

# ACTIVITY TITLE: Sky Shadows – Exploring Time Through Sundials and History

Activity code: ncACINV01



	DURATION	90 min
	AGE RANGE	11 - 12 YEARS
	TOPICS	ASTRONOMY CREATIVITY DESIGNING



## Description of the project

In this activity, students will explore how ancient civilizations used the Sun to measure time and will build their own sundial using simple materials.

The goal of the activity is to understand how people in the past measured time by observing the Sun and to construct a sundial that tells the time based on its position in the sky.

They will learn key concepts such as:

- The relationship between the Sun's position and the passage of time.
- The Earth's rotation and its effect on shadows.
- The difference between solar time and civil time (clock time).
- The role of women in the field of astronomy.

During the activity, we are integrating science, engineering, mathematics, and art into a single project. By the end of the session, students will have built a functional sundial and will understand how it works. They will also reflect on the importance of solar observation throughout history and its relevance today.



## Objectives: What will I learn?

- Understand how ancient and modern societies observed the Sun to measure the passage of time by analyzing historical practices and discussing example to recognize the role of astronomical observation in the development of timekeeping.
- Build a functional sundial using simple and accessible materials through a guided hands-on construction process to experience firsthand how solar time can be measured using basic tools.
- Observe how the position of a shadow changes throughout the day by using the constructed sundial and tracking shadow movements to understand the relationship between the Sun's apparent movement and time.

- Differentiate between solar time and civil time (the time shown on modern clocks) through observation, comparison, and discussion of solar readings vs. clock time to develop a critical understanding of different timekeeping systems.
- Apply knowledge from science (astronomy and Earth's rotation), technology (use of a compass or app), engineering (device assembly), art (visual design of the sundial), and mathematics (relationship between angles and hours) by integrating concepts of astronomy (Earth's rotation), technology (compass use), engineering (sundial assembly), art (sundial design), and mathematics (angles and time) to foster holistic STEAM learning and problem-solving.
- Value traditional knowledge and sustainable, electricity-free technological solutions by reflecting on the historical and modern relevance of sundials and similar tools to promote awareness of environmentally friendly alternatives and cultural heritage.
- Encourage scientific curiosity and critical thinking through active experimentation and reflection on natural phenomena to inspire ongoing inquiry and deeper engagement with the natural world.
- Promote knowledge and visibility of women's contributions to astronomy by introducing historical figures such as Caroline Herschel and discussing their achievements to highlight gender equity in STEAM fields and inspire diverse role models.



## Materials: What do I need?

The materials needed to develop the activity will be listed. They will have to be divided into:

- 1. Provided by the teacher/institution:**
  - Scissors or Cutter, Glue, Cardboard, Skewer, Pen or Marker Compass (can be a mobile app)).
- 2. Provided by students**
  - Computer
  - Internet access
  - Notebook and pencils
- 3. Downloadable resources**
  - [Sundial Template](#)
  - [Worksheet "Comparing Solar Time and Civil Time + Tracking Shadow Movement"](#)



## Previous preparation

List of actions to complete before starting the activity, such as:

- Have all consumable materials ready
- Printing materials
- The speaker reviewed information about Caroline Herschel beforehand, to give a brief introduction to this brilliant woman, who played a significant role in the field of astronomy.

## Caroline Herschel

Caroline Lucretia Herschel was born in Hanover on March 16, 1751. She was a German astronomer who also lived in England.

She worked with her brother, William Herschel, helping him build telescopes and assisting with his observations. She discovered eight comets, six of which bear her name, including the periodic comet 35P/Herschel-Rigollet, which she found on December 21, 1788.

At first, she did not receive any formal education because she was a woman, but she moved to England with her brothers to pursue a career as a singer. Eventually, however, she began her scientific career in astronomy under the supervision of her brother, although she later started training herself. Together, they built the best telescopes of the time and observed celestial bodies, which they later analyzed jointly.

Alongside her brother, she discovered a thousand double stars, and together they demonstrated that many of them were binary systems, thus providing the first evidence of gravity beyond the solar system. On her own, she discovered eight comets and three nebulae, and compiled various catalogs. She was the first woman to detect a comet, later discovering seven more.

In 1835, she presented Flamsteed's work to the Royal Academy of Göttingen. She was named an Honorary Member of the Royal Astronomical Society. The Royal Irish Academy granted her the same title, and at the age of ninety-six, the King of Prussia awarded her a gold medal in science.

