BRITISH SCIENCE WEEK

8-17 March 2024

SECONDARY ACTIVITY PACK

Activities for students aged 11-14 (approx.)

britishscienceweek.org

Delivered by

BRITISH SCIENCE ASSOCIATION

Supported by

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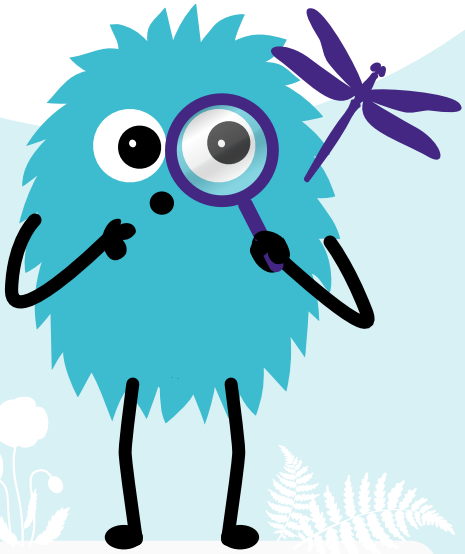
3M

BRITISH SCIENCE WEEK



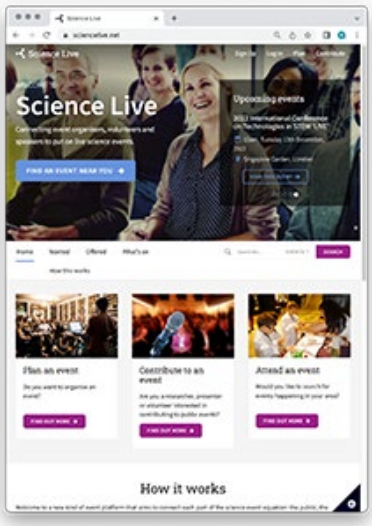
8-17 March 2024

This activity pack is a one-stop shop to support you during British Science Week, and you can use it all year round!

When developing this pack, we looked for activities which promote cross-curricular learning and break down the stereotypes surrounding science, technology, engineering, and maths (STEM). We therefore encourage you to use British Science Week as an opportunity to link STEM to other curriculum subjects, and to your children's own backgrounds, lives, and interests.

We have included activities for students to complete in any setting, whether that is their school, a club, an organisation, or at home with their families.

You can share your brilliant activities, vlogs, or images on social media! Join the conversation or see what's happening during the Week by tagging British Science Week on Twitter (**@ScienceWeekUK**) and using the hashtag **#BSW24**.



Find an activity near you

Last year, hundreds of thousands of people participated in activities around the UK. Help us make British Science Week 2024 even bigger and better! Visit **sciencelive.net** to find science activities in your local area.

BRITISH SCIENCE WEEK

CONTENTS

INTRODUCING THE THEME

BRITISH SCIENCE WEEK 2024

The theme this year for British Science Week is **'Time!'** It's the **30th anniversary of British Science Week** – we want you to celebrate this huge milestone with us, thinking about time since the Week began, and looking to the future!

Here are some ways you can introduce the theme to students in a fun, imaginative way to get them excited about the Week:

- Ask students to design a poster based on this year's theme and enter it into our poster competition for the chance to win some fabulous prizes! Some of the activities in this pack can provide inspiration too, simply look out for the activities marked with the paintbrush symbol shown to the left!

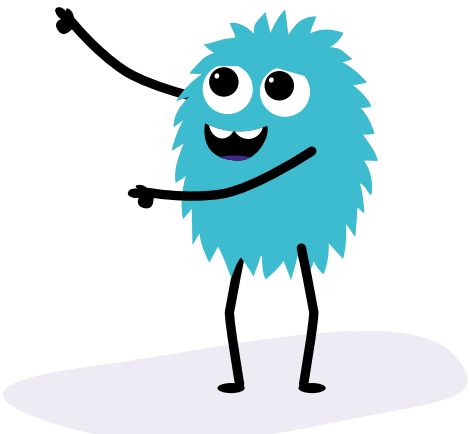
  You can find more information about how to enter on page 31 and at **britishscienceweek.org/plan-your-activities/poster-competition**.
- Get students talking about what time means to them. How do they tell the time, and how does it differ from the way their parents or grandparents told the time?

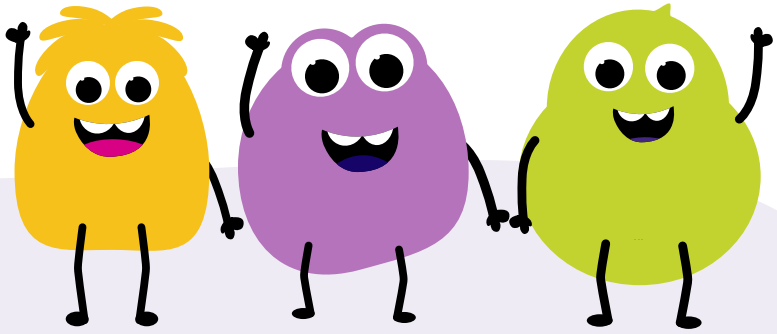
  What about things that go very fast (the fastest animals, ways of travelling) or very slow (plants growing, building cities and large structures)?

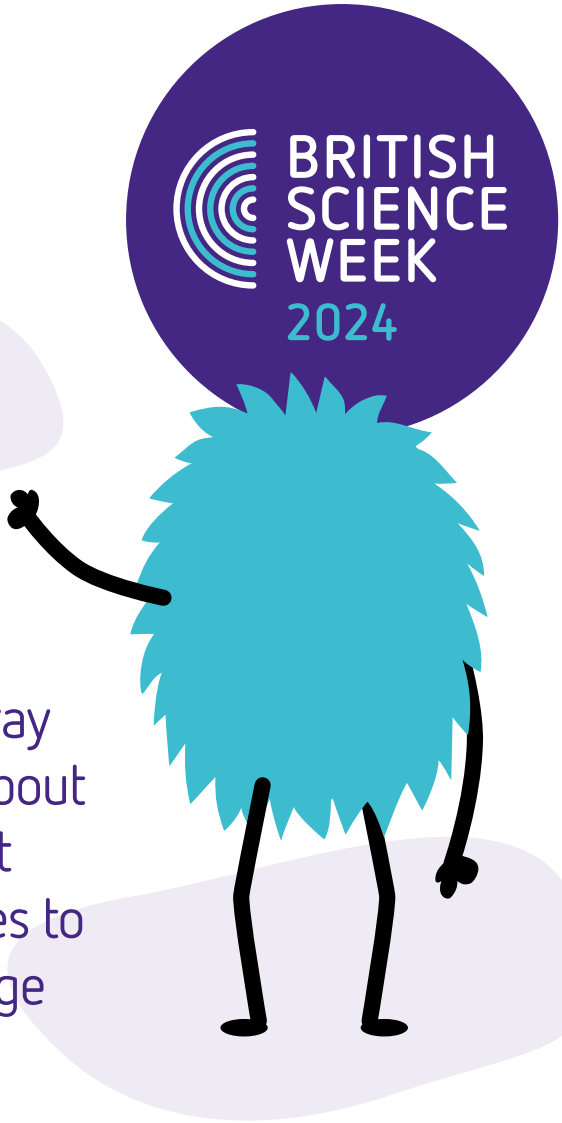
Invite a special guest or someone from the school community to share with students their own experience of time. Are there any watchmakers local to you, or clock towers to visit? Maybe a photographer could talk about capturing 'moments in time'? See page 5 for information on how to get volunteers.

Here are some other ideas to include at the beginning of British Science Week:

- Tell students about the plan for the Week and give them a challenge related to the theme. If you are sending home an experiment, maybe you could introduce or demonstrate it first.
- Time affects every part of our lives. Has 'time' as a theme been in the news recently, or do you have an example from the local area? Are there any historic sites you can talk about, and through which you can explore previous eras?







MAKING THE MOST OF VOLUNTEERS

Face-to-face engagement is a great way to get students involved and excited about a volunteer speaker and their topic, but don't forget there are also opportunities to get volunteers and presenters to engage with students online.

STEM Ambassadors are volunteers who offer their time and enthusiasm to help bring STEM subjects to life, and to demonstrate their value to young people. It is now possible to request both in-person and remote STEM Ambassador support, meaning that Ambassadors from across the UK can inspire young people wherever they are.

Find out more and make a request for STEM Ambassador support here: **stem.org.uk/stem-ambassadors/find-a-stem-ambassador**.

You can also look for presenters and volunteers via Science Live (**sciencelive.net**), or ask parents and carers if they work in STEM-related jobs to describe what they do in more detail. You could also:

- Schedule two or three different guests to talk about their jobs or science-related hobbies during the Week. If possible, get children anticipating who the next guest will be and what they do. These sorts of experiences can inspire students to think about their future, they're never too young to explore their career options!
- Where available, involve volunteers/Ambassadors who challenge stereotypes the students might have absorbed and promote a positive attitude towards science. For example, women engineers, people early on in their careers, and those in roles not typically linked to science but still involve it – such as chefs, tech start-ups, gardeners, sportspeople etc. Ask volunteers/Ambassadors to share how their job relates to science to show that scientists don't just work in labs!
- Book your visitors early as many speakers get booked up during British Science Week. Have a clear idea of what you want them to do and communicate this ahead of time.

Volunteers come from a range of careers and experiences, from engineers, designers, and architects to scientists and technicians, so get students looking forward to inspirational career talks which broaden their choices and interests!

Visit the Inspiring the Future website (**inspiringthefuture.org**) for some helpful ideas for using volunteers.

BRITISH SCIENCE WEEK AT HOME

Do you want to help students carry on participating in British Science Week at home? Here are our top tips for engaging parents and carers with the Week:

- **Make the most of parent newsletters,** the Parent-Teacher Association (PTA) and chat group and text messaging services, if you have them. Let parents and carers know what you have planned for British Science Week at least a month in advance, and how you'd like them to be involved.

