



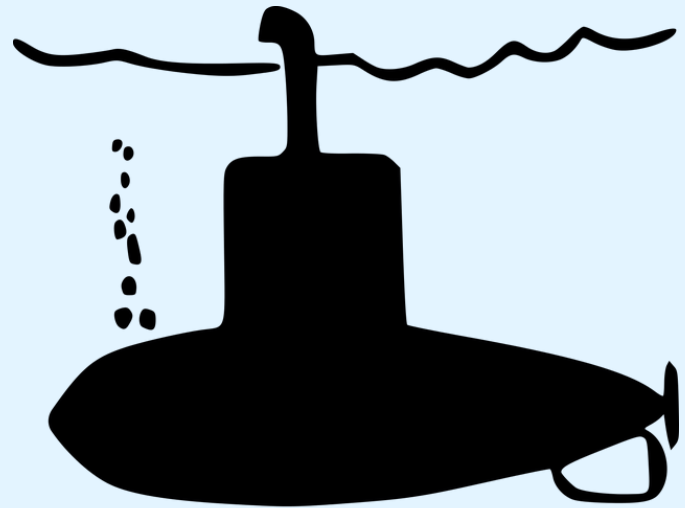
# Periscopes

# STEM Learning objectives

- **Science** – explore the way that light behaves
- **Technology** – give reasons for the particular uses of everyday materials
- **Engineering** – construct a periscope and understand how it works
- **Maths** – draw and measure angles in degrees using a protractor



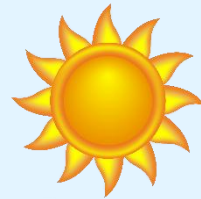
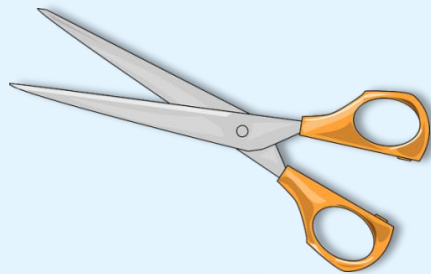
# What are periscopes used for?



# Working safely

Look at the tools and equipment.

Can you spot any potential hazards?

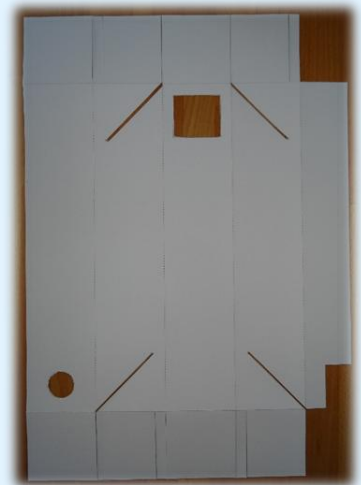


Can you think of ways to reduce the risks?

# Materials provided

You have the following materials to make your periscope:

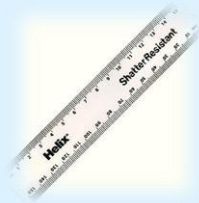
- Strip of greyboard
- Strip of mirror material
- Box template
- Foam leaf shapes



# Tools provided

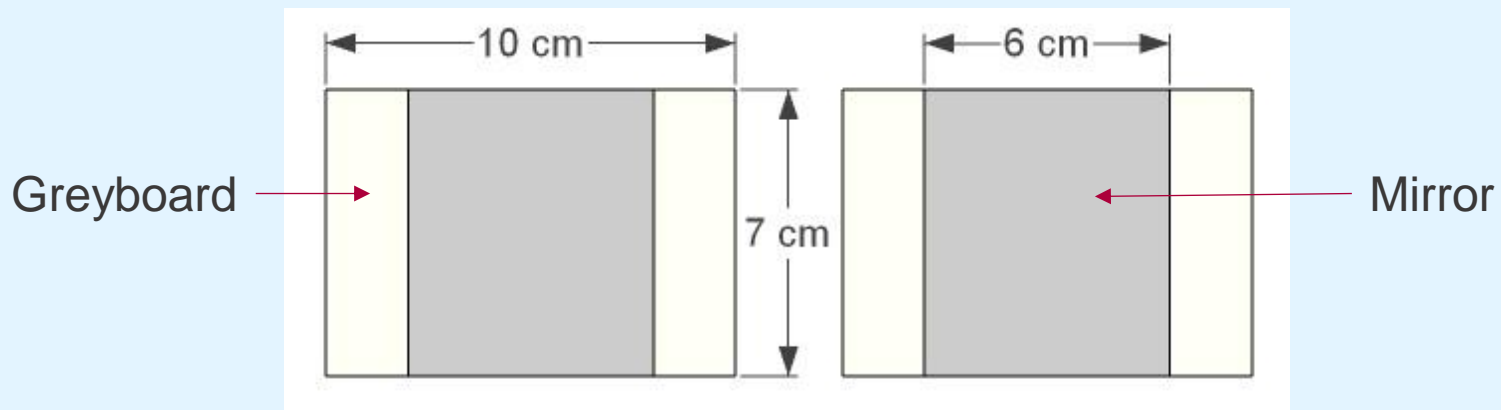
You have the following tools with which to make your periscope:

