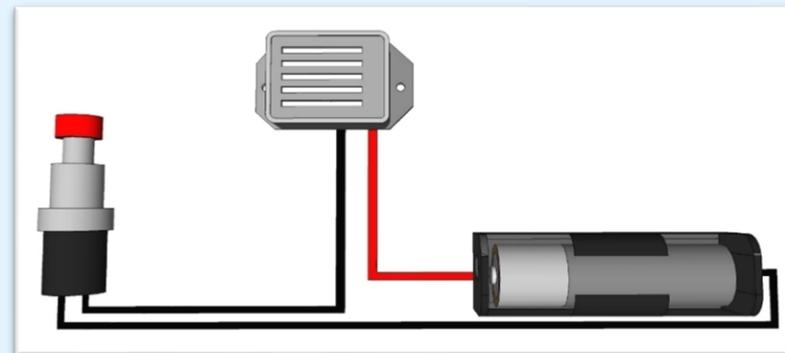




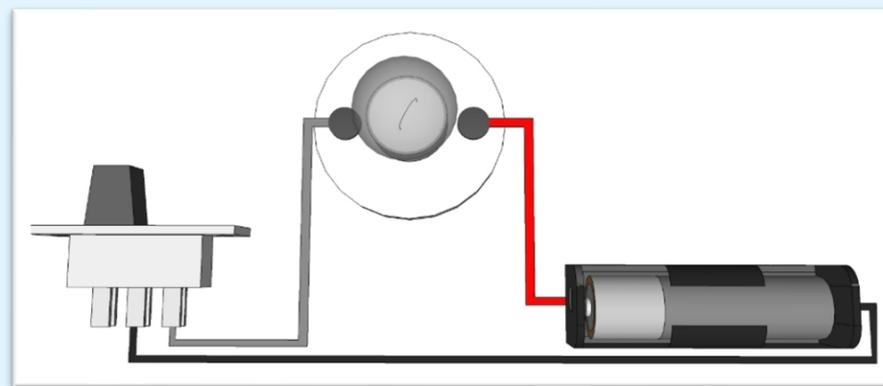
# Build-a-House



# Make and wire up a model house



Doorbell



Light

# Learning objectives

- **S**cience – construct simple series electrical circuits.
- **T**echnology – understand and use electrical systems in products.
- **E**ngineering – understand what different switches are used for.
- **M**aths – measure distances and angles.

Discover how much fun **STEM** can be!



# Working safely

Look at the tools and equipment.

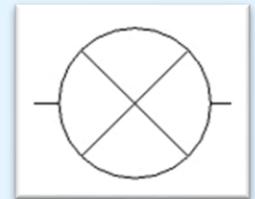
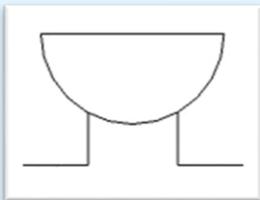
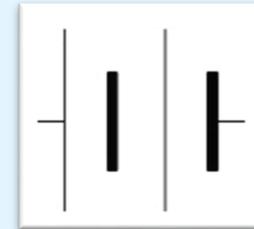
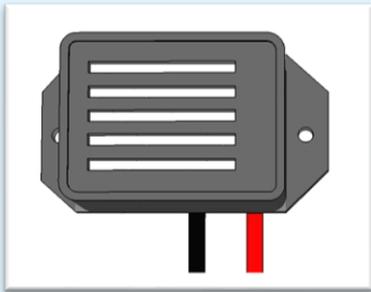
Can you spot any potential hazards?



Can you think of ways to reduce the risks?

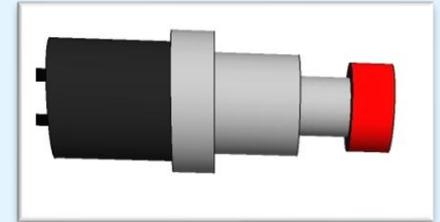
# Electrical Parts

Name these electrical components:

