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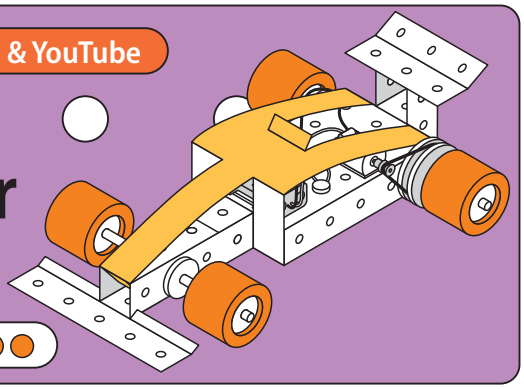
Formula T Car



Workshop Pack Skill Level ●●●●●

Build an exciting high speed electric racing car!

Explore how electricity can create mechanical force!

See how to make with TechCard on our website.

Assembly videos on YouTube!

Parts to make **1** model

Structural Parts	
TechCard Base	1
TechCard Beam	2
TechCard Girder	1
TechCard Strip	1

Additional Materials	
1.5V AA Battery	2
A4 Size Thin Card	1
120mm Foam Pipe	1
Insulation Tubing	

Mechanical Parts	
25mm Discs	11
40mm Pulley	1
300mm Dowel Axle	2
Motor	1
Motor Pulley	1
No16 Rubber Band	1
3 AA Battery Holder	1
Sticky Foam Pads	2
Rivets and Collars	3
Paper Clips	4

You will have parts left over towards other models.

Parts to make **10** models

Structural Parts	
TechCard Base	10
TechCard Beam	15
TechCard Girder	10
TechCard Strip	4

Additional Materials	
1.5V AA Battery	20
A4 Size Thin Card	10
120mm Foam Pipe	10
Insulation Tubing	

Mechanical Parts	
25mm Discs	110
40mm Pulley	10
300mm Dowel Axle	15
Motor	10
Motor Pulley	10
No16 Rubber Band	10
3 AA Battery Holder	10
Sticky Foam Pads	20
Rivets and Collars	30
Paper Clips	40

Based on pupils sharing off-cuts between them.

Using Batteries Safely

Important! Please read these guidelines before using the Workshop Pack

What is a battery and how do they work?

Batteries are a common part of our everyday lives but it's important to understand how they work to use them safely in circuits that we build ourselves.

A battery is basically a little power station. When a circuit is switched on, chemical compounds inside the battery react and electrical energy (electricity) is generated which flows through the circuit.

A battery has two terminals which are often positioned one at each end of the battery. When a circuit is switched on, electrical energy flows from one battery terminal through the various components in the circuit and back to the other terminal of the battery.

It is important to remember that electricity flows in a 'circuit'. It doesn't just fall out of the ends of a battery! The terminals of a battery have to be connected in some form of circuit before electricity is generated by the battery.

In normal use, the energy in the circuit flows through components which consume the energy. For example, electrical energy flowing through a motor is consumed as the motor converts the electrical energy into a useful mechanical force. The motor will continue to run until the chemical compounds in the battery are depleted and can no longer produce electrical energy.

Problems occur with batteries when what is called a 'short circuit' occurs. A short circuit occurs when the terminals of a battery (or any power supply) are connected without anything in the circuit to use the energy. When a short circuit occurs, electrical energy still flows from one terminal to the other but there is nothing in the circuit to use the energy. As a result, the energy is converted into heat inside the battery and the battery can become dangerously hot. Hot enough to cause a painful burn.

Sometimes more than one battery is used to power a circuit to increase the voltage. For example two 1.5 volt batteries can be used together to generate 3 volts. The rules are the same for circuits powered by a series of batteries as for those powered by a single battery.

How to prevent a short circuit.

