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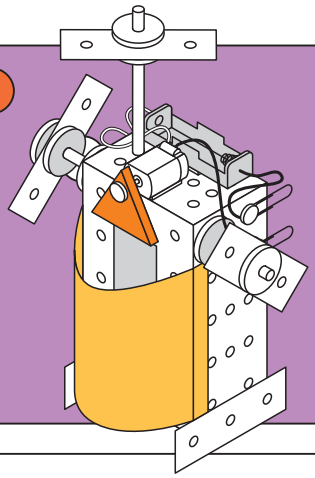
JudderBot

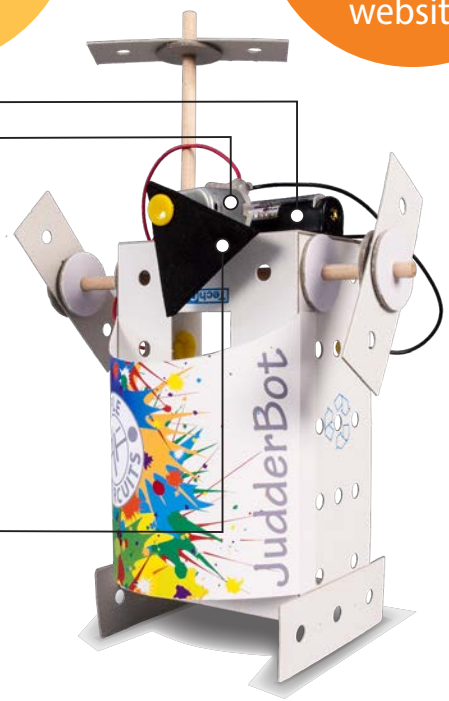


Workshop Pack Skill Level ●●●●●

Build a juddering robot that harnesses vibration to move around!

Explore how the motor converts energy into mechanical force!

See how to make with TechCard on our website.



The battery stores electrical energy.

The motor converts electrical energy into mechanical force.

The off-centre weight causes vibration that moves the Bot forward.

Assembly videos on YouTube!

Parts to make **1** model

Structural Parts	
TechCard Project Base	1
TechCard Strip	2

Mechanical Parts	
25mm Disc	9
300mm Dowel Axle	1
Motor	1
Foam Triangle	1
1.5V AA Battery Holder	1
Sticky Foam Pads	2
Rivets and Collars	4
Paper Clips	2

Additional Materials	
1.5V AA Battery	1
A5 Size Thin Card	1

You will have parts left over towards other models.

Parts to make **10** models

Structural Parts	
TechCard Project Base	10
TechCard Strip	15

Mechanical Parts	
25mm Disc	90
300mm Dowel Axle	10
Motor	10
Foam Triangle	10
1.5V AA Battery Holder	10
Sticky Foam Pads	20
Rivets and Collars	40
Paper Clips	20

Additional Materials	
1.5V AA Battery	1
A5 Size Thin Card	10

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.

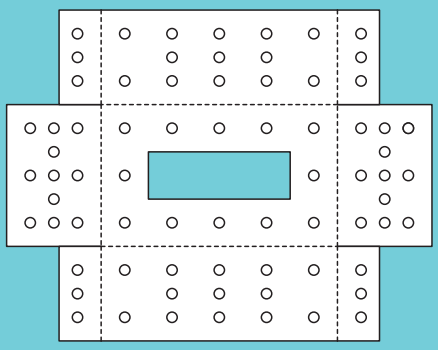
Teachers should also check that models are assembled correctly and supervise their use. Axles, and other mechanical parts, should revolve freely so as not to slow the motor. Obstacles must not obstruct the motor and prevent the motor axle from turning when it is powered as this can cause the electrical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

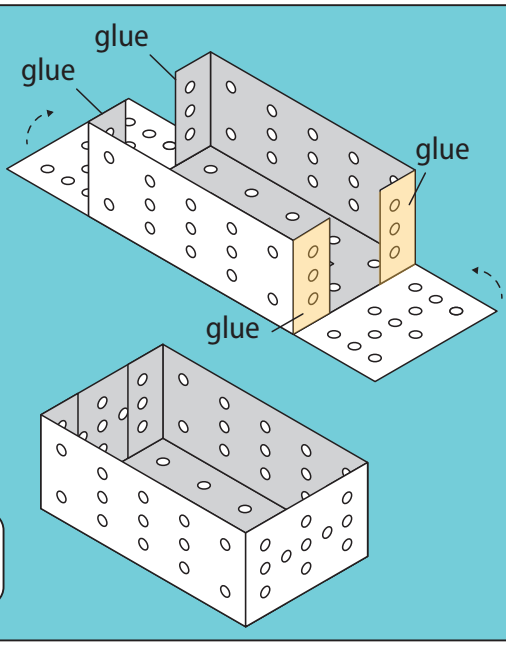
Building simple circuits and using batteries is part of the curriculum and an important learning experience. Building simple circuits and making powered models is an ideal way to demonstrate important topics in the science and technology curriculums and makes learning engaging, memorable and fun!

