Eclipse Viewing

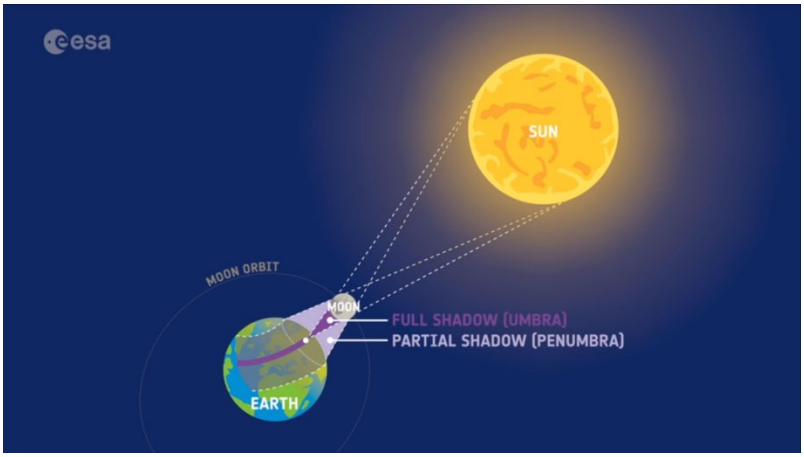
Engineers Week 2025

Classroom Resource Booklet

BLACKROCK CASTLE OBSERVATORY
The Space For Science

Taighde Éireann
Research Ireland

About Eclipses



Eclipses occur when the Moon, as it orbits the Earth, moves between the Sun and the Earth. The Moon casts a really long shadow across space and this blocks out the sunlight as seen by people on Earth.

A **total** solar eclipse occurs when the Moon completely covers the disc of the Sun. When this occurs, the shadow of the Moon is cast onto the Earth along what is called the path of totality, and that region is cast into darkness. Parts of the Earth to either side of totality will experience a **partial** solar eclipse.

A total eclipse occurs once on average every 16 to 18 months somewhere around the world. However, for it to occur in a single location is extremely rare – usually only once in every 375 years. This is why a total eclipse is a once-in-a-lifetime event. There are at least two solar eclipses each year, up to a maximum of five. These eclipses may not all be total – that depends on the exact position of the Moon in space as it orbits the Earth.

Partial Eclipse, credit: John Pindar

The next total solar eclipse visible from Ireland is 23 September 2090. It will be visible from the far southwest of the country. Other parts of the country will see a partial solar eclipse.

On 29 March 2025, there will be a partial solar eclipse and in Ireland at least 40% of the Sun will be covered, with a deeper eclipse the further north or west you are. The next partial eclipse is an amazing 93% to 97% on the evening of 12 August 2026, with a deeper eclipse the further south you are. In Northern Spain this will be a total eclipse.

Safe Viewing Guidance

During a partial eclipse it is NOT safe to stare directly at the Sun. This is because the Sun is extremely bright, and that intense light can cause permanent damage to your retina (the back of your eye that is responsible for vision). During an eclipse some of the Sun is covered, so you may think that it is safe to look at the Sun. Humans have a reflex where our eyes blink in response to bright light. During an eclipse, the Sun appears less bright, so the blink reflex does not work. This means that you may expose your eyes to damaging amounts of light. Read more here.

You can safely view an eclipse through special eclipse glasses. Do NOT use eclipse glasses that are scratched or damaged. Do NOT wear eclipse glasses and then look through a telescope at the Sun. Sunglasses are NOT eclipse glasses!

ESA astronaut Alexander Gerst views a solar eclipse at an event for children in Germany in Berlin, Germany. Credit: ESA

You can project the image of the eclipsed Sun with a pinhole camera. A very simple pinhole camera can be made with a card with a tiny hole poked into it. It will project the image of the Sun onto the ground.

A colander or cheese grater can be used to project the image of the Sun onto a sheet of paper. The holes in the colander or cheese grater act as pinholes and will show the crescent shape of the eclipsed Sun.

A mirror can be used to reflect the image of the Sun into a darkened room.

Credit: Joe Mabel, CC BY 4.0 via Wikimedia Commons

BCO The Space For Science

Ireland esero

Curious Minds/ESERO Framework for Inquiry

Theme	Eclipse Viewing
Curriculum	Science > Energy and Forces > Light: Infant Classes: -- explore how shadows are formed First and Second Classes: -- recognise that the sun gives us heat and light, without which we could not survive -- become aware of the dangers of looking directly at the sun Third and Fourth Classes: -- be aware of the dangers of looking directly at the sun -- investigate the relationships between light and materials Fifth and Sixth Classes -- know that light travels from a source -- be aware of the dangers of excessive sunlight **Skills Development:** Working Scientifically: Questioning; Investigating & Experimenting; Analysing. Designing and Making: Exploring; Planning; Making; Evaluating

Engage

The Prompt	Wondering	Exploring
When it is not possible to see the Sun? [at night, during eclipses, on cloudy days etc] Paxi and Our Moon Phases and Eclipses https://youtu.be/w4U_cuF-_hI?si=ygqtNX0Lh6ZEWyeS&t=182 A solar eclipse seen from 36000 km away. Image from ESERO 53 ESA Video: What is an Eclipse?	How do eclipses happen? What blocks the light from the Sun from reaching us during an eclipse? Could there be a solar eclipse on Venus? [no – Venus has no moon] Explore a digital model of the Earth-Moon-Sun with NASA Eyes on the Solar System Why should you not look directly at an eclipse?	Create a model Earth-Sun-Moon (see ESERO 53), either with objects and a torch, or create a personal eclipse on a sunny day blocking out sunlight with their hand. CAUTION – do not stare at the Sun while doing this. Create a paper orrery from Stargazing Live. Create a very simple pinhole camera with a sheet of card with a small pinhole in it. Project an image of the Sun onto a second piece of paper on the ground. See The Sun in our box from AstroEdu. Change the distance between the pinhole and the paper and observe the changes in the image.