There are three likely ways a short circuit can occur. The first is if the battery is inserted in the battery holder before the battery holder is incorporated into the circuit. In this case, the wires from the battery holder can touch and cause a short circuit. The second is if the circuit has not been assembled correctly and electrical energy flows from one battery terminal to the other without being properly connected to the components intended to use the energy. The third is if a piece of conductive material comes into contact with the circuit and allows the electricity to bypass parts of the circuit creating a direct route from one battery terminal to the other.

Conductive materials are materials that electricity can flow through. Most metals are conductive no matter what form they take. For example a metal foil food tray is just as conductive as a piece of wire. Most other materials such as wood, paper, plastic and stone are not conductive.

Keep other conductive materials away when building and do not use conductive materials for decorating or developing the models. Examples of conductive materials that pupils might find to use but should not be used are wire of various kinds and paper clips (apart from those supplied with the kit) paper fasteners and drawing pins, metal tins, foil packaging, aluminium foil, pipe cleaners, wire wool and any other items that may have a metal or conductive surface or coating.

If at any point a short circuit is suspected then disconnect the batteries immediately, allow components to cool and investigate. Be careful to store batteries safely so that they cannot short circuit when not in use.

Using the Workshop Pack

Discuss the safe use of batteries with your pupils explaining that, like many familiar things, they can be dangerous if misused. Teachers should remember to check circuits are assembled correctly before batteries are fitted, not to allow other conductive materials to be used when making powered models and to store and dispose of batteries safely. There are detailed instructions at the end of the model assembly instructions for the installation of batteries which must be followed.

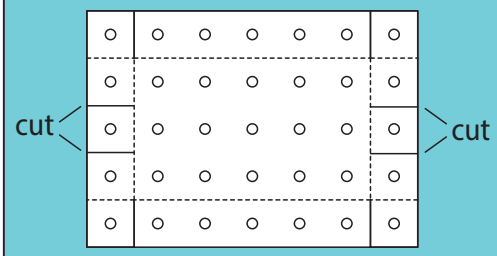
Teachers should also check that models are assembled correctly and supervise their use. Axles, and other mechanical parts, should revolve freely so as not to slow the motor. Obstacles must not obstruct the motor and prevent the motor axle from turning when it is powered as this can cause the electrical components to become hot.

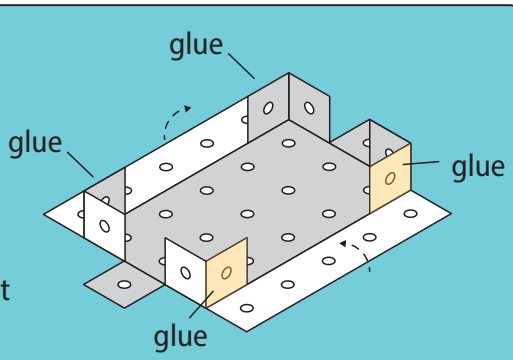
Building simple circuits and using batteries is part of the curriculum and an important learning experience. Building simple circuits and making powered models is an ideal way to demonstrate important topics in the science and technology curriculums and makes learning engaging, memorable and fun!

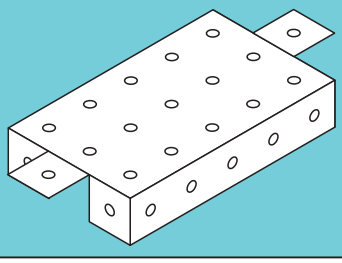
Make the Formula T Car

Before you start see **'Make with TechCard'** on our website.

1 Prepare the chassis.



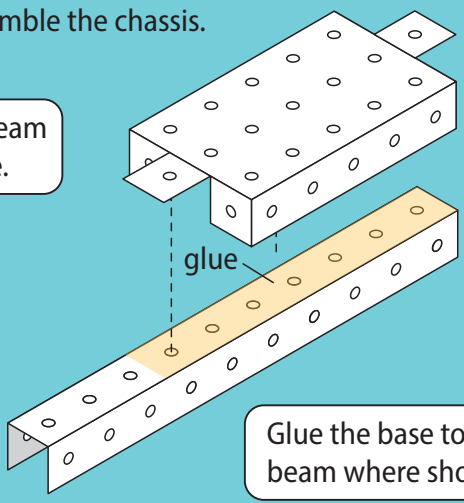




Cut fold and glue a TechCard Base as shown.

