

WHIZZING ON FIZZ

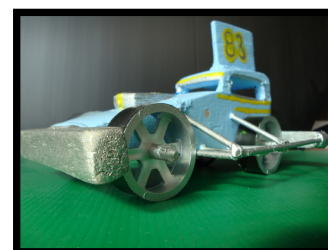
Building CO2 Powered Cars with Primary School Students

Bruce McKenzie, 2 McCarthy St Hawera, 062787786, 021657877,
brucenancy@xtra.co.nz



A CAR KIT...includes:

- ☐☐the specified standard wheels,
- ☐☐a balsa base block with two axle pilot slots and a hole to take the charger,
- ☐☐four pieces of add-on balsa to be cut, shaped and attached as needed,
- ☐☐two screw eyelets (to accept nylon monofilament running underneath the car from front to back,)
- ☐☐two plastic axle rods, (larger than necessary so they can be trimmed them to the size required,)



DESIGN IDEAS

Building W CARS Notes

An essential part of building a CO2 W CAR is having the right tools BUT YOU DON'T NEED A HEAP OF EXPENSIVE TOOLS. Quality cars can be shaped from simple hand tools such as a coping saw, files, rasps and potato peelers. 60 grit sand paper is also good for shaping. Use loose pieces but also glue some to flat pieces of 6 or 9 mm mdf about 150 x 300mm long and fix them to an old desk or bench with small nails. Other grades of sandpaper (120, 180) help create a smooth finish

Craft knives should be used under one-on-one adult to child supervision and there needs to be lessons in how to use them. How to LOCK THE BLADE, TO HAVE

PROTRUDING ONLY 20mm, TO WORK AWAY FROM BODY AND OTHER HAND, TO HAVE TO BLOCK HELD DOWN ON A FLAT FRICTIONED SURFACE AND NOT HELD IN THE OTHER HAND.

It's best to avoid power tools for safety reasons but a cordless drill and a scroll saw are OK to use under adult supervision.
ALWAYS EMPHASISE SAFETY – HAVE THE USER WEAR EYE PROTECTORS.



Although the chances of an accident are minimal, it is just good training for students to get into the habit of thinking SAFETY...

Teach the children how to hold and use the tools.

Have them take their time and constantly check each piece they are shaping against their 'plan' so that they do not take too much material away through over zealousness.



Always have them CUT TO A LINE! Have them mark the balsa with lines that they intend to cut or shape to rather than cutting based on guesswork.

DRAW UP A PLAN

Let the children 'play' with the blocks, fitting them in different ways to get a feel for the material and how they would like it to come together. There is nothing wrong with templating; it assists thinking and in design work it is an excellent tool, so...



Get them to draw around the shapes onto coloured thick paper/thin cardboard. Use the limits of the paper shapes to pencil on different ways they may wish to cut the blocks. These could be cut out with scissors and glued to a background piece.



SHAPING THE PIECES

Once you have decided how your car will fit together, shape the pieces with the requisite tools. Do as much of the finishing work prior to joining because once joined it is often hard to get into small corners to smooth them down.



GLUING PIECES TOGETHER

Always mark where the pieces are to fit so that after glue application you can re-align the pieces exactly where you want them. Make sure there is a good amount of flat surface area for gluing shapes together. Kids often think that glue will hold at a point or line when what is needed is clean slightly roughened surface area for glue to work well. Glue works best when the two surfaces being joined are touching each other. They may be held together by fingers, weight or pressure from tape while the glue sets (cools.)

Aim for a seamless join. Don't use too much glue and spread it over as much of the surface area as possible. HOT GLUE GUNS ARE EXCELLENT HERE...



FINISHING

You can use school/art acrylics or any suitable paint to finish the cars. Avoid spray paints. Use small stiff brushes, the smaller the better. Apply two or three coats. Let them dry and sand between coats. Try for a smooth finish. Finish with decals and logos. Spray with a clear acrylic lacquer to seal the paint off and stop it flaking or powdering.

Finally, screw the eyelets into the base of the car at points A and B below, making sure that the shaft of the back eyelet at A doesn't break through into the powerplant chamber.



SPECIFICATIONS

There are limits placed on design (just as with designing things in any situation) and the children can learn from these by having to measure and weigh according to those limits.

They are:

1. Length minimum 130mm maximum 220mm
2. Height minimum 45mm maximum 75mm
3. Width minimum 40mm maximum 100mm
4. **Rear Overhang.** any added part (e.g. a spoiler) may overhang the rear of the main block by no more than 25 mm.
5. **Power plant.** The 19mm hole designed to accept the co2 charger at the rear of the vehicle must have at least 3mm of timber surrounding it at all points.
6. **Weight.** The car shall weigh at least 50 grams.