Investigate: Solar Eclipse (from ESERO 53)

Explore	Plan	Make	Evaluate
Create a physical model of the Moon's orbit around the Earth.	Consider what size objects should be used to represent the Earth and the Moon. What distance apart should they be? Use Our Solar System as a resource in considering the size of the Earth compared to the Moon.	Create your model and use it to demonstrate a solar eclipse. If using a torch as the Sun, can you see the shadow of the Moon on the Earth?	Learners should evaluate their model in terms of how well it shows a solar eclipse. Can it be used to demonstrate a lunar eclipse?

Considerations for inclusion

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Curious Minds/ESERO Framework for Inquiry

Design & Make: Make a Pinhole Camera

Explore	Plan	Make	Evaluate
Explore how light travels in straight lines and creates an image through a pinhole. Follow a guide (see instructions from The Sun in our box from AstroEdu or from Stargazing Live) to create a pinhole camera.	Learners can choose equipment from material supplied by the teacher: Paper Card Foil Darning needles to make the holes Baking parchment Cereal boxes Juice boxes	Create a pinhole camera from supplied material. Modify it in light of experience.	How does distance between the hole and screen affect the size of the image? Is the image clear and sharp?

Take The Next Step

Applying Learning	Making Connections	Thoughtful Actions

Can pinhole cameras be used to take photographs? Explore how camera obscuras work.
Mathematical Extension: Use https://mreclipse.com/main/preview.html to tally how many eclipses happen each year. Is there a pattern between the time between eclipses? Does it matter if you look at solar eclipses or lunar eclipses or both?

Reflection	Did I meet my learning objectives? Are the learners moving on with their science skills? Ask the learners if they enjoyed the lesson. What questions worked very well? What questions didn't work well? Ask the learners would they change anything or do anything differently. Are there cross curriculum opportunities here?

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Curricular Links:

Primary Science Curriculum: Content Objective(s) / Learning Outcome(s): Energy and Forces > Light

Infant Classes:

-- explore how shadows are formed

First and Second Classes:

-- recognise that the sun gives us heat and light, without which we could not survive

-- become aware of the dangers of looking directly at the sun

Third and Fourth Classes:

-- be aware of the dangers of looking directly at the sun

-- investigate the relationships between light and materials

Fifth and Sixth Classes

-- know that light travels from a source

-- be aware of the dangers of excessive sunlight

Junior Cycle Science Learning Outcomes, Earth and Space

Students should be able to:

4. develop and use a model of Earth-Sun-Moon system to describe predictable phenomena observable on Earth, including seasons, lunar phases, and eclipses of the Sun and the Moon.

Modelling Eclipses

Use a variety of spheres to act as the Earth and Moon to create a three-dimensional model of the Earth-Moon system. Use a torch to act as the Sun and attempt to cast the shadow of the Moon onto the Earth.

See the detailed instructions in ESERO 53.

The Earth – Moon – Sun can be modelled as a 'personal eclipse' on a sunny day for older learners.

Use a ball on a stick or your own hand clenched into a fist to act as the Moon, the Sun is the Sun, and your head is the Earth. Be careful not to stare at the Sun while modelling the Earth-Moon during an eclipse.

Ask: *Where does your hand have to be to cast a shadow on your face?*

Ask learners to look at another learner to see the shadow of the 'Moon.'

Younger learners can use a large ball as the Moon and attempt to cast its shadow onto a chalked circle on the ground. This will work best on a sunny day and can be included in work on shadows as part of Science: Energy and Forces > Light.

A paper orrery can be created using the template from Stargazing Live. Use the template to show where the Moon must be in its orbit to block sunlight from reaching the Earth.

Solar eclipse
Looking at the stars

53

time
50 minutes

learning outcomes
To:
- know that during a solar eclipse the Moon comes between the Sun and the Earth
- know that a solar eclipse does not take place every month

end product
- a model showing a solar eclipse

materials needed
- 12 rulers
- 12 oranges
- 12 torches
- 12 toilet paper rolls
- 12 table tennis balls
- 12 pieces of wire 55 cm long
- 12 pieces of polystyrene measuring 30 x 20 cm
- sticky tape
- optional computer with internet

The Sun 10 min.

Sit in a circle with the children. Discuss the Sun. Do they know that the Sun is a star? Ask where the Sun goes when it sets. Explain to the children that it looks as if the Sun is moving, but this is because the Earth is turning on its axis. Explain that we can no longer see the Sun when it sets at night, but, in addition, very occasionally we cannot see the Sun in the middle of the day. We call this a solar eclipse. Show the photograph of the solar eclipse on the discussion sheet.

The children investigate what causes a solar eclipse.

Solar eclipse 35 min.

Encourage the children to complete Task 1 on the worksheet. Help the children where necessary as they make their model. They can use the internet to look up the answer to question c.
Discuss the answers. During a solar eclipse the Moon is positioned exactly between the Sun and the Earth.