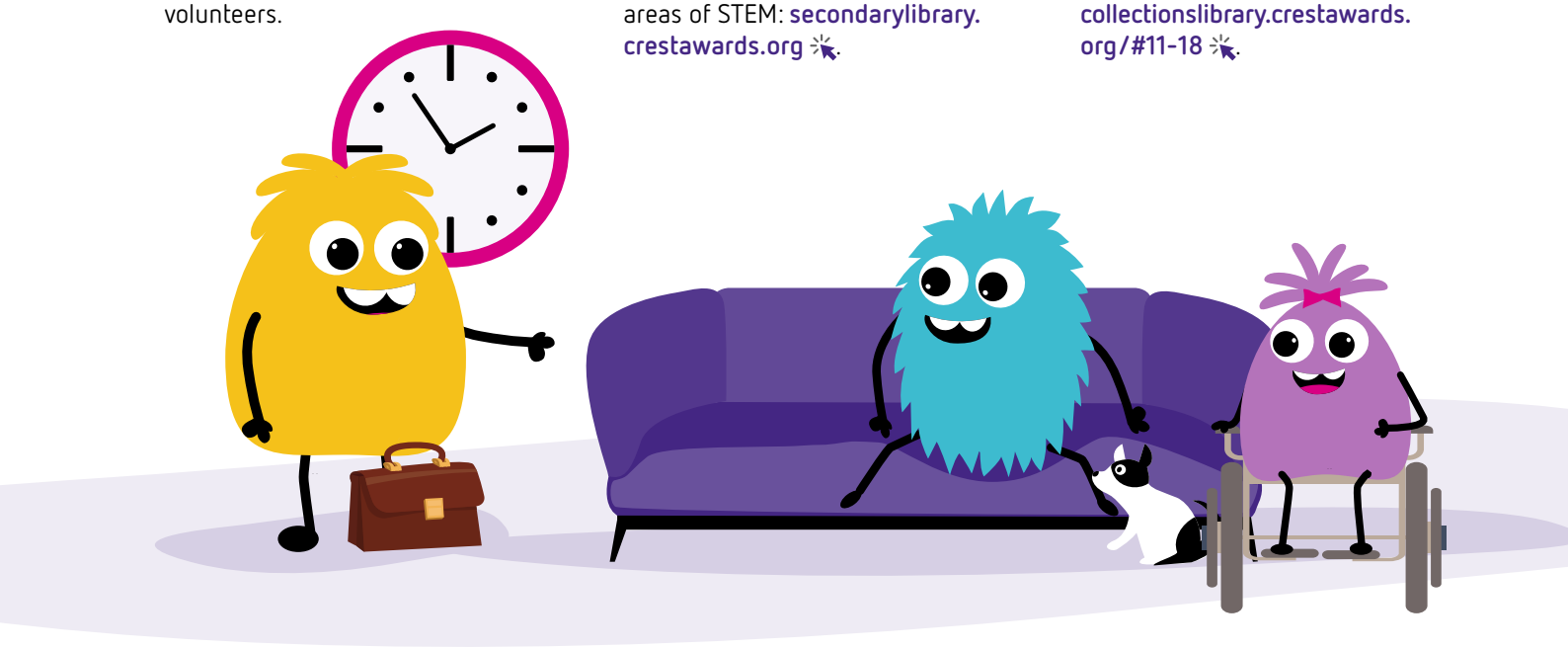
  Ask them to collect or donate materials and tell them what they will need to get involved in any experiments at home, so they have time to plan themselves. The PTA may be able to support you financially to run activities during the Week or help to drum up parent volunteers.

- **Ask parents and carers to think** about how their own jobs might link to STEM subjects and encourage them to chat with their children about this. You could do this via a newsletter or send students questions or activities they can do at home.

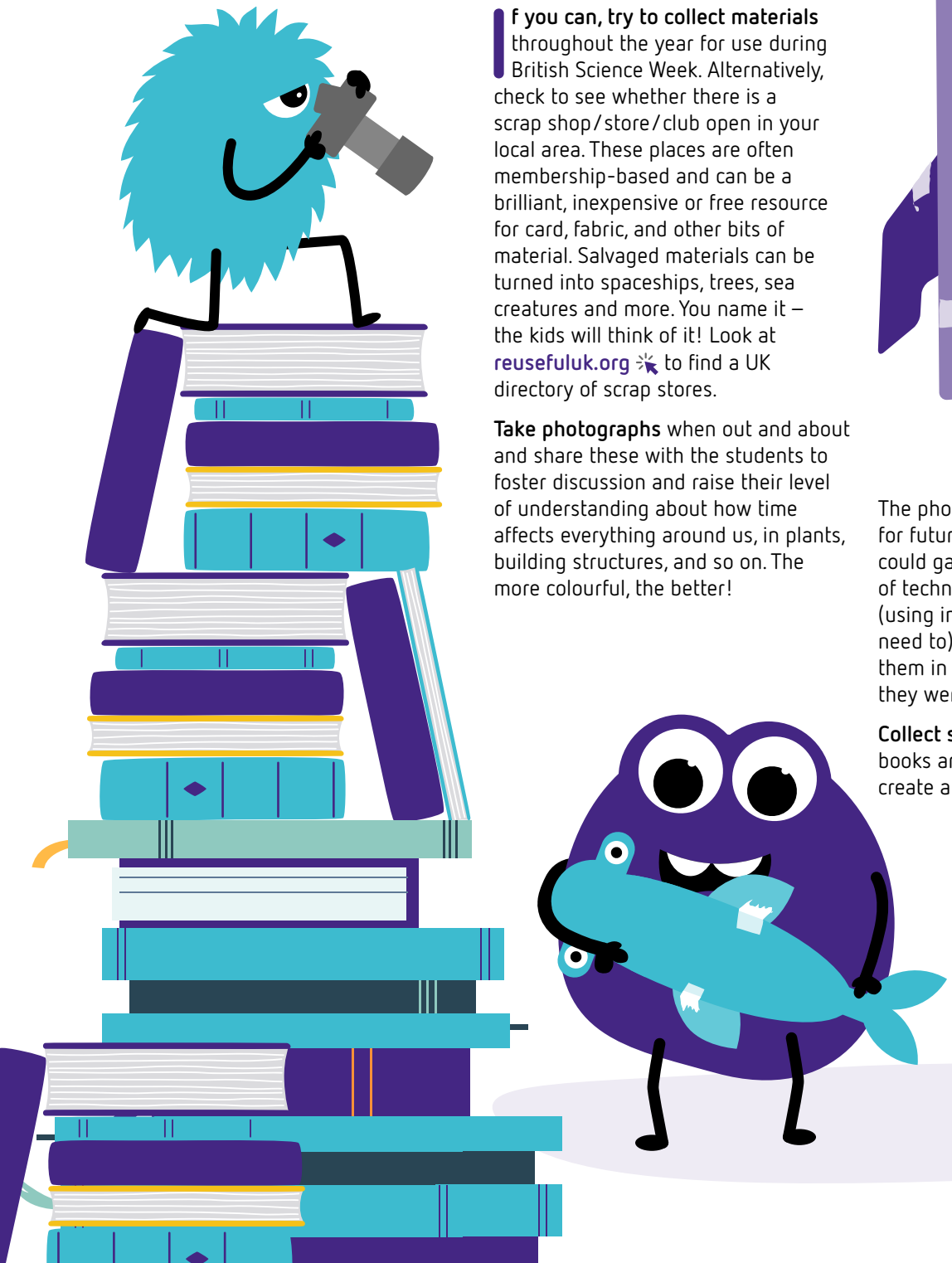
- **Encourage exploring outdoors**, in the community or in local cultural spots. This could be anything from going on a nature walk around local parks to spotting STEM in real life, street lighting engineers or infrastructure like bridges and construction work. Many secondary CREST activities focus on these areas of STEM: **secondarylibrary.crestawards.org**.

- **Send an experiment idea home** during the Week to spark discussions around science. Try to make it as low-resource as possible. It can help if it's something the students have tried or seen at school first so that they feel like the 'experts' when they do it at home with family, allowing them to lead the learning. Some of the activities in this pack have been adapted to be easily run at home, so they are a great place to start!

  There are also a range of science-based home activities requiring few resources in the CREST Home Learning collection: **collectionslibrary.crestawards.org/#11-18**.

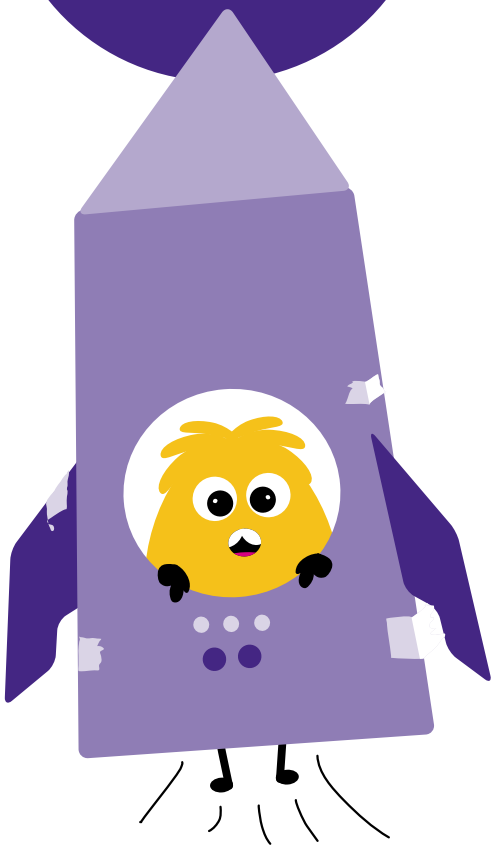


GATHERING RESOURCES FOR THE CLASSROOM OR HOME



If you can, try to collect materials throughout the year for use during British Science Week. Alternatively, check to see whether there is a scrap shop/store/club open in your local area. These places are often membership-based and can be a brilliant, inexpensive or free resource for card, fabric, and other bits of material. Salvaged materials can be turned into spaceships, trees, sea creatures and more. You name it – the kids will think of it! Look at reusefuluk.org to find a UK directory of scrap stores.

Take photographs when out and about and share these with the students to foster discussion and raise their level of understanding about how time affects everything around us, in plants, building structures, and so on. The more colourful, the better!



The photos can be a reference point for future activities. For example, you could gather photos of a certain type of technology, televisions perhaps, (using images from internet if you need to) and ask students try to put them in chronological order of when they were invented.

Collect story books and reference books around the theme of time to create a themed library.

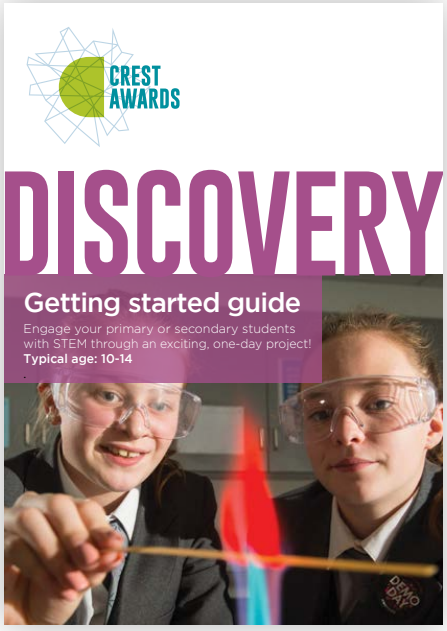
BEYOND THE WEEK

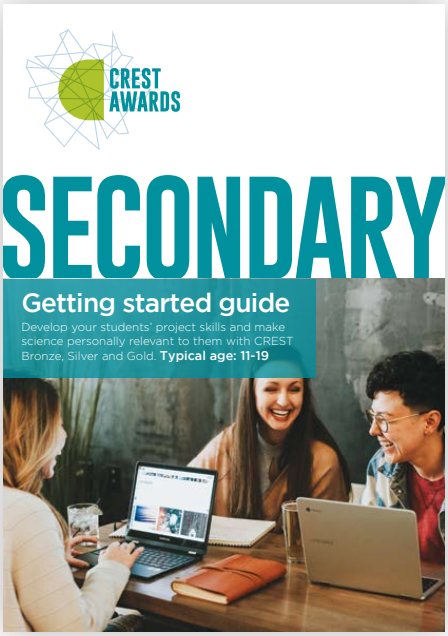
Exploration and curiosity don't have to end once British Science Week is over!