Most of the limits are to ensure safety and that the car can fit into the starting equipment on the track.

Basic Tools

- ☐ Wood rasp
- ☐ Half-round wood file
- ☐ Coping saw or small hack saw
- ☐ Sandpaper 80, 120, 180 grit
- ☐ Ruler (or other measuring device)
- ☐ Scissors
- ☐ School acrylic paints
- ☐ Clamps
- ☐ Crafts knives
- ☐ Sanding boards
- ☐ Hot glue gun
- ☐ Masking tape
- ☐ Potato Peelers



RACING: (the fun part..)

(We hire the launching gear at a nominal rate to schools for a period of two weeks as long as they promise to pay for the return of the gates within that period of time. Have you booked a set? Email us!)

Teachers and students together can decide how they will run a competitive challenge. They can invite "spectators" and set the racing up as though it is a real Drag Meet.

Below provides pictures to give some idea of the launching gear we hire

You will also need CO2 chargers, probably two per car.

They come in boxes of 10.

...FROM THE NOTES PROVIDED FOR LAUNCHER ASSEMBLY.



You will need these to assemble the gates...

Duct tape, pillow, 30lb monofilament, cordless drill...

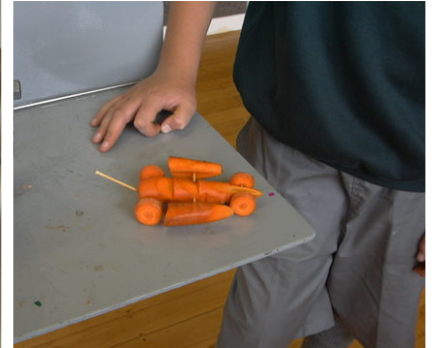


Exploded view of launcher

Phone us on the numbers below at anytime shc

CARROT CARS

Define the challenge that suits your class...



Some carrots and kebab sticks



A method for testing them...



A few simple tools...



An opportunity to teach craft knife safety..



A ramp.

Useful Advice...

This set of instructions is for teachers and is the “bones” of the concept, having applied none of the finesse and imagination that I know your students will.

First and foremost...teach safety when using craft knives.

Craft knives should be used under direct adult to child supervision and there needs to be lessons and practise in how to use them.

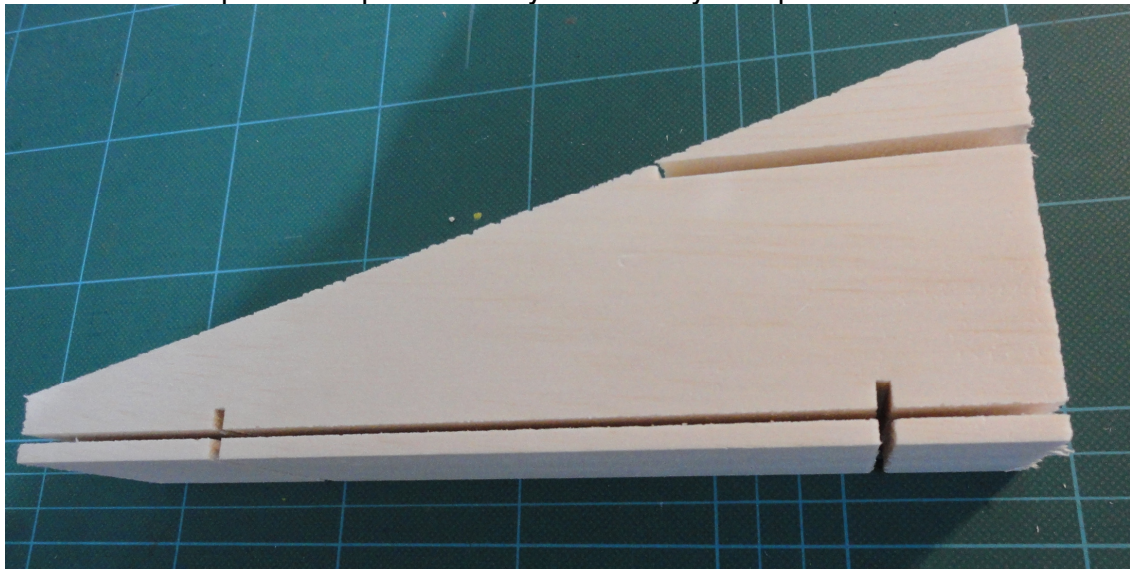
How to:

- LOCK THE BLADE;
- HAVE IT PROTRUDING ONLY 20mm;
- WORK AWAY FROM BODY AND OTHER HAND;
- TAKE SMALL CHUNKS;
- HOLD THE BLOCK HELD DOWN ON A FLAT FRICTIONED SURFACE;
(provide a frictioned surface by gluing 80 grit sandpaper to a table surface...)
- NEVER HOLD THE BLOCK IN ONE HAND OFF A SURFACE WHILE CUTTING WITH THE OTHER.