Some interesting facts about her are:

- The lunar crater C. Herschel is named in her honor.
- She is considered the first professional female astronomer.

(CarolineLucretiaHerschel.jpg)





## RESEARCH



### Have a look at these resources

For thousands of years, people have searched for ways to measure time by observing the sky. Long before digital watches, wristwatches, or mobile phones existed, ancient civilizations already knew that the position of the Sun in the sky changed throughout the day... and they used it to tell time! Knowledge of the sky was key to organizing daily life: work schedules, farming, religious ceremonies, and travel all depended on sunlight and the passage of time.

One of the oldest and most fascinating instruments that emerged from this observation is the **sundial**, also known as a *gnomon*. Although its functioning is simple—a moving shadow—, behind its construction lies a great deal of science, a deep connection with nature, and also an artistic dimension.

In this activity, we will build a sundial, a very simple instrument that allows us to estimate the time based on the shadow cast by a stick when exposed to sunlight. We will use very basic materials, yet this activity connects us with ancient astronomical knowledge and a way of understanding time rooted in direct observation of the environment.

This activity is relevant because it helps us:

- Understand how humans have used nature observation to solve everyday needs, such as measuring time.
- Connect knowledge from science (apparent movement of the Sun, Earth's rotation), mathematics (angles, time fractions, symmetry), engineering (building a functional device), and art (design and decoration of the sundial).
- Value sustainable, electricity-free technological solutions like sundials, which were—and in some contexts still are— practical tools.
- Develop critical thinking and scientific curiosity by observing natural phenomena and proposing explanations.

The following questions can be asked before, during, or after the activity:

- Why does the shadow change position throughout the day?
- What is the relationship between the Sun and the passage of time?
- Why doesn't a sundial work indoors or at night?
- How could a sundial be adapted for use in different parts of the world?
- Do you think solar time and clock time always match? Why or why not?
- What other natural ways to tell time do you know or can imagine?
- What do you think life was like before modern clocks existed?
- What are the advantages and disadvantages of sundials compared to digital clocks?



## CREATE



### Some things you need before beginning

Sundials have been — and still are — very useful throughout history:

- Sundials can still be found in public squares: we can see them on churches, town halls, and other buildings.
- Before the use of mechanical clocks, farmers and sailors relied on sundials to organize their daily routines.
- Many modern buildings use the Sun's position to optimize the use of natural light.

Knowledge about the Sun's movements is still useful today!

What is solar time?

Solar time is the time shown by a sundial: it depends directly on the position of the Sun in the sky. Solar noon occurs when the Sun is at its highest point in the sky (at that specific location). Each solar hour is determined by how much the Sun's shadow moves.

What is "civil" or "official" time?

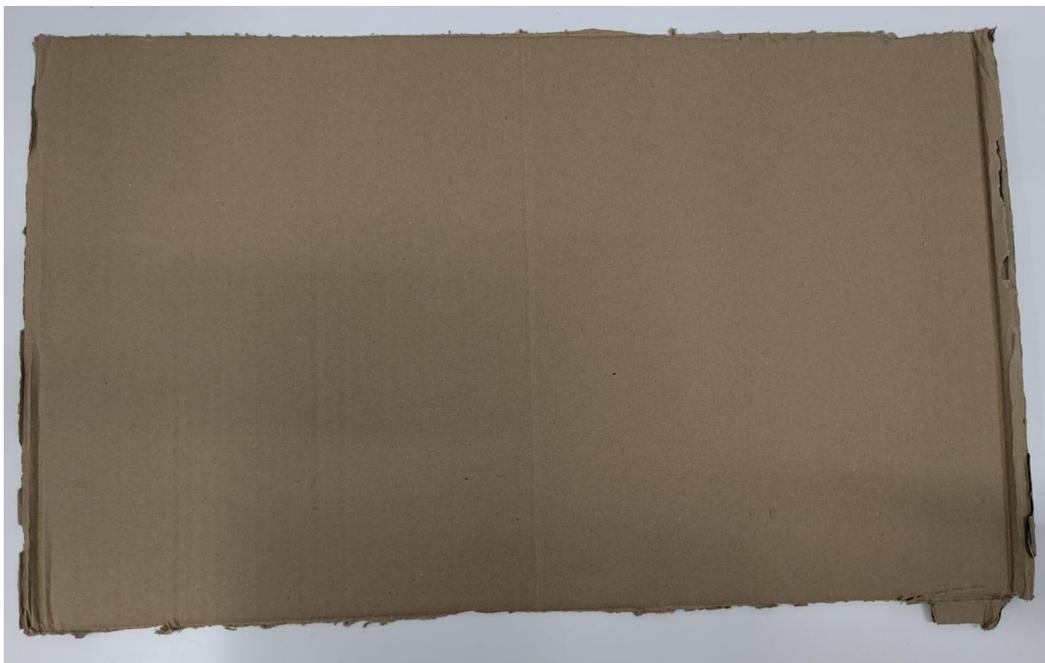
It's the time we use on our watches, phones, or digital clocks. It is regulated by time zones established for convenience, so that all places within the same region share the same time.