- Ruler
- Protractor
- Lump of poster tack
- Transparent sticky tape
- Glue gun
- Paint, paintbrushes and/or other decorations (optional)
- Marker pen
- Pencil



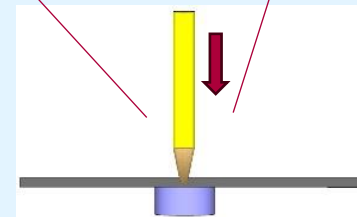
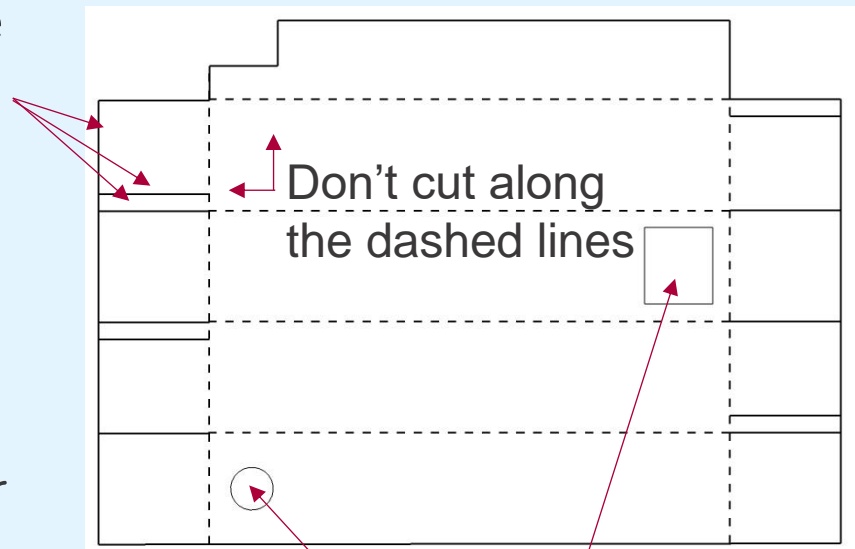
# Cut and mount your mirrors

1. Use the marker pen and scissors to mark and cut two rectangles of greyboard 7 cm x 10 cm.
2. Mark and cut two rectangles of mirror 6 cm x 7 cm.
3. Peel the plastic covers off the back of the mirrors and stick them to the mountboard as shown.
4. Peel the plastic covers off the front of the mirrors.



# Cut out your box

1. Carefully cut out the outline of box template along each of the solid lines with scissors.
2. To cut out the rectangular and circular holes, first place the template on the lump of poster tack, with the hole just over the poster tack.
3. Pierce the hole with the sharp pencil. You can then use the scissors to cut out the hole outline.