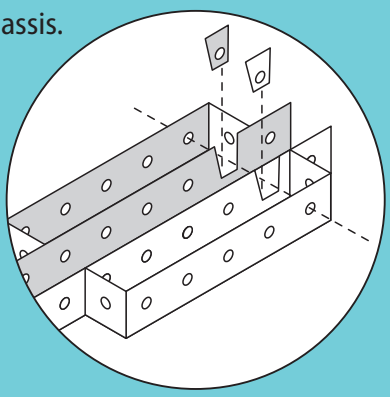
2 Assemble the chassis.

Fold a beam to shape.



Glue the base to the beam where shown.

3 Trim the chassis.

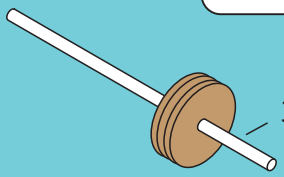


Cut out two pieces from the chassis so the rear axle will turn freely.

4 Fit the pulley.

Cut a 165mm axle.

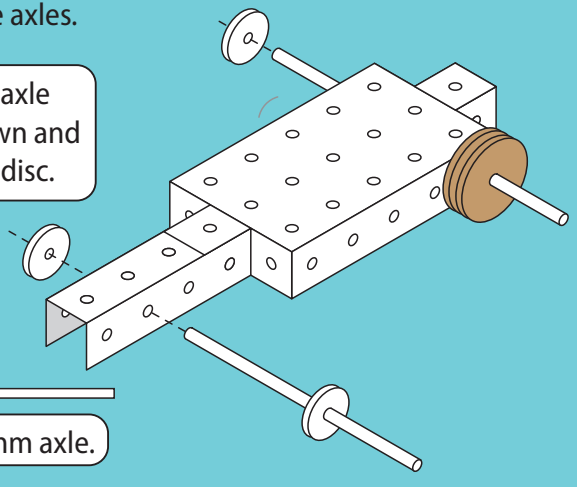
Fit a 40mm pulley 35mm from the end of the rear axle.



If the axle fit is too tight then sand the axle a little. If the pulley is loose put a thin piece of string through the pulley and then fit the axle.

5 Fit the axles.

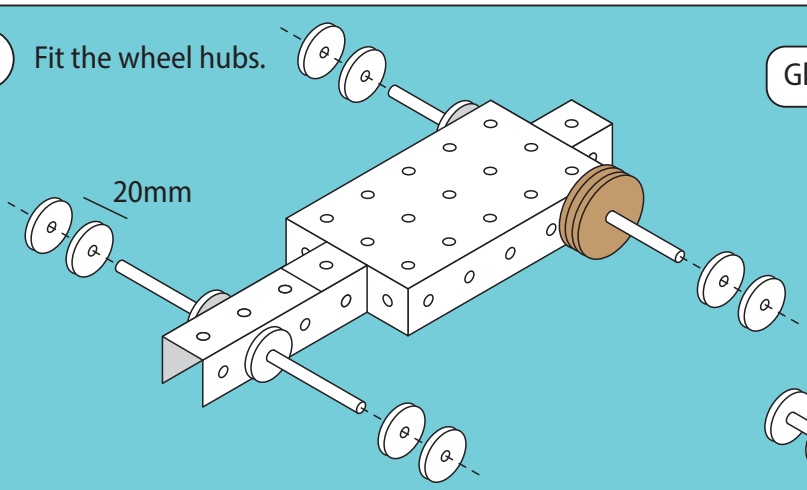
Fit the rear axle where shown and fit a 25mm disc.



Cut a 140mm axle.

