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Circuits Workshop

D&T Workshop Skill Level ● ● ● ○ ○



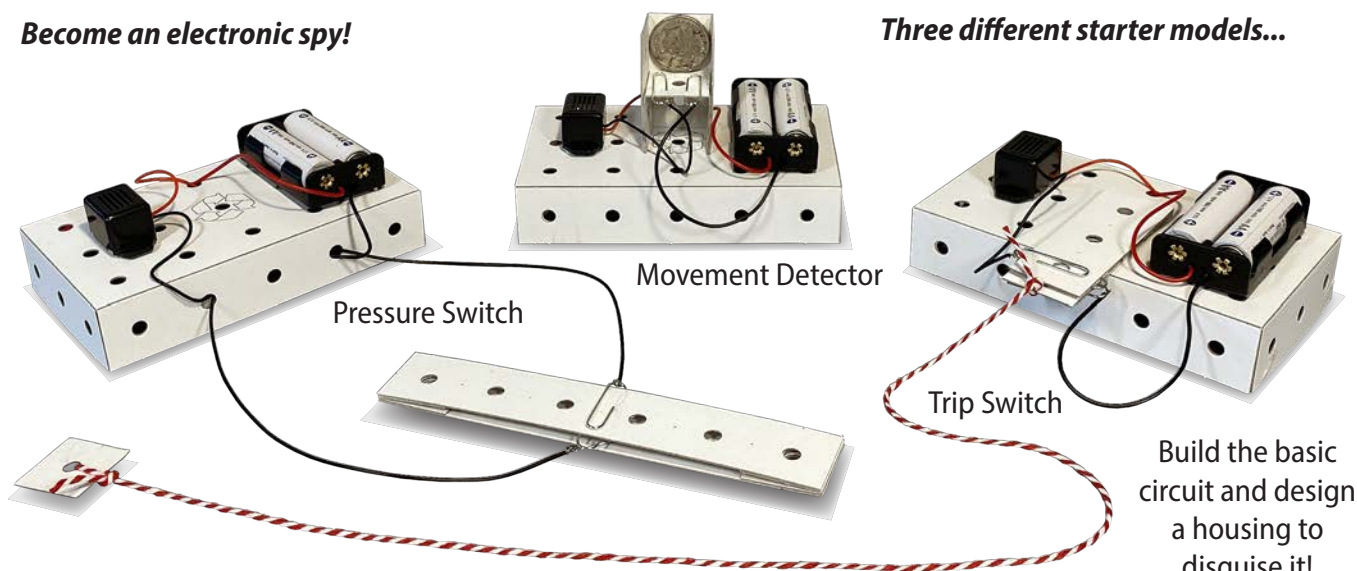
Build three basic models that explore simple circuits.

Learn how electrical energy can convert to a mechanical force.

See how to make with TechCard on our website.

Become an electronic spy!

Three different starter models...



Build the basic circuit and design a housing to disguise it!

Great for electric alarms projects!

Parts to make 1 model

Structural Parts

TechCard Strip	1
TechCard Beam	1
TechCard Base	1

Electrical Parts

3 Volt Buzzer	1
Double AA Battery Holder	1
50mm Electrical tape	1
30mm Lipless Paperclips	2
200mm Thin Insulated wire*	2

*Only need for pressure switch

Additional Materials

Sticky Foam Pads x2
50cm Thin String (only needed for trip switch)
10 Pence Coin (only needed for movement detector)

You will have parts left over towards other models.

Parts to make 10 models

Structural Parts

TechCard Strip	10
TechCard Beam	4
TechCard Base	10

Electrical Parts

3 Volt Buzzer	10
Double AA Battery Holder	10
50mm Electrical tape	10
30mm Lipless Paperclips	20
200mm Thin Insulated Wire*	20

*Only need for pressure switch

Additional Materials

Sticky Foam Pads x20
5M Thin String (only needed for trip switch)
10 x 10 Pence Coin (only for movement detector)

Based on pupils sharing off-cuts between them.

Using Batteries Safely

Important! Read these guidelines before beginning the Workshop.