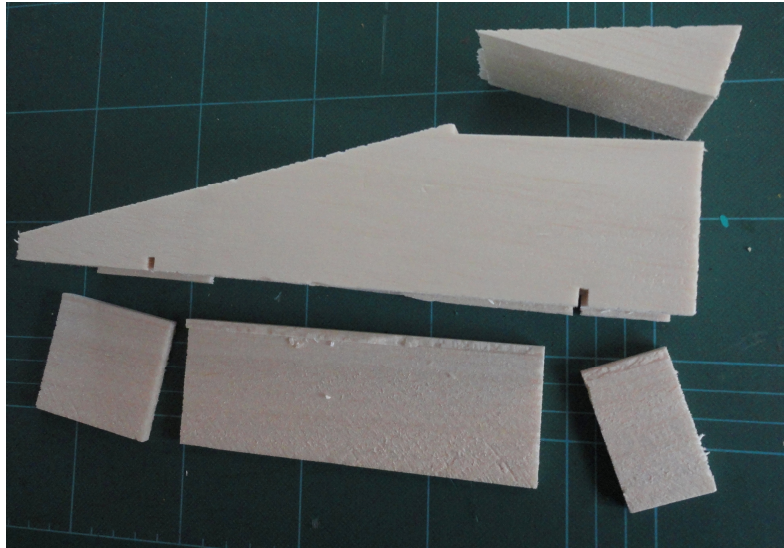
Be a good judge of who you think has the coordination to use a craft-knife.

This block is cut to provide 5 pieces ready to carefully “snap” off.



The big one forms the “chassis” and the other smaller pieces can be shaped with tools and sandpaper then hot glued into place to form the additions to the chassis to make each vehicle a student’s own.

Let the students experiment with the shapes freely, thinking about how they wish to fit them together, similar to the way pre-schoolers “play” with blocks stacking and pulling apart and rearranging them.



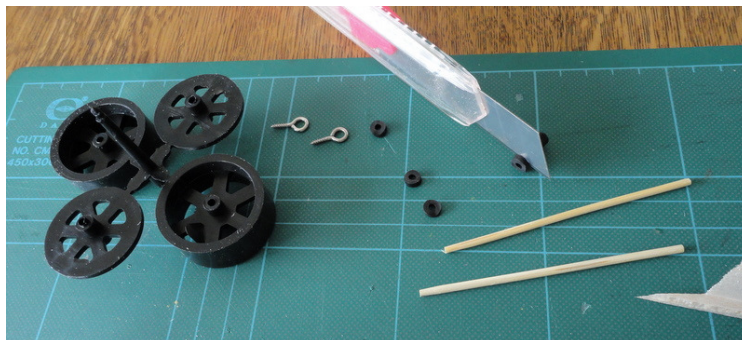
Glue some 600mm lengths of 60 to 80 grit sandpaper to the top (and at the edge) of an old school desk or to boards of 9mm mdf cut to the same size as the paper. Use PVA and put weights on the paper to hold it in place while it dries overnight. The mdf blocks can be nailed to a flat surface such as an old desk.

The students can then remove the “lips” created when breaking off the body parts by rubbing them across the sandpaper.

The sandpaper bench can also serve as a shaping device for the smaller pieces. The aim is to shape them to look more like car body parts and less like blocks of balsa timber. Encourage the students to use more than just one part. Let them know that the only limitation is that their vehicle should not be any wider than 100mm.

Build a 100mm tunnel which they can use as a testing station.

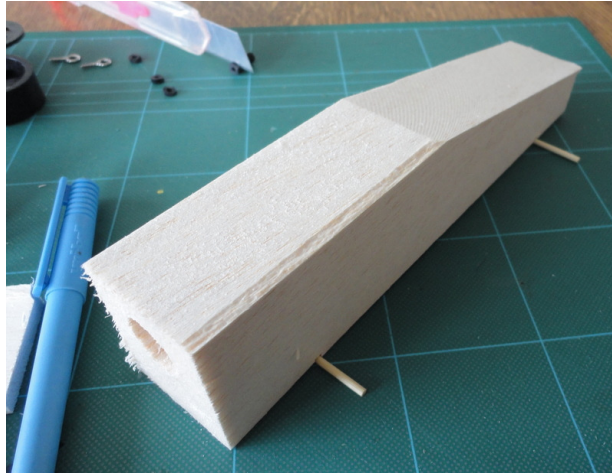
THIS PICTURE SHOWS THE WHEEL ASSEMBLY PIECES



The axles can be cut for length. A good tool for this is a pair of side cutters.