### Now, follow these steps

Here you have to describe all the necessary steps (with photos if needed) to develop the activity.

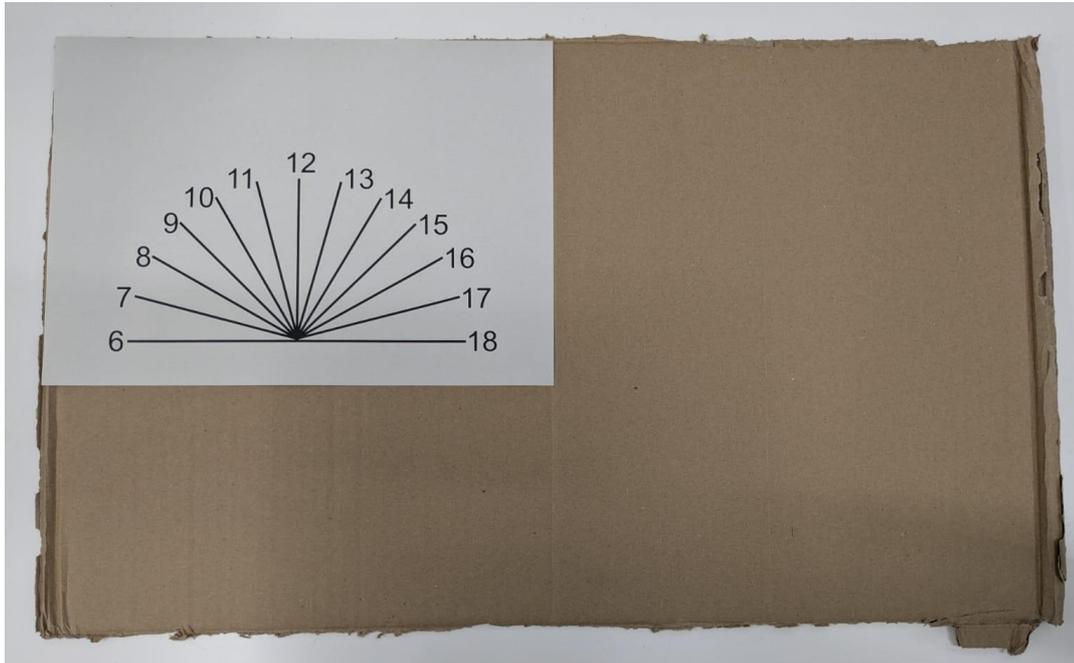
**Step 1.** Place the sundial template on top of the cardboard. [\(Imagen1.jpg\)](#)



