The Smallpeice Trust

ENGINEERING @HOME

01

The Rubber Band Car Challenge

#SmallpeiceRBCC

Suitable for ages:	Time needed:
8-16	1hr+

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Dare to imagine

Curriculum links: Energy change and transfer; forces

Skills learnt: Design, testing and evaluation skills

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Dare to imagine

Since our Smallpeice team can't visit schools, we've decided to challenge each other to build the best rubber band-powered car, just with materials we have at home and we'd like to invite you to join in.

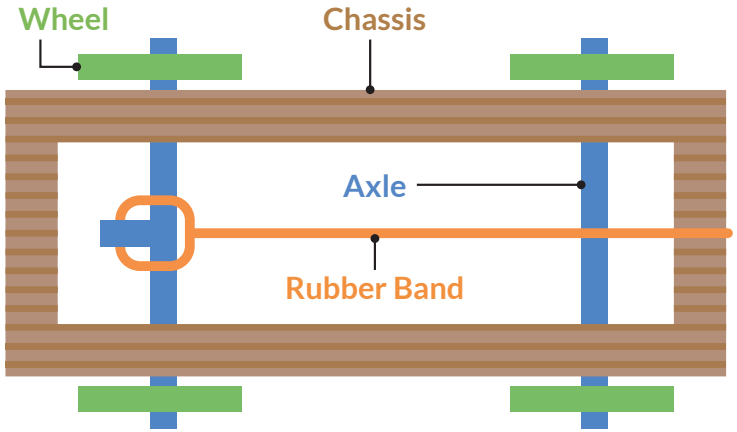
01

What is a rubber band car?

A rubber band is a really simple way to power a model car. By stretching a rubber band, you are turning your mechanical energy into elastic potential energy. When you let the car go, this is then turned back into mechanical energy as it turns the wheels, powering the car forward.

Rubber band car designs

There are a huge variety of designs for rubber band cars. Usually they are made up of a chassis and two pairs of wheels connected by an axle. One axle should be connected to one end of a rubber band, the other connected to the chassis. That axle can then be rotated, wrapping the band around it, creating elastic potential energy. When the axle is let go, the car should race forward.



Rotate the axle, stretching and winding the band around it

Once released, the car should race forward

WHAT MATERIALS TO USE

You can use cardboard, plastic, wood, or anything else that works well and you can get at home.

Try looking in your recycling box.

SOME IDEAS ARE:

- **WHEELS:** bottle tops, cardboard circles, or even old cds
- **AXLES:** chopsticks, straws, pencils, cocktail sticks
- **CHASSIS:** plastic bottle, lollypop sticks, pencils, cardboard (a toilet roll tube will do, although this may need reinforcing)
- **RUBBER BAND:** you can also use loom bands connected together
- **TAB ON THE REAR AXLE:** the example below uses cardboard reinforced with tape, but a stronger one might be made using a small nail or screw
- Attaching the parts together can be achieved with a glue gun ideally, but if you don't have one, tape will do

ENGINEERING CHALLENGES

How to attach the axles to the chassis so they are free to move

One good way is to put the axle through a tube (a straw, or make one from newspaper) which is attached to the chassis.

