

# CO2 Dragster

## Objectives:

- ~ Students will use problem-solving skills to design and build a CO2 Dragster.
- ~ Students will follow safety rules for hand and power tools while working in the Tech Lab.

## Introduction

One of the most important considerations when designing a vehicle is aerodynamics. Aerodynamics involves how air flows past an object or how an object moves through air. The more aerodynamic a vehicle is the better your car will move through the air. We will test the aerodynamics of your car with the wind tunnel. In the wind tunnel we can see and measure how the air flows around the shape of your car. This flow of air is called streamline. A car body with an overall rounded or square shape will cause the air to stray from the streamline causing swirls of air. This turbulent air movement, called drag, will slow down the vehicle.

In this activity, you will design, construct, and test an aerodynamic vehicle. A CO2 cartridge will then power your car. Make sure you take your time and follow the limitations while building your dragster. It will have a better chance of looking good and going fast.

## Problem

You are an automotive design engineer for the PCMS Automotive Company. You have been asked to design a vehicle (using the limitations at the bottom of this page) that is aerodynamic, fuel efficient, and stylish. You will be in charge of the designing, constructing, and testing of the new vehicle. All the cars in the company will be compared for excellence in design, craftsmanship, aerodynamics, and the fastest racing time.

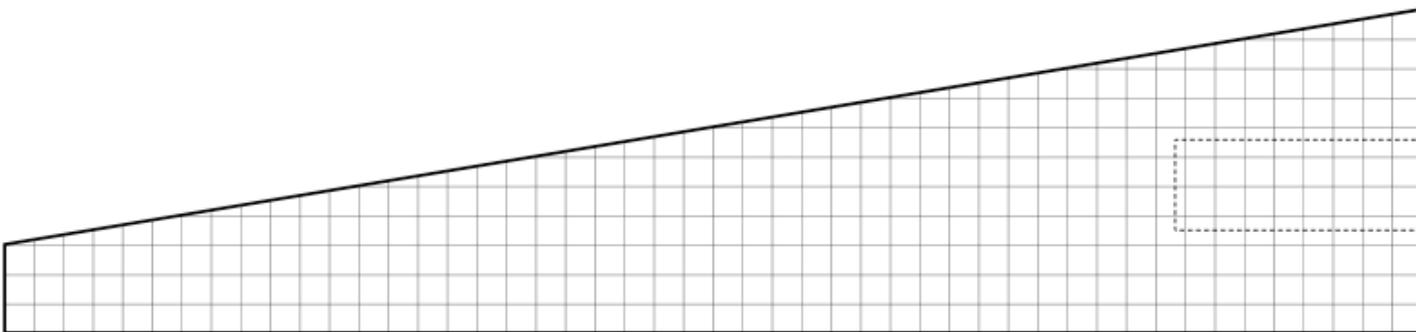
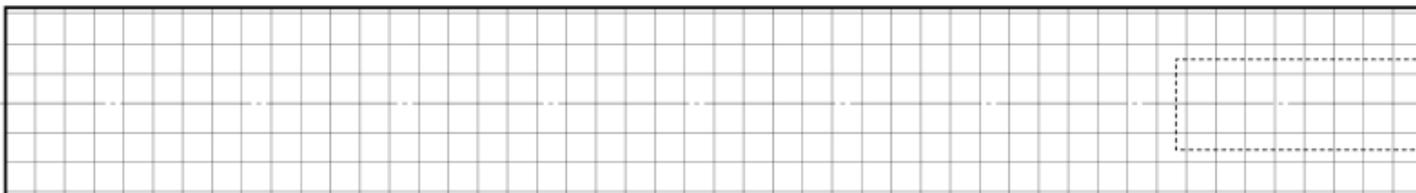
<b>Materials/Supplies</b>	<b>Tools/Equipment</b>
<ul style="list-style-type: none"><li>• Co2 Design Template</li><li>• Masking tape</li><li>• Sandpaper</li><li>• Soda straws</li><li>• 2 axles</li><li>• 4 washers</li><li>• 1 body blank</li><li>• 2 rear wheels</li><li>• 2 front wheels</li><li>• 2 1/8" screw eyes</li><li>• CO2 cartridges for race</li></ul>	<ul style="list-style-type: none"><li>• Drawing tools</li><li>• Scissors</li><li>• Wood rasp/file</li><li>• Band saw/Scroll saw</li><li>• Drill press</li><li>• Dremel Tool</li><li>• Sander</li></ul>