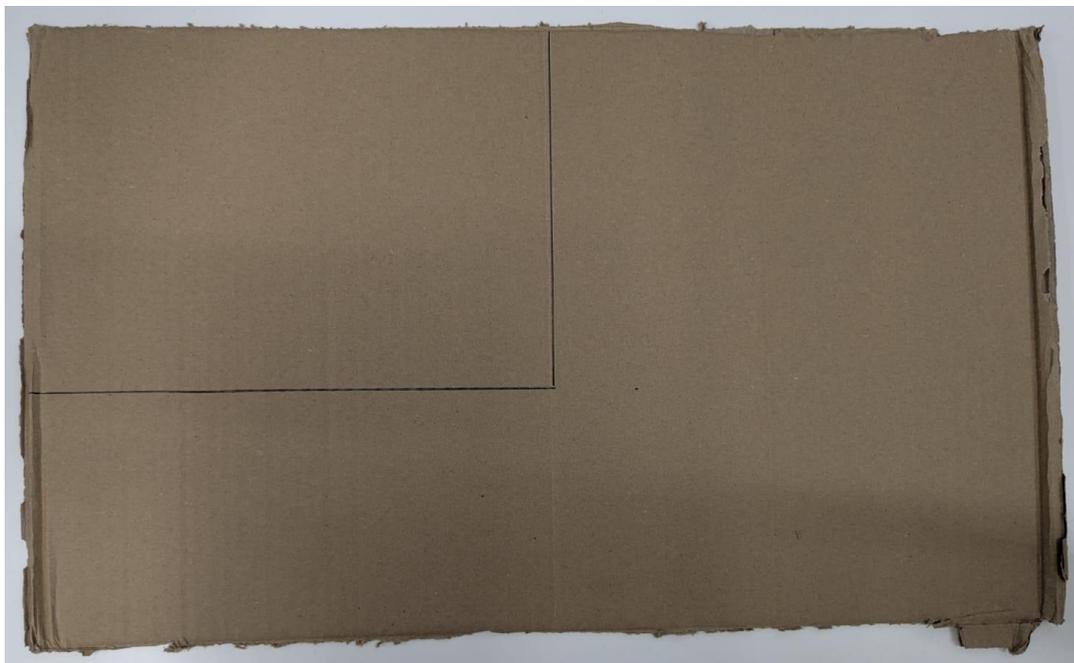


Now, follow these steps

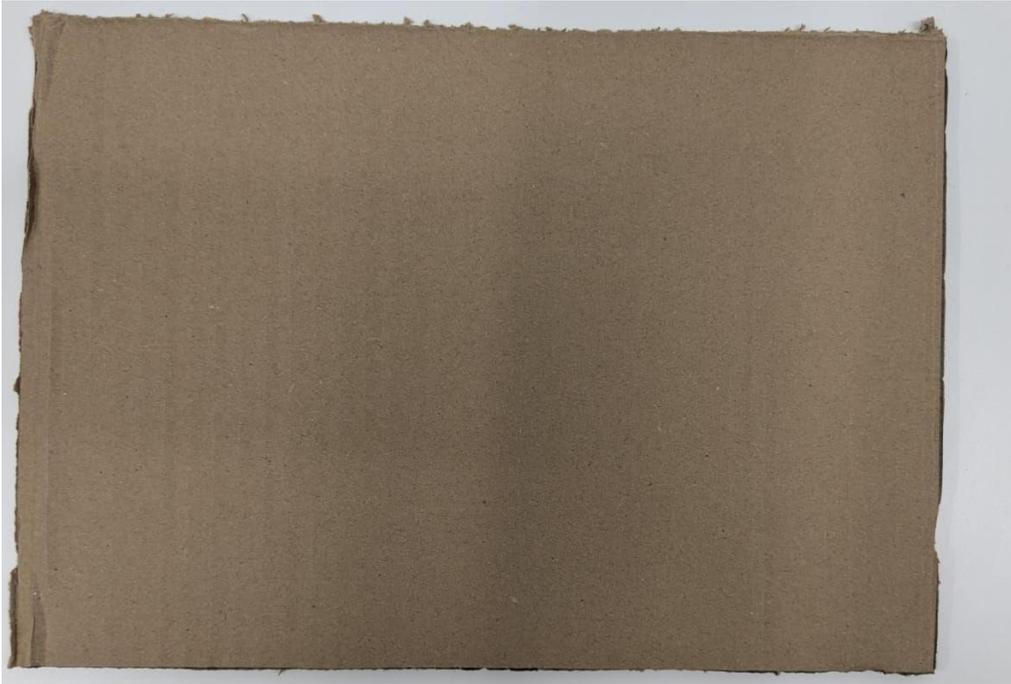
(Imagen2.jpg)



**Step 2.** Using a marker or pencil, we mark the shape of the clock and the size of the sheet of paper, then cut it to the appropriate dimensions. (Imagen3.jpg)