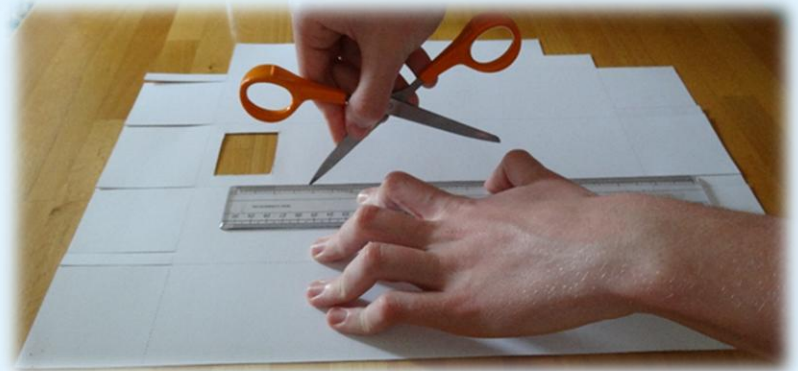




# Fold up your box

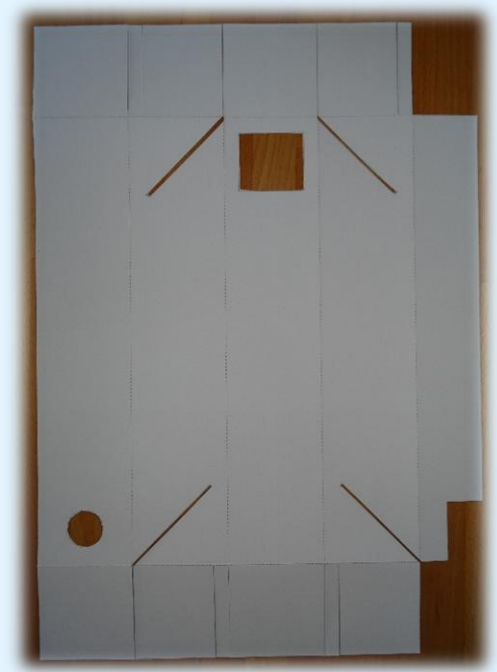
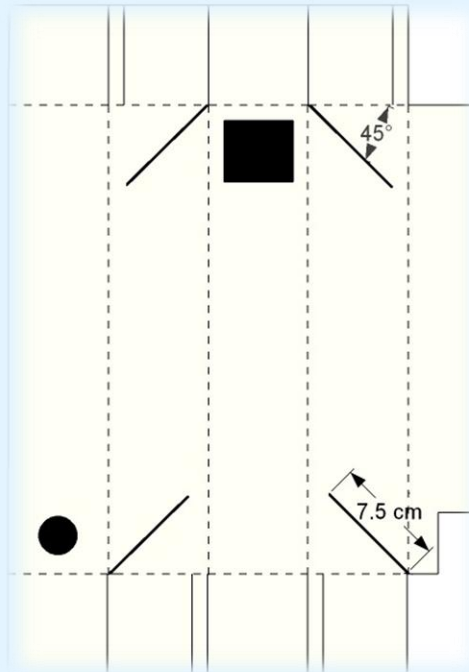
1. Use a ruler and one blade of the scissors to score along the dashed lines. Don't break through the card.
2. Fold the card along the dashed lines to make a box.

The score lines should be on the outside.



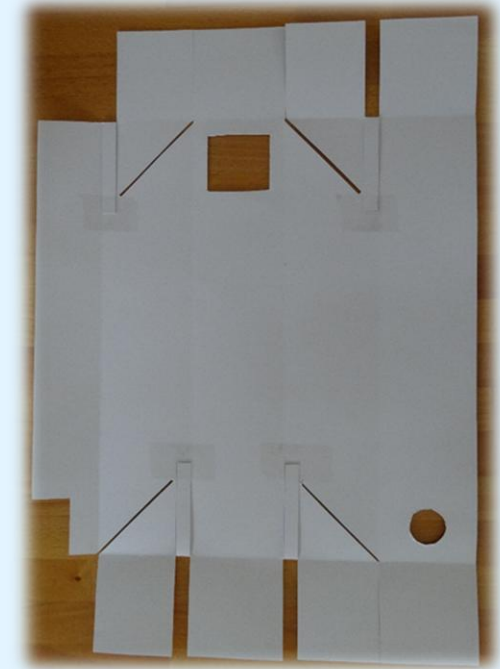
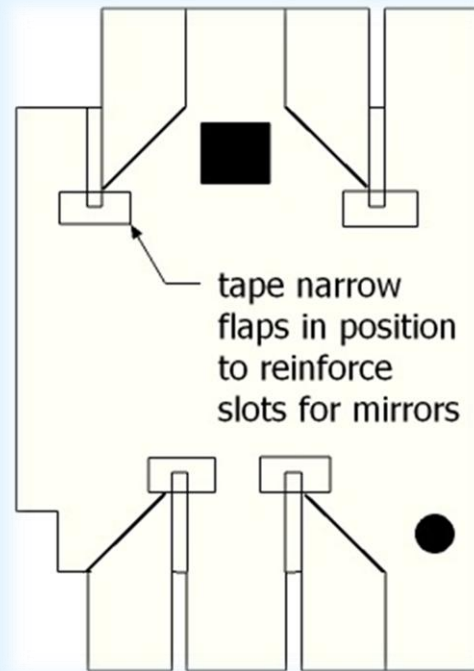
# Cut slots to mount the mirrors