Some of the following ideas could help you to expand the learning beyond the Week:

- Have students take part in a CREST Award. CREST is a scheme that encourages young people to think and act like scientists and engineers. To achieve a CREST Award, students complete hands-on projects to suit their abilities, interests and age groups.
- Take a look at the secondary-level Bronze, Silver and Gold projects here: **secondarylibrary.crestawards.org**.
- If you have the opportunity, consider running a STEM club or curiosity lab. You can find supporting resources at **stem.org.uk/stem-clubs**.
- Find ways to link time into other subjects. In history, you could explore how our understanding of science and the world has changed over time. In PE, you could think about the speed of athletes and how time is important in other aspects, such as reaction times. In geography, you could talk about seasons and the weather.

INSPIRED? FIND OUT MORE CREST AWARDS





UNLOCKING SKILLS

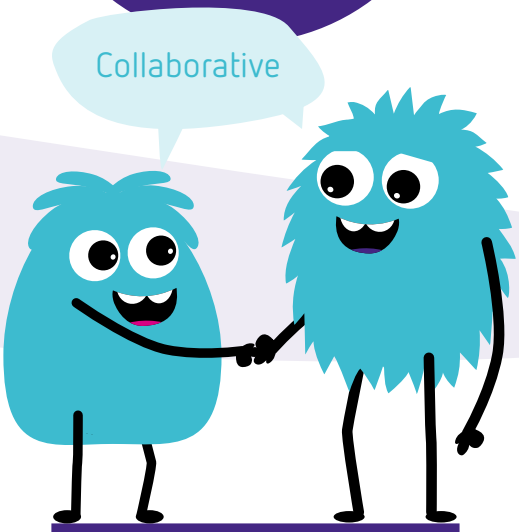
BRITISH SCIENCE WEEK 2024

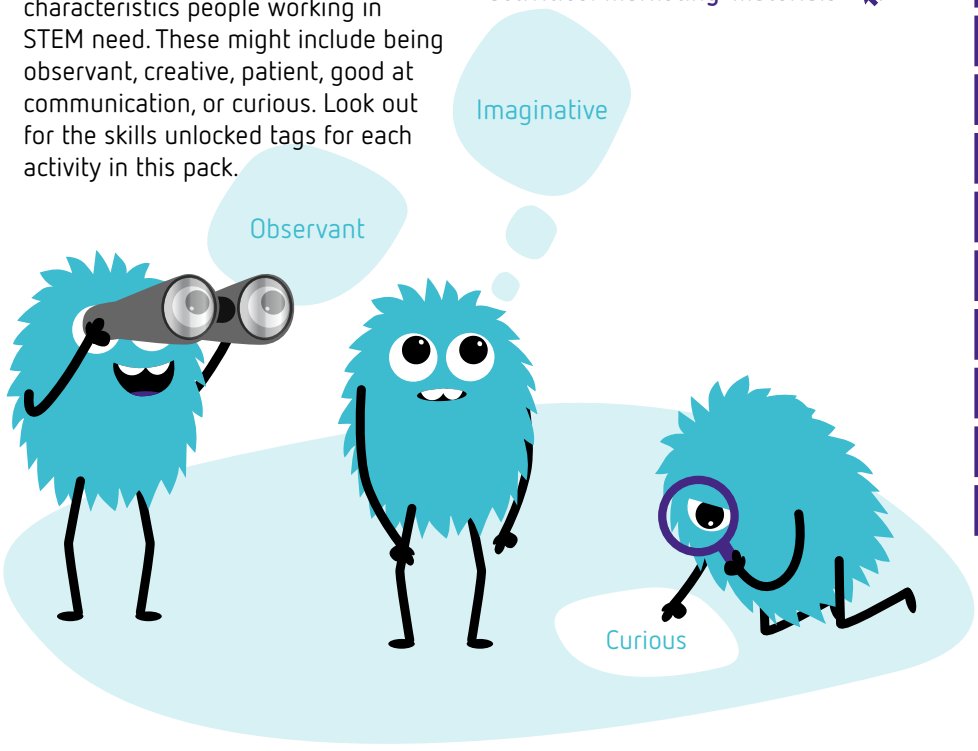
A fantastic way to encourage students to take an interest in STEM is to introduce transferable skills used by those working in STEM-related jobs.

These skills will strengthen positive attitudes and reduce stereotypes of those working in the field.

You could, for example, use the **STEM Person of the Week** activity from NUSTEM at Northumbria University or introduce a scientist from the **Smashing Stereotypes** campaign. Ask students to identify what characteristics people working in STEM need. These might include being observant, creative, patient, good at communication, or curious. Look out for the skills unlocked tags for each activity in this pack.

The table opposite has a complete list of attributes developed by NUSTEM to use as a talking point or to share with other teachers. As a little bit of motivation, why not award students with a sticker or certificate for each STEM characteristic they demonstrate well during the Week? You can download and print the stickers from **britishscienceweek.org/plan-your-activities/marketing-materials**.





Observant
Open-minded
Committed
Curious
Logical
Creative
Imaginative
Patient
Self-motivated
Collaborative
Resilient
Clear communicator
Passionate
Hard-working
Organised

BRITISH SCIENCE WEEK 2024

MAKE A ROLLERCOASTER FASTER

This activity is designed to get you exploring the relationship between angles, speed and time.

You will build your own prototype rollercoaster and experiment with how you can control the time it takes for the cart to reach the end of the ride, by adjusting the tracks.

2+ hours

Kit list

- Flexible plastic or tubing cut in half lengthways to make tracks
- Adjustable clamp to hold the tubing
- Toy car/ball bearing/ marble that fits on the tracks – as the rollercoaster cart
- Measuring tape
- Timer

INSPIRED? FIND OUT MORE CREST AWARDS

Instructions

1. Build your first rollercoaster by attaching the end of a length of tubing to the clamp and making sure the other end touches the floor or a tabletop. Try sketching ideas and thinking of ways to do this first. Find examples of how others have done this using the Internet.
2. Use a measuring tape to measure the height of the clamp and record it in a table that has a column for clamp height and a column for time.
3. Place your rollercoaster cart at the top of the track and time how long it takes to reach the bottom. It might be helpful to work in pairs – one timer, one rollercoaster operator.
4. Add this time to your table.
5. Adjust the clamp so that the top of the tube is higher or lower than it was for your first rollercoaster, then roll the cart again and record its time.
6. Try the rollercoaster from lots of different heights and record the times. What do you notice about the relationship between the 2 numbers?

Watch out

Make sure to collect any toy cars or ball bearings, as people could trip on them.

Next steps

This activity can be put towards a CREST Bronze Award. For more information, follow this link: crestawards.org/crest-bronze.

At home

How do you work out the time it takes for an object to get from one spot to another? Can you use the distance, speed, time equation?

Skills unlocked

Collaborative, hard-working

Career options

- Structural engineers design and build rollercoasters.
- Engineers build all sorts of impressive structures such as bridges and skyscrapers.

BRITISH SCIENCE WEEK 2024

CREST AWARDS

PLANT GROWTH AND NUTRIENTS

Lots of factors influence the time it takes for plants to grow, including the nutrients in the soil. In this activity you will monitor seedlings which are growing in different compost, over 3 or 4 weeks.

2+ hours

Kit list

- Seeds (radish or lettuce because they grow quickly)
- Seed trays
- Soil
- Compost
- Propagator lid or makeshift propagator (optional)

INSPIRED? FIND OUT MORE CREST AWARDS

Instructions

1. Prepare your seed trays with different combinations of compost and soil. Record the proportions in each one.
2. Plant your seeds in the seed trays, following packet instructions. Water them and place them in a well-lit location.
3. You can help the seedlings to grow by using a propagator lid to maintain humidity. Alternatively, you could use makeshift propagators such as a simple polythene bag inflated around the seed tray, or a plastic bottle cut in half to provide a close-fitting lid.
4. Ensure that the soil/compost in the trays remains moist – trays without covers will need regular watering.
5. Remember that you want your tests to be fair so make sure all your seeds are in the same conditions of light, temperature, moisture and so on.
6. Keep a daily record of the number of seeds that have germinated, plant growth, and observations about plant health such as colour, height and so on. Decide what measurements to use as indicators of plant growth, such as plant height or number and the size of leaves.
7. You will need to make your measurements daily for about 3 to 4 weeks.
8. Choose at least 2 of your indicators of plant growth to plot as graphs to show how the different combinations of compost and soil affect plant growth. Interpret your results with the following questions in mind:
   - Did the results align with what you expected?
   - Was there a pattern to your results?
   - Were your results consistent enough for you to be able to make a conclusion?
   - Which of the different ways of measuring plant growth do you think was the most suitable? Why?

Watch out

- Always complete a risk assessment before you start your experiment. Use the Student Safety Sheets available online (science.cleapss.org.uk/Resources/Student-Safety-Sheets) to help you to assess the risks (i.e., think about what could go wrong and how serious it might be).
- Make sure you pick soil samples that are not contaminated, such as those containing dog muck or broken glass.
- Always wash your hands thoroughly after handling soil.

Skills unlocked

Patient, self-motivated

Next steps

This activity can be put towards a CREST Bronze Award. For more information, follow this link: www.crestawards.org/crest-bronze.

BRITISH SCIENCE WEEK 2024

SUSTAINABLE TRANSPORT FUTURES DESIGN CHALLENGE

What will our future transport look like? In this activity, you will explore sustainable transport solutions, including autonomous vehicles! You will identify challenges for reaching net zero, gain insights from experts, develop your own ideas, and bring them to life using Minecraft, Lego or simply with pens and paper.

