thorough and include and/or do everything that the specs require you to do.

Design Notebook (summative)	**100**
1) Problem Stated	5
2) Evidence of research; all criteria and constraints listed	10
3) Sketches of 3 different designs	10
4) Advantages/disadvantages of each design; reason for picking selected solution	10
5) All required drawings, bill of materials, description of build process (what you did, problems, etc.)	40
6) Tests you did and results; description of adjustments you made	10
7) Description of differences between original and final design; all your race results	10
8) Title page, table of contents, completed sign-off page	5
Car (summative)	**100**
1) Meets all structural specs listed, including those on 'Go/No Go' template	50
2) Meets all cosmetic specs listed	50
Presentation (summative)	**100**
1) Meets all presentation requirements listed	70
2) Individual participation in presentation	30
Work Ethic, Efficiency, and Participation (summative)	**100**
1) Participates in all team's activities (-5 per violation)	variable
2) Accounts for all materials at the end (-10 for wheels, -5 for others)	variable
3) Replacement parts (-20 for car block, -10 for wheels, -5 for others)	variable
Weekly Work Check (formative) – end of weeks 1 and 2	**100**
1) Completion of weekly work check status sheet (details to come later)	100