1. Open the box out flat again.
2. Measure and draw four 7.5 cm long lines at  $45^\circ$  as shown.
3. Cut 2 mm wide slots along the four lines with scissors.



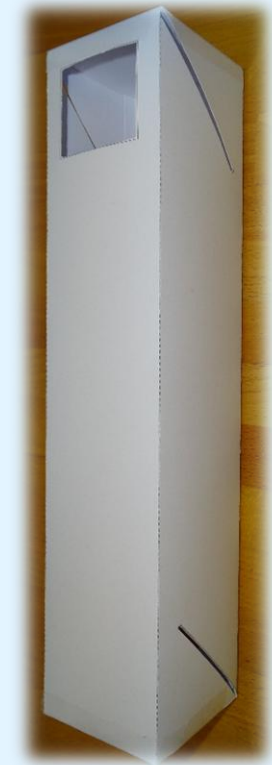
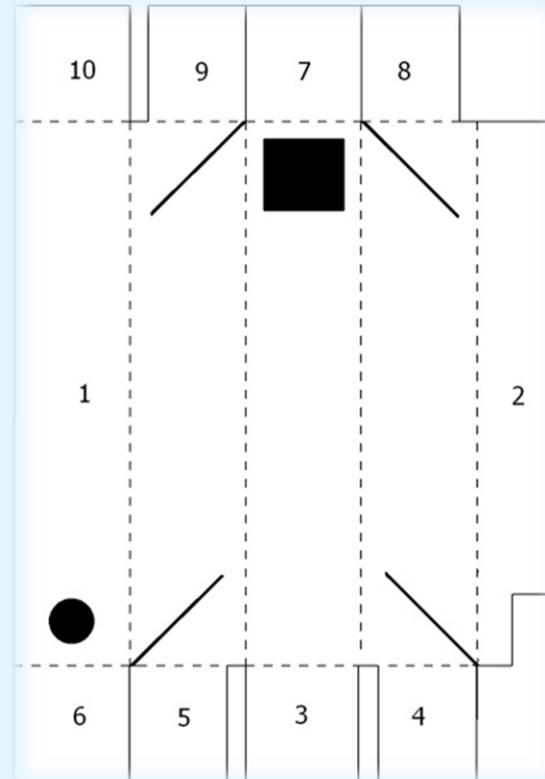
# Reinforce the slots for the mirrors

1. Turn the box over.
2. Fold the four narrow flaps down flat.
3. Tape them in position.
4. Don't block the mirror slots with tape.



# Fold into a box shape

1. Fold the box along the fold lines in the order shown.
2. The dashed lines should be on the outside.
3. Tape up all the seams.
4. Don't block the slots with tape.



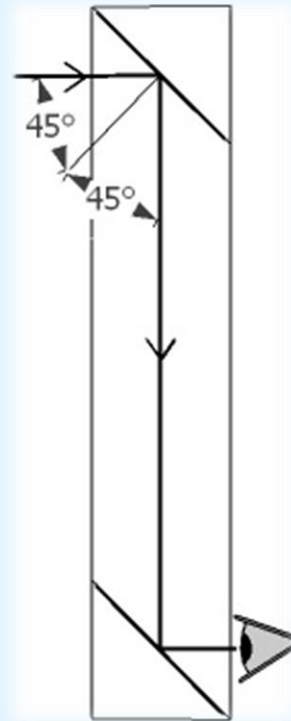
# Fit the mirrors

1. Slide the two mirrors into the slots.
2. If the slots are too narrow cut them slightly wider.
3. One mirror should be facing the round hole.
4. The other mirror should be facing the rectangular hole.
5. Tape the ends of the greyboard in place.