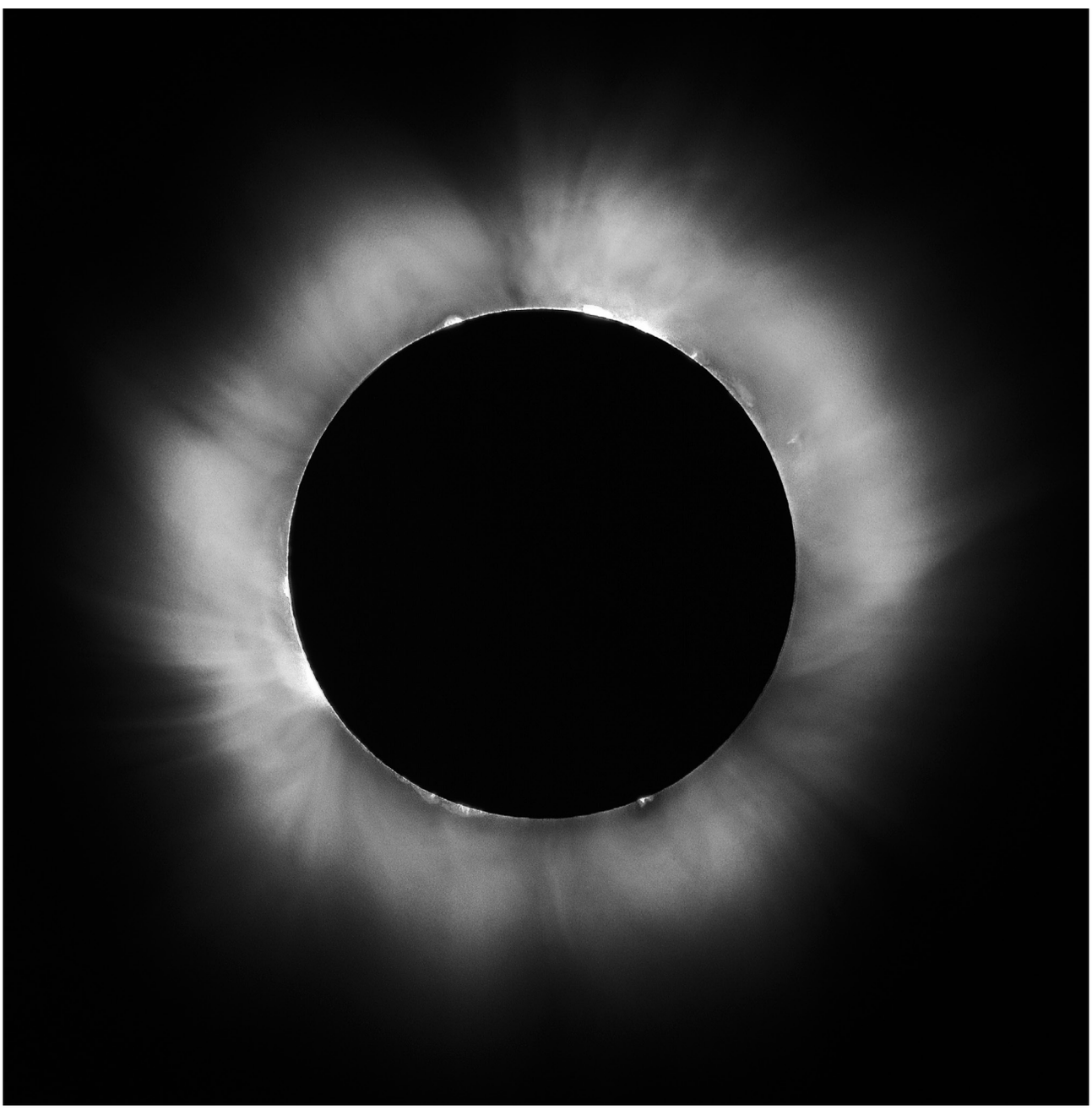
Ask the children the question: When it is not possible to see the Sun? The answer is: at night, and during a solar eclipse. A solar eclipse occurs because the Earth revolves around the Sun and the Moon around the Earth, and sometimes these three celestial bodies are all lined up in a straight line. However, the Moon does not pass exactly between the Earth and the Sun during every revolution, so we don't have a solar eclipse every month.

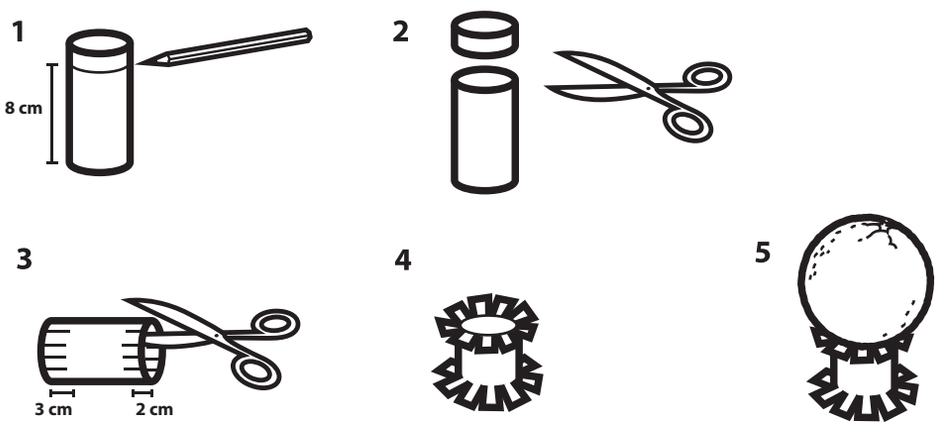
Other planets or moons 5 min.

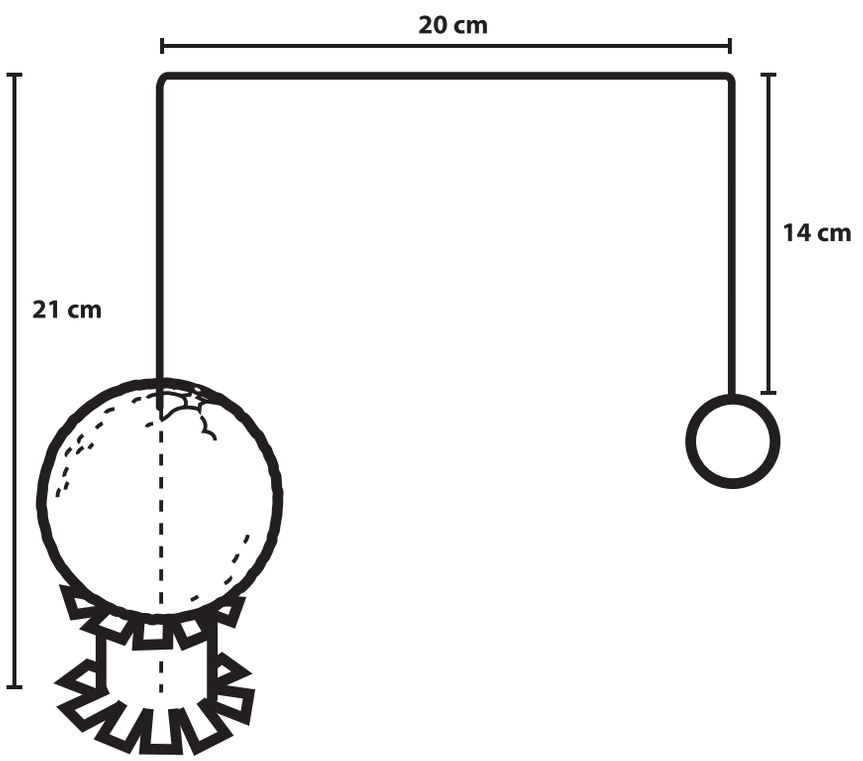
Ask the children whether they think solar eclipses occur on other planets as well. Could there be a solar eclipse on Venus?