Batteries are part of our everyday lives but it's important to understand how they work to use them safely in circuits we build. 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 and when a circuit is switched on, electrical energy flows from one terminal, through the components in the circuit and back to the other terminal. It is important to remember that electricity flows in a 'circuit'. 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 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 a 'short circuit' occurs which is when the terminals of a battery (or any power supply) are connected without anything in the circuit to use the energy. Short circuits can cause batteries to become dangerously hot and must be avoided by following the correct procedures.

Preventing a Short Circuit

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.

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 can be just as conductive as a piece of wire. Most other materials such as wood, paper, plastic and stone are not conductive.

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.

Before the Workshop

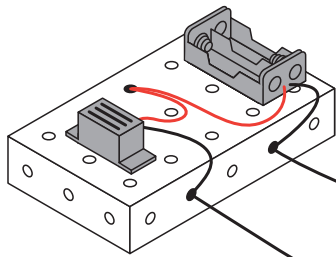
Discuss the safe use of batteries with your pupils explaining that, like many familiar things, they can be dangerous if misused. Teachers should remember to check that circuits are assembled correctly before batteries are fitted. Teachers should also check that models are assembled correctly and supervise their use.

Pupils should not use conductive materials to decorate or extend their models. Batteries must be stored and disposed of correctly. Detailed instructions for the installation of batteries, which must be followed, are on the last page.

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 curriculum and makes learning engaging, memorable and fun.

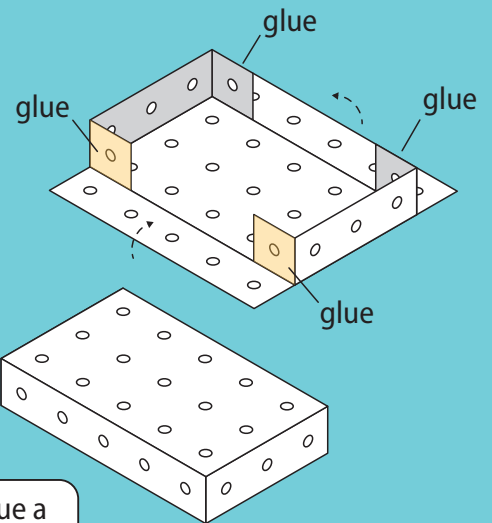
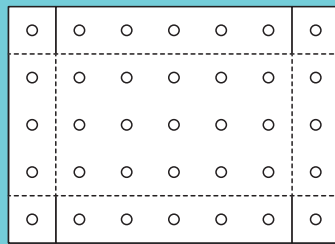
Instructions for fitting batteries are on the last sheet of these instructions.

Make the Electric Pressure Pad Alarm



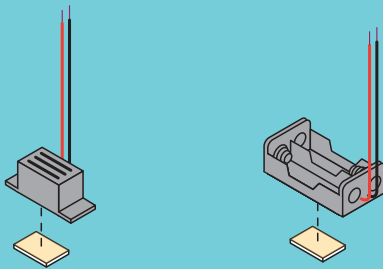
Before you begin see
'Make with TechCard'
on our website.

1 Make the base.



Fold and glue a
TechCard base.

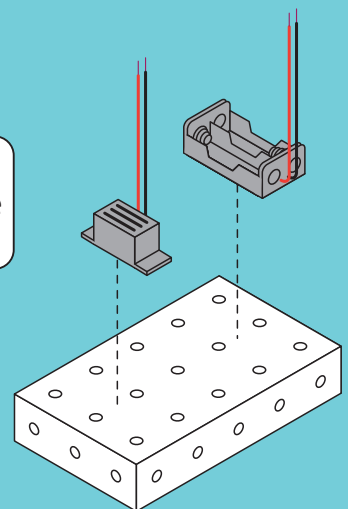
2 Fit the tape.



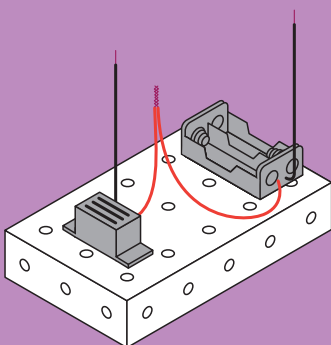
Stick a foam pad under the
buzzer and battery holder.

