

CARteens



CO₂ DRAGSTER

WOOD BASE

THE PURPOSE...

The purpose of this activity is to learn the Design Process to design and build a unique, creative, high quality, light, aerodynamic and fast dragster powered by a CO₂ Canister. You will race the car in Single-Elimination competition against the other vehicles in your class, with one car being declared the Champion!

THE PREPARATION...

To complete this activity you will need the following:

- | | |
|---|---|
| <input type="checkbox"/> Internet access | <input type="checkbox"/> 4 screw eyes |
| <input type="checkbox"/> Printer access | <input type="checkbox"/> CO ₂ Canister |
| <input type="checkbox"/> Paper | <input type="checkbox"/> Demonstrated safe use of the Band Saw |
| <input type="checkbox"/> Pencil | <input type="checkbox"/> Demonstrated safe use of the Scroll Saw |
| <input type="checkbox"/> Eraser | <input type="checkbox"/> Demonstrated safe use of the Drill Press |
| <input type="checkbox"/> Ruler | <input type="checkbox"/> Wood rasp |
| <input type="checkbox"/> Scissors | <input type="checkbox"/> Files |
| <input type="checkbox"/> Wood dragster blank | <input type="checkbox"/> Sandpaper |
| <input type="checkbox"/> 2 - 1/8" metal rod axles | <input type="checkbox"/> Paint |
| <input type="checkbox"/> 4 - 1/8" washers | |
| <input type="checkbox"/> 4 wheels | |

THE PROCEDURE...

There are six stages to the Design Process that we will be using for our dragster: Research, Brainstorming, Sketching, Drafting, Prototyping, and Testing.

Paper is cheap! It is always better (and cost-effective) to mess up many sheets of paper than it is to mess up even one piece of wood!

Since you are going to come up with a fantastic unique dragster, you have to do more than grab a piece of wood and start hacking it up. All top designers research their market for ideas to help them design. They use brainstorming to try out ideas on paper before any material is used. Good designs are sketched out in detail, and critically evaluated. The best design is then selected, and drafted in perfect detail and quality. This final design is then used as the "blueprint" for production.

The first three stages are the most critical - quality time **must** be spent here to ensure quality results!

Terminology:

Can you imagine what would happen if cars were not well planned and tested before being mass produced?

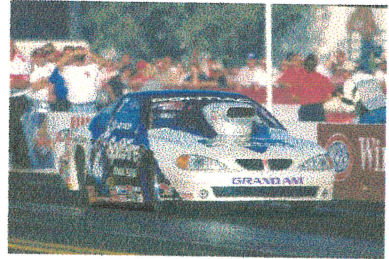
We would have ugly cars, dangerous cars and cars too expensive to buy!

Imagine if just one step in the design process were skipped!

Doorslammer A vehicle in which the doors are attached and fully functional.

Traditionally the body is still metal, although other materials such as fibreglass or carbon-

fibre can be used for fenders, doors, hoods and trunks. An example of this is the "Pro Stock" class



Imports:

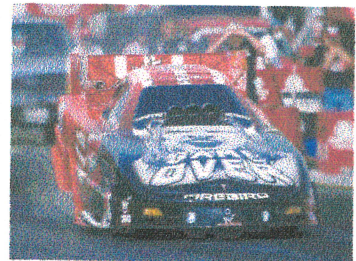
A vehicle that has traditionally been manufactured outside the North American continent. The term is a misnomer, as many

"Import" companies design and build their vehicles in Canada and the US!