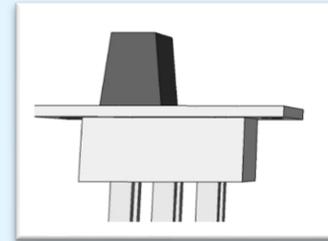


# Electrical Circuit

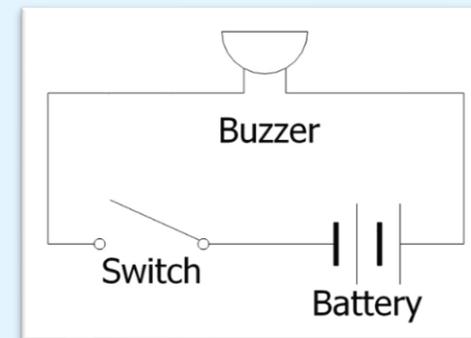
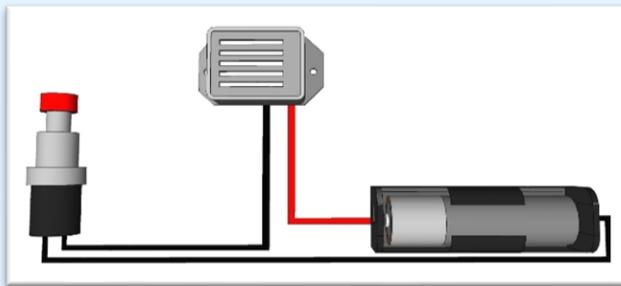
- How do you operate a push-to-make switch?



- How do you operate a slide switch?



- Why would you use a circuit diagram to represent your circuit?

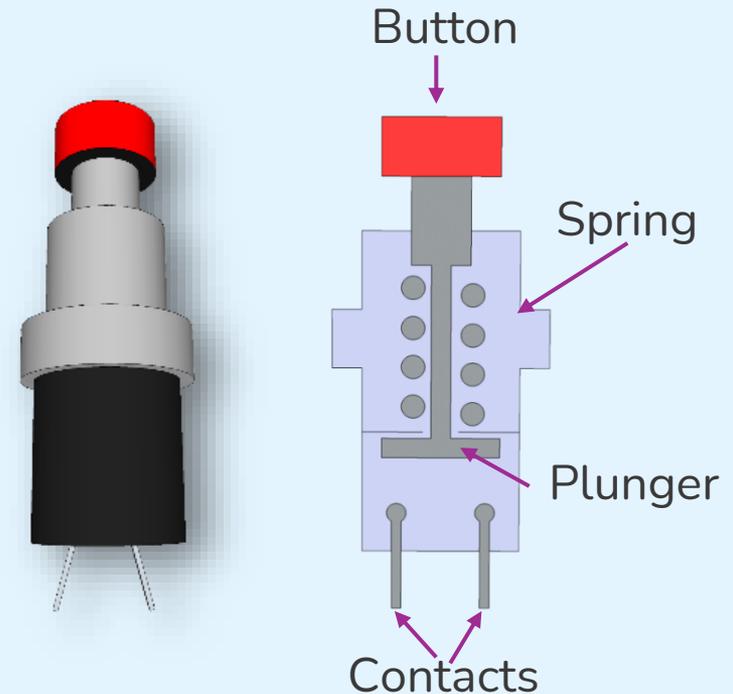


# How a push-to-make switch works

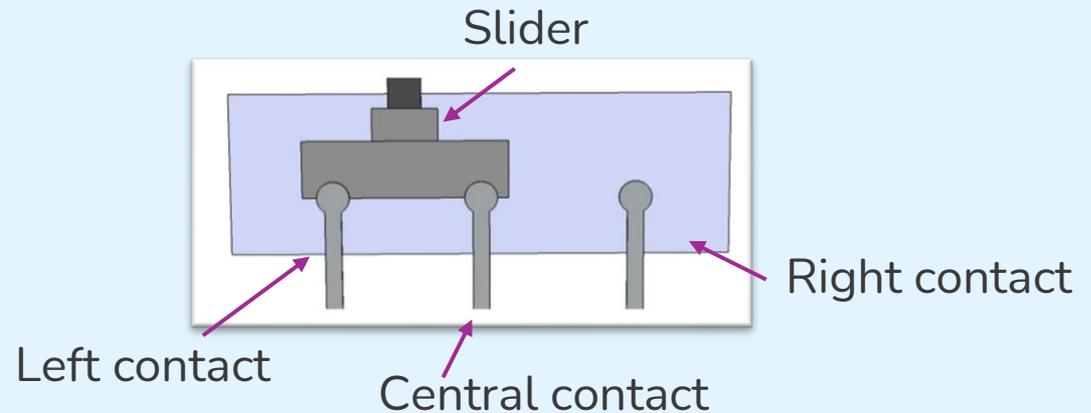
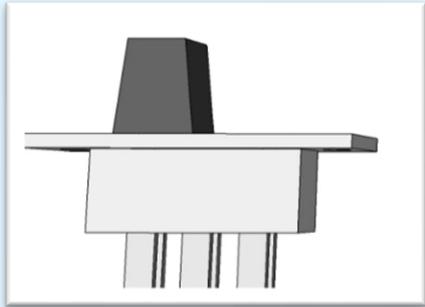
When the plunger is up, the two contacts are not connected. This means there is a gap in the circuit.