1 hour (longer for Minecraft if time allows)

Kit list

- Access to Minecraft Creative mode
- Internet-connected device

Don't have Minecraft? You can use:

- Lego
- Pens and paper

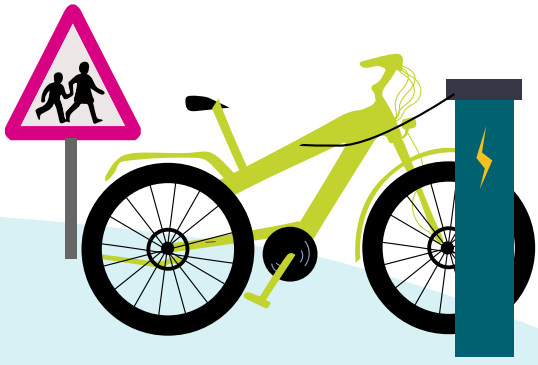
Instructions

Engineer your future by designing sustainable transport in your area! Record your findings on the worksheet provided.

1 Understand: Think about your journey to school, or a trip into town. What are the transport options to get you there? How did your parents get to school in the past? What sort of green transport would you like to take in the future?

2 Explore: Imagine you're the Mayor of your area and need to keep your town/city moving while also reducing carbon emissions. Some options might be better: connected public transport, active travel in 15-minute cities, or autonomous shared vehicles. Research how autonomous buses or trams might be used to solve this problem, such as Mi-Link.

3 Create: What sort of green future can you engineer? Using Minecraft (Creative Mode) as a digital engineering tool, see if you can design a better alternative for your area. What would your ideal bus or tram look like? How will they run alongside walkers or cyclists? How will you encourage people to use your transport mode in the future?



Next steps

We know transport emissions contribute to the climate crisis. Take a look at the options to reach Net Zero on page 6 of the Sustainability Solutions Summit bit.ly/sustainable_solutions_summit.

At home

Empathise: Talk to drivers about why they use combustion cars, despite producing air pollution and carbon emissions. How will your new design overcome their fears or travel habits?

Skills unlocked

Creative, curious

Career options

Did you know you can put your creativity and design skills to work in a green job? Real experts are working on future travel solutions! Some of these jobs include:

- transport geographers and urban planners
- engineers
- transport designers.

Visit careerpilot.org.uk/job-sectors/green-jobs for more information about green careers.

BRITISH SCIENCE WEEK 2024

Leeds Museums & Galleries

BIOMAGNIFICATION IN FOOD CHAINS

In this activity, you'll explore biomagnification within a food chain. Split into insect, bat, and peregrine falcon groups - you'll use coloured tokens to mimic predator-prey interactions in a competitive rock, paper, scissors game. Discover how toxins accumulate as you move up the chain, affecting top predators.

30-45 minutes

Kit list

A collection of small items such as buttons or squares of coloured paper in two colours. For this example we'll use red and yellow. These tokens will be used to symbolise food.

The distribution ratio of the tokens needs to be 3 red to 1 yellow.

The yellow coloured tokens represent contaminated food.

A clear space with no tripping hazards to play the game.

Instructions

1. Split yourselves into 3 groups:
   - Half of you will become insects.
   - A third will take on the role of bats.
   - The remaining players will be peregrine falcons.
2. Food tokens will be placed around the room.
3. Insects, you'll have 20 seconds to collect as many food tokens as you can before the bats are released.
4. Bats, your goal is to eat as many insects as possible. You'll play a game of rock, paper, scissors with the insects:
   - If you win, the insect gives up one food token to you.
   - If you lose, you move on without taking a token.
5. After a short delay, peregrine falcons are released to prey on the bats in the same way.
6. When the time is up, count your tokens and separate them by colour.
   - Yellow tokens represent pollutants (like DDT). Insects and bats holding these coloured tokens are considered 'dead'.
   - Peregrine falcons, being larger, can survive higher pollutant levels, but these pollutants make their eggshells so thin that they break, preventing chick hatching. Any falcons that have collected yellow food will not reproduce.
7. Discuss the impacts of the biomagnification of pollutants on this food chain and then in wider food webs.

At home

To find out more, visit **mylearning.org** and type 'biomagnification' into the search bar. Download graphs and other resources. For other learning materials, type in 'ecology'.

Skills unlocked

Curious

Career options

If this activity piqued your interest, you might want to explore some of the following careers:

- museum curator
- marine biologist
- conservation officer
- academic researcher
- fieldworker.

HISTORY OF THE UNIVERSE

This activity allows you to explore the history of the universe. You will begin by creating a timeline of your own life before seeing if you can order certain events in time over 13.8 billion years, back to the beginning of the universe!

45 minutes

Kit list

- Worksheets
- Scissors
- Paper
- Pens

Instructions

Your timeline:

1. Take a moment to think about your earliest memory. How far back can you remember in your life?
2. Using the provided "My timeline" worksheet, create a visual timeline that showcases key events in your life, starting from your birth and leading up to the present.
3. In pairs, share and discuss your life stories, highlighting significant events and memories.

Image: NASA, ESA, CSA, STScI

Timeline of the universe:

1. Cut out the "cards for the events of the universe."
2. If possible, team up with your classmates to collectively arrange these events in chronological order, representing the timeline of the universe.
3. If you encounter any events you're not familiar with, use the internet to research and understand them better.
4. After constructing your universe timeline, compare it with the timelines created by other groups. Discuss any variations or insights you've gained during this activity.

Next steps

To extend the activity and improve your mathematics skills, calculate and place key events of the universe on a timeline, as if it took place over one year rather than 13.8 billion years.

Further details can be found here: stem.org.uk/rxg8aa.

At home

Talk with older family and friends about their timelines. Do they remember any of the events in the timeline of the universe?

Skills unlocked

Collaborative, organised

Career options

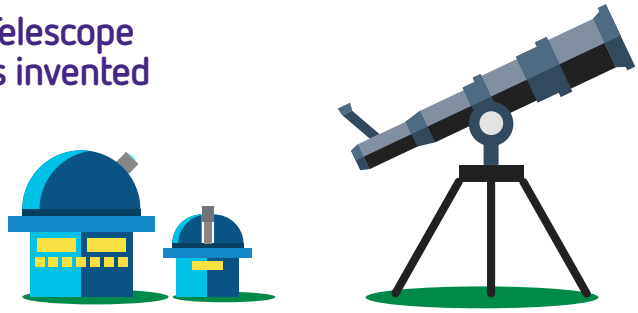
If you enjoyed this activity, one of the following careers might be perfect for you:

- historian
- astrobiologist
- space scientist
- archaeologist
- palaeontologist
- astronomer
- physicist
- Earth observation scientist
- astrochemist
- planetary scientist.

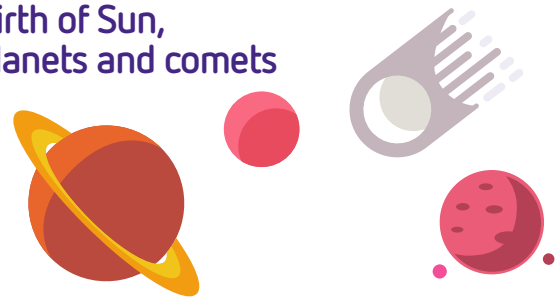
HISTORY OF THE UNIVERSE
MY TIMELINE

BRITISH SCIENCE WEEK

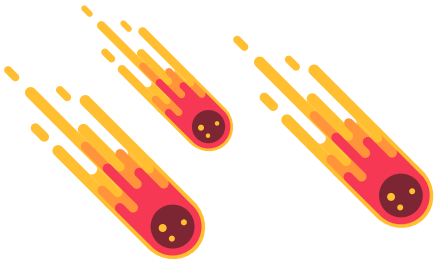
Telescope is invented



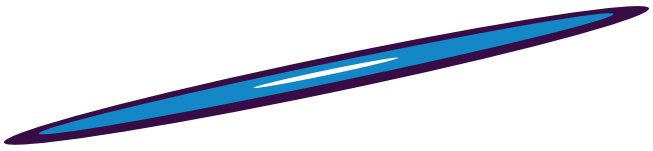
Birth of Sun, planets and comets



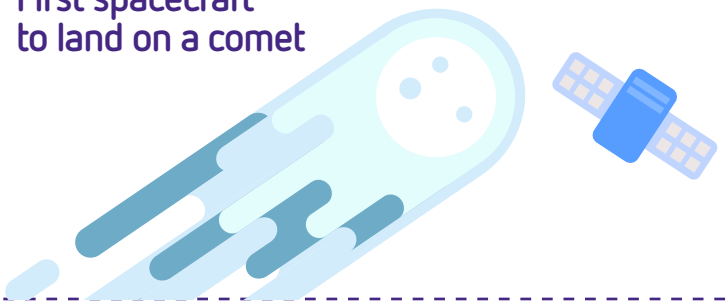
Heavy asteroid bombardments



Beginning of the universe



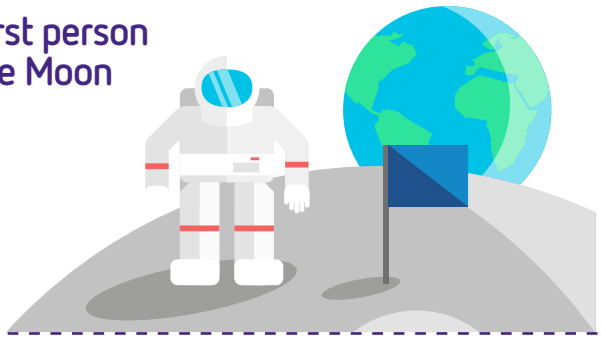
First spacecraft to land on a comet



Mammals appear on Earth

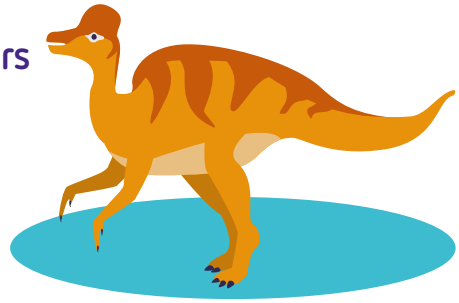
Homo sapiens appear

First person the Moon

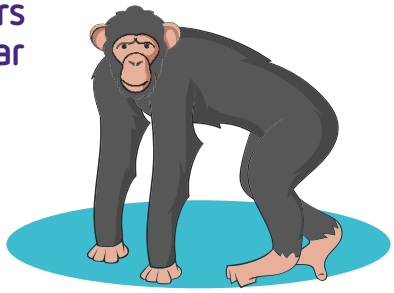


BRITISH SCIENCE WEEK

Extinction of the dinosaurs



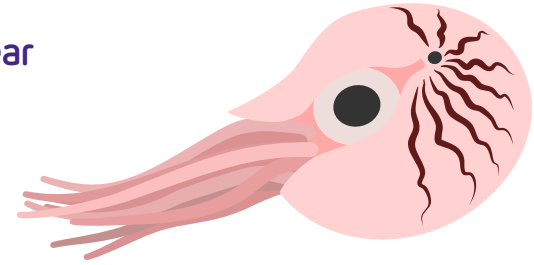
First ancestors of man appear



Creation of the Moon

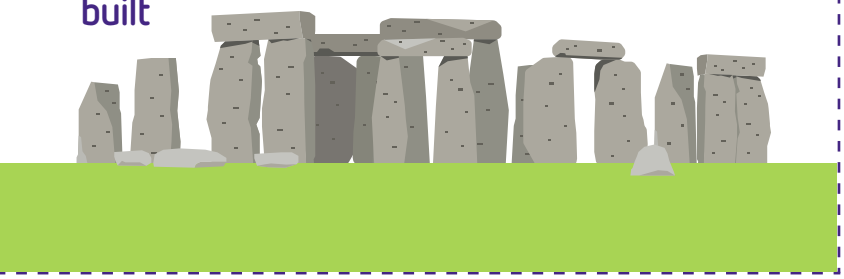
Birth of galaxies

First life forms appear



First person in space

Stonehenge built



BRITISH SCIENCE WEEK

HOW MUCH RAIN?