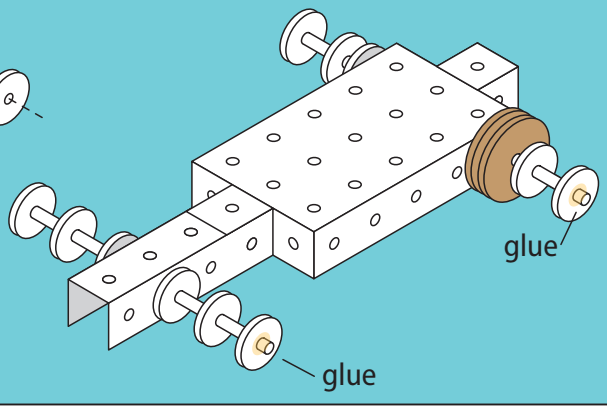
Fit a 25mm disc onto the 140mm axle and pass through the front of the chassis where shown. Fit a second 25mm disc.

6 Fit the wheel hubs.

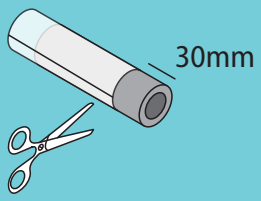


Fit a pair of 25mm discs onto the ends of the axles as shown. Space the discs 20mm apart.

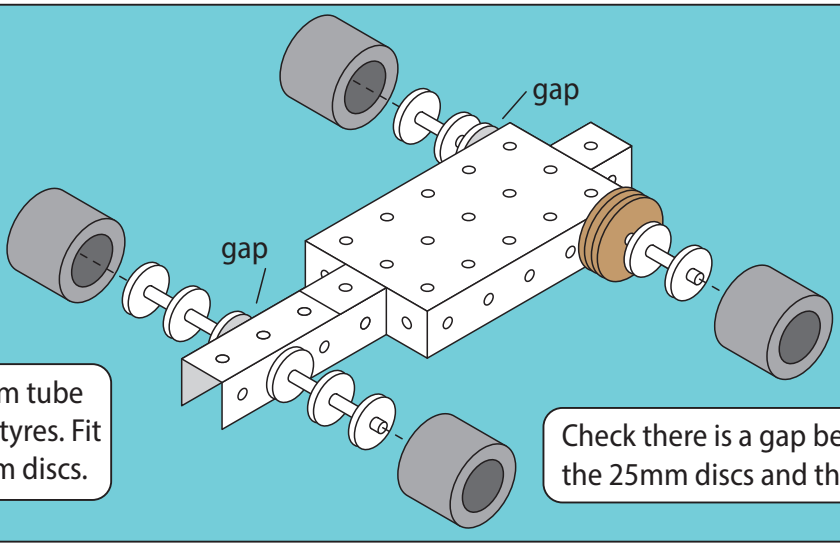
Glue the outer discs to the axles.



7 Fit the tyres.



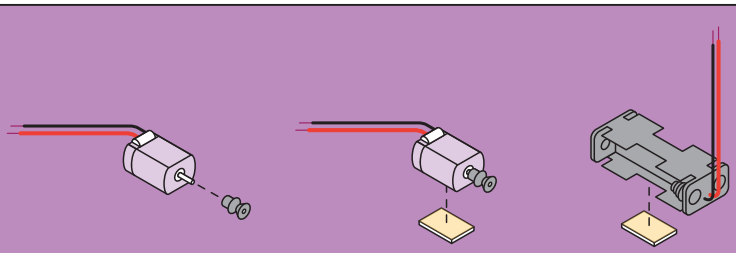
Roll a piece of paper around the foam tube as a guide. Carefully cut four 30mm tyres. Fit the tyres over the four pairs of 25mm discs.



Check there is a gap between the 25mm discs and the chassis.

