

Make your own chair-o-plane

What you'll need

Electrical parts:

Battery holder with AA zinc chloride cell fitted (**do not use alkaline or rechargeable cells** - if you accidentally short circuit your battery these will get hot)

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 60 cm long

Sheet of 3 mm thick Corrugated 17 cm x 17 cm

6 passengers (lightweight plastic figures, small soft toys, bugs or similar - 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

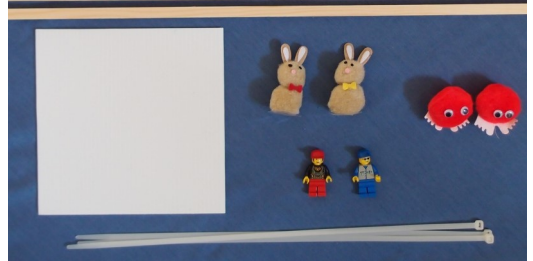
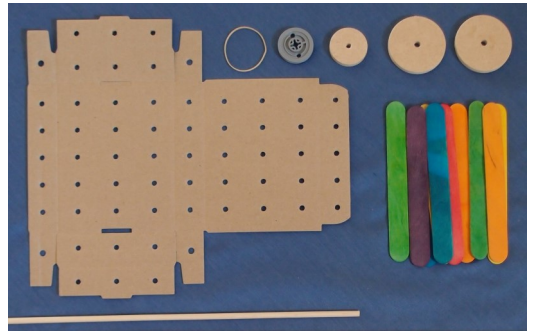
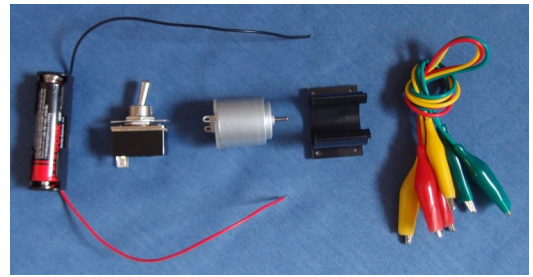
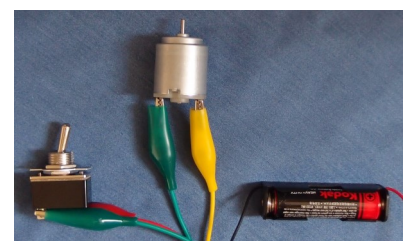
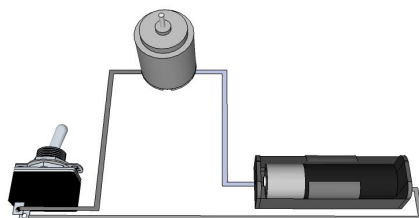
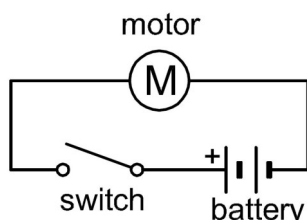
Low melt temperature glue gun

Secateurs (optional - to be used by adults only)

Corrugated or card offcuts and decorations

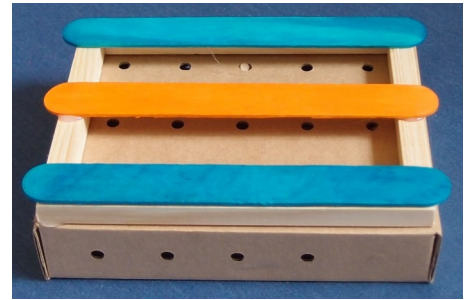
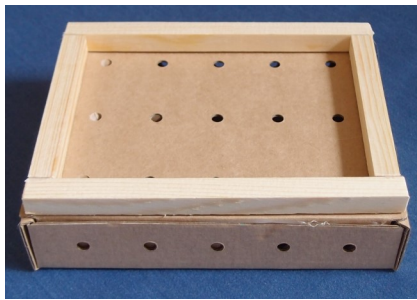
Step 1.

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.



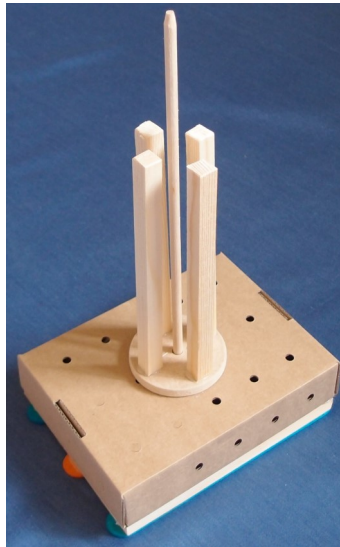
Step 2.

