Periscopes

Lesson Plan

Periscopes

- Recommended level – Years 3-6
- Time taken – 2-3 hours
- Pupils to work individually
- Additional adult help is useful – you could invite in parent helpers
- Expectation – each pupil to complete a working periscope

Skills and Learning

STEM Links

- **S**cience – explore the way that light behaves, including reflection.
- **T**echnology – give reasons for the particular uses of everyday materials.
- **E**ngineering – construct a periscope and understand how it works.
- **M**aths – draw and measure angles in degrees using a protractor.

Curriculum Learning Objectives – it is recommended to cover these topics prior to the exercise so that the pupils are reinforcing their knowledge and understanding, rather than meeting the topics for the first time.

Science: Light

Pupils should be taught to:

- recognise that they need light in order to see things
- notice that light is reflected from surfaces
- recognise that light from the sun can be dangerous
- recognise that light appears to travel in straight lines

Pupils should explore what happens when light reflects off a mirror.
Pupils might work scientifically by designing and making a periscope and using the idea that light travels in straight lines to explain how it works.

Design and Technology

Use a range of tools and equipment to perform practical tasks (for example cutting, shaping, joining and finishing) accurately.
Use a range of materials according to their functional properties and aesthetic qualities.

Mathematics

Pupils should be taught to:

- Draw given angles and measure them in degrees (°)

Pupils become accurate in drawing lines with a ruler to the nearest millimeter and measuring with a protractor.

Resources

Parts included in class kit:

- Periscope card templates (60)
- Greyboard, 10 sheets 635 x 760 mm (enough for 60 periscopes plus spare)
- Plastic mirror, 10 A4 sheets (enough for 60 periscopes plus spare)
- Colourful foam leaf shapes (500)

Check you have received the correct contents in your class kit. Please let TTS know if there are any problems as soon as possible.

Associated resources:

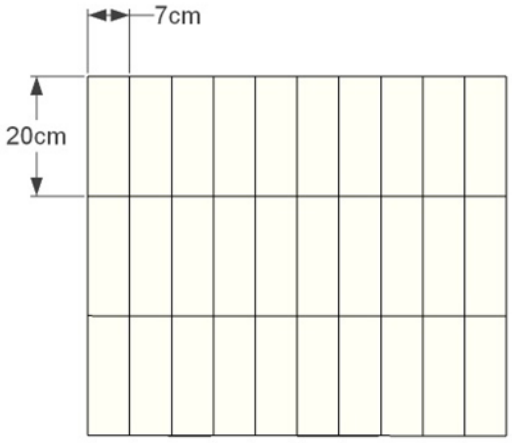
- Periscopes Presentation
- Periscopes Worksheet
- Periscopes Worksheet - Suggested Answers
- Make a Periscope Instructions

Tools and consumables (not included):

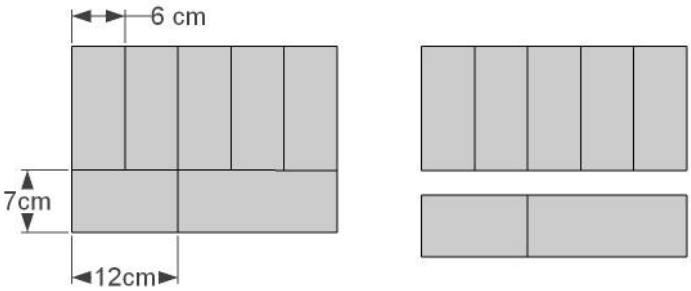
- 30 cm rulers (1 each)
- Protractors (1 each)
- Marker pens or felt tip pens (1 each)
- Scissors (1 each – if possible larger and sharper than the usual school scissors)
- Sharp pencils (1 each)
- Lump of poster tack (1 each)
- Transparent sticky tape (1 dispenser per table)
- Cool melt glue guns and cool melt glue sticks for decorating
- Optional – acrylic paint and paintbrushes
- Optional – other decorations, e.g. coloured paper

Preparation Needed:

- Pre-cut the greyboard into 7cm x 20cm strips to distribute to the pupils. A craft knife, straight edge and cutting mat is recommended for this. You should get 30 rectangles from one sheet of greyboard – one for each pupil. The pupils will measure and cut their strips into two 10cm lengths for mounting the mirror on.



- Pre-cut the mirror to distribute to the pupils. A marker pen and ruler is useful to mark the lines before cutting. First cut a 7cm wide strip off the bottom, and cut it in two. Then cut the remainder into 6cm wide strips. You should get 7 strips from each A4 sheet as shown.



- Build a sample periscope to explore any pitfalls, and to demonstrate to the pupils what they will be making and how it works. Instructions are given in the 'How to make a periscope' blog.
- Print out a worksheet for each pupil.

Risk Assessment:

Conduct a risk assessment before undertaking the activity. A sample risk assessment is given below; you can use this as a starting point when writing your own.