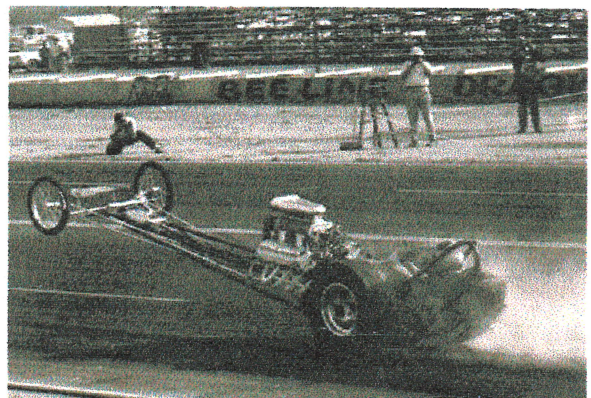
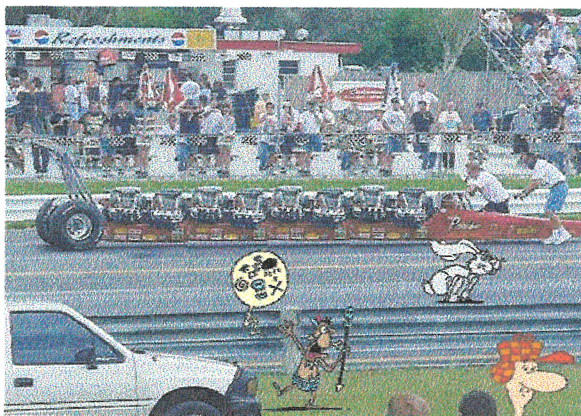
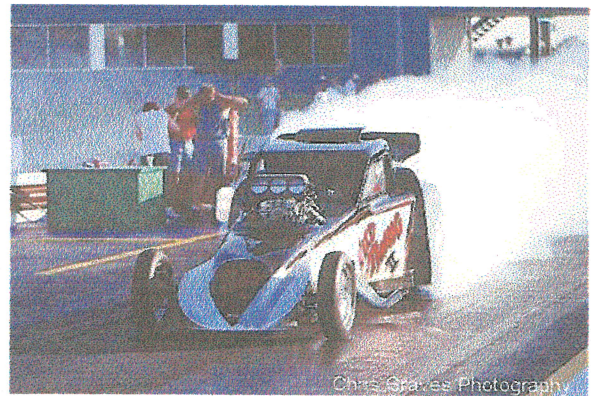
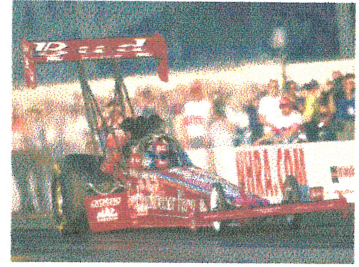
Funny:

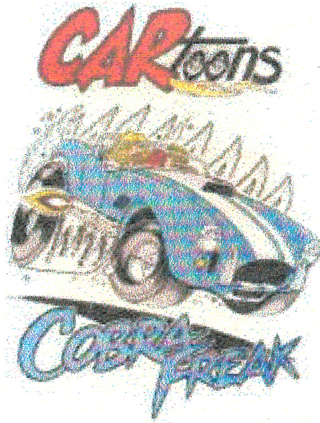
Traditionally a vehicle with a stretched wheelbase, today they are essentially a full-bodied Rail. Also known as a "Flopper."



Rail:

A narrow, tube frame vehicle designed to be the fastest of the fast. 0-300+ Mph in less than 5 seconds.





RESEARCH

STEP ONE

The first step in this project is to get some ideas of what types of dragsters exist.

A "Dragster" is a vehicle that is used in "Drag Racing." Drag Racing is a straight line, acceleration race where two vehicles race side-by-side from a standing start to maximum speed within 1/4 mile. The first one across the finish line is the winner.

The origin of the term "Drag Racing" is somewhat unclear. Explanations range from a simple challenge ("Drag your car out of the garage and race me!") to geographical locale (the "main drag" was a city's main street, often the only one wide enough to accommodate two vehicles), to the mechanical (to "drag" the gears meant to hold the transmission in gear longer than normal).

The first "dragsters" were little more than street cars with lightly warmed-over engines and bodies chopped down to reduce weight. Eventually, professional chassis builders constructed purpose-built cars, bending and welding together tubing and planting the engine in the traditional spot, just in front of the driver; the engines, and the fuels they burned, became more exotic, more powerful, and, naturally, more temperamental.

Your First Assignment!



Using the Internet, find at least six examples of dragsters that you like. Although you may choose from "Doorslammers" to "Imports" or "Funnys," The type of dragster that you may find the easiest to emulate is the "Rail." The six examples you find should be printed out and handed in with your name printed on the top right of the page.