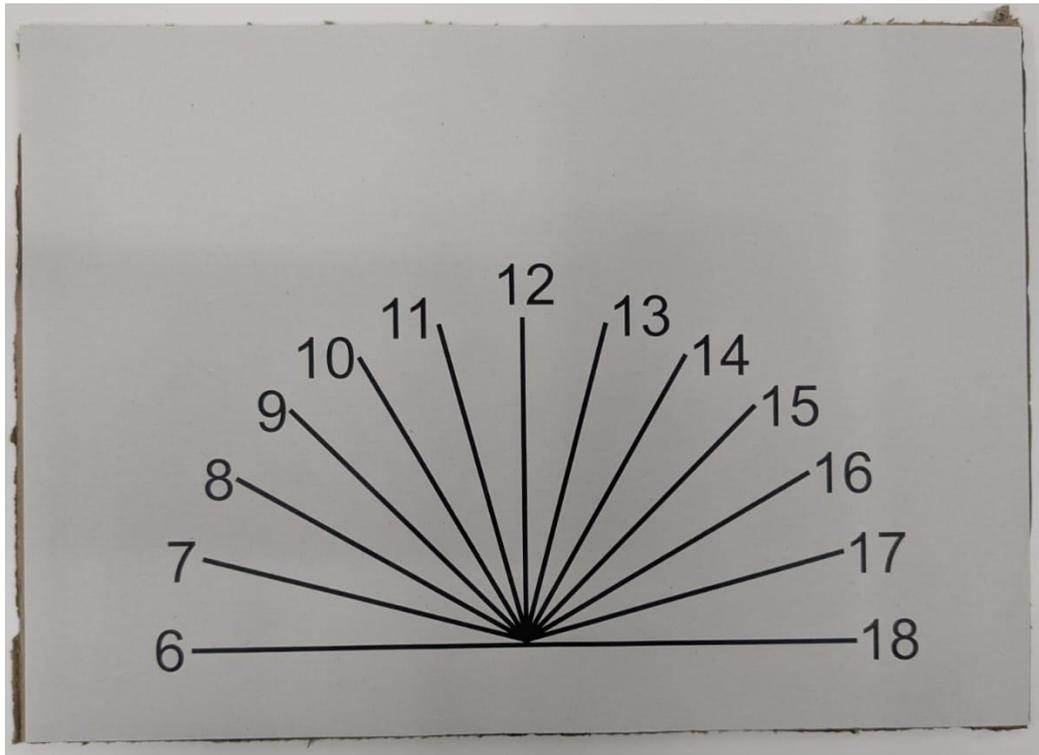
Step 3. We cut out the cardboard. (Imagen4.jpg)



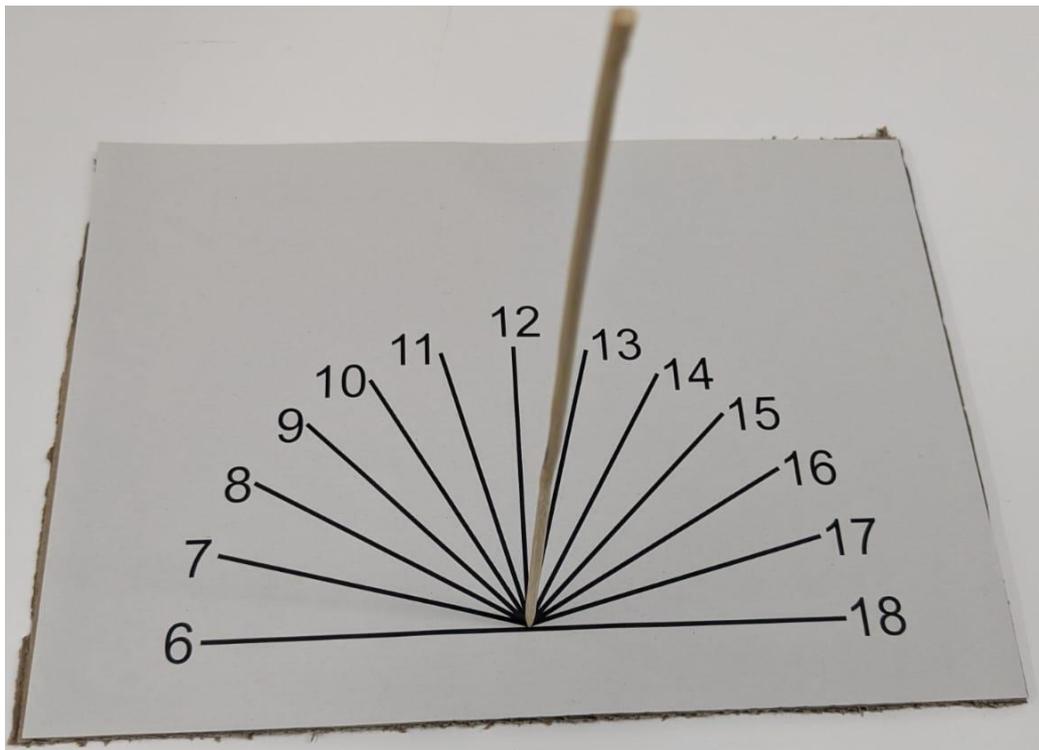
Step 4. We glue the clock onto the cardboard. (Imagen5.jpg)