When you press the button, the plunger moves down and bridges the two contacts, completing the circuit.

When you release the button, the spring pushes the plunger back up, so the two contacts are no longer connected.



# How a slide switch works



- When the slider is moved to the left, the left contact is connected to the central contact.
- When the slider is moved to the right, the right contact is connected to the central contact instead.

# Avoid short circuits

If batteries are 'short-circuited' they can get hot.

- Do not connect the bare metal ends of the wires from the battery directly together; the battery must be connected across the buzzer or the bulb.
- Make sure the plastic sleeves cover the crocodile clips as shown here, to help prevent short-circuits if the clips touch.



# Make your doorbell circuit

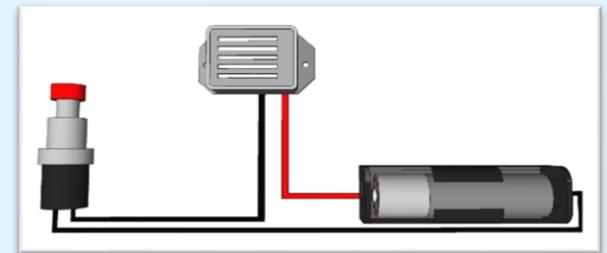
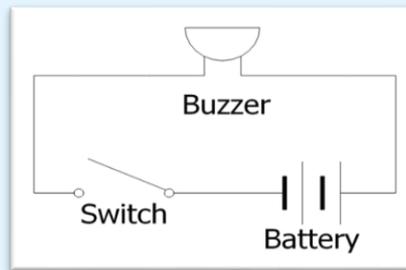
## Equipment

Collect these components:

- 1 buzzer
- 1 push-to-make switch
- 1 cell
- 1 battery holder
- 3 crocodile leads

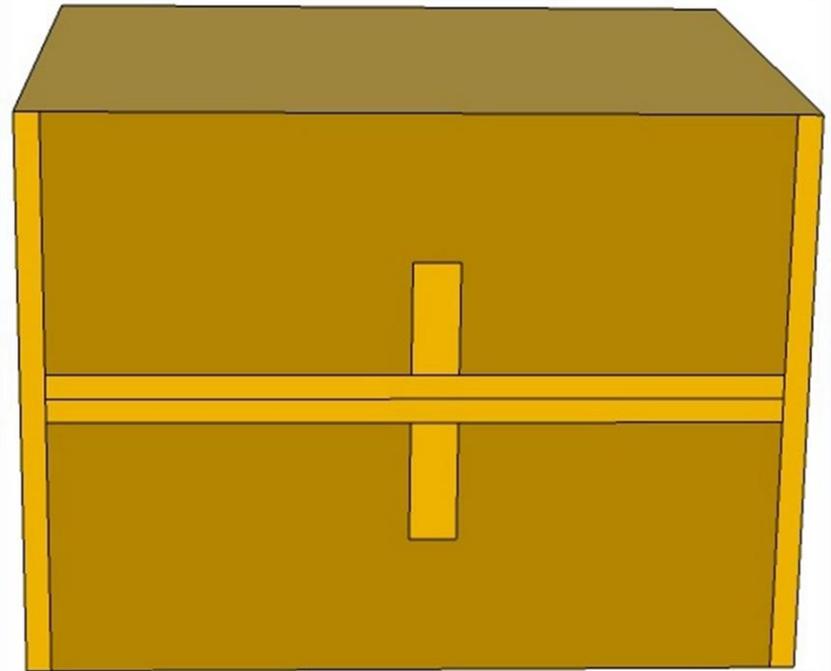
## Method

1. Lay out your components in a triangle and connect up this circuit. The red wire from the battery must be connected to the red wire to the buzzer.
2. Clip crocodile clips onto bare metal, not onto plastic insulation!
3. Fit the cell into the battery holder (the right way round). Press the red button and check the buzzer sounds.