Make the JudderBot

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

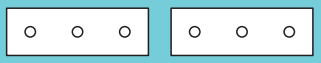
1 Make the body.



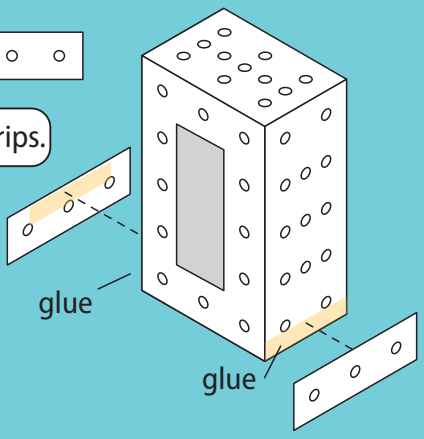


Fold and glue a TechCard Project Base to make the body.

2 Fit the runners.



Cut two 75mm strips.

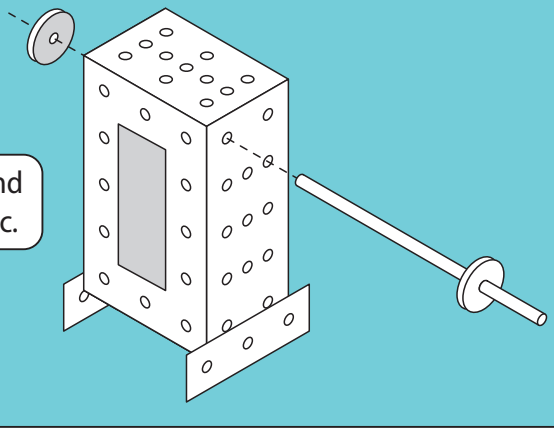


Glue the two strips to the base as shown so they stick out below the base.

3 Fit the axle.

Cut a 150mm axle.

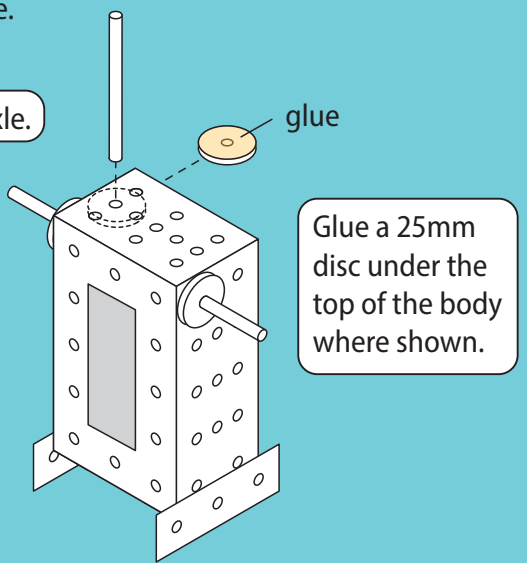
Fit a 25mm disc and pass the axle through the body where shown.



Fit a second 25mm disc.

4 Fit the top axle.

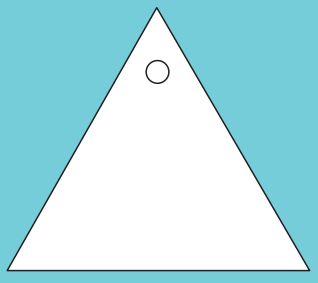
Cut a 100mm axle.



Glue a 25mm disc under the top of the body where shown.

Fit the axle into the 25mm disc.

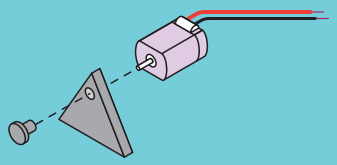
5 Fit the weight.



40mm

Cut the triangle shape from the foam sheet and make a small hole at the top.

6 Prepare the motor and battery holder.

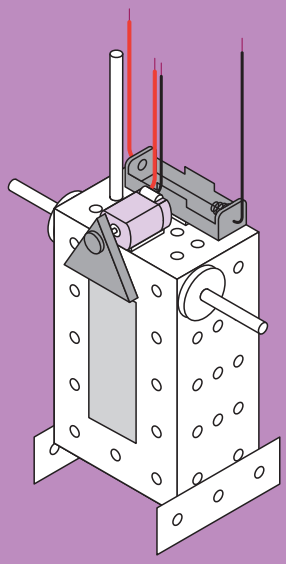


Use a rivet to fit the foam triangle to the motor axle.