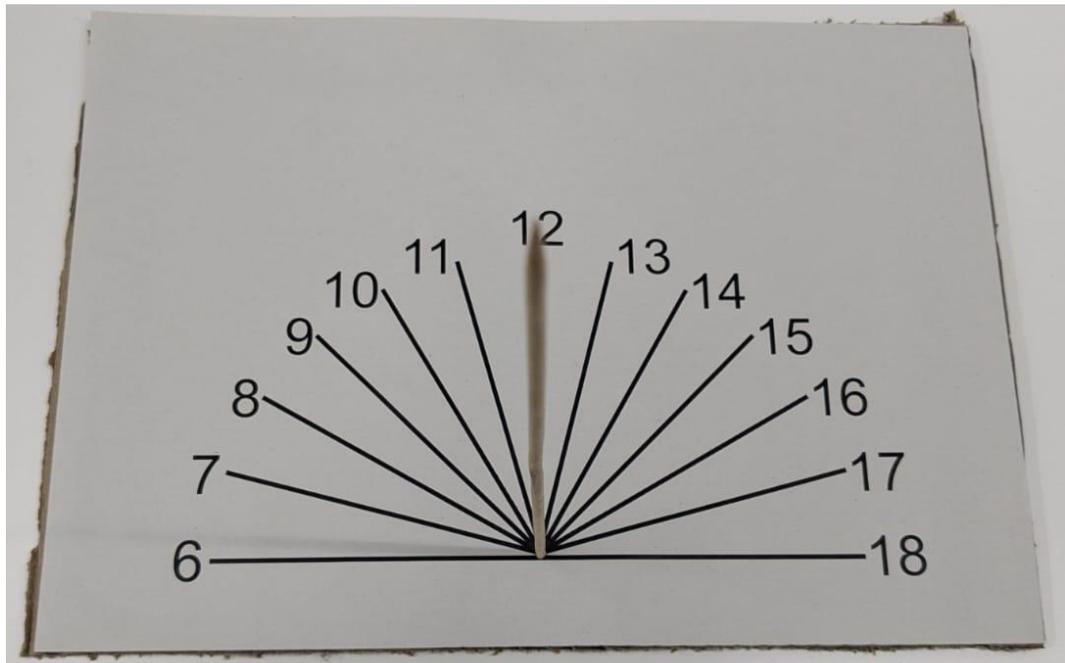
(Imagen6.jpg)