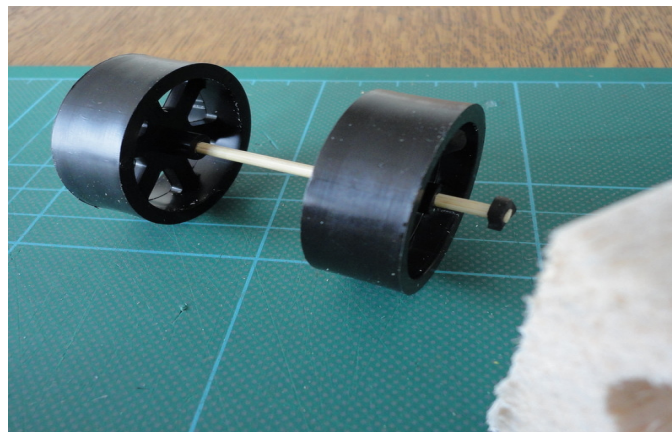
The rubber “hub nuts” can be cut to about 3mm long. Once in place a dab of hot glue will permanently fix them.

The back wheels fit onto the vehicles one way only. Have the protruding hub in against the body of the vehicle.

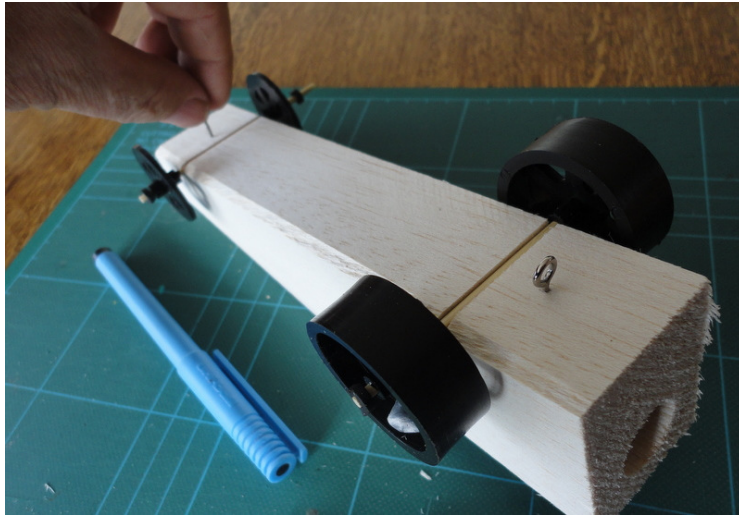


Sellotape the axles in place at first so that adjustments can be made if they need it.

Test on a ramp to make sure the wheels turn and the vehicle travels straight. Modify as necessary then hot glue the axles in place.



The back wheels fit onto the vehicles one way only. Have the protruding hub in against the body of the vehicle.



Remove the wheels and mask out the axle stubs when it is time to paint.

The paint types in the picture below work well because they dry quickly.

Supply different brush sizes; thin brushes take longer to complete the paint job but the students can control them better and you tend to get better results.

Allow to dry between coats.

Apply an over-all colour first then let that dry then add the embellishing colours. Lighter colours should be applied first.



Axle Material

White plastic axle rods have been included with your kits.

The manufacturer found it difficult to produce them with a consistent diameter.

The students could drill the wheel-hub holes out a little to compensate if it is needed.

Use a **3 .5mm** bit. **1**

A big advantage with this material is in the fitting of them to hold the wheels on. It can be done rather neatly and with far less likelihood of the wheels riding off the axle.

If you heat the ends of them and push them onto a smooth flat surface the ends will splay slightly forming a bead which should hold the wheels on the axles nicely and look tidy too.

You could use a soldering iron which is the easier way, but if you don't have one, use a candle and a small glass dish with 2cm of water in the bottom. **2**

Heat the end of rod over a candle for about 3 or 4 seconds. **3** Push the end down onto the glass surface of the bottom of a small dish. The rod end should splay nicely. **4**

Don't forget to put the wheels on before you do the other end.

Place the axle in the wheel groove and fix with a dab of hot glue. **5**

