How to make a chair-o-plane

Follow this step-by-step guide on how to make your own chair-o-plane.

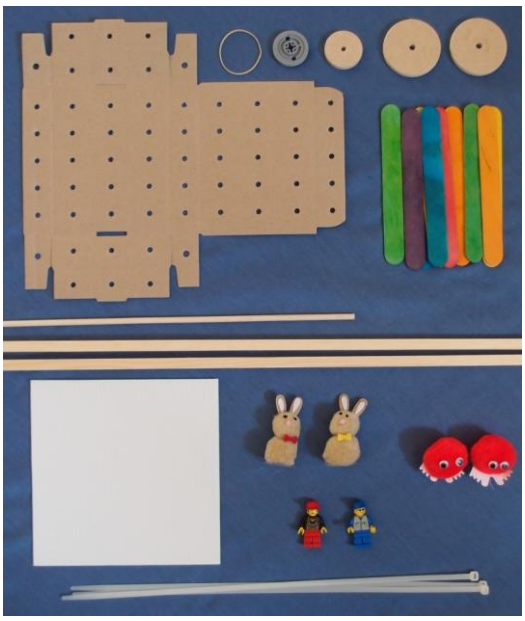
Associated resources:

- Fairground Rides lesson plan
- Fairground Rides lesson presentation
- Fairground Rides worksheet & suggested answers
- Fairground Ride Design sheet

You will need:

Electrical Parts

- Battery holder
- AA zinc cell
- Toggle switch
- Motor
- Motor mount
- 3 crocodile leads



Mechanical Parts

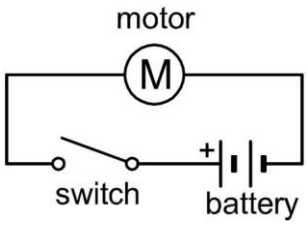
- Focused task box
- Rubber band – 1.5 mm x 1.5 mm x 6 cm long
- Plastic pulley 30 mm diameter
- 35 mm diameter wheel
- 2 wheels with 6 mm diameter hole
- 11 giant lolly sticks
- Wooden rod 5 mm diameter x 25 cm long
- 2 lengths of square section wood 60cm long
- Sheet of 3 mm thick corrugated plastic sheet 17 cm x 17 cm
- 6 passengers (lightweight plastic figures, small soft toys, bugs, pompoms or small pine cones with googly eyes or smaller – try to use pairs with roughly equal weight so that they balance) 3 cable ties 30 cm long.

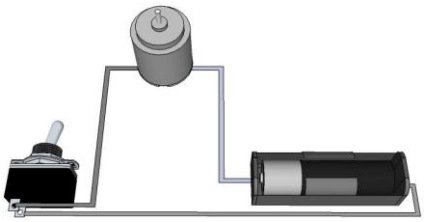
Tools and consumables

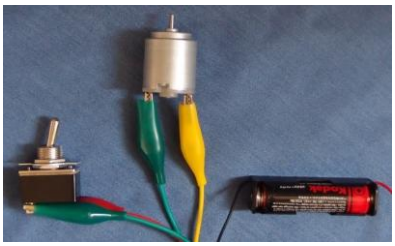
- Ruler
- Pencil
- Pencil sharpener
- Blu-Tack
- Pair of compasses or a plate about 16-17 cm diameter
- Protractor
- Large scissors
- Junior hacksaw and vice
- Sandpaper
- Sellotape
- Low melt temperature glue gun
- Secateurs (optional – to be used by adults only)
- Corrugated plastic or card offcuts and decorations

Step 1

Make this circuit and check that the motor shaft goes round when you switch on. Be careful not to short circuit your battery (i.e. connect the wires from your battery directly together) – they must go via the motor. Switch off once checked.