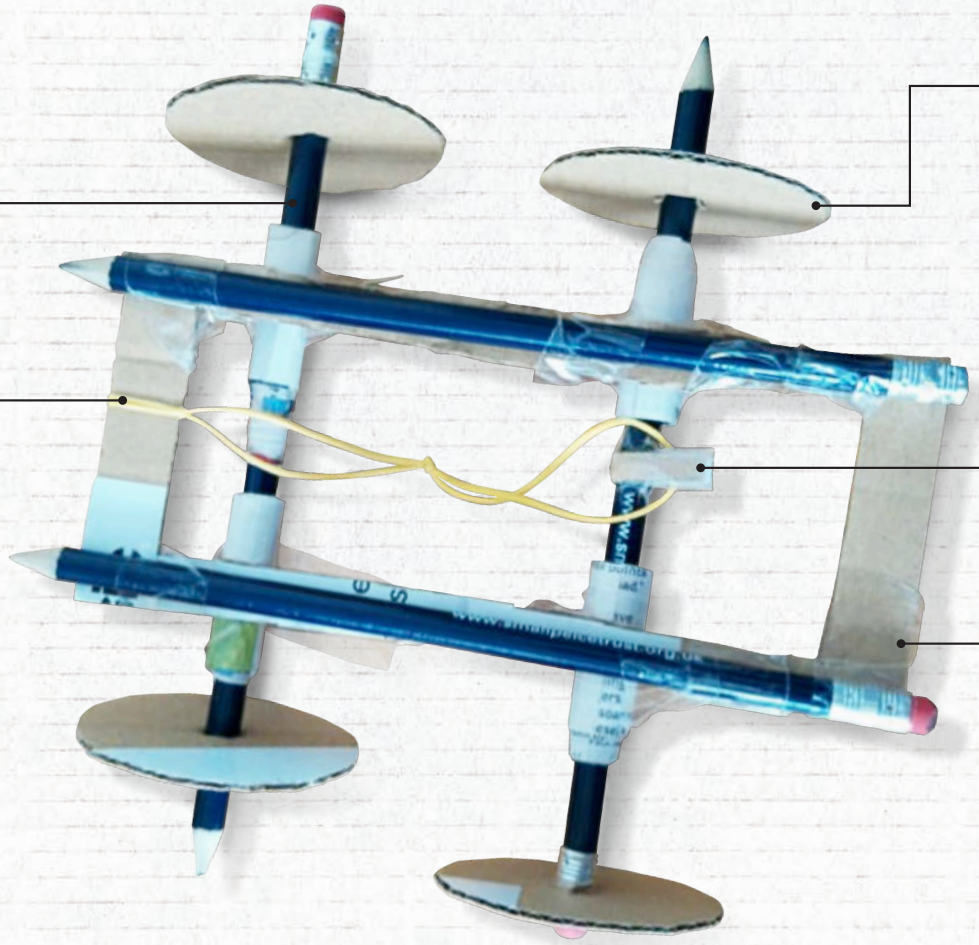
Spinning wheels without moving forward

A common problem once you've built your car is that the wheels spin without moving the car forward. This happens when the wheels don't grip the surface well enough, in other words, there is not enough friction between the wheel and the floor. There are several ways to increase the friction force.

- We can increase the downwards force of the car. The downwards force is weight and is due to gravity and the mass of the car. We can't change the strength of gravity (unless we go to another planet) but we can increase the mass of the car. Try adding some bluetac or playdough to the wheels. Although a heavier car will not move as far from the same force (remember F=ma), so we need to balance this against the need for more friction. These kinds of considerations are typical of engineering.

- Alternatively, we can change the smoothness of either the wheel, or the surface. The simplest way is to run your car along carpet which leads to much more friction than a smooth floor. You could also investigate reducing the smoothness of your wheels. In real cars, tyres have tread, which is a pattern of grooves in the rubber, reducing the smoothness, increasing the friction between them and the road.

A BASIC EXAMPLE



Axle

Made of a pencil, slipped through a tube made of newspaper which is taped to the chassis

Wheel

A cardboard disc with a hole made with a pencil

Rubber band

looped around the chassis at one end and a tab on the axle at the other, which holds it in place

Tab

This needs to be strong enough to not bend when the rubber band is under tension

Chassis

Made of cardboard, reinforced with two pencils

Once let go, the car should race forward

Rotate the axle, stretching and winding the band around it

TESTING

With any engineering project, testing is essential. You're unlikely to get it right first time, and there are always adjustments you can make to optimise performance.

The key objective is to get your vehicle to travel as far as possible with one 'charge' of the elastic band.

Try adjusting some variables (weight, friction of the surface, friction of the wheels, turns of the rubber band) until your car is at peak performance.

Remember: only change one variable at a time or you won't know which of the changes has been effective.

THE CHALLENGE

Once you've got your car running at its optimum, film it in action, including you making a measurement of how far it travelled (in metres - m) and share your video on:

www.facebook.com/TheSmallpeiceTrust

www.twitter.com/SmallpeiceTrust
Use the hashtag **#SmallpeiceRBCC**

www.instagram.com/SmallpeiceTrust