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 rests 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.



rod slightly at the top and bottom.



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. Sharpen the end of the rod furthest from the pulley to a point to reduce friction.

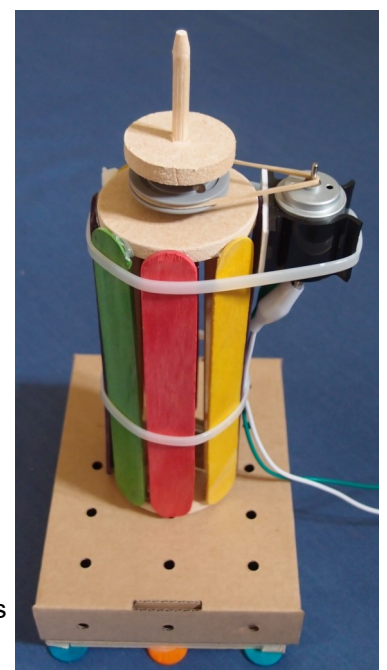


Step 6.

Clip the motor into the motor mount and then stick it 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 getting in the way of the rotating parts.

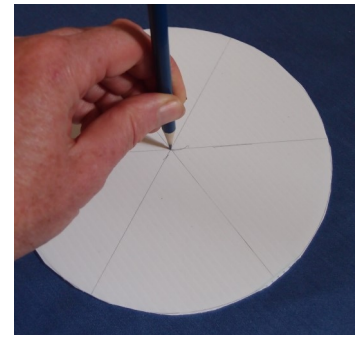
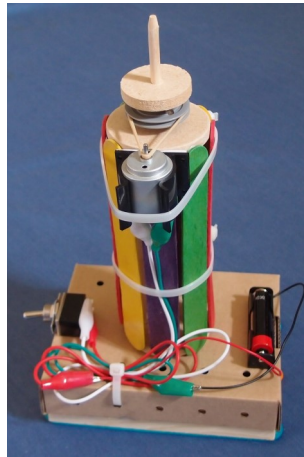
Step 7.

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.



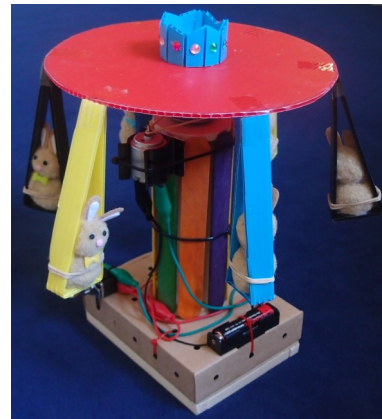
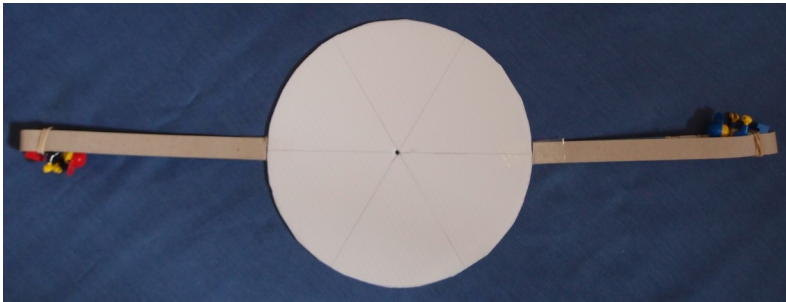
Step 8.

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 Corriflute about 17 cm in diameter and cut it out with the large scissors. Draw a line through the centre then mark out lines at 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. 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 Corriflute. Try out your chair-o-plane to make sure it works. You can then decorate it and make any adjustments.



10.



Step

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 = $8 \times 60 / 10 = 48$ rpm

Diameter of circle travelled by passengers = 0.38 m, so circumference = $\pi \times 0.38 = 1.2$ m

Distance travelled in one minute = $48 \times 1.2 =$ approximately 58 m

Distance travelled in one hour = 60×58 m = approximately 3500 m = 3.5 km

Distance travelled in one hour (in miles) = $3.5 \times 5 / 8 = 2.2$ miles

Speed = 3.5 kilometres per hour, or 2.2 miles per hour