In this activity you will explore the importance of monitoring weather to predict climate change and natural disasters. You'll create your own rain gauge to measure local rainfall, just as farmers do in crop planning and meteorologists in forecasting weather-related events and climate shifts.

60 minutes

Kit list

- An empty clear plastic bottle (1 or 2 litres, smooth-sided and without the lid)
- Scissors
- Pebbles
- Eco-friendly sticky tape
- Ruler
- Non-toxic permanent marker
- Water

Instructions

1. Cut off the top of the bottle at the widest point. Take care when using scissors.
2. Place some pebbles in the bottom of the bottle (these will help to keep it weighed down).
3. Turn the top part of the bottle upside down, put it inside the bottom part of the bottle and secure it in place with tape, creating a funnel to collect the rainwater.
4. Use the ruler and permanent marker to add a vertical scale onto the side of the bottle in millimetres. Start with the zero a little way above the pebbles, and then mark every 5mm all the way to the top.
5. Add water to the bottom of the bottle to the level of the zero line on the scale.
6. Place the bottle outside and record the water levels at time intervals of your choosing, such as daily, weekly, or monthly.
7. Discuss your findings and draw a graph to record them.

Next steps

Put different bottles in different places. How do they compare? What could be the reason for this?

At home

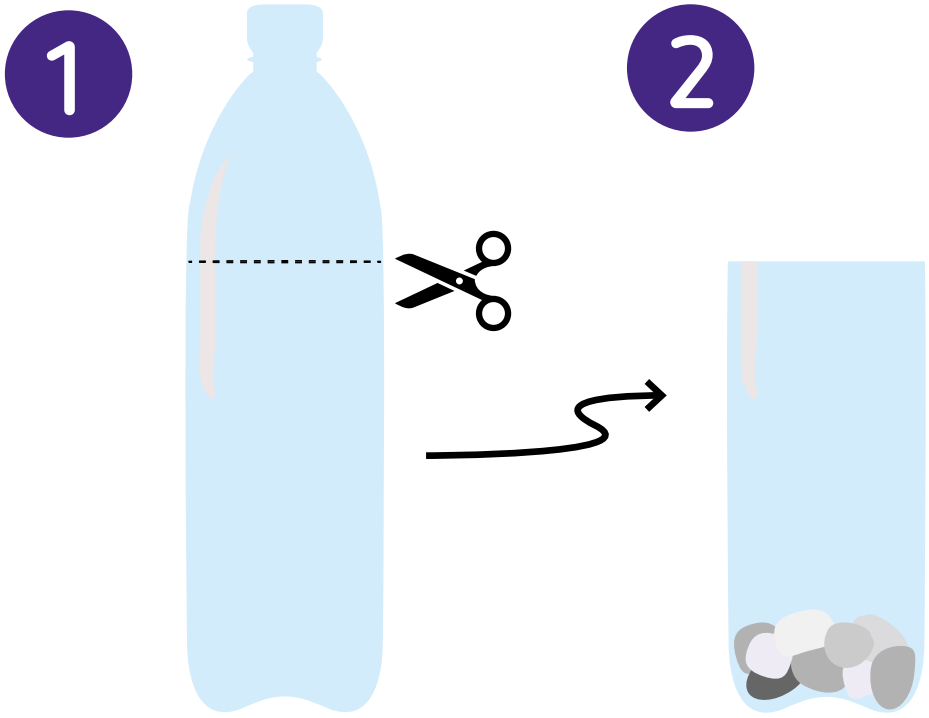
Talk to your family about what the weather patterns are like where you live? Have these been unusual? What unusual weather patterns have you heard about in the news?

Skills unlocked

Curious, observant

Career options

- Meteorologists collect and study data from the atmosphere and oceans to make weather forecasts and carry out research.
- Environmental policy advisors give expert advice to the government and other organisations on issues like climate change.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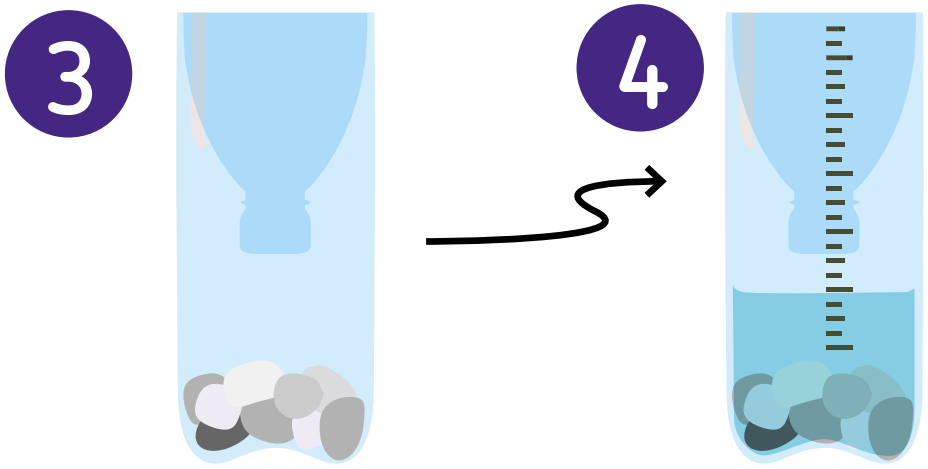
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BRITISH SCIENCE WEEK 2024

sustrans
JOIN THE MOVEMENT

HOW COMMON IS MY JOURNEY TO SCHOOL?

You are one of 10 million school pupils in the UK making a journey from home to school and back each day. In this activity you will explore data around journeys to school and how your mode of transport and journey length compares to the UK average.

20 minutes

Kit list

- Access to the internet
- Google Maps
- The 'How common is my journey to school?' PowerPoint

Instructions

1. Estimate the percentage of children in the UK traveling to school by: cycling, local bus, train, car/van, private bus, walking.
2. Discuss your answers with your classmates. Why do you think most people use these modes and what's stopping people from cycling to school?
3. Use Google Maps to find out how long it takes for you and 6 friends to get to school. Fill in the table on the next page.
4. Calculate the average using mean, median and mode for your group's journey times. How does it compare to the national average of 19 minutes?
5. Discuss any differences between your average travel times and the national average. What does this tell you about how common your journey to school is?

Next steps

Register for The Big Walk and Wheel, an inter-school competition inspiring students to make active journeys to school, improve air quality in their neighbourhood and discover how these changes benefit their world. bigwalkandwheel.org.uk.

Check out the other educational resources, support and funding opportunities at sustrans.org.uk/for-professionals/education.

At home

How do you think your travel choices are influenced by your gender? Check out #andshecycles, the national campaign aiming to address the barriers faced by teenage girls and young women when cycling. Follow @and_she_cycles on Instagram, and check out the website here: sustrans.org.uk/campaigns/andshecycles.

Skills unlocked

Good communicator.

This activity will also improve your journey planning skills.

Career options

At Sustrans we employ a wide range of people from diverse educational backgrounds to support us to make walking and cycling easier for everyone. Our team includes:

- engagement professionals
- urban landscape designers
- engineers
- communications and media professionals.

Visit sustrans.org.uk/careers to find out more!

Answers: cycle (2%), car/van (37%), local bus (11%), private bus (4%), train (1%), walk (45%).

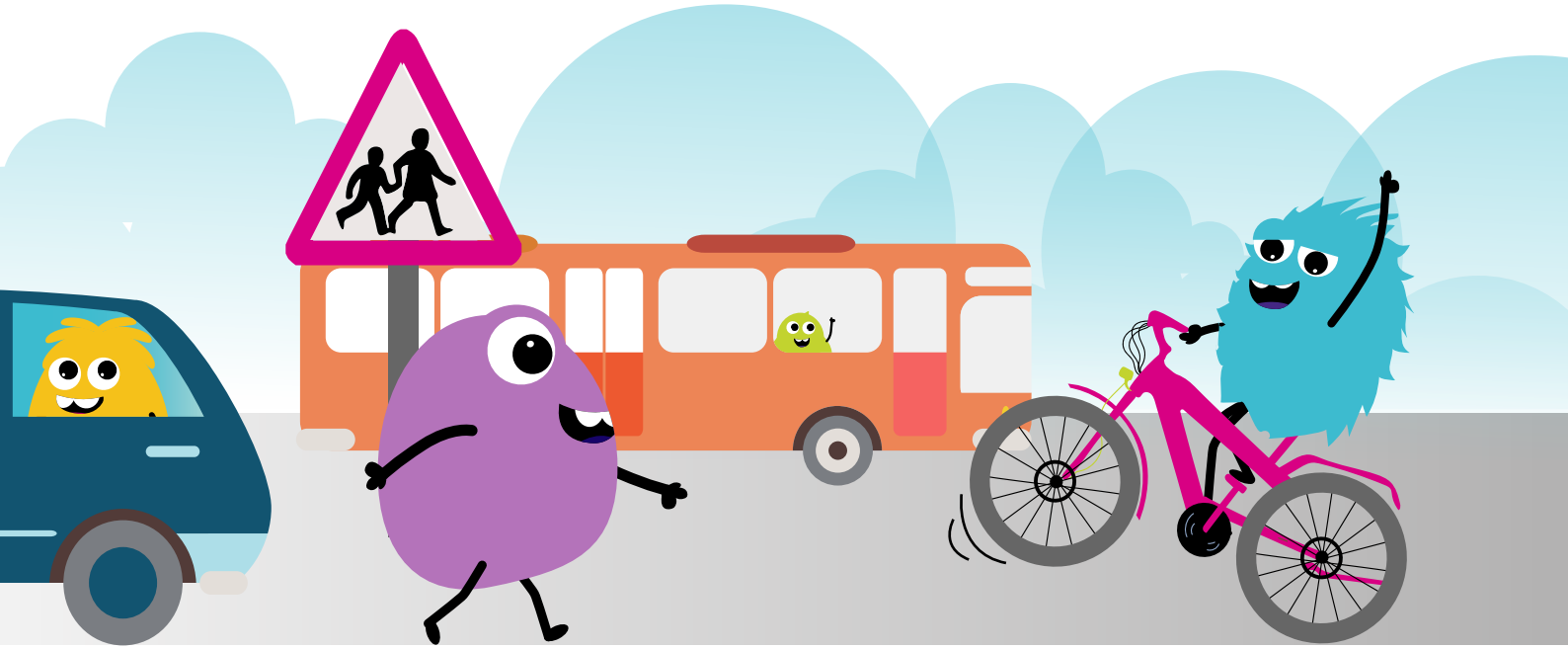
HOW COMMON IS MY JOURNEY TO SCHOOL?
WORKSHEET

sustrans
JOIN THE MOVEMENT

Use Google maps to calculate your journey to school and fill in the table below.