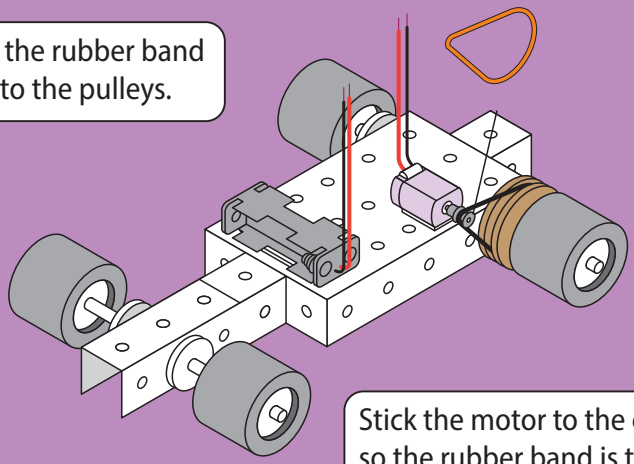
8 Prepare the motor and battery holder.

Fit the motor pulley onto the motor axle. Fit a double sided foam pad under the motor and battery holder.



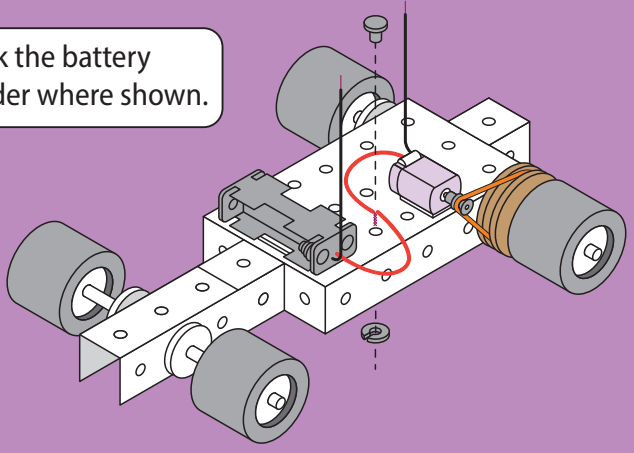
9 Fit the motor and battery holder.

Fit the rubber band onto the pulleys.



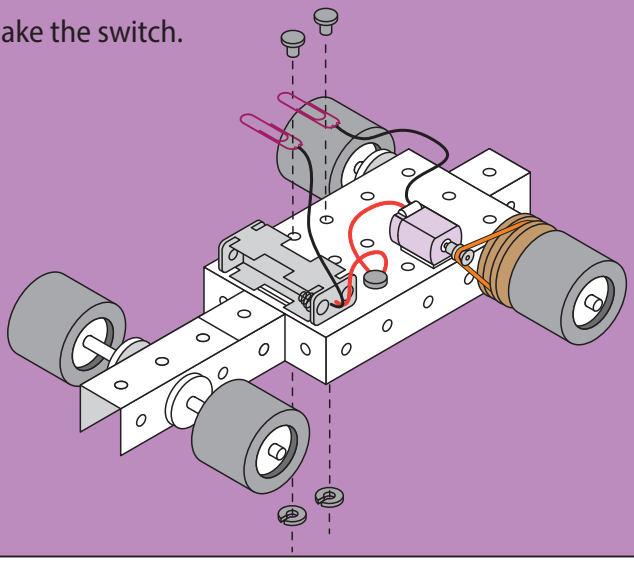
Stick the motor to the chassis so the rubber band is taut.

Stick the battery holder where shown.

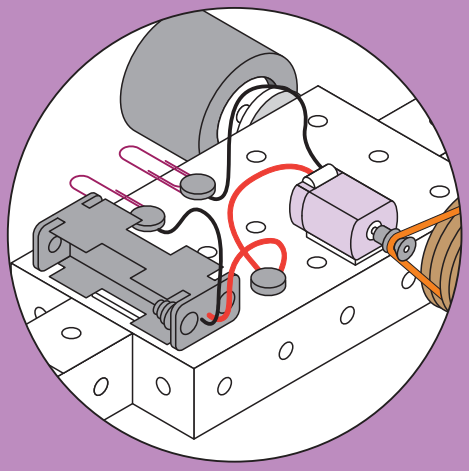


Twist the ends of the two red wires together. Use a rivet and collar to fix them to the chassis.