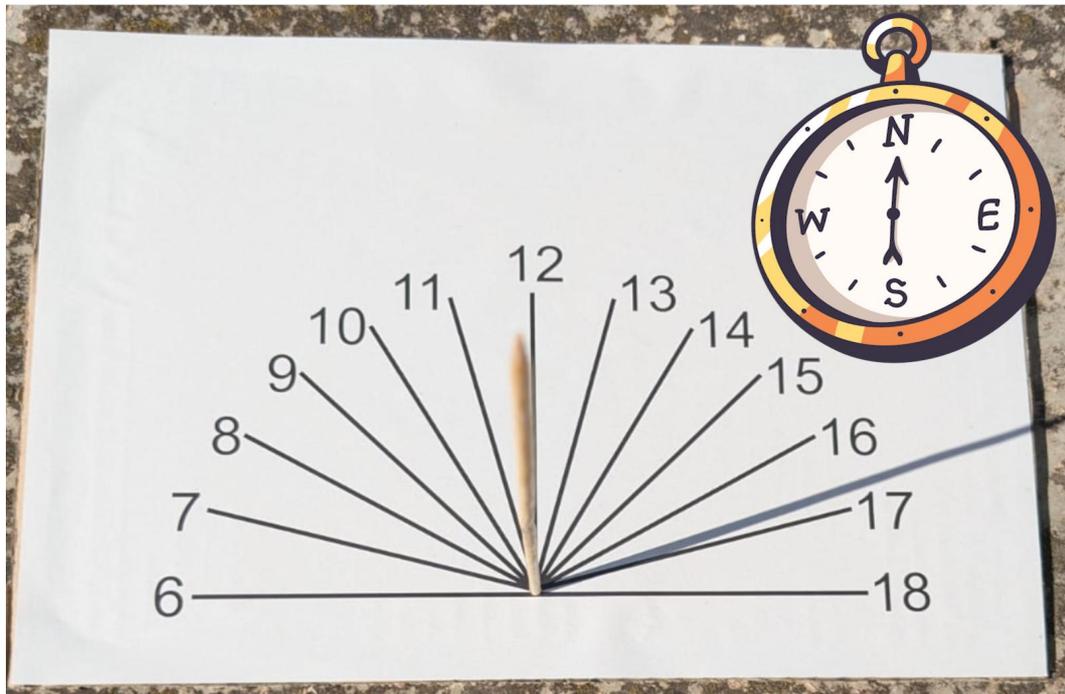
**Step 5.** We pass the skewer through the middle of our clock. First, we'll make the hole with the skewer itself, and once we've pierced the paper and cardboard, we'll insert it from the other side, meaning the tip would be facing up, and the flat part of the skewer would be underneath the cardboard. (Imagen7.jpg)



(Imagen8.jpg)



**Step 6.** Using a compass, point the watch to the sun. North should be at the 12 o'clock mark. (Imagen9.jpg)



Once this is done, we will be able to see the solar time thanks to our Sundial.

**Step 7.** Use your sundial to record the solar time at different moments of the day. Afterwards, compare it with the time shown on your digital or analog clock and record your observations in the worksheet provided by the teacher "**Comparing Solar Time and Tracking Shadow Movement.**"

Once the worksheet is filled in, answer the questions and complete the shadow drawing.

**Step 8.** Now that you have tested your sundial think about how well it worked; if you could improve it and how. Later, answer to these questions:

1. Did the sundial give correct times? If not, why do you think this happened?
2. Was the shadow easy to read? Could you change something to make it clearer?
3. Could you make the sundial stronger or easier to use? How?

If possible: **make one small improvement** and test it again!

Be ready to share:

- What you improved.
- Why you chose that improvement.
- What result you got after testing again.

**Step 9.** Now that your sundial is built and you are observing how it works, think about how you can make it a message of inclusion — a sundial that shows that science and technology are for everyone, and that celebrates diverse contributions from women, girls, and different cultures.

In this step, you will add creative elements to your sundial:

1. **Show that science and technology are for everyone**
  - Add a symbol, drawing, or sentence to your sundial to express that anyone can learn and contribute to science.
    - Example idea: add symbols of diversity (rainbow, globe, people working together).
2. **Celebrate the contributions of women, girls, or people from different cultures**
  - Think about Caroline Herschel or other women and girls in science and add a symbol, name, or small tribute to your sundial to honor these contributions. You can also add patterns, colors, or designs from your own culture or from another culture to show how science belongs to everyone around the world.
    - Example ideas:
      - Names of famous women scientists around the border.
      - Patterns inspired by cultural art and timekeeping traditions.

When you present your sundial, be ready to show and explain:

- What symbols or decorations did you choose?
- Why did you choose them?
- How do they show that science and technology are for everyone?

**Step 10.** Finally, create a short narrated video (1-2 mins) explaining the sundial created and its inclusive design elements, incorporating photos of the sundial, reflections from the worksheet done, and any cultural or ethical insights explored. These can be shared on the class blog, school website, or project's social media.



## COMMUNICATE

It's time to share your thoughts:

- Do you find this type of invention useful in your daily life?
- Under what circumstances would you find this sundial useful?
- Imagine you are a girl living in a rural village without a public clock or personal watch. How would you know what time it is, and for which daily activities would knowing the exact time be most important? How might your experience of time differ from that of a boy living in the city with easy access to clocks? Use drawing, storytelling, or short dramatization to show the girl's daily routine and how she navigates time. Compare it creatively with a city boy's routine. Consider making a mini-comic or photo collage of both lives



### It is time to share!

In this section different social media will be presented in order to upload their activity result.  
#sundialworkshop

- LinkedIn: <https://www.linkedin.com/company/steambrace-project