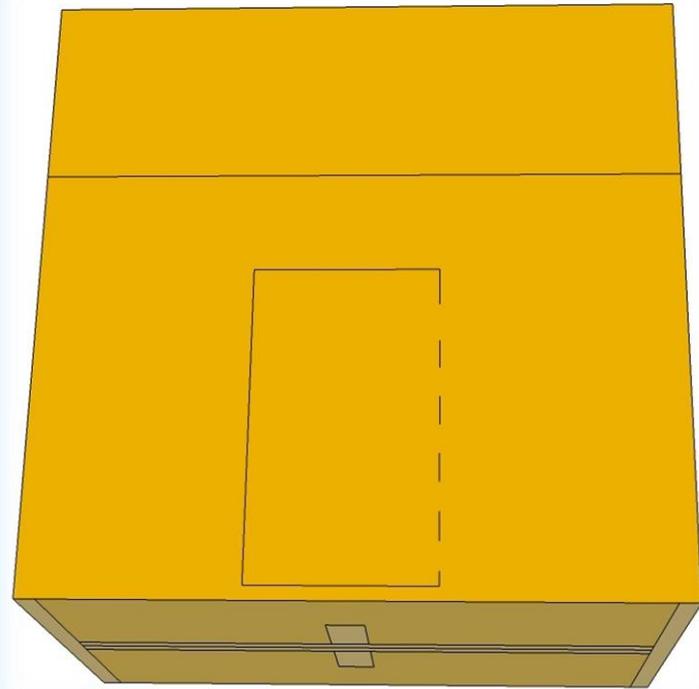
# Start making your house

1. Collect a cardboard box.
2. Open it up and fold in two end flaps.
3. Fold in the two side flaps.
4. Tape the flaps in position as shown.
5. This will be the bottom of your house.



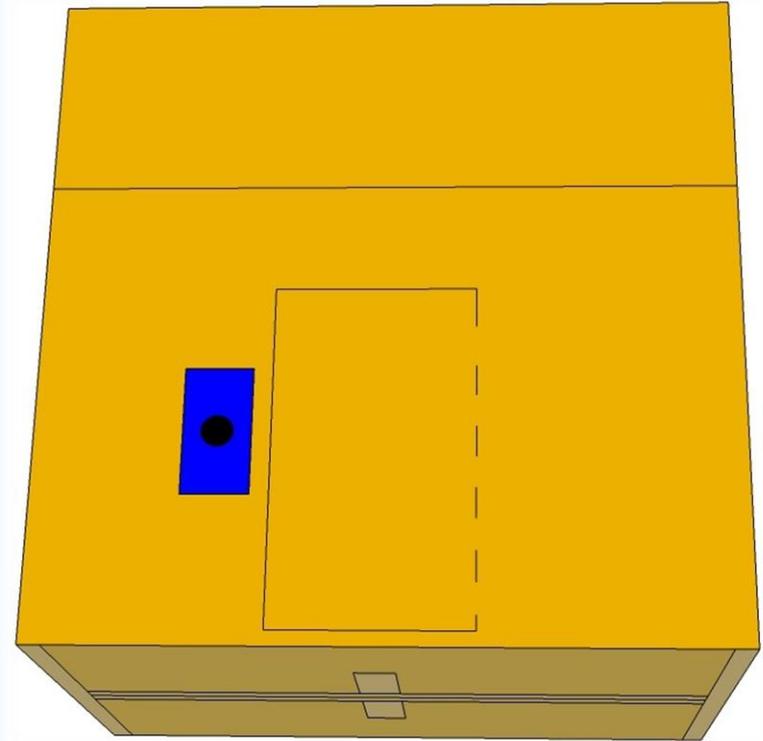
# Make your door and windows

1. Use the ruler and felt tip pen to draw a front door on the box. Make sure it is big enough to get your hand through.
2. Cut out three sides with the pointed scissors, leaving the fourth side as a hinge (shown here as a dashed line) so you can open and shut the door.
3. Mark and cut out one or more windows at the back of the house