Another element in research that you must know is Parameters. "Parameters" are rules that you must follow in designing your

dragster. All competitions have rules; some to ensure safety, some to prevent an unfair advantage, and some to maintain intentions of the competition. Our CO₂ Dragster has rules too! It is very important that you read and understand the rules to ensure your dragster's success!

CO₂ DRAGSTER RULES	
Body Limitations	
Length	8" (230mm) - 12" (300mm)
Width	3/8" (10mm) - 1 5/8" (42mm)
Height	2 3/4" (70mm) maximum
Axle Housing	Fully enclosed
Colour	Must be painted
Material	Softwood
Power Plant Limitations	
Size and Material	Metal Cartridge
Location	1 1/4" (32mm) from car bottom to centre
Housing Size	Totally enclosed with 1/8" (3mm) thickness around cartridge
Axle, Bearing, Wheel Limitations	
Axle size and material	1/8" (3mm) diameter metal rod
Bearing size and material	3/16" (4mm) drinking straw
Wheel size and material	1 5/8" (39mm) plastic
Axle location	Centerline 3/8" (9mm) from car bottom
Steering System Limitations	
Screw eye alignment	Centerline along car bottom
Distance between screw eyes	Minimum 6" (152mm) apart

Make sure you know the rules! You don't want to build a dragster that would be disqualified from competition!

BRAINSTORMING

STEP TWO

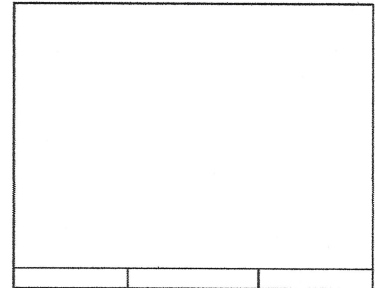
Drawings should speak for themselves. This is not a **Salvador Dali** exhibit - if you have to explain it, redraw it!

Brainstorming involves drawing small sketches of what your dragster is going to look like. These sketches should be around 2" in size and should be good quality pictures. Explore different design possibilities, and don't be afraid of making something that looks "stupid" - that's all part of the design process! Don't erase any mistakes! In Brainstorming, there is no such thing as mistakes. Letting your mind run with ideas will allow you to produce the most creative, unique design of them all!

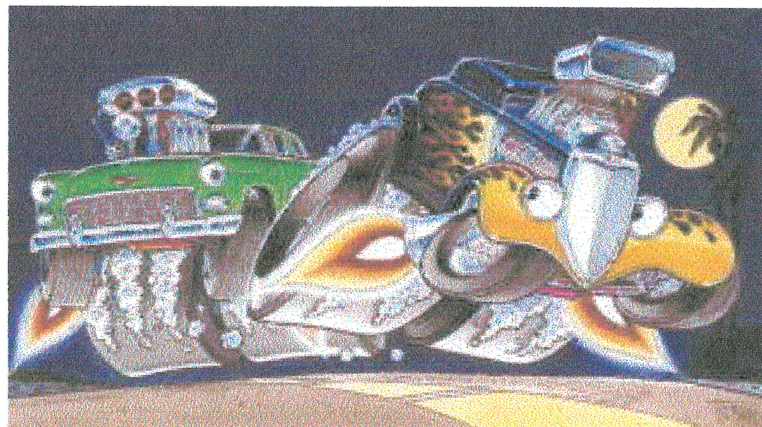
Your Second Assignment!

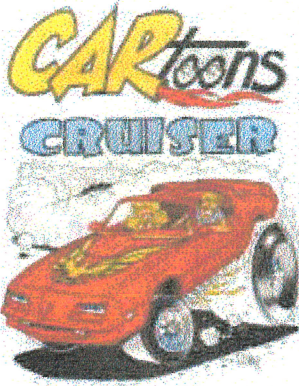


Prepare a blank piece of paper with a border and a title block as shown at the right. Use a ruler to ensure straight lines for the border. In the title block, put the date on the left, "CO₂ Brainstorming" in the centre, and your name on the right.



Sketch at least 10 different, unique, creative potential designs for your dragster in pencil on this paper. Be creative!