3 Fit the components.

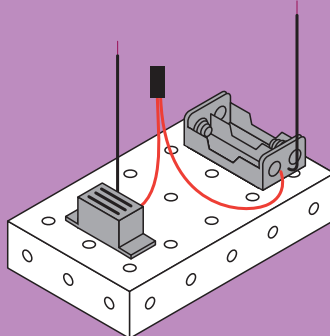
Stick the buzzer and
battery holder onto the
base where shown.



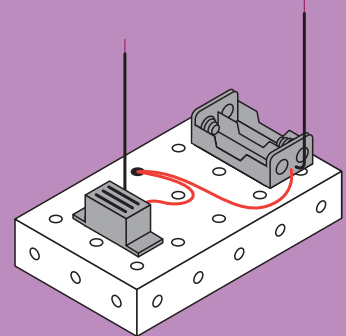
4 Connect the red wires.



Strip the ends of the red wires
and twist them tightly together.

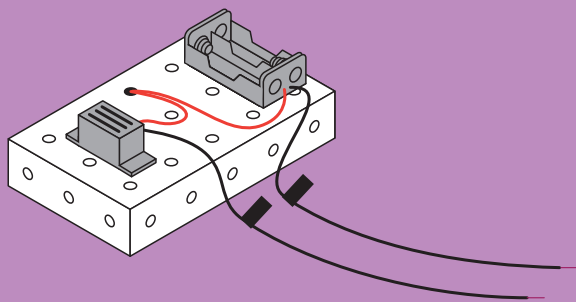


Securely cover the ends of
the wires with tape.

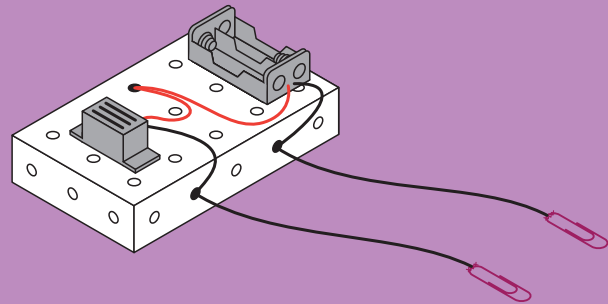


Tuck the ends of the red wires
into the base where shown.

5 Connect the black wires.



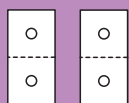
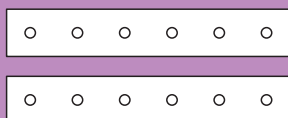
Tuck the ends of the wires into the bases where shown.



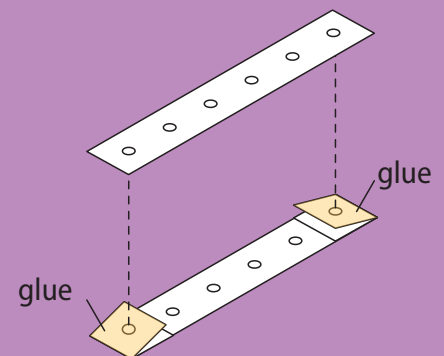
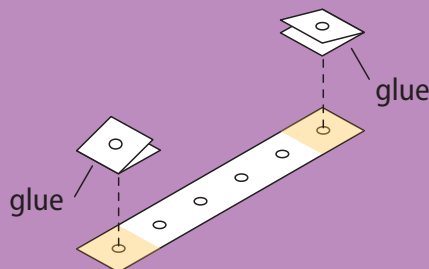
Strip the ends of the two 200mm wires. Tightly twist the ends of the wires onto the two black wires from the circuit and securely tape over the connection.

Twist the ends of the wires onto two paperclips as shown.

6 Make the pressure switch.



You can cut these from a TechCard beam if you don't have any girders.

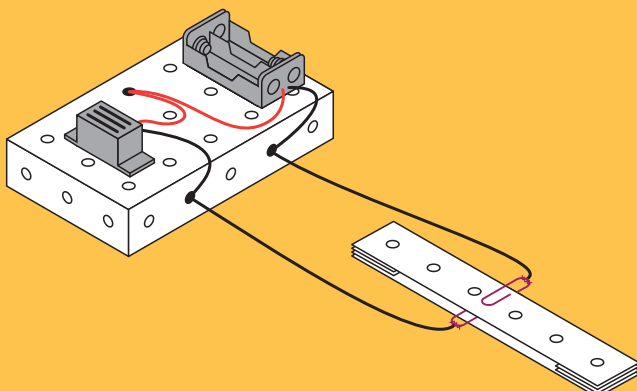


Cut two 150mm strips and two 25mm girders.