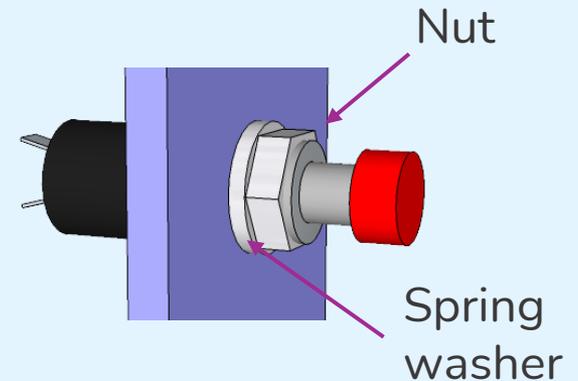
# Prepare your doorbell attachment

1. Cut out a 3cm x 5cm rectangle of corrugated plastic.
2. Use the sharp pencil to make a hole in the middle.
3. Place the rectangle near the door, draw round it with the felt tip pen and mark the hole.
4. Cut a hole in the cardboard where you marked it – this hole must be big enough for the switch to fit through.



# Fit your push-to-make switch

1. Unclip the crocodile leads.
2. Unscrew the nut and remove the spring washer from the switch. Don't lose them!
3. Enlarge the hole in the plastic rectangle and push the threaded part of the switch through – it should fit tightly.
4. Refit the washer and nut – tighten with the pliers or spanner.
5. Glue the plastic in the position you marked on the house, with the red button on the outside.



# Fit your buzzer and re-make the circuit

1. Glue the buzzer to the outside of the house.
2. Pierce a hole with the sharp pencil and push the wires through.
3. Glue the battery box inside the house.
4. Re-connect the wires.
5. Try out the doorbell and make sure it works.
6. Tidy up the wires and tape them to the inside of the house.



# Make your lighting circuit

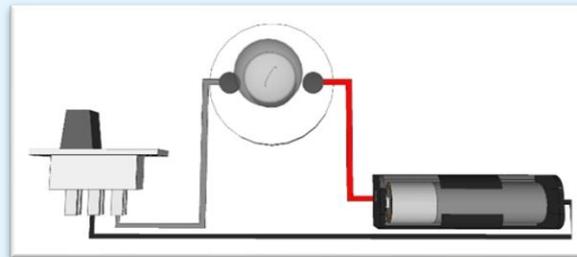
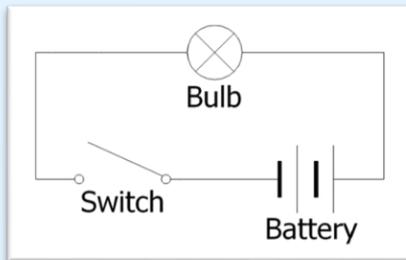
## Equipment

Collect these components:

- 1 bulb holder with bulb fitted
- 1 slide switch
- 1 cell
- 1 battery holder
- 3 crocodile leads

## Method

1. Lay out your components in a triangle and connect up this circuit.
2. Clip crocodile clips onto bare metal, not onto plastic insulation!
3. Fit the cell into the battery holder (the right way round). Check the bulb lights up when you slide the switch one way and goes off when you slide it the other way. Switch off when not in use.



# Fit your light switch

1. Unclip the crocodile leads.
2. Work out a position on the outside of the house to fit your light switch (if you put it on the outside, you can reach it easily).
3. Cut a rectangle 13mm wide by 25mm high.
4. Check the switch body slides into this hole.
5. Glue on the switch.