To calculate the average, add the times for your journey, Friend 1, Friend 2, Friend 3, Friend 4, Friend 5 and Friend 6 together and divide that total by 7.

My journey time	Friend 1	Friend 2	Friend 3	Friend 4	Friend 5	Friend 6	Average



BRITISH SCIENCE WEEK

BRITISH SCIENCE WEEK 2024

Collins

HOW TO ACCURATELY MEASURE TIME

Accurate measurement is a cornerstone of good science. But how can we be certain of our instruments' accuracy and the reliability of their readings? In this activity you will dive into the timeless pursuit of measuring time.

45 minutes

Kit list

- Ramp
- Marbles
- Metre ruler
- 30cm rulers
- Timer
- Paper cups
- Scissors
- Sand
- Water
- Pens

Instructions

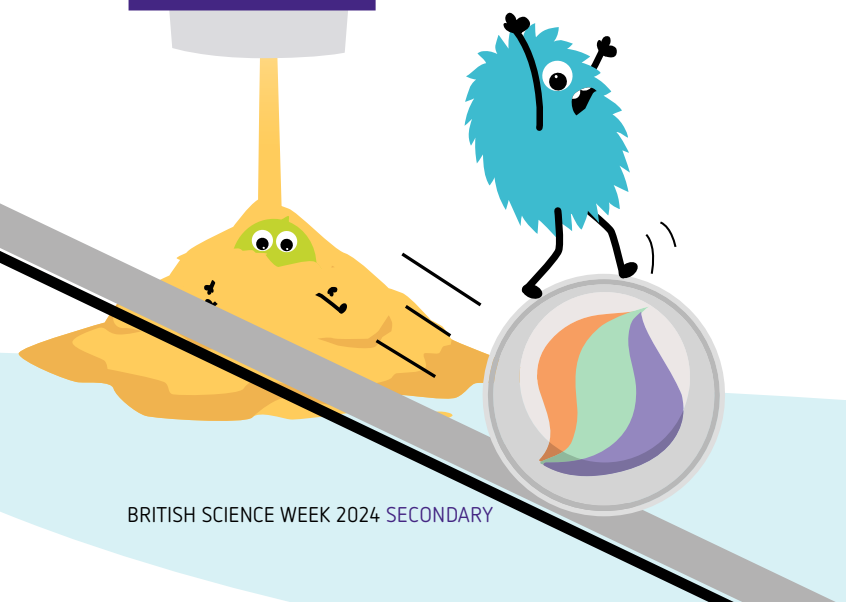
In small groups of 2-4, your challenge is to find the most accurate method for measuring a 10-second interval. You have three options:

- Rolling a marble down a ramp
- Sand flowing from a paper cup
- Water flowing from a paper cup

1 Choose your approach and explain why you think it's the best. You have 10 minutes to set up and test your equipment, but the timers will be removed after that.

2 Prepare your equipment. The teacher will signal when to start. When your device reaches 10 seconds, one team member should raise their hand. The teacher will announce the closest group.

3 In your notebook, record your chosen strategy, assess its effectiveness, and discuss why it was or wasn't the best choice.



Next steps

Devise a way of measuring one minute as accurately as possible. Will you use the same approach, or would it be better to switch to a different one?

Think about other measurements that must be calibrated. How could you devise an instrument that would measure a force of exactly one Newton?

Skills unlocked

Collaborative, patient

Career options

Precision in measurement, including instrument design and upkeep, is a crucial skill. Explore opportunities at the National Physical Laboratory's YouTube channel and instrument manufacturing companies. They seek individuals with strong practical and mathematical aptitude.

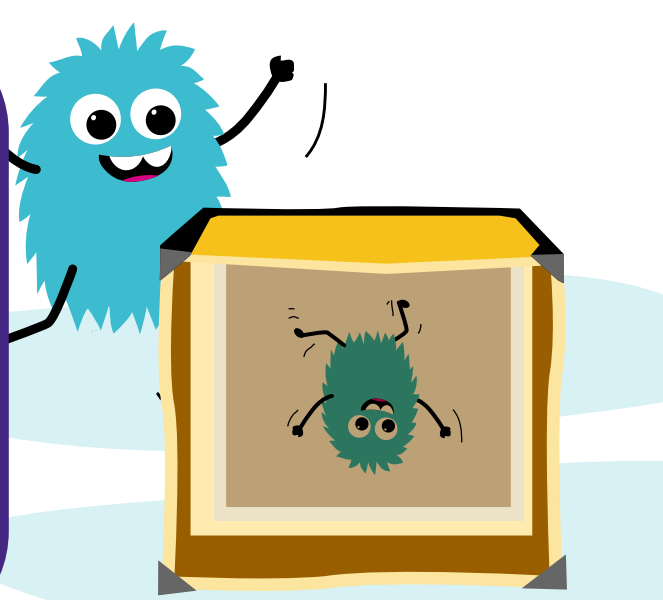
BRITISH SCIENCE WEEK 2024

nsead

MAKE A TIME CHAMBER!

A camera obscura (Latin for 'dark chamber') reflects what you see onto a screen. In this activity, you are going to make a sealed light-tight box, with a lens at one side and a movable screen at the other that you can use to create captivating drawings.

45 minutes plus time for drawing



Kit list

- Cardboard box
- Black duct tape
- Masking tape
- Sheet of tracing paper (or baking paper)
- Scissors
- Stanley knife or box cutter knife
- Pencil
- Magnifying glass

Instructions

1. Seal your cardboard box's corners and joints with duct tape so that no light can get in, leaving the top open.
2. Cut out one side of the box to create a screen frame.
3. Draw a 5cm margin around the sides of the cut-out, then trim along it to form a frame.
4. Cut the tracing paper to fit the frame and tape it in place. This is your screen.
5. Draw a 2cm square on a side opposite the screen and cut it out.
6. Tape a magnifying glass over this square as the lens.
7. Slide the screen back into the box, opposite the lens.
8. Place the box near a bright window; an image should project on the screen.
9. Adjust the screen's distance from the lens to focus.
10. Tape the top flaps down to block light, and you can now trace the projected image.

Next steps

For art, craft and design education inspiration and information visit: www.nsead.org.

At home

Artists capture time when they make drawings of what they see. Try your box in different locations. Simply tape a new piece of tracing paper on the frame when you want to make another drawing.

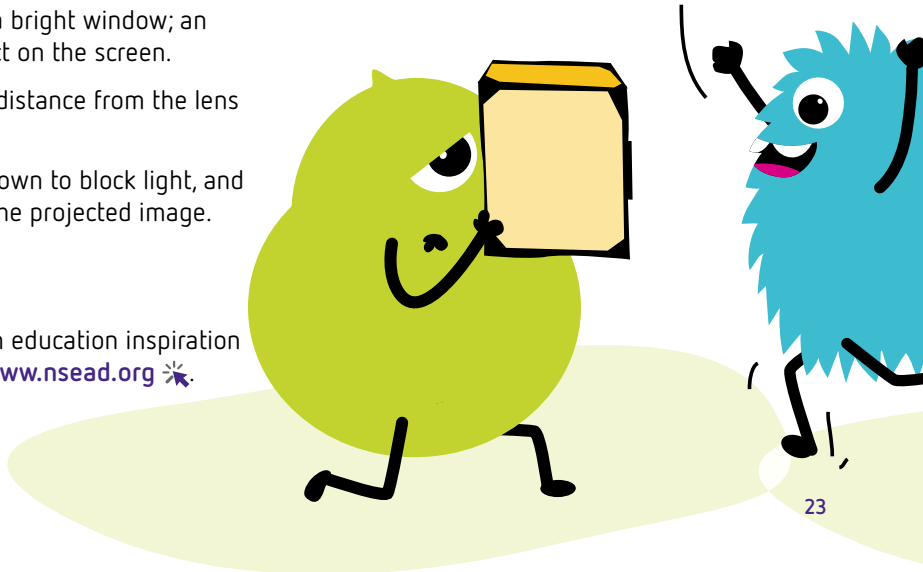
Skills unlocked

Observant

Career options

If you found this activity fascinating, you might discover rewarding career paths in:

- photography and film
- astronomy
- optical engineering.



BRITISH SCIENCE WEEK 2024

ROYAL OBSERVATORY GREENWICH

SEASONS TELLURIUM

In this activity you will cut and assemble your very own Tellurium, witnessing the captivating impact of the Earth's tilt and orbital journey around the Sun through its seasons. After assembly, manipulate Earth's position and observe the ever-changing sunlight it receives throughout the year.

30 minutes

Kit list

- Seasons Tellurium sheet printout
- Scissors
- 4 paper fasteners

See page 25 for build instructions

Instructions

1. Carefully cut out all 4 shapes from the Tellurium worksheet.
2. Locate armature A on the worksheet. Position it beneath the roundel representing the sky.
3. Find armature B and place it above the roundel that symbolises the sky.
4. Using paper fasteners, secure each armature through the corresponding holes, matching them with the numbered labels provided on the worksheet. Make sure the fasteners are tight but allow the armatures to move freely.
5. Once your Tellurium is assembled, discuss the following questions:
   - Why does Earth have a tilted axis? Explore how this tilt contributes to the changing seasons on our planet.
   - Consider Earth's orbit around the Sun. Is it a perfect circle, or does it have a different shape?
   - Reflect on the possibility of other planets experiencing seasons similar to Earth. What factors might affect whether other celestial bodies have seasons?

Next steps

You can discover more about the reasons for seasons in this video resource from the Royal Observatory Greenwich: rmg.co.uk/schools-communities/teacher-resources/reasons-seasons.

At home

Discuss with your family how the number of daylight hours change each month. You can keep a record by noting the number of daylight hours for the middle of each month.