Fold the two hinges and glue to a strip as shown.

Glue the second strip as shown.

7 Fit the pressure switch.



Fit the paper clips to the top and bottom strips of the pressure pad. The paper clips should not touch unless the pad is pressed.

Operate your Electric Pressure Pad Alarm!

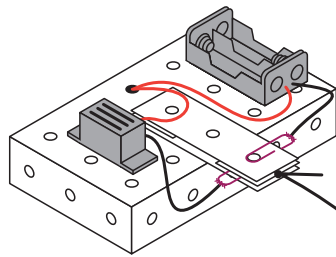
Ask an adult to check your circuit is assembled correctly and to supervise fitting the batteries.

Batteries can be dangerous and the battery instructions must be followed.

Design and make a box for your circuit and design something to disguise your pressure pad so it can't be seen!

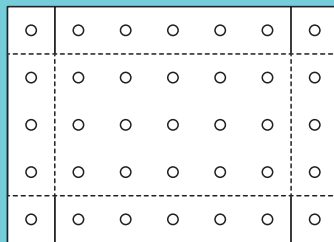
When the batteries are fitted the buzzer will sound when something presses down on the pad. How can you use your alarm!?

Make the Electric Trip Wire Alarm

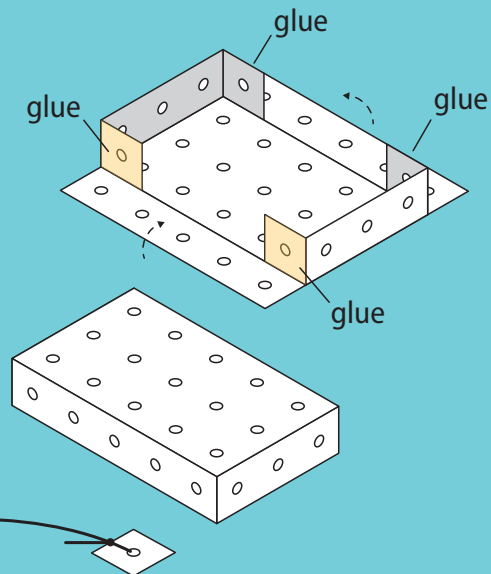


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on our website.

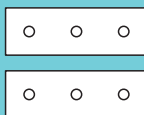
1 Make the base.



Fold and glue a
TechCard base.

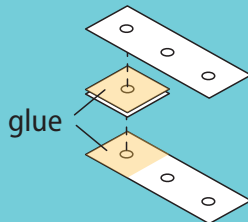


2 Make the switch mount.



Fold and glue the
girder together.

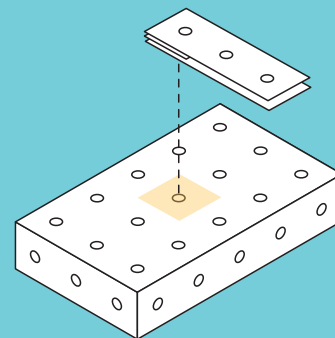
— You can cut this from
a TechCard Beam if you
don't have any girders.



Cut two 75mm
strips and one
25mm girder.

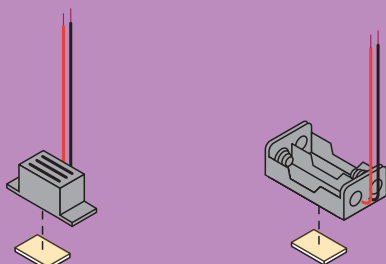
Glue the girder and strips
together as shown.