## Step by Step

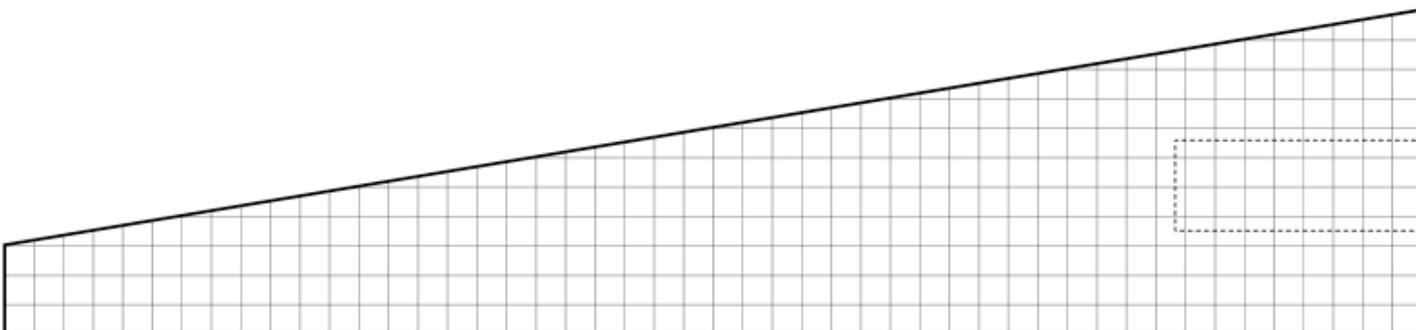
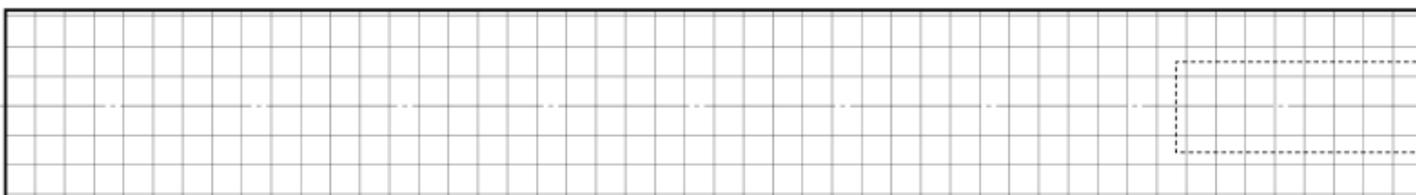
**Step 1: Thumbnail Sketches** - Thumbnail sketches are little. Be Creative. Don't be afraid to experiment with some strange designs. They do not have to have much detail. They are quick sketches that give you simple ideas (brainstorm). Develop 4 on your Research and Design Sheet.

**Step 2: Rough Sketches** - Develop 2 rough sketches. Each set of rough sketches must have a top and side view of the thumbnail you have chosen. Lightly draw your designs in the boxes below. When you are satisfied with the outline of your car, darken the lines. Finally, lightly shade in the design adding any paint designs you may wish to add. **Make sure to decide the final length of the car.**

### Design One



### Design Two



**Step 3: Working Drawings** - Decide which of the two sets of rough drawings you like best. Show it to other students in your class. Discuss your idea with them. Draw your design accurately on your Research and Design sheet supplied by your teacher. These drawings must not be rushed. Follow all the measurements listed below.