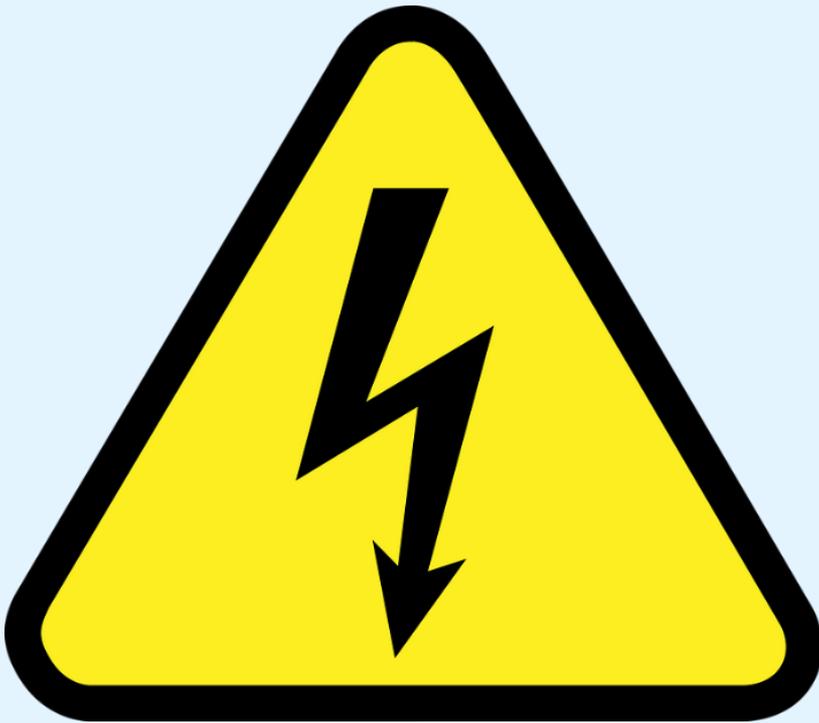


# Fit your lamp and re-make the circuit

1. Work out a position inside your house to fit your bulb holder.
2. Glue it in position.
3. Work out where to attach your battery and glue it on.
4. Re-connect the wires.
5. Try out the light, then switch off.
6. Tidy the wires and tape them to the inside of the house.



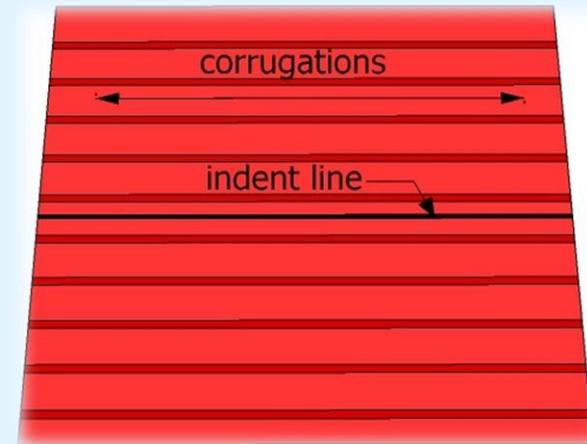
# Electrical Safety



- Your circuit uses 1.5 volts of electricity.
- Mains voltage used in a real house (in the UK) is 240 volts.
- Can you think of any hazards of mains electricity?
- Can you think of ways to avoid these hazards?

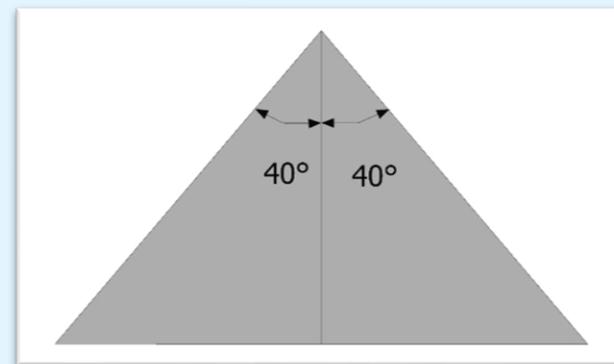
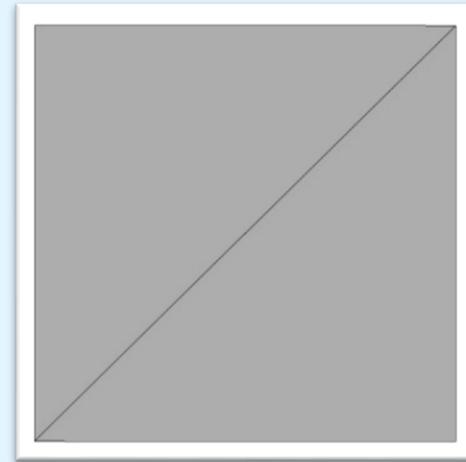
# Start making the roof

1. Take your large square of corrugated plastic.
2. Use the ruler and **blunt** pencil to indent a line down the middle. Make sure it is **in line** with the corrugations as shown.
3. Bend the roof in half with the line you have scored along the ridge-line. It should bend neatly where you have indented it.