3 Fit the switch mount.



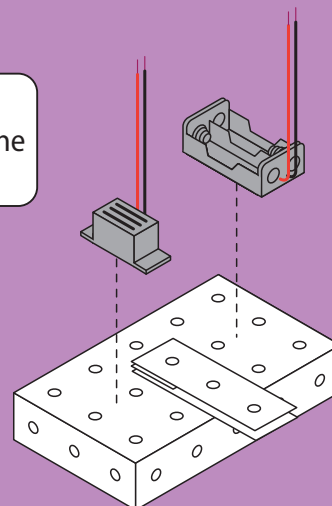
Glue the strips onto the
base where shown.

4 Fit the components.

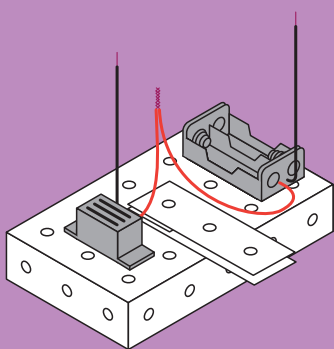


Stick a foam pad under the
buzzer and battery holder.

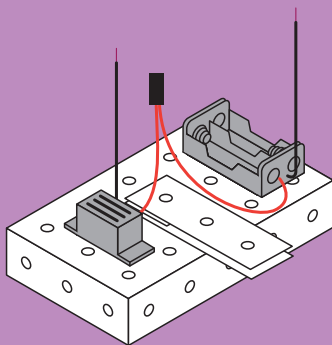
Stick the buzzer and
battery holder onto the
base where shown.



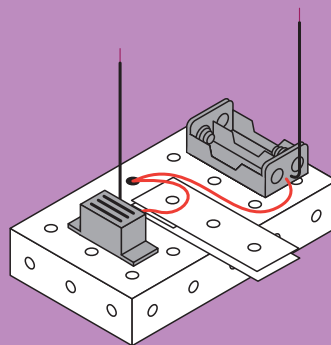
5 Connect the red wires.



Strip the ends of the red wires and twist them tightly together.

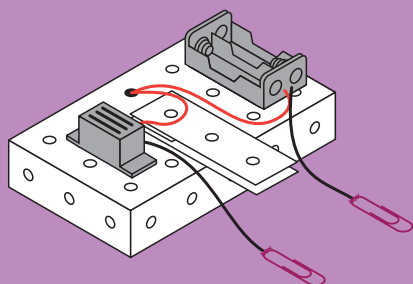


Securely cover the ends of the wires with tape.

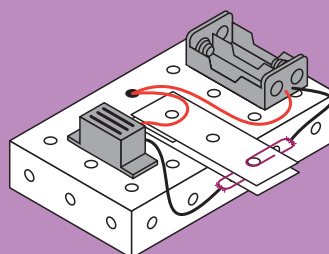


Tuck the ends of the red wires into the base where shown.

6 Connect the black wires.

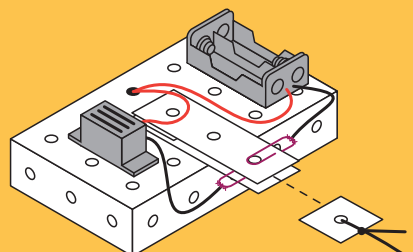


Twist the ends of the wires onto two paperclips as shown.



Fit the paper clips to the top and bottom strips. The paper clips should touch each other.

7 Fit the 'trip wire'.



Cut two squares of TechCard and tie a piece of string to them. Fit one square between the paper clips to keep them apart.

Operate your Electric Trip Wire Alarm!

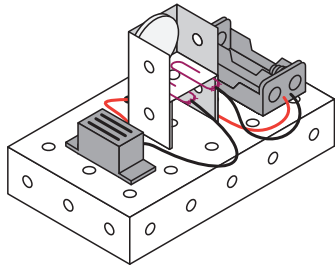
Ask a an adult to check your circuit is assembled correctly and to supervise fitting the batteries.

Batteries can be dangerous and the battery instructions must be followed.

Design and make a box for your circuit. Can you set up your trip wire so the alarm sounds when someone walks through a doorway?

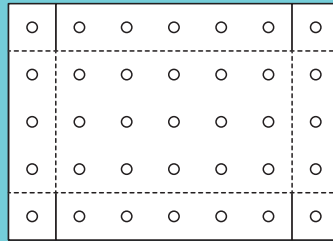
When the batteries are fitted the alarm will sound when the string is pulled.