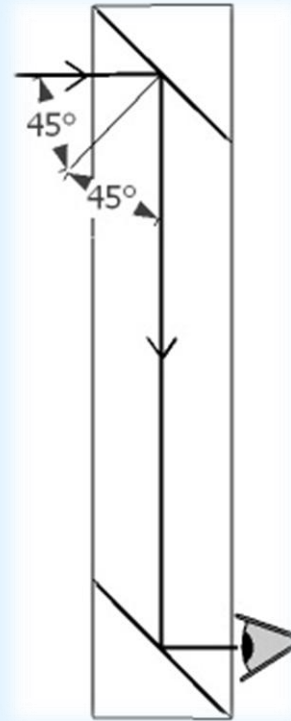
# 1 How the periscope works

- Look into the round hole to use your periscope. Try using it to see over or around solid objects.
- Discuss how the periscope works.
- What does reflection mean?
- Which properties of a mirror enable it to reflect light?



## 2 How the periscope works

- Incoming light rays pass through the rectangular hole at the top.
- The top mirror reflects the light rays at  $90^\circ$  ( $45^\circ + 45^\circ$ ) down the body of the periscope.
- The bottom mirror then reflects the light rays at  $90^\circ$  out through the round hole into your eye.
- This allows you to see over or around solid objects (although it seems as though you are looking straight ahead).



# Decorate your periscope

- Decorate your periscope.
- You could glue on foam leaves to camouflage it.
- Suggest situations where you might want a periscope not to be noticed.



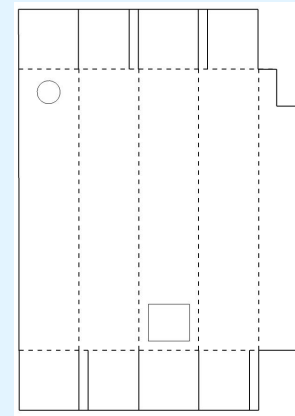


# Properties of materials

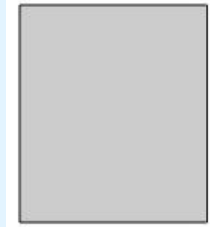
- Does a smooth shiny surface or a dull surface reflect light better?
- Which of the materials you used reflects light?
- Which needs to be stiff? Why?
- Which ones are sticky?
- Which do you need to be able to cut?
- Which do you need to be able to bend?



Greyboard



Box template



Mirror



Sticky tape



Glue

# Plenary

Discuss how the activity went and what you have learnt.

- What difficulties did you encounter and how did you overcome them?
- What have you learnt about:
  - How light behaves?
  - How you see things?
  - How a periscope works?
  - Using materials for particular purposes?
- What did you enjoy most about the activity?



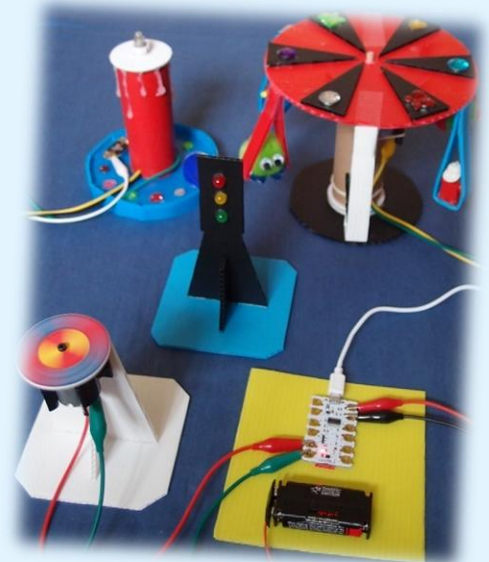
# More fun TTS class kits



Balloon Buggies



Fan boats



Crumble kit