<b>Factors</b>	<b>Minimum</b>	<b>Maximum</b>
<b>Dragster Body length</b>	200mm	305mm
Body height with wheels		75mm
Body weight (completed car without CO2)	50g	80g
Body width at axles, front and back	35mm	42mm
Vehicle total width (including wheels)		90mm
<b>Axles/axle holes/wheelbase</b>		
Dragsters must have two (2) axles per car, no more	2	2
Bottom of axle hole or bearing above bottom of car (measured at sides)	5mm	10mm
Axle hole from front or rear of car	9mm	100mm
Wheelbase (axle distance apart at farthest points)	105mm	270mm
Bearings, bushings and lubricants may be used.	yes	yes
<u>Spacer washers</u> Silicone or any other type of glue/adhesive may not be used in place of wheel clips to hold wheels or axles in place.		4
<b>Power plant (CO2 cartridge hole)</b> The power plant hole must be at the farthest point at the rear of the car and must be drilled parallel to the racing surface to assure proper puncture of the CO2 cartridge. A minimum of 3mm thickness around the entire power plant hole must be maintained on the dragster for safety. There should be no paint inside the CO2 cartridge hole.		
Hole depth		52mm
Safety zone thickness	3mm	
Chamber diameter	19mm	20mm
Lowest point of chamber diameter to race surface (With wheels)	26mm	40mm
<b>Eye screws</b> Dragsters must have no more than two (2) eye screws per car that meet tolerances. Eye screws must not make contact with the racing surface. The track string must pass through both eye screws, which are located on the center line of the bottom of the car. Glue may be used to reinforce the eye screws. It is the responsibility of the car designer/engineer to see that the eye screw holes are tightly closed to prevent the track string from slipping out.	2	2
Distance apart (at farthest points)	150mm	270mm
<b>Wheels</b> A dragster must have exactly four (4) wheels. All four (4) wheels must touch the racing surface at the same time. All wheels must roll. Wheels must be made entirely from plastic.		

**Step 4: Drilling Axle Holes -**

1. Cut out the top and side view templates using a scissors.
2. Tape the side view to the body blank given to you by your teacher.
3. Using a **11/64"** drill bit. Drill your axle holes using the drill press.(Following Safety rules.)

**Step 5: Cutting** - (Follow all Safety Rules)

Side View - Use the band saw to cut out the side view of your drawing. Make sure you get permission to use the band saw before you start to cut. Take your time. Make sure you cut on the waste side of your line. If you make a mistake your car will surely change. Any such change may disqualify you from racing.

Top View - Use the band saw to cut out the top view of your drawing. Once again, take your time. Make sure you cut on the waste side of your line. If you make a mistake your car will surely change. Any such change may disqualify you from racing.

**Step 6: Shaping** - Carefully use a rasp, wood file and sandpaper to round and smooth your dragster. This is one of the most important steps. Take your time. Hollowing out the body can be done in a number of ways. A drill can be used to drill various sized holes from the bottom of the car. A chisel can be used to remove the wood that is unwanted. Begin by working the rough spots with rasps and files gently, then smooth with sandpaper. The body blank will sand fairly smooth. Take your time and remember that craftsmanship here will pay big dividends in the race.

**Step 7: Painting** – Place CO2 hole onto the painting fixture use as a handle. Now you can begin to paint your car by hand. (Your car is required to be painted)

1. Take time to put on a thin coat instead of a thick messy coat. Remember to wash you brush out when finished with the first coat. Allow the first coat to dry overnight, then lightly sand away the imperfections with fine sandpaper. You now give your car a second coat.

**Step 8: Wheels and Screw Eyes** - Follow the instructions of the teacher as we assemble the wheels and put the screw eyes on during class when everyone is ready.

**Step 9: Testing** - Weigh your CO2 car on the scale.

**Co 2 Dragster Design  
Check List\***

1 Piece body construction	
Body length <b>200-305 mm</b>	
Body Height w/ wheels <b>75mm</b>	
Body Mass: <b>Min 55 to 80 Max grams</b>	
Body width at axles: <b>35-42mm</b>	
Vehicle total width: <b>90mm</b>	
<b>2 axles</b> per dragster	
Axle hole <b>above</b> car bottom: <b>5-10mm</b>	
Rear axle hole: <b>9-100mm</b>	
Wheelbase: <b>105-270mm</b>	
Bearings, bushings, lube OK	
Spacer washers: <b>4 MAX</b>	
End of car, no paint in the hole	
Hole depth: <b>52mm</b>	
Safety Zone thickness: <b>3mm</b>	
Chamber Diameter: <b>19-20mm</b>	
Low point of power hole: <b>26-40mm</b>	
2 screw eyes MAX, glue OK	
Screw eye distance: 150-270mm	
4 wheels required	