SKETCHING

STEP THREE

Sketching is where you explore some of your brainstorm drawings in finer detail and in even higher quality. In these drawings, you will be drawing in Orthographic Format. "Orthographic Format" is a three-view drawing showing the top, side and front views.

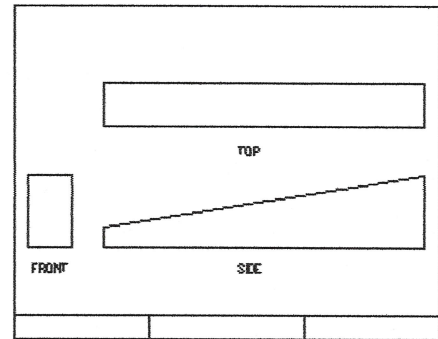
The top view is always **directly above** the front view. The side view is **directly beside** the front view. Ensure that the depth of the object is shown the same on the top and side views (rookie mistake).

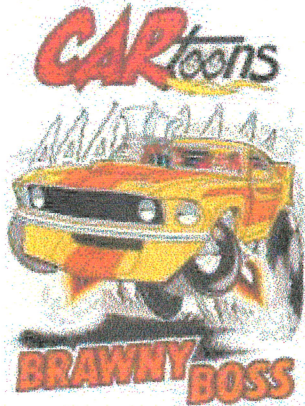
Your Third Assignment!



Prepare three blank pieces of paper with a border and a title block. In the title block, put the date on the left, "Sketching #1" in the centre (or #2, #3, depending), and your name on the right.

Choose your three favourite brainstorming sketches, and draw each one in pencil on it's own piece of paper. Arrange the three views as shown to the right.





DRAFTING

STEP FOUR

This drawing is shown in exact detail and is drawn to exact scale. In these pictures, show absolutely all the detail you can. If there are important details that you can not see, draw another view depicting those details. You should be able to give these designs to someone from a different class, and they should be able to build the product for you! If they can't, it is your drawing that is at fault! This drawing is essentially your "Blueprint."

Detail! Detail!! Detail!!!

Your Fourth
Assignment!



Get a CO_2 Dragster Template from your instructor in order to complete this drawing. This final drawing will act as your blueprint and template used in production. Ensure that this drawing is as high quality and as high accuracy as you can possibly make it - the success of your project depends on it!

Make sure your dragster conforms to all the required parameters!

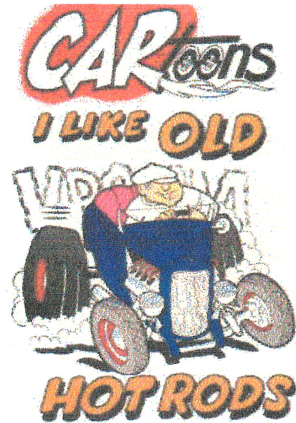
Show your finished drawing to your instructor. If and only if it is perfect, will you receive your materials to complete the next step!

The "Blueprint" process:

In the Bad-Old Days, hand-drafted plans were placed on top of paper treated with a photosensitive solution; the paper sandwich was then rolled out onto platforms outside the window to be exposed to the sun.

After the exposure, the paper was processed; it turned blue except where the lines of the original drawing had covered it, where it stayed white.

Today, the blueprint process is only recently obsolete, yet the term "blueprint" remains firmly embedded in our daily vocabulary!



PROTOTYPING

STEP FIVE

This stage is where all your intense planning and effort come to fruition. This is where your design will sink or swim.

Whether you use carefully made patterns, or you carefully measure and mark the material directly, be particularly careful in this stage of layout. *Measure three times, cut once.* Sometimes materials can be so expensive or difficult to obtain, that even a simple mistake can become a very costly one!

Your Fifth
Assignment!