10 Make the switch.

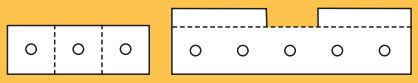


Twist the ends of the black wires around two paper clips. Use a rivet and collar to fix them to the body where shown.

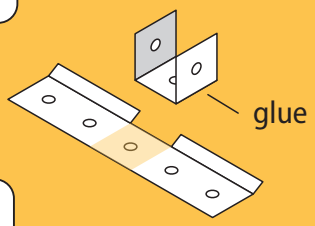


View of the completed circuit.

11 Make the front wing.

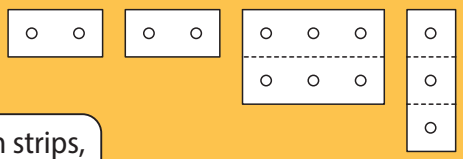


Cut a 25mm beam and cut a 125mm girder and trim it as shown.

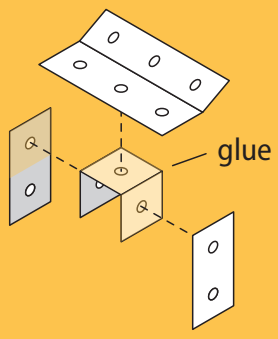


Fold the parts to shape and glue as shown.

12 Make the rear wing



Cut two 50mm strips, a 75mm girder and a 25mm beam.



Fold the parts to shape and glue as shown.

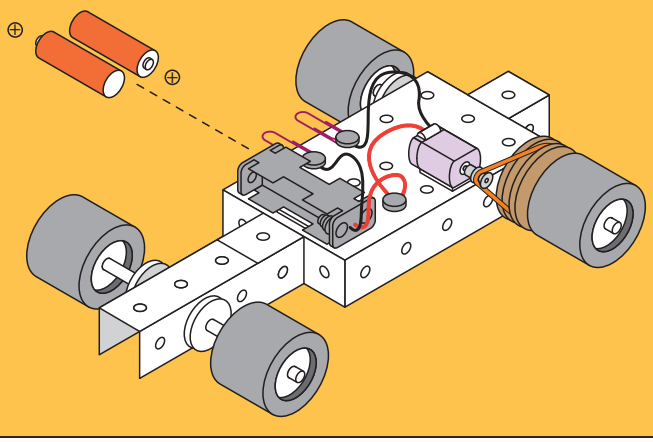
13

Important! Follow these instructions to install the battery.

1. Your teacher or supervising adult must check your model before fitting the battery.
2. Fit the battery under adult supervision.
3. Operate the model under adult supervision.
4. The model must be assembled as shown in the instructions.
5. Do not insert the battery until the model is complete.
6. Check the switch is in the 'off' position before inserting the battery.
7. Requires two 1.5 volt AA batteries.
8. Make sure you insert the battery correctly checking the polarity of the battery is correct. The '+' symbol on the battery must align with the '+' symbol in the battery holder.
9. Make sure the supply terminals in the battery holder are not short circuited.
10. Remove the battery from the model when not in use.
11. Replace exhausted batteries right away to avoid damage.
12. Rechargeable batteries must be removed from the model before recharging.
13. Rechargeable batteries must be recharged under adult supervision.
14. Do not attempt to recharge non-recharable batteries.
15. Do not mix old and new batteries.
16. Do not mix alkaline, standard (carbon-zinc) and rechargeable (ni-Cd) batteries.

14 Fit the batteries.

Follow the instructions above to fit the batteries in the battery holder.