Make the Electric Movement Detector Alarm

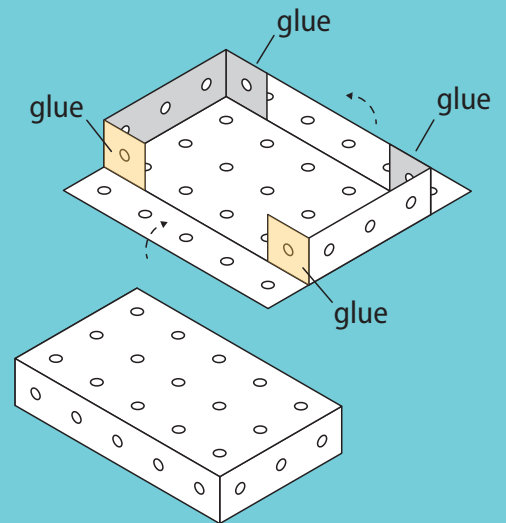


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on our website.

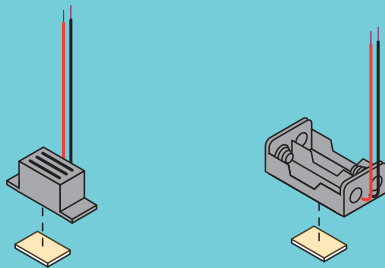
1 Make the base.



Fold and glue a
TechCard base.

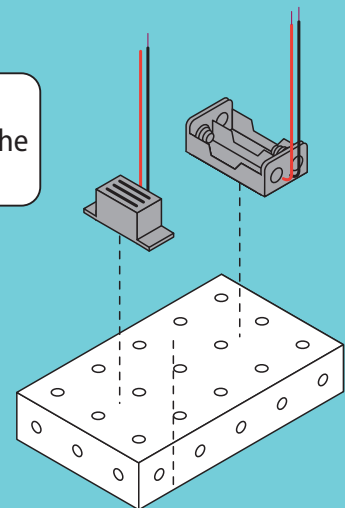


2 Fit the components.

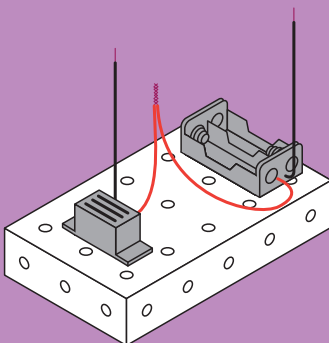


Stick a foam pad under the
buzzer and battery holder.

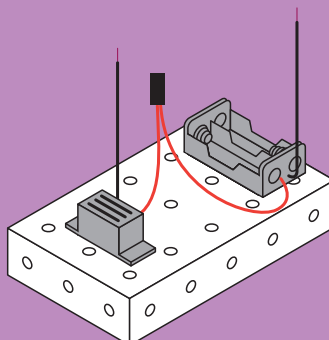
Stick the buzzer and
battery holder onto the
base where shown.



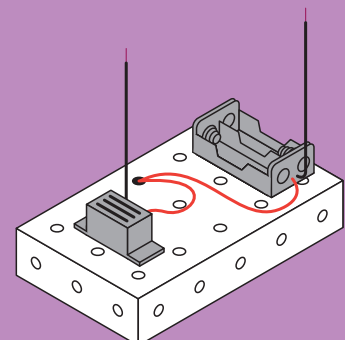
3 Connect the red wires.



Strip the ends of the red wires
and twist them tightly together.

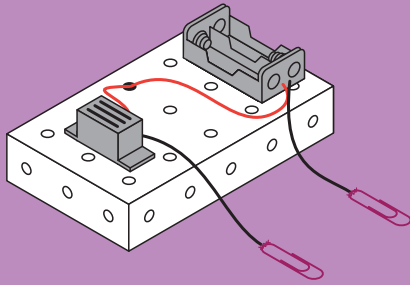


Securely cover the ends
of the wires with tape.