Explain that it would be very rare for there to be a solar eclipse on another planet. This is because for a solar eclipse to occur, there has to be a celestial body between the Sun and the planet. And this body must be able to completely cover the view of the Sun. On Earth it just so happens that the Moon can be on a straight line between the Earth and the Sun and it is the right size to completely cover our view of the Sun.

A solar eclipse has also been recorded on the Moon, where the Earth blocked the view of the Sun (on Earth this appeared as a lunar eclipse). One of the moons of Saturn is able to cover the view of the Sun on that planet. This is seen as a solar eclipse on Saturn. A planet can also be eclipsed. When seen from Earth, the planet Venus can be eclipsed by our Moon.




1
8 cm
2
3
3 cm
2 cm
4
5


20 cm
14 cm
21 cm

Solar eclipse

You are going to investigate what causes a solar eclipse.

1 Solar eclipse

What do you need?

- toilet paper roll
- ruler
- sticky tape
- orange
- torch
- table tennis ball
- piece of wire, 55 cm long
- piece of polystyrene measuring 30 x 20 cm

What do you need to do?

The orange represents the Earth. The table tennis ball represents the Moon.

Look closely at the drawing.

1 Take the toilet paper roll. Draw a line 8 cm from one end.

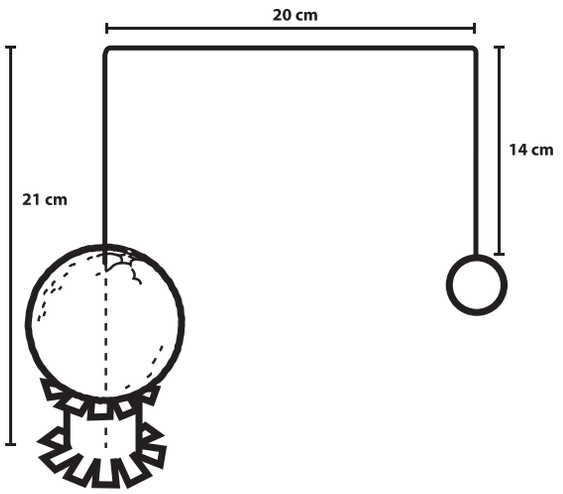
2 Cut the toilet paper roll in two at this line.

3 Take the largest piece of the toilet paper roll. On one end of the roll make 10 small cuts all the way round, each 2 cm deep.

4 Make 10 small cuts on the other end, but this time 3 cm deep.

5 Fold the strips of card on each end of the roll outwards. Stand the toilet paper roll upright, with the longer strips at the bottom.

6 Put the orange on the toilet paper roll, so it is supported on the short strips. You can use sticky tape to fix them in place.



7 Measure 21 cm from one end of the wire. Bend a 90 degree angle in the wire at this point. From here measure another 20 cm and make another 90 degree bend, so that you have a U shape.

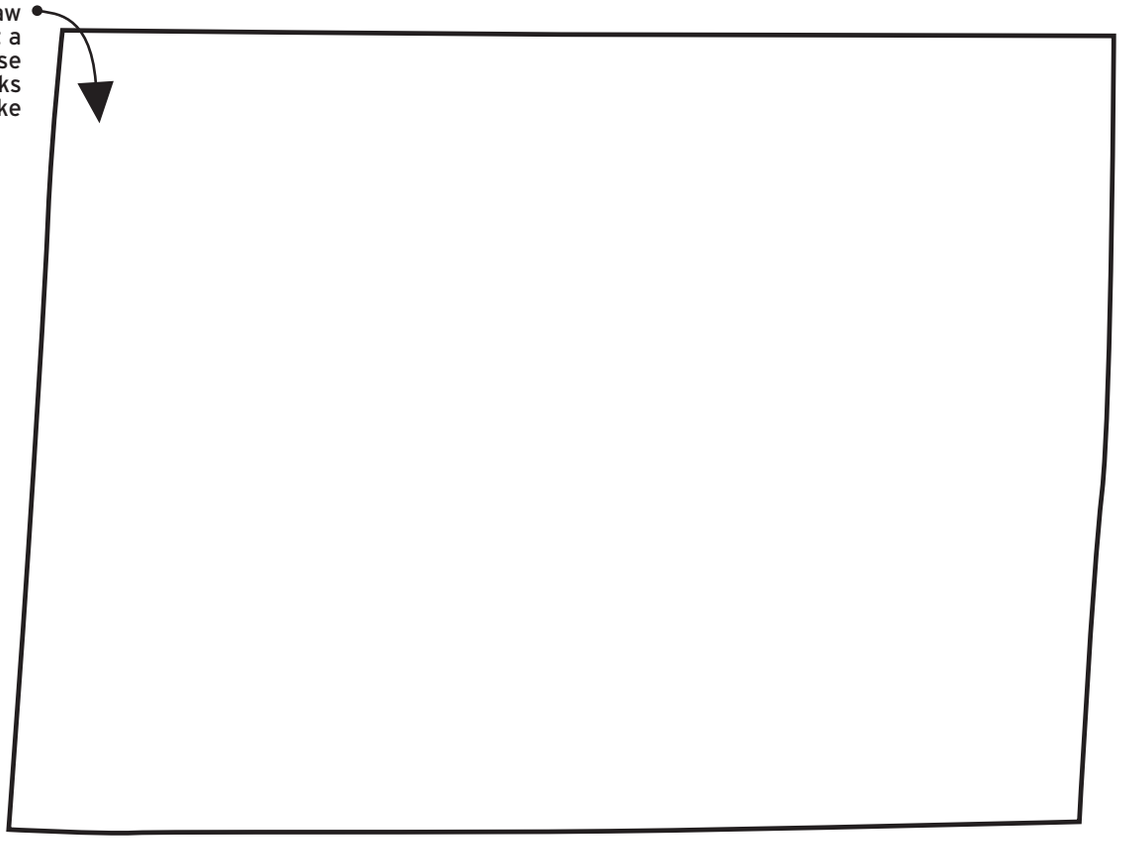
8 The longest piece measures 21 cm. Stick this piece of wire through your orange from top to bottom. Push it far enough for the wire to stick out through the toilet roll tube.