Skills unlocked

Curious, logical

Career options

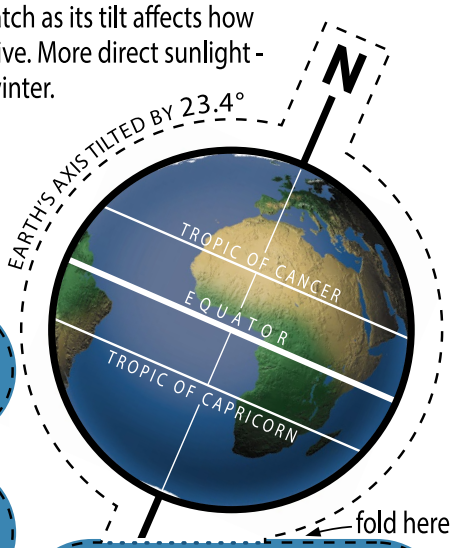
The skills learnt in this activity include problem solving and understanding the world around us. This can help develop skills for lots of different careers, including:

- scientist
- teacher
- historian
- astronaut
- astronomer.

THE Seasons

This Tellurium is designed to demonstrate how the Earth's axis gives us our seasons. Once complete, move the Earth around the Sun and watch as its tilt affects how much sunlight we receive. More direct sunlight - summer. Less direct - winter.

As the Earth orbits the Sun its axial tilt affects the weather in a profound way.
During northern hemisphere summer the north pole leans towards the Sun, while in winter the opposite is true - this change is called the seasons.
There are four - **Winter, Spring, Summer and Autumn**.



+1 A Fix **under** sky roundel 2+

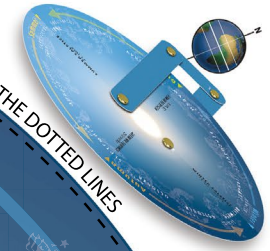
+3 B 4+

+3 1+

Cut out all four shapes - the more care at this stage, the better the final tellurium. Armature A should be placed under the roundel of the sky, B on top. Now secure each with a paper fastener through their corresponding holes as numbered.

Paper fasteners not included

CUT ALONG ALL THE DOTTED LINES


Completed Tellurium

Summer
midday Sun
higher Sun = warmer

Winter
midday Sun
lower Sun = cooler

SOUTH

Note:-
the Earth will not make a complete orbit of the Sun when operating this model

Designed by Greg Smye-Rumsby

SCISSORS OR CRAFT KNIVES SHOULD BE USED WITH CARE

ROYAL OBSERVATORY GREENWICH

BRITISH SCIENCE WEEK 2024

ROYAL OBSERVATORY GREENWICH

TELLING THE TIME BY THE STARS

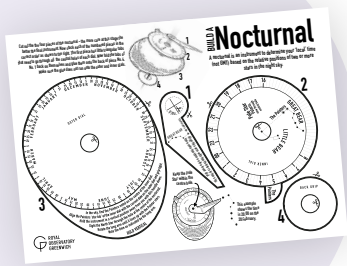
In this activity you will explore a 400-year-old timekeeping marvel with our cut-and-assemble Nocturnal. It utilises the positions of well-known stars and constellations in the night sky to tell time. For an in-depth explanation of its workings, don't miss our blog post on Nocturnals!

45 minutes

Kit list

- Nocturnal sheet printed on paper or card
- Glue or sellotape
- Scissors
- Compass (optional)

See page 27 for build instructions



Instructions

1. Carefully cut out all four shapes of the Nocturnal. Precision is key for best results!
2. In piece 1, cut along the marked X within the circle to create four triangular tabs.
3. Arrange the pieces according to the provided diagram, stacking them in order of their numbers.
4. Fold the four triangular tabs through the central holes of pieces 2, 3, and 4.
5. Secure each tab onto the back of piece 4 using glue or sellotape. Ensure it is firmly attached.
6. With your completed Nocturnal rotating correctly, turn the inner pointers dial to today's date as indicated on the lower dial. Hold it in position.
7. Locate the Great Bear constellation in the night sky.
8. Align the North Star (Polaris) so that it is visible through the centre of the Nocturnal.
9. Align the long arm with the pointers in the sky and make a note of the time on the inner dial.

Next steps

You can see a real Nocturnal from the ROG archives here: rmg.co.uk/collections/objects/rmgc-object-10283 and discover more related resources on our pages, including our "Look Up!" podcast which will talk you through what you can see in the sky throughout the month rmg.co.uk/schools-communities/royal-observatory-classroom-resources.

At home

What alternative timekeeping method could you use on a cloudy night?

Skills unlocked

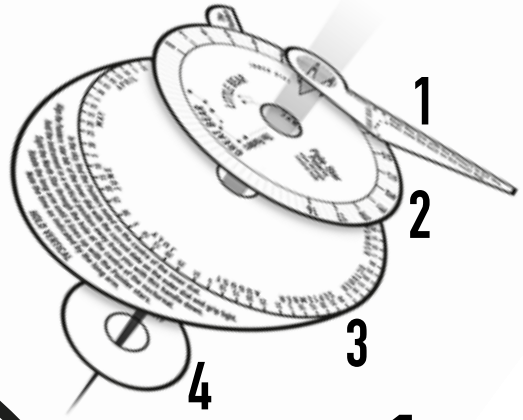
Logical, patient

Career options

The skills learnt in this activity include problem solving and understanding the world around us. This can help develop skills for lots of different careers, including:

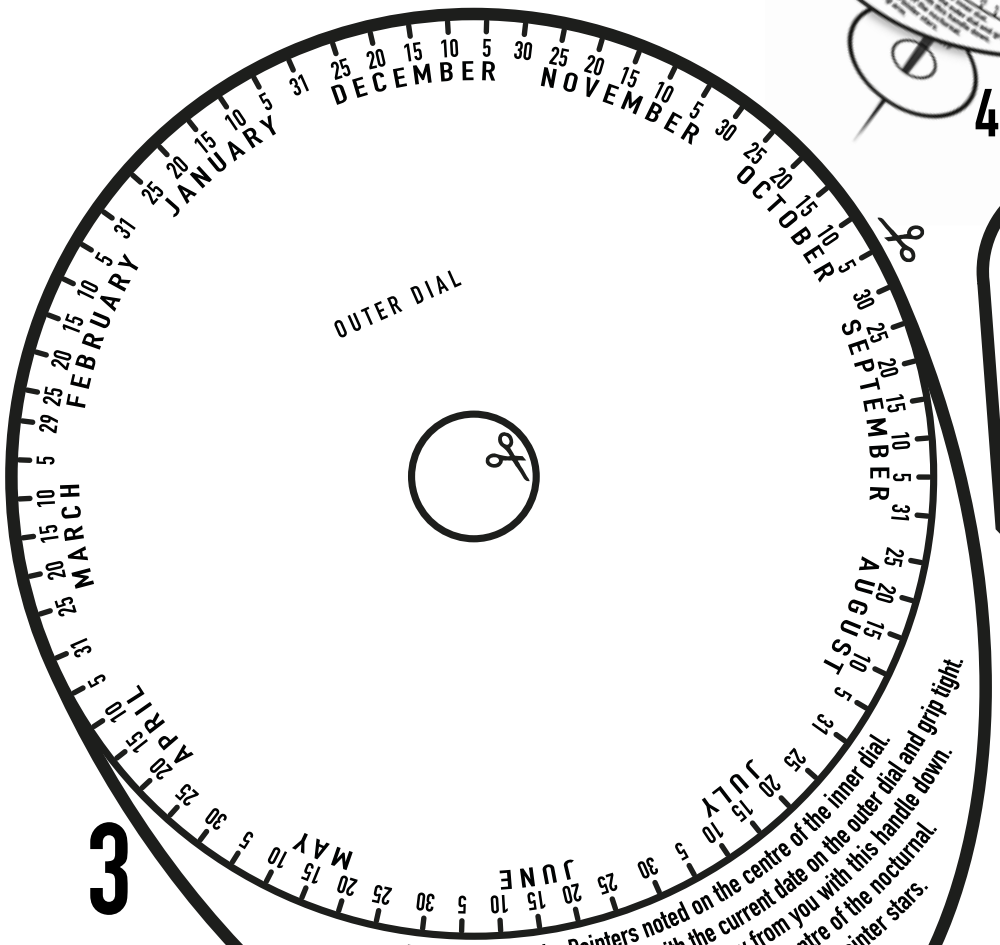
- scientist
- teacher
- historian
- astronaut
- astronomer.

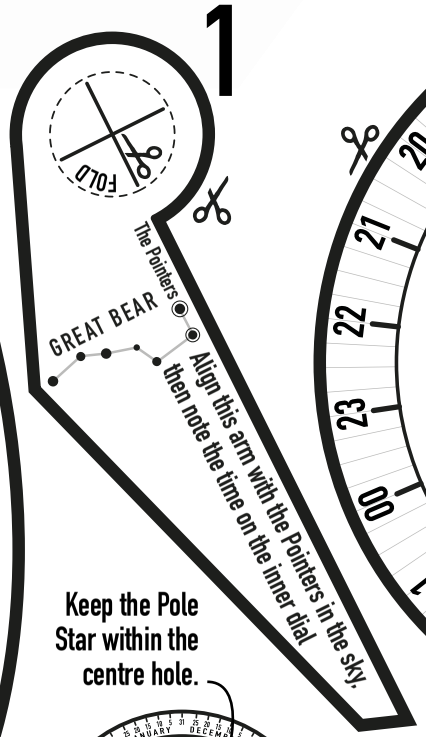
Cut out the the four pieces of the nocturnal – the more care at this stage the better the final instrument. Now stack each of the numbered pieces in the correct order as shown to the right. The first piece has little triangular tabs that need to go through all the central holes of each dial. Now fold the tabs of No. 1 back on themselves and glue them onto the back of piece No. 4. Make sure the glue does not run onto the outer and inner dials.