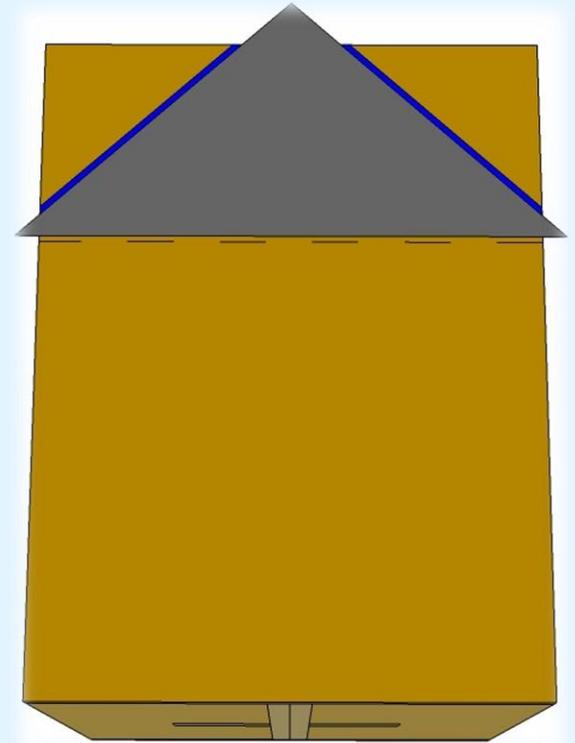
# Make the ends of the roof

1. Take your small square of corrugated plastic.
2. Cut it in half diagonally with the large scissors.
3. Mark the centre line of each triangle with the felt tip pen.
4. Use the protractor to measure and mark  $40^\circ$  from the centre line in either direction.
5. Trim both the triangles to the shape shown.



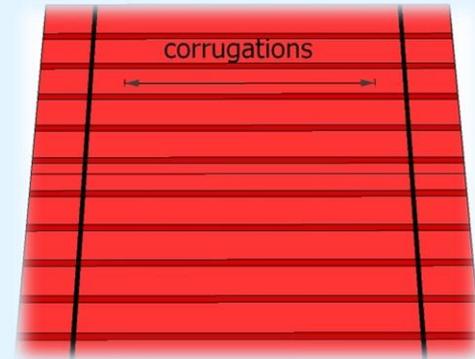
# Trim the box ends to fit the roof

1. Fold the side flaps on top of your box inwards and tape in place.
2. Leave the end flaps sticking up.
3. Place one of your triangles against one of the sticking-up end flaps, with the bottom on the fold line.
4. Mark and then cut off the corners of the end flaps (indicated by the blue lines on the picture).
5. Repeat for the other end of the box.



# Finish the roof

1. Turn the roof over and mark two lines on the underside with the felt tip pen 15mm from either end. These must be across the corrugations.
2. Run a line of glue along both short sides of a triangle and stick it to the roof along the line you marked.
3. Repeat for the second triangle.
4. Place the roof on the house.



# Decorate and populate your house

- Use pipe cleaner, pompoms and wiggly eyes to make people and pets to go in your house.
- Add decorations to the walls or roof made from self-adhesive foam sheet, for example climbing plants and solar panels.
- Use offcuts of corrugated plastic to construct a chimney or furniture.



# Plenary

Discuss how the activity went and what you have learnt.

- What type of switch did you use for the doorbell circuit?
- Would this switch be suitable for a lighting circuit?
- What type of switch did you use for the lighting circuit?
- Would this switch be suitable for a doorbell circuit?
- Did it matter which way round you connected your buzzer?
- How about your light?
- What will happen if you leave your light switched on?
- What did you enjoy most about this activity?



# Fun TTS STEM design & make class kits

Balloon Buggies



Crumble Kit



Periscopes



Fairground Rides



Make your own light



Fan boats