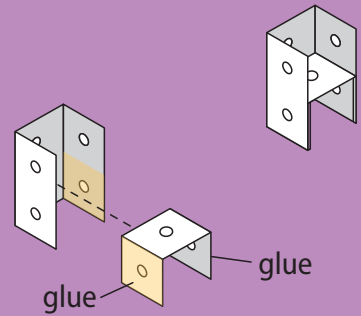
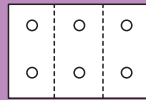
Tuck the ends of the red wires
into the base where shown.

4 Connect the black wires.



Twist the ends of the wires onto two paperclips as shown.

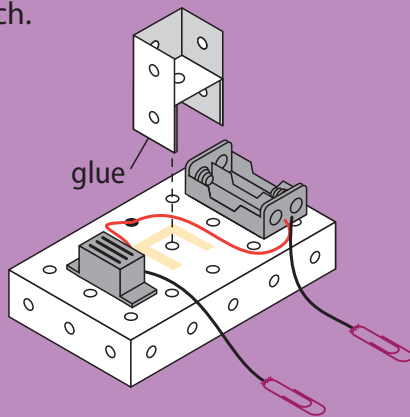
5 Make the switch box.



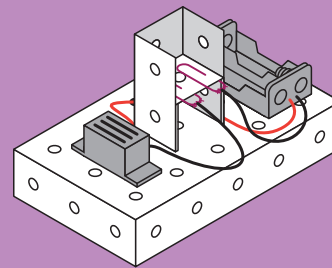
Cut a 50mm and a 25mm beam.

Fold the beams and glue them together as shown.

6 Fit the switch.

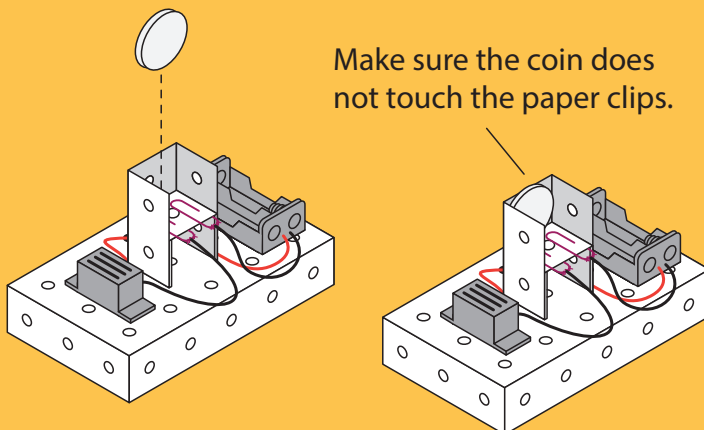


Glue the switch mount onto the base where shown.



Fit the smaller ends of the paperclips onto the beam where shown.

7 Fit the 'trip wire'.



Once the circuit is in position, place a ten pence piece in the switch box.

Operate your Electric Movement Detector Alarm!

Ask a an adult to check your circuit is assembled correctly and to supervise fitting the batteries.

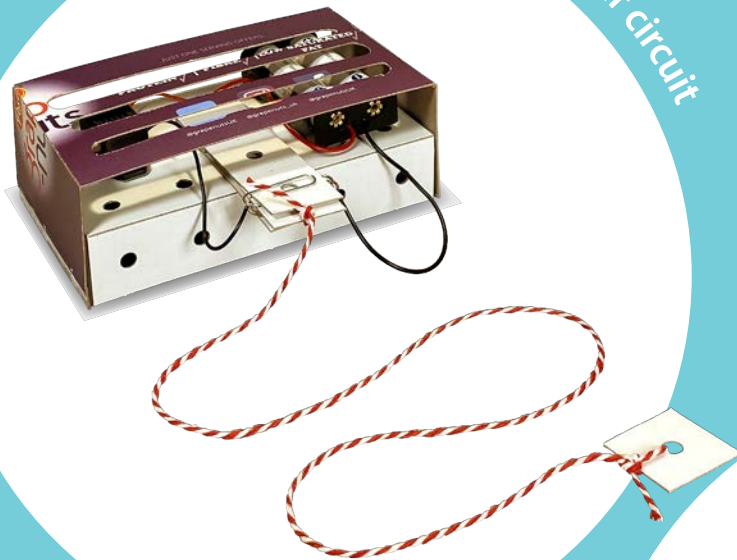
Batteries can be dangerous and the battery instructions must be followed.