9 Place the piece of polystyrene under the toilet roll tube with the orange. Push the wire into the polystyrene. You can also tape the toilet roll tube to the polystyrene.

10 Tape the table tennis ball to the end of the short arm of the wire.

a Shine the Sun (torch) on the Earth (orange). Rotate the Moon (table tennis ball) around the Earth. Draw the position of the Earth, Sun, and Moon during a solar eclipse.

draw **HERE** what a solar eclipse looks like



MAKE AN ORRERY

STARGAZING LIVE

WHAT IS AN ORRERY?

An Orrery is a mechanical model of the Solar System. Here you can make a simple Orrery, showing the Sun, Earth and Moon, and how they move.

SAFETY

Children will need adult supervision.

WHAT YOU NEED

- Scissors
- 2 paper fasteners

WHAT TO DO:

1. Carefully cut out the four templates shown on the next page.
2. Place Piece 1 where shown on top of Piece 2.
3. Place the Earth over Piece 1, and secure all three pieces together with a paper fastener.
4. Now place Piece 2 on top of the Sun where shown and secure with another paper fastener.
5. Your Orrery is now ready to use. You can orbit the Moon around the Earth and see how it seems to change over a month. You could also try orbiting the Earth around the Sun to see how it moves throughout a year.

DID YOU KNOW?

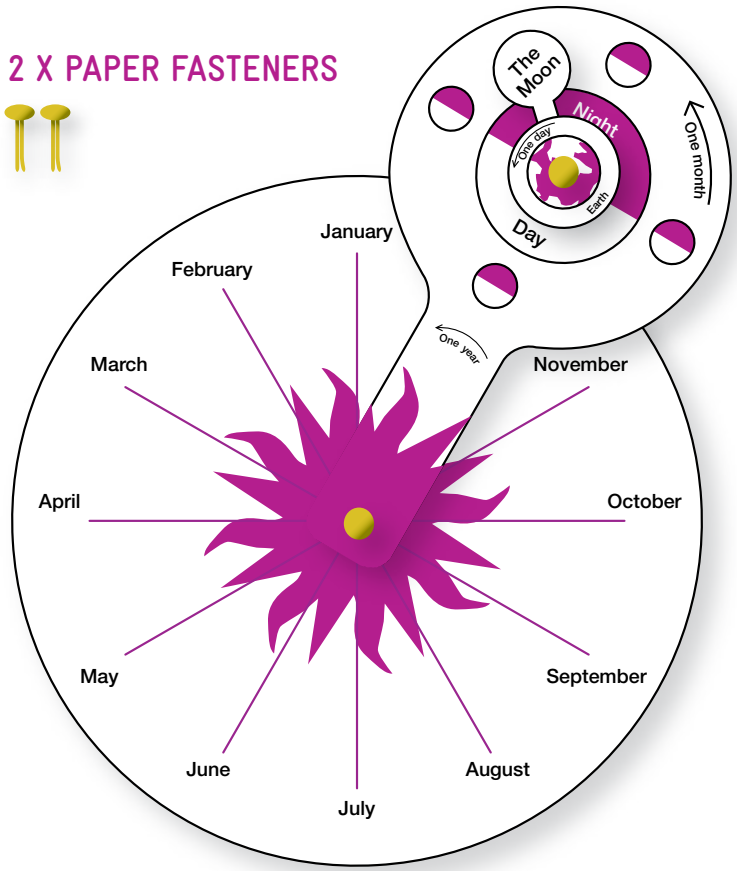
A day is the length of time it takes for the Earth to completely spin on its axis, which is approximately 24 hours.

A lunar month is the time it takes for the Moon to complete one set of phases (full Moon back to full Moon) and is approximately 29.5 days.

A year is the time it takes for the Earth to complete one orbit of the Sun, which is approximately 365¼ days.