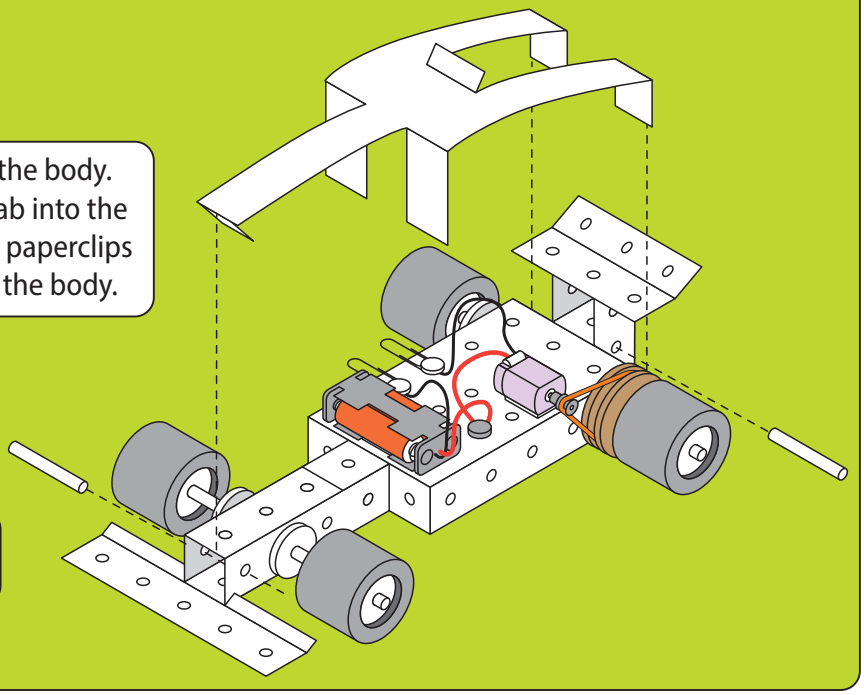


15 Fit the wings and body.

Cut two 50mm axles.

Cut, fold and fit the body. Tuck the front tab into the chassis. Use two paperclips to fix the rear of the body.

Use the axles to peg the wings in place



16 Race your Formula T Car!

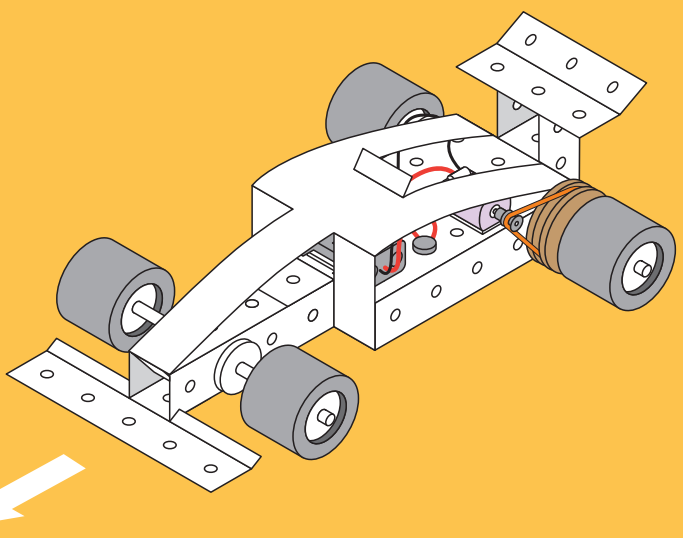
When you 'close' the switch, electricity flows in a 'circuit' from the battery, through the motor and back to the battery.

As the electricity flows through the motor it generates a 'magnetic field' in wire coils arranged around the motor axle.

The magnetic field in the wire coils is attracted to fixed magnets in the motor and this attraction causes the motor axle to spin.

The motor converts the electrical energy into a mechanical force.

Generating the magnetic field eventually uses up the electricity stored in the battery.



Race your car on a smooth surface.

Card Panels