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

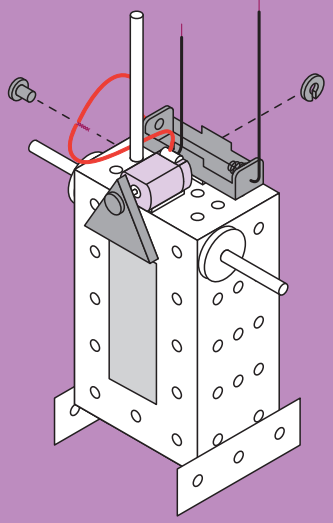
7 Fit the motor and battery holder.

Fit motor and battery holder where shown. Make sure the foam triangle does not hit the body.

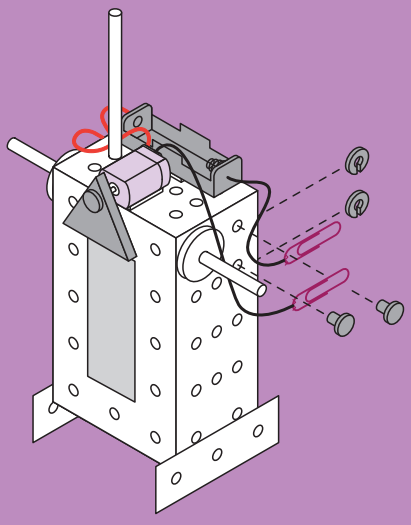


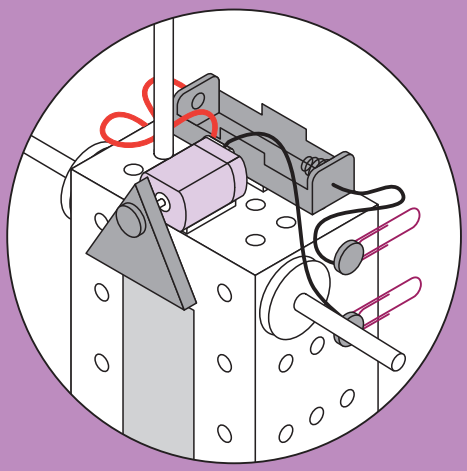
8 Connect the red wires.

Twist the ends of the two red wires together and use a rivet and collar to fix them to the side of the body where shown.



9 Assemble the switch.

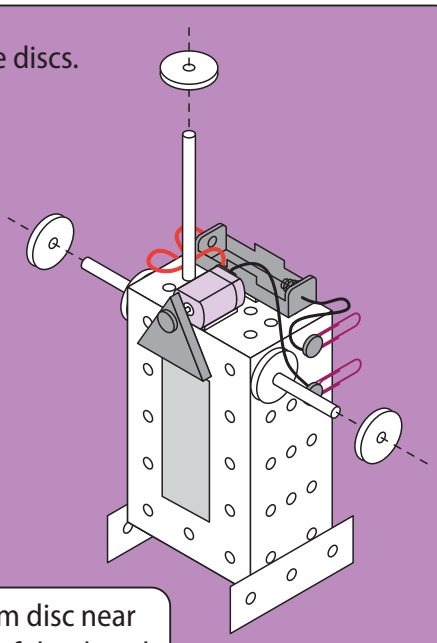




View of the completed circuit.

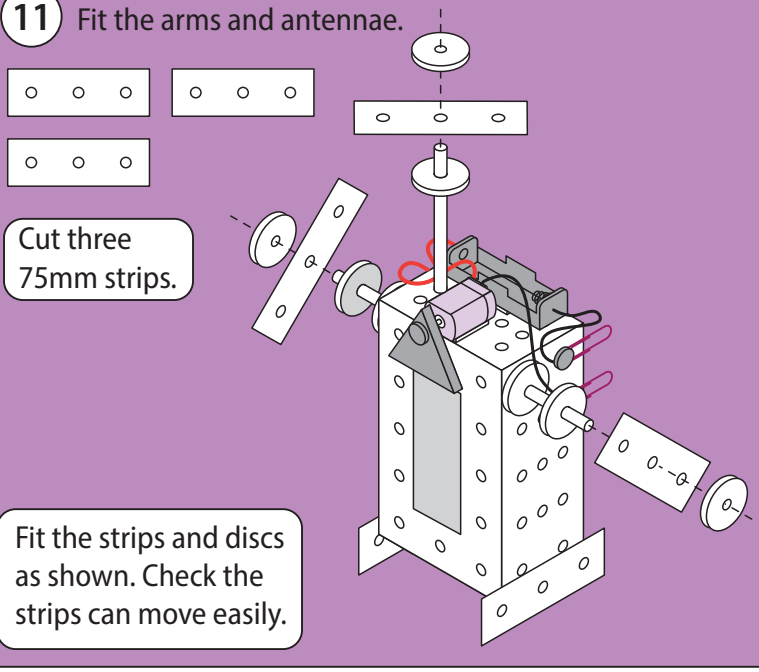
Twist the ends of the black wires around two paper clips. Use a rivet and collar to fix them to the body where shown.