COMPLETED ORRERY

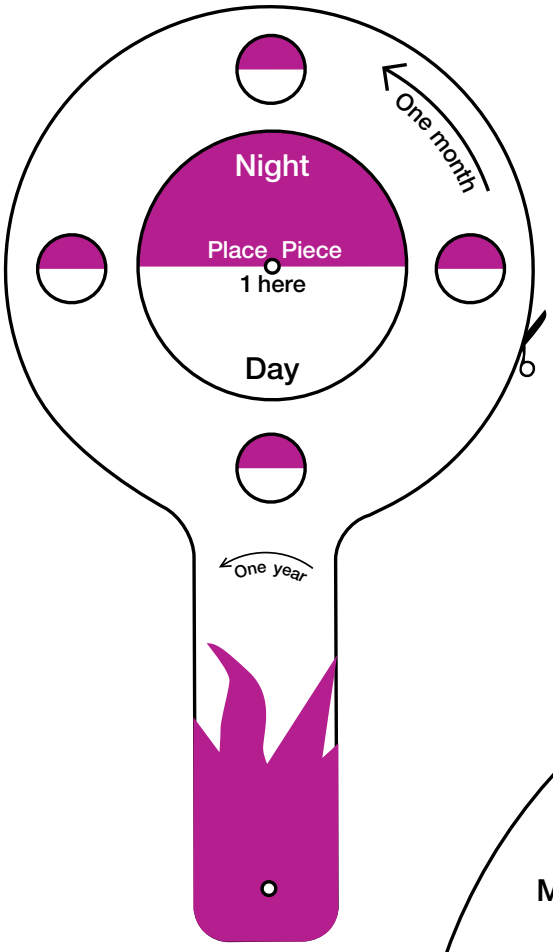
2 X PAPER FASTENERS



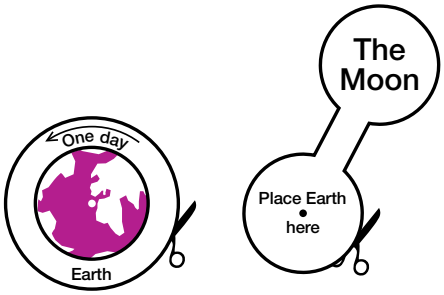
Orrery activity produced with thanks to the Wynyard Woodland Park Planetarium and Observatory.

THE ORRERY

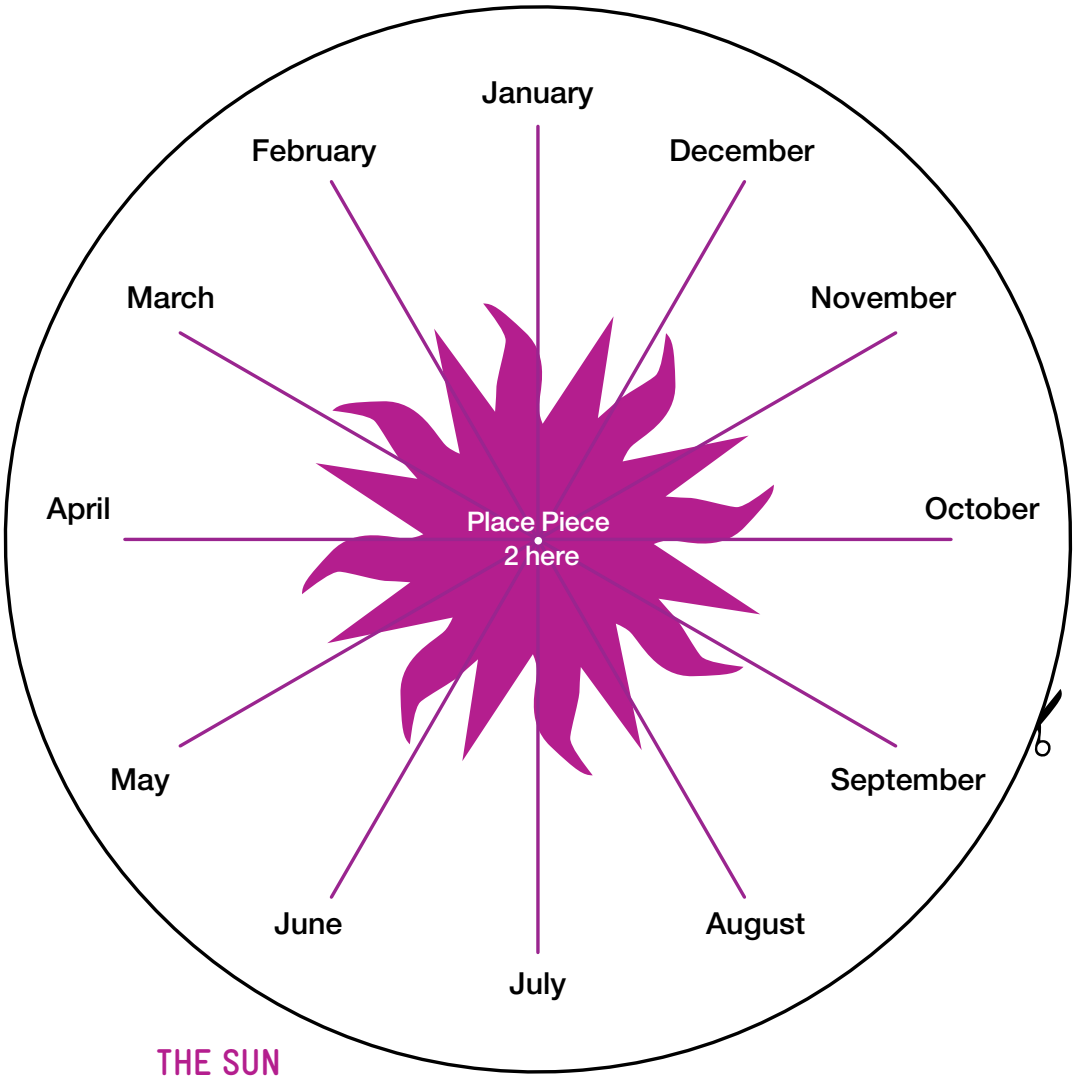
STARGAZING LIVE



PIECE 2



PIECE 1



THE SUN

For Second Level learners:

At what phase of the Moon does an eclipse happen? [New Moon]

How often does New Moon happen in this simple model of the Moon orbiting the Earth? (use the paper orrery or the ESERO 53 model) [every month]