- Carefully cut out your drafted drawing
- Use a pen to trace the side profile pattern onto the wooden dragster blank
- Carefully mark the axle holes
- Drill the axle holes in the wood block
- Use a band saw to cut out the side profile
- Use a pen to trace the top profile pattern onto the wooden dragster blank
- Use a band saw to cut out the top profile
- Use a rasp to shape the dragster closer to what you had designed
- Use a file to smooth the dragster, removing all the rasp marks
- Use coarse (60 grit) sandpaper to remove all the file marks
- Use medium (150 grit) sandpaper to remove all the coarse grit marks
- Use smooth (220 grit) sandpaper to smooth the surfaces into a beautiful, perfect finish
- Cut and install drinking straw bearings
- Use a file to smooth the ends of the axles
- Insert axles into bearings
- Place washers into position
- Force wheels onto axles

Do not put paint on so thick that it runs!

Two thin coats are much better than one thick one!

- Be certain that the wheels are securely attached to the axles, and that the axles turn freely
- Insert the screw eyes
 - Make sure you have proper ground clearance
 - Make sure the screw eyes are aligned and centred
- If everything looks good, and the vehicle rolls easily and straight, carefully disassemble the car and prepare it for paint
 - Check the entire vehicle over for nicks or scratches that must be removed
 - Use your hands - they can "feel" imperfections easier than your eyes can see them
 - Any imperfections left now will show up hideously when the vehicle is painted
 - Only if it feels good are you ready for paint
 - Ask your instructor for a painting stand for your vehicle
 - If you are using a brush to paint, use a small brush ($\frac{1}{2}$ " wide) and use acrylic paint in a well ventilated area
 - If you are using spray paint, shake the can for at least one minute to mix the paint
 - Use a cardboard box or something to prevent over-spray from getting on anything in the shop!
 - Hold the can about 10" away, and lightly "mist" the paint onto the vehicle - this is only a very light coat of paint!
 - After about 10 minutes, inspect the surface and the paint of the dragster
 - If there are any defects, NOW is the time to fix them
 - A light sanding between coats with very smooth sandpaper (320 grit) will produce a very nice finish
 - Apply a second light coat
 - Allow the paint to fully dry for one day before Assembling



COMPETITION

STEP SIX

Race day!

All you planning, designing and fabricating is put to the test today! Are you ready?

Your Sixth
Assignment!

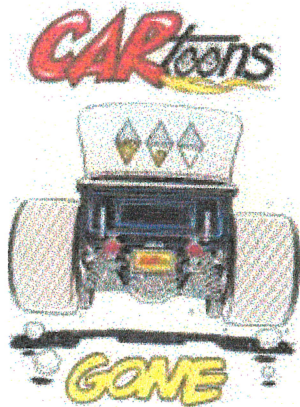


Before we get into the race, do note that some vehicles, like in real racing, may come to an untimely end. It is important to get your car marked on design and construction **before** you race. Give your vehicle to your instructor for marking at this time!

Traditional drag racing is single elimination competition. Each competitor is paired up with one other; the winner moves to the next round, the loser goes home. Regardless of how many rounds in which you *could* compete, your *success* matters in THIS round, right now!

Your instructor will randomly select competitors for the first round. When called, you will place your CO₂ dragster on the guideline, insert a CO₂ canister and adjust the trigger to the height of your vehicle. Place the canister into the trigger, and wait until everyone is ready and out of the way.

When the vehicles are launched, they will rocket to the end of the course, straight if you designed and built your car accurately. The vehicle should be decelerated via a blanket at the end of the course to prevent total destruction. If you won, you go on to the next round!!



CO₂ DRAGSTER	Name:
Complexity of design	/10
Quality of cutting	/10
Quality of shaping/sanding	/10
Quality of assembly	/10
Conforms to rules	/10
TOTAL:	/50

CO₂ DRAGSTER	Name:
Complexity of design	/10
Quality of cutting	/10
Quality of shaping/sanding	/10
Quality of assembly	/10
Conforms to rules	/10
TOTAL:	/50

CO₂ DRAGSTER	Name:
Complexity of design	/10
Quality of cutting	/10
Quality of shaping/sanding	/10
Quality of assembly	/10
Conforms to rules	/10
TOTAL:	/50

CO₂ DRAGSTER	Name:
Complexity of design	/10
Quality of cutting	/10
Quality of shaping/sanding	/10
Quality of assembly	/10
Conforms to rules	/10
TOTAL:	/50