Design and make a 'safe box' to put your circuit in. Place a coin in the switch box so it is upright and resting against the beam. Make sure it is not touching the paperclips.

When the batteries are fitted, if someone tries to move your safe box the alarm will sound!

Make it your own!

Design a housing for your circuit

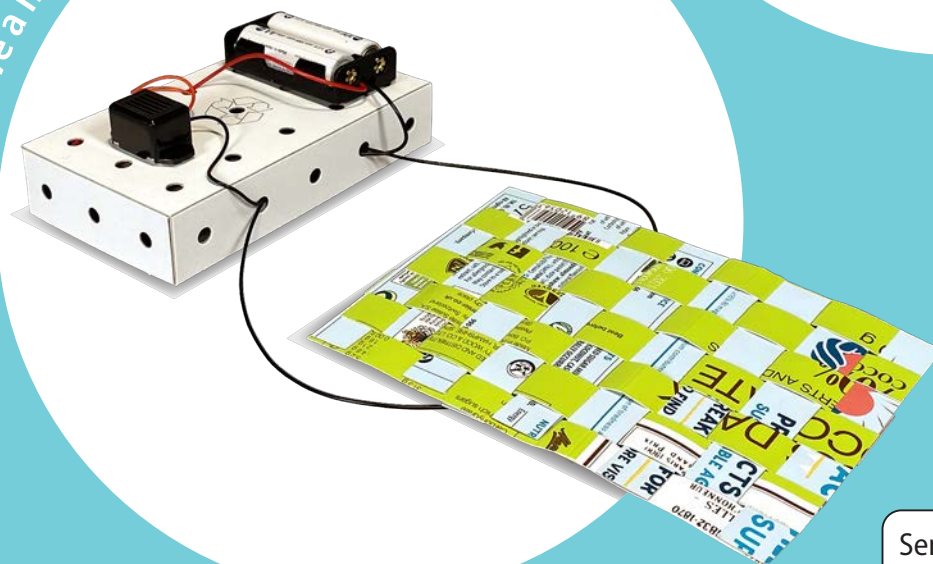


Design and make ways to disguise your detectors so they won't be seen. Who can you catch!?

Make a box to hide your detector



Can you weave a mat to cover your pressure switch?



Send us photos of your models so we can post them on Instagram!

How your circuit works!



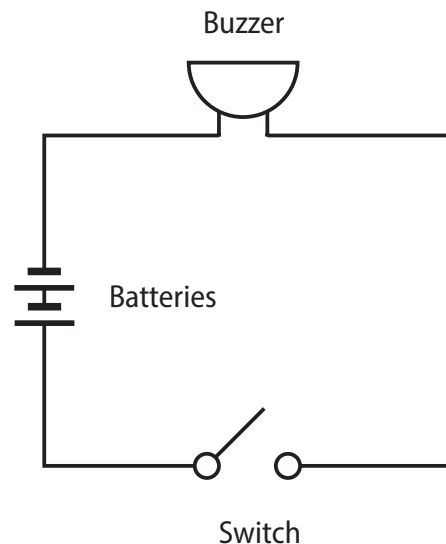
When the switch is 'closed' electricity flows from the batteries, through the buzzer and back to the batteries in a circuit.

The electricity is generated by a chemical reaction between chemical compounds inside the batteries. The chemical reaction starts when the circuit is switch on and stops when it is switched off.

The electricity flows through the buzzer where it powers an electro magnet that causes a piece of metal to vibrate producing a buzzing sound.

As the buzzer sounds it uses the electrical energy. Eventually the chemical compounds in the battery will become depleted and will no longer generate electricity.

Circuit Diagram showing the symbols and circuit layout.



The two 1.5 volt batteries are arranged in 'series' so they produce three volts.

Installing Batteries

Important! Follow these instructions to install the batteries.

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 model is switched off before inserting the battery.
7. Requires two 1.5 volt AA batteries.
8. Make sure you insert the batteries 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 and dispose of safely.
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-rechargeable batteries.
15. Do not mix old and new batteries.
16. Do not mix alkaline, standard (carbon-zinc) and rechargeable (ni-Cd) batteries.