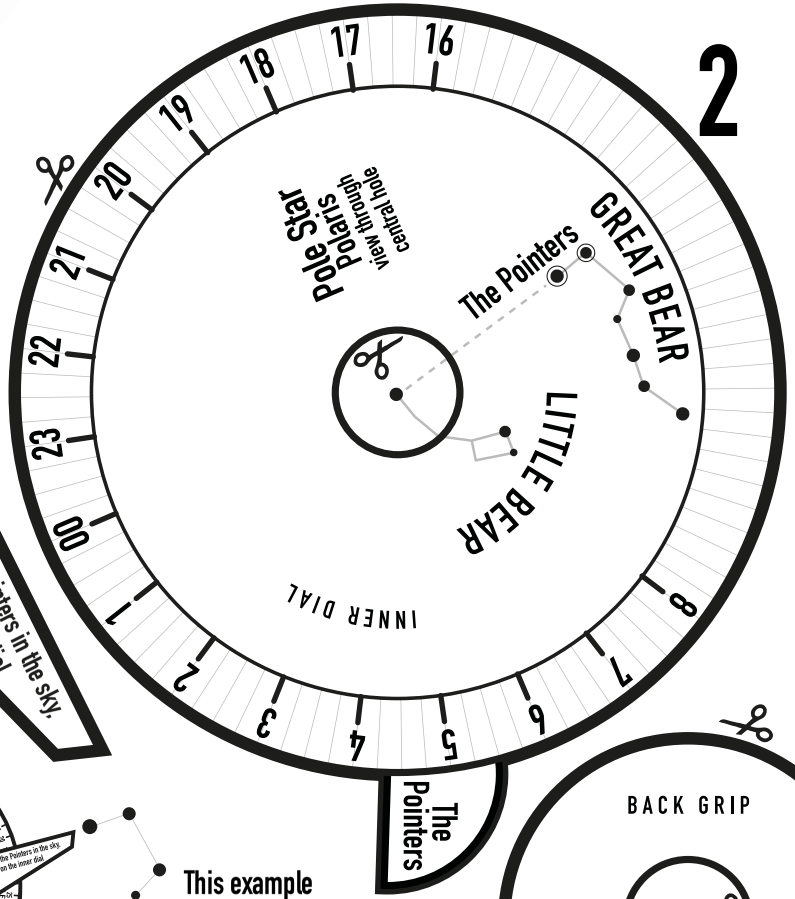


BUILD A Nocturnal

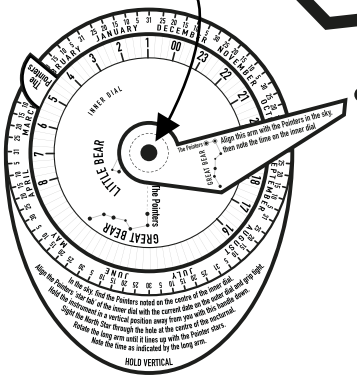
A nocturnal is an instrument to determine your 'local' time (not GMT) based on the relative positions of two or more stars in the night sky.



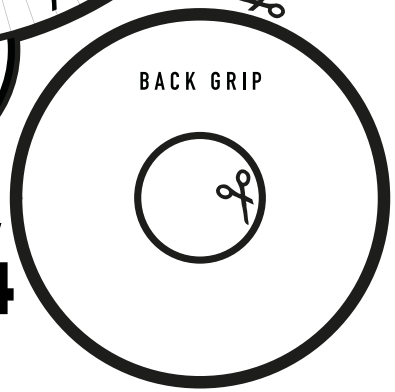




Keep the Pole Star within the centre hole.



This example shows the time is 20.00 on the 20 February.



ROYAL OBSERVATORY GREENWICH

BRITISH SCIENCE WEEK 2024

KING'S College LONDON

HOURS, MINUTES, AND YOCTOSECONDS!

A radionuclide is an unstable atom. The stability (or rate of decay) of a radionuclide is measured in half-life.

Half-life is the time taken for the sample's activity to fall by half. Uranium-238 has the longest half-life of 4.5 billion years.

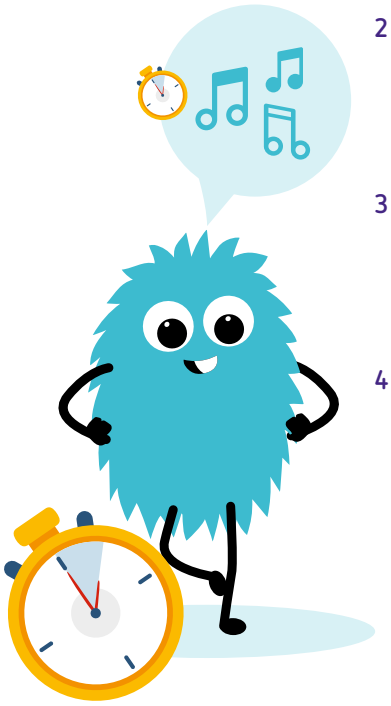
Some radionuclides have half-lives of minutes, seconds, or even yoctoseconds - one trillionth of a trillionth of a second!

10 – 20 minutes

Kit list

Stopwatch

Print out cards and table on page 30 (optional)



Instructions

Watch this video about radiation and radioactive decay and half-lives youtube.com/watch?v=M0uw4ZNpqcI.

1. Look at the set of cards with information about radioactive materials and their rate of decay/half-life.
2. Notice the small number next to the initials of each radionuclide e.g. ^{75}Se - this number 75 is the mass number which is the total number of protons and neutrons together in an atomic nucleus.
3. Different types of radioactive decay are characterised by their changes in mass number as well as atomic number and this number helps us calculate how quickly a radionuclide will decay.
4. What can you do in the time if we imagine the mass numbers are seconds? Use your stopwatch to time yourself and see if you can do the following activities in the times. For example can you sing Happy Birthday in 52 seconds? Can you stand on one leg for 123 seconds? Put a tick or cross in each box on page 29 to show what you can do in the time.

Next steps

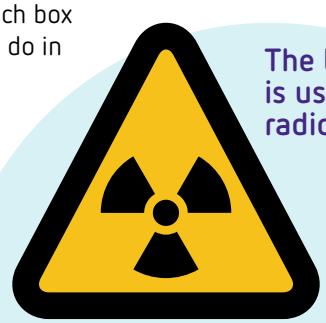
To learn more about radiation, click on the links below:
crukradnet.colcc.ac.uk
instagram.com/radiation_hotstuff

Skills unlocked

Observant, curious, open-minded

Career options

- Radiation researchers test hypotheses by carrying out studies to advance our knowledge and understanding of radiation and improve diagnosis and treatments for patients.
- Therapeutic radiographer, Nuclear Medicine physician, and medical physicist work in hospitals.
- Radiation Protection Advisors ensure there are adequate level of radiation shielding and rules to protect people.



The trefoil symbol is used to indicate radioactive material.

HOURS, MINUTES, AND YOCTOSECONDS!






Radionuclide	Seconds	Sing Happy Birthday	Make a paper aeroplane	Do 10 star jumps	Draw the symbol above (which is called the radioactive trefoil)	Stand on one leg
^{75}Se, Selenium-75	75					
^{52}Mn, Manganese-52	52					
^{111}In, Indium-111	111					
^{89}Zr, Zirconium-89	89					
^{123}I, Iodine-123	123					
^{68}Ga, Gallium-68	68					
^{11}C, Carbon-11	11					
^{13}N, Nitrogen-13	13					
^{15}O, Oxygen-15	15					
^{82}Rb, Rubidium-82	82					

BRITISH SCIENCE WEEK

HOURS, MINUTES, AND YOCTOSECONDS!

Radionuclide
^{75}Se, Selenium-75

Imaging Uses
Liver function

Half-life
120 days

Radionuclide
^{13}N, Nitrogen-13

Imaging Uses
Myocardial perfusion (heart blood flow)

Half-life
10 minutes

Radionuclide
^{52}Mn, Manganese-52

Imaging Uses
Manganese in body

Half-life
6 days

Radionuclide
^{82}Rb, Rubidium-82

Imaging Uses
Myocardial perfusion (heart blood flow)

Half-life
1.3 minutes

Radionuclide
^{68}Ga, Gallium-68

Imaging Uses
Tumours and infection

Half-life
68 minutes

Radionuclide
^{111}In, Indium-111

Imaging Uses
Tumours, inflammation, infection and diabetes

Half-life
3 days

Radionuclide
^{89}Zr, Zirconium-89

Imaging Uses
Tumours, immune cell activity a nd new blood vessel formation

Half-life
79 hours

Radionuclide
^{123}I, Iodine-123

Imaging Uses
Thyroid function

Half-life
13 hours

Radionuclide
^{15}O, Oxygen-15

Imaging Uses
Myocardial perfusion (heart blood flow)

Half-life
2 minutes

Radionuclide
^{11}C, Carbon-11

Imaging Uses
Neurology

Half-life
20 mins

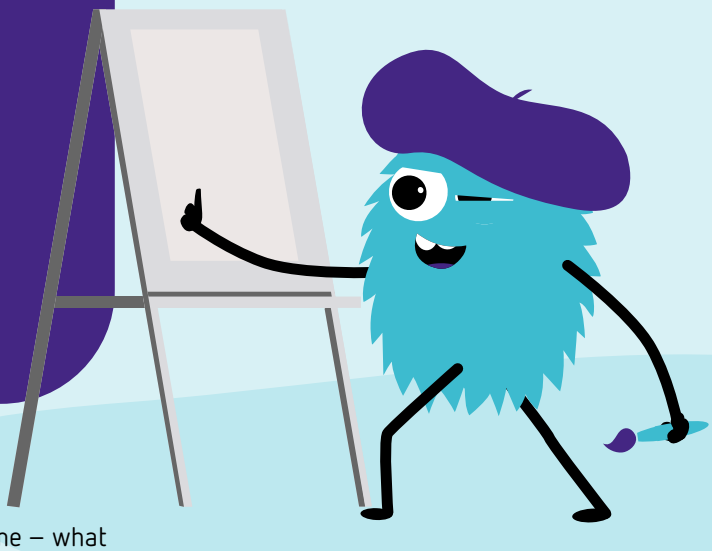
BRITISH SCIENCE WEEK 2024

POSTER COMPETITION

Students can get creative and enter the British Science Week annual, UK-wide poster competition! To enter, they simply need to create a poster which fits in with the theme of 'time'.

Schools then select the 5 best creations and submit them for a chance of winning an array of prizes. You can use the activities in this pack for inspiration!

2+ hours



Kit list

Paper (A4 or A3)

Creative materials such as:
pens
pencils
scissors
glue
watercolours
paint
crayons
pipe cleaners
felt
thread
wool
foil
clay
string
beads
stamps
foam
pompoms

Instructions

Encourage students to think about time – what it means to them and how it relates to the science they've learnt about – to come up with ideas to include in their poster. Here are some points and questions to get you going:

- Get students to think about their own time – how do they spend it? At home, out playing in the park, arts and crafts, learning at school?
- What about 'time' in the world, and beyond? How do we measure time – seconds, days, seasons, centuries? What about time in space?
- Are there any scientists they know of whose work relates to time? What about time travel in films, TV and music?

Make your poster

Once they've done their thinking, it's time for students to get creative! Posters must be A4 or A3 in size and you'll need to be able to take a photograph of each one so it can be sent to us online for judging. Students can use pop-up pictures, pull out tabs or materials such as pencils, paints, crayons and paper to create their posters.

Send us your poster

Posters will be judged on creativity, how well they fit the theme, how well they have been made or drawn, and how engaging they are. Once a student's poster is complete, take a photo of it and complete the online form to submit it as an entry.

Next steps

Celebrate! For more details, along with the full set of poster competition rules and tips, check out our website: britishscienceweek.org/plan-your-activities/poster-competition.

BRITISH SCIENCE WEEK

britishscienceweek.org

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