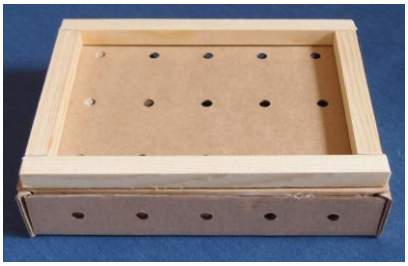






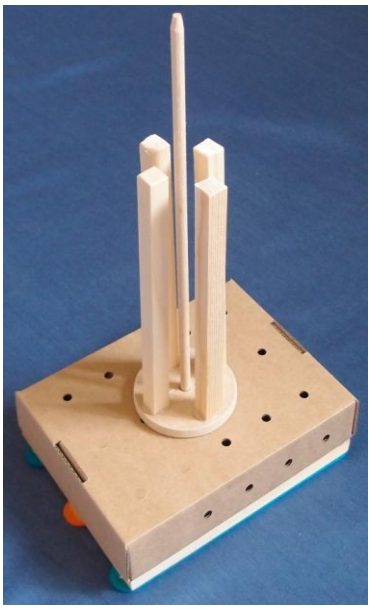
Step 2

Fold up the focused task box and glue the final seam to make a cardboard base. Cut two 14 cm lengths of square section Wood and two 8.5 cm lengths. Smooth the ends with sandpaper. Make a rectangular frame out of the wood and glue it to the base as shown. Take three giant lolly sticks and glue them onto the frame, with one stick either side and one in the middle. Turn the base over.



Step 3

Use the pencil sharpener to sharpen the wooden rod slightly at the top and bottom. Slide it down through the two holes in the base so that it resets on the central lolly stick. Using this as a guide, take one of the wheels with a 6 mm hole (it should be very loose on the wooden rod) and glue it to the top of the base, without getting glue on the rod or in the central hole.



Step 4

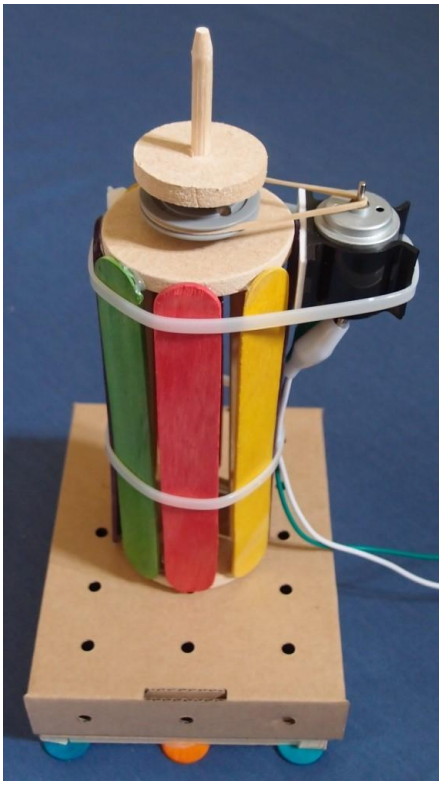
Mark and cut four 14 cm lengths of wood, trying to make them the same length and the ends square. Smooth the ends with sandpaper. Glue the ends of the lengths of wood onto the wheel, and then glue the second wheel with the 6 mm hole onto the top, again using the rod as a guide. Remove the rod so that you don't get glue on it. Glue the ends of the eight remaining giant lolly sticks onto the two wheels as shown.

Step 5

Make a mark 5 cm from the end of the rod and push on the pulley so that it covers the mark. The pulley can be a very tight fit. You could use a 5 mm drill or reamer to open up the hole in the pulley, or you could clamp the rod in a vice so that the mark is just showing and use your weight to push the pulley down the rod. Push the 35 mm diameter wheel onto the short end of the rod until it is about 1 cm from the pulley. If it is loose, glue it to the rod. Sharpen the end of the rod furthest from the pulley to reduce friction – it should be tapered but not spikey.

Step 6

Clip the motor into the motor mount; push it in from the end as shown, not from above, to avoid snapping the motor mount. Stick the mount to the top of one of the lolly sticks as shown. Attach it firmly with a cable tie. Use a second cable tie to attach the crocodile leads to the central column to stop them from getting in the way of the rotating parts when fitted.