Activity	Identified Hazard	Initial Risk Rating L/M/H	Control Measures	Controlled Risk Rating L/M/H
Use of scissors	Injury e.g. to fingers	M	Make the children aware of the dangers. Do not give out the scissors until after the safety briefing.	L
Use of sharp pencils to make holes in templates	Injury e.g. to fingers	M	Make the children aware of the dangers. Use a lump of poster tack underneath the template to support the paper and to make sure that the sharp point of the pencil goes into the poster tack	L
Use of glue guns	Burns	H	Children should be supervised by a responsible adult at all times when using the glue guns. Explain to children how to use the glue guns. Warn them that the ends are very hot. Use only low melt temperature glue guns. If burned hold under running water for ten minutes. Don't switch on the glue guns until after the safety briefing.	M
Running extension leads along floor for glue guns	Trip hazard	M	Otherwise make sure extension leads are run where they cannot be tripped over.	L

Damaged extension leads or glue gun leads	Electrocution hazard	H	Conduct a visual check of all electrical items before session to ensure the leads are undamaged. PAT test electrical items regularly.	L
Use of tape dispensers	Injury e.g. to hands	M	Make the children aware of the dangers. Show them how to use the tape dispensers safely.	L
Using periscope to look at the sun	Damage to eyes	M	Warn children not to use the periscope to look at the sun because it will damage their eyes.	L

Slide 3

What are periscopes used for?

- In World War 1 soldiers used them to see out of the trenches without exposing themselves to enemy fire.
- They are used in submarines to see what is happening above the water without having to surface. They are used to see out of tanks and armoured vehicles.
- They are used at golf matches, horse racing and festivals to see over the heads of crowds.

Slide 4

Work safely

- Don't cut yourself with the scissors or tape dispenser.
- Don't burn yourself with the glue gun.
- Don't use the periscope to look at the sun.
- Don't spike yourself with the sharp pencil.

Slide 5 & 6

Materials Provided and Tools Provided

Initially, just hand out the greyboard and mirror strips, rulers, marker pens and scissors.

Slide 7

Cut and mount your mirrors

Ask the pupils to try not to bend the mirror and greyboard during cutting and mounting, as this will affect the final image quality.

Slides 8	**Cut out your box** • Hand out the box templates, sharp pencils, poster tack, protractors and sticky tape. • Make sure the pupils only cut along the solid lines, not the dashed lines. • You can show the pupils how to pierce the rectangular and circular holes using the sharp pencil and poster tack, in order to cut out the outline of the two holes. • The templates could be painted at this stage and left to dry, if this was a convenient break in the making process. Acrylic paint can take 30-60 minutes to dry.
Slide 9	**Fold up your box** You can show the pupils how to score the lines without breaking through, then fold up the box.
Slide 10	**Cut slots to mount the mirrors** • If pupils are not familiar with using a protractor, they may need help drawing on the lines at 45°. • The slots need to be long enough and wide enough to avoid distorting the greyboard and mirror during fitting, as this will affect the quality of the image.
Slide 11	**Reinforce the slots for the mirrors** • If the pupils have forgotten to cut the sides of the flaps, they can cut them now. • Make sure they don't tape over the mirror slots.
Slide 12	**Fold into a box shape** • The entire periscope box should be folded into a long square tube, before folding in the end flaps in the order shown by the numbers on the diagram. • If the periscope box is painted, it should be glued along the seams instead of taped. Tape does not usually stick well to paint.
Slide 13	**Fit the mirrors** • Taping the end of the greyboard should stop the mirrors from sliding out of the slots. • Pupils can tape the edges of the greyboard to the template, or they can tape over the ends of the greyboard. • Alternatively, the greyboard can be glued in place.

Slide 14

How the Periscope Works – 1

- Students could try crouching down and looking over the table surface, looking around the doorframe, through a window, over a whiteboard or wall etc.
- When light from an object is reflected by a surface it changes direction. It 'bounces off' the surface at the same angle that it hits it.
- The smooth shiny surface of the mirror enables it to reflect light.

Slide 15

How the Periscope Works - 2

- Light coming in through the square hole is reflected by the top mirror down the middle of the periscope. It then reflects off the lower mirror and into your eye.
- The light reflects off the mirror surface at the same angle that it hits the surface, in this case 45°.The mirrors need to be mounted at 45° so that the light is reflected at right angles down the periscope and then again at right angles into your eye.

Slide 16

Decorate your periscope

- It is difficult to paint the periscope all over at this stage because the paint does not cover the tape well. It could be partially painted to camouflage it.
- As well as foam leaf shapes, students could decorate their periscopes with coloured paper or anything else suitable from the school cupboard.

Slide 17

Properties of materials

- A smooth shiny surface reflects light better.
- The mirror reflects light.
- The greyboard needs to be stiff to keep the mirror flat.
- The sticky tape, glue and the back of the mirror are sticky.
- The greyboard, mirror and box template all need to be cut.
- The box template needs to be bent. However, it also needs to be stiff enough to support the mirrors.