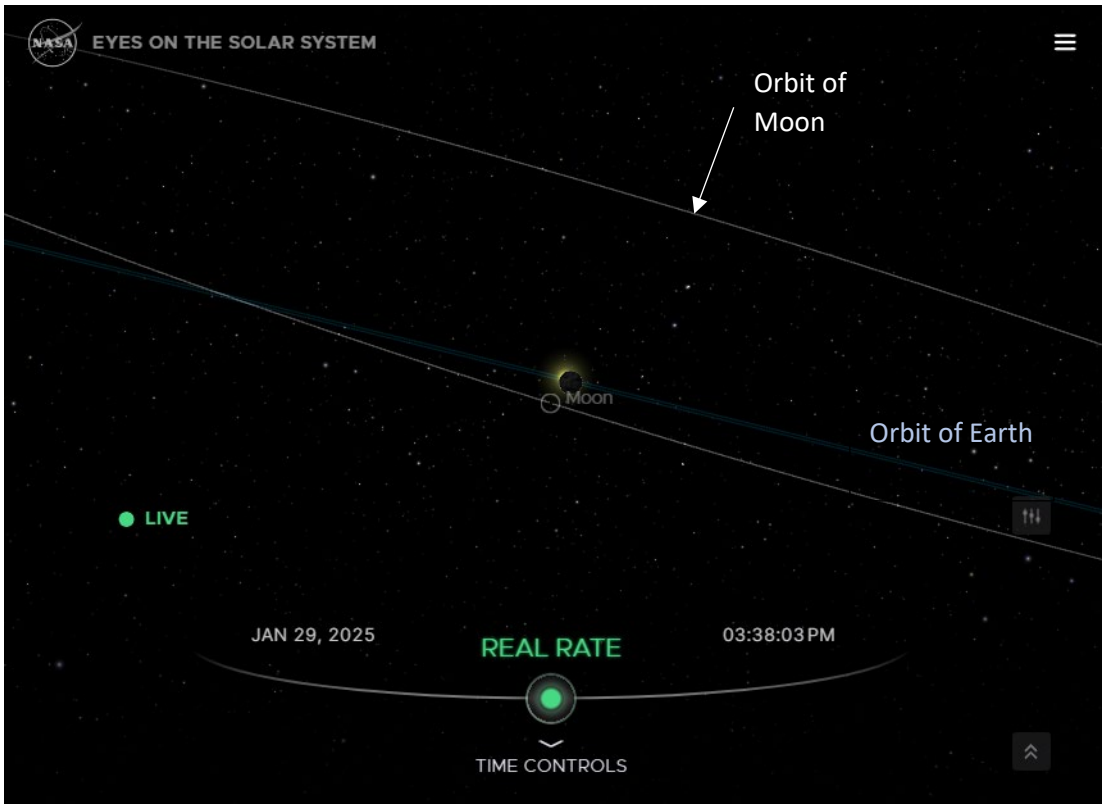
Does an eclipse actually occur every month? [No]

How must we modify this model of the Earth – Moon – Sun so that eclipses only happen a few times a year, not every month?

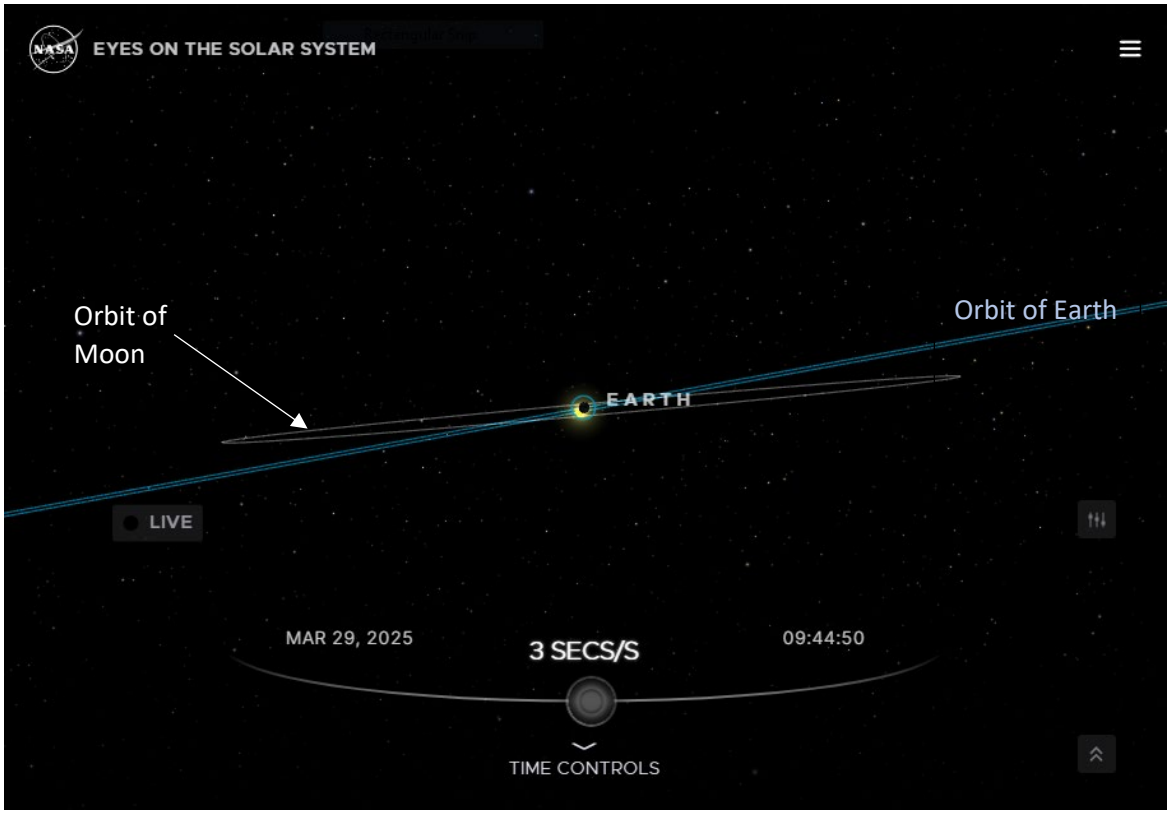
Use NASA Eyes on the Solar System to explore how the Moon's orbit is related to the Earth-Sun orbit.