10 Fit the discs.



Fit a 25mm disc near the ends of the dowel.

11 Fit the arms and antennae.



Cut three 75mm strips.

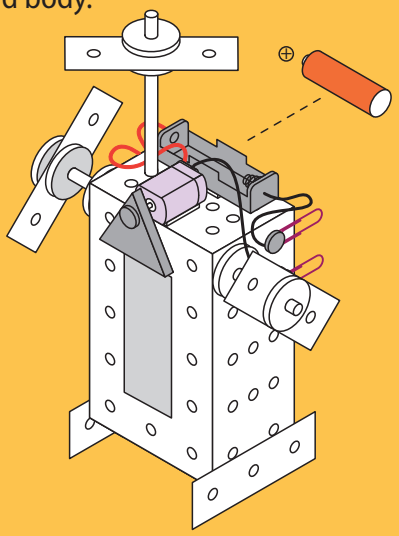
Fit the strips and discs as shown. Check the strips can move easily.

12

Important! Follow these instructions to install the battery.

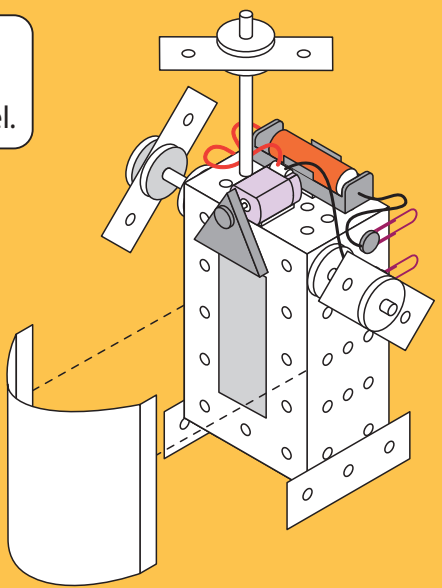
1. Your teacher or supervising adult must check your model before fitting the battery.
2. Fit the battery under adult supervision.
3. Operate the model under adult supervision.
4. The model must be assembled as shown in the instructions.
5. Do not insert the battery until the model is complete.
6. Check the switch is in the 'off' position before inserting the battery.
7. Requires one 1.5 volt AA battery.
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.

13 Fit the battery and body.



Fit the battery into the battery holder following the instructions above.

Cut, fold and glue the body onto the model.



14 Operate your JudderBot!

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

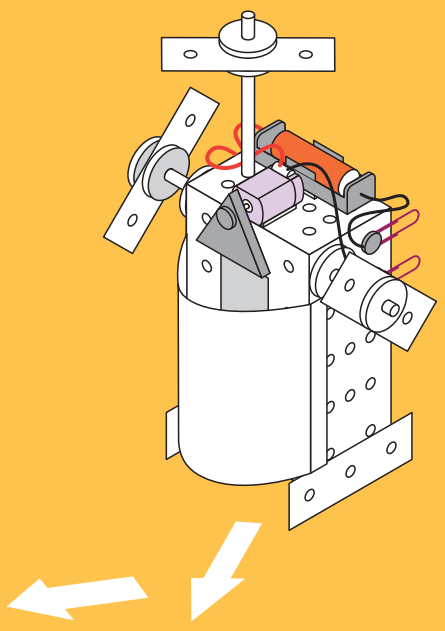
As the electricity flows through the motor it generates a 'magnetic field' in wire coils arranged around the motor axle.

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 foam triangle rotates as the motor axle spins. The weight of the foam triangle is off-centre and causes the robot to judder as the foam triangle spins.

The two strips under the robot act as skates and transfer the juddering action into movement over the surface.

The juddering also causes the antennae and arms to oscillate and rotate.



Operate your bot on a smooth surface.

Card Panels

Print and cut along the solid lines and fold the along dotted lines of the panel.