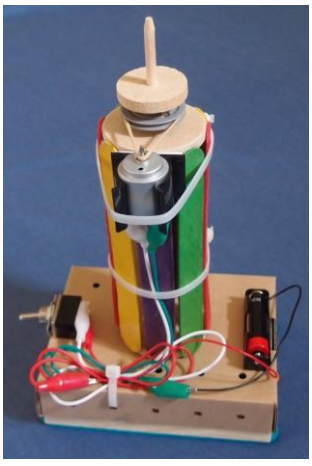


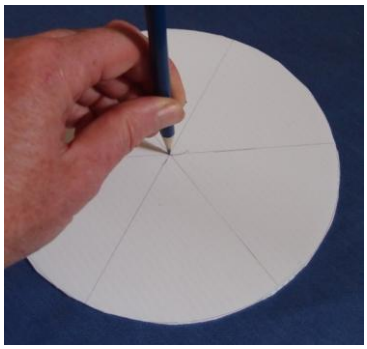
Step 7

Fit the rubber band over the pulley and slide the rod down through the holes until it rests on the lolly stick under the base. Check the pulley is in line with the middle of the motor shaft; you can slide the motor up or down in its mount to achieve this. Stretch the rubber band over the motor shaft, turn on and check the rod rotates. If it is too tight in the holes in the base, you can sand the rod down a bit.

Step 8

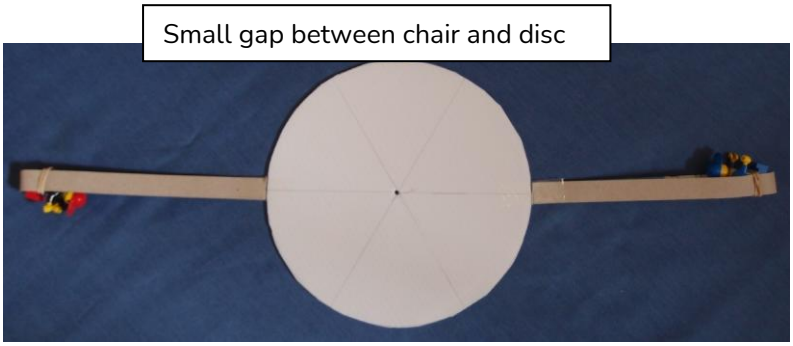
Glue the switch and battery box to the base. Tidy the crocodile leads up and cable tie them to the base. Mark out a circle on the corrugated plastic sheet about 17 cm in diameter and cut it out with the large scissors. Draw a line through the centre then mark out lines 60° to this. Place the disc on a lump of Blu Tack and use a sharp pencil to make a hole in the centre, just big enough to fit onto the shaft. Glue the disc onto the top of the 35 mm wheel at the top of the shaft.





Step 9

Design and make chairs for your passengers using offcuts and spare materials, then Sellotape them firmly to the outside of the disc in the positions you have marked. Leave a small gap between the chair and the disc; the Sellotape should act as a hinge so that the chairs can fly out as the disc rotates. Make sure passengers of roughly equal weight are opposite one another and the chairs are the same length, so that the forces are balanced. You can make seat belts for your passengers using small rubber bands, cable ties or sticking on small offcuts of card or corrugated plastic. Try out your chair-o-plane to make sure it works. You can then decorate it and make any adjustments.



Step 10

You could stick a piece of brightly coloured insulating tape onto the fairground ride (near the middle so that you can see it as it rotates) and time 10 revolutions, to work out the number of revolutions per minute (rpm). You could estimate the diameter of the circle travelled by the passengers, work out the circumference, multiply by the rpm, then convert your units into miles per hour to find out how fast the passengers are travelling. For example:

10 revolutions takes 8 seconds, so revolutions per minute = 8 x 60/ 10 = 48 rpm
Diameter of circle travelled by passengers = 0.38 m, so circumference = π x 0.38 = 1.2 m
Distance travelled in one minute = 48 x 1.2 = approximately 58 m
Distance travelled in one hour = 60 x 58 m = approximately 3500 m = 3.5 km
Distance travelled in one hour (in miles) = 3.5 x 5 / 8 = 2.2 miles.
Speed = 3.5 kilometres per hour, or 2.2 miles per hour.