Change the date shown (click to the left of the date shown and enter a new date) to see where the Moon is in its orbit on New Moon dates. You can use the Moon Calendar to track dates of New Moon.

The Moon's orbit around the Earth is inclined slightly compared to the Earth's orbit around the Sun.



29 January 2025, New Moon. The Moon is below the Earth-Sun line and no solar eclipse can occur.



29 March 2025, New Moon, the Moon is on the Earth-Sun line and an eclipse can occur.

Can learners explain why a lunar eclipse is always preceded or followed by a solar eclipse?

SOLAR ECLIPSE VIEWER

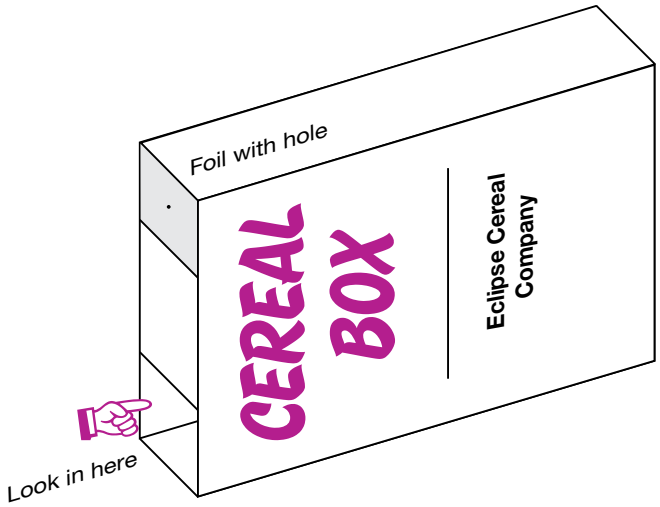
STARGAZING LIVE

WHAT IS A SOLAR ECLIPSE?

A solar eclipse occurs when the Earth, the Moon and the Sun are all aligned with one another in such a way that from Earth, the Moon appears to block the light coming from the Sun.

One of the safest and easiest ways to view a solar eclipse is with a pinhole viewer. Here's how to make one.

SOLAR ECLIPSE VIEWER



SAFETY

Children will need adult supervision.

Remember! Looking directly at the Sun can permanently damage your eyes. You must never look at the sun directly or use any devices such as binoculars or telescopes to view it.

WHAT YOU NEED

- An empty cereal box
- Scissors
- Glue
- Aluminium foil (approx. 10cm by 10cm)
- Sticky tape
- A strip of white paper – the same size as the bottom of your cereal box
- A pin
- A ruler

WHAT TO DO:

1. Open your cereal box at the top and stick the white paper onto the inside of the bottom of the box using glue. This is going to be the 'viewing area'.
2. Cut off the two small tabs at the top of the box and cut off 4cm from each end of the two larger flaps.
3. Fold the remaining flaps together and secure with sticky tape so that you have a box with two rectangular holes in the top.
4. Place the foil over the hole on the right-hand side of the box and secure with sticky tape.
5. Carefully pierce the middle of this foil with the pin – making sure that you only make a very small hole.

Your pinhole viewer is now ready to use! Look into the box through the uncovered hole, whilst making sure the foil-covered hole is pointing towards the Sun. Move the box until an image of the Sun appears on the 'viewing area' at the bottom of the box.

Curious Minds ESERO

Framework for Inquiry - Promoting Inclusion

SPECIAL EDUCATION SUPPORT SERVICE
building on ability

When planning science activities for students with Special Educational Needs (SEN), a number of issues need to be considered. Careful planning for inclusion using the framework for inquiry should aim to engage students in science with real purpose. Potential areas of difficulty are identified below along with suggested strategies. This list is not exhaustive, further strategies are available in the Guidelines for Teachers of Students with General Learning Disabilities (NCCA, 2007).

ENGAGE

POTENTIAL AREA OF DIFFICULTY	STRATEGIES
Delayed language development/poor vocabulary/concepts	• Teach the language of science demonstrating meaning and/or using visual aids (material, property, strong, weak, textured, dimpled, absorbent, force, gravity). • Have the student demonstrate scientific phenomena, for example gravity —using 'give me, show me, make me,' as much as possible. • Assist the student in expressing ideas through scaffolding, verbalising a demonstration, modelling. • Use outdoor play to develop concepts.

INVESTIGATE

POTENTIAL AREA OF DIFFICULTY	STRATEGIES
Fear of failure/poor self-esteem/fear of taking risks	• Model the speculation of a range of answers/ideas. • Repeat and record suggestions from the students and refer back to them.
Understanding Time and Chronology	• Practice recording the passing of time, establish classroom routines that draw the students' attention to the measurement of time. • Teach and practice the language of time.
Fine/Gross Motor Difficulties	• Allow time to practice handling new equipment. • Allow additional time for drawing diagrams, making models etc. • Give students the option to explain work orally or in another format.
Short Term Memory	• Provide the student with visual clues/symbols which can be used to remind him/her of various stages of the investigation.

TAKE THE NEXT STEP

POTENTIAL AREA OF DIFFICULTY	STRATEGIES
Developing Ideas	• Keep ideas as simple as possible, use visuals as a reminder of earlier ideas. • Discuss ideas with the whole group. • Repeat and record suggestions from students and refer back to them. • Encourage work in small group and in pairs.
Communicating Ideas	• Ask students to describe observations verbally or nonverbally using an increasing vocabulary. • Display findings from investigations; sing, do drawings or take pictures. • Use ICT: simple written or word-processed accounts taking photographs, making video recordings of an investigation.

REFLECTION

- Did I take into account the individual learning needs of my students with SEN? What differentiation strategies worked well?
- Did I ensure that the lesson content was clear and that the materials used were appropriate?
- Was I aware of the pace at which students worked and the physical effort required?
- Are there cross curriculum opportunities here?
- Are the students moving on with their skills? Did the students enjoy the activity?

More strategies, resources and support available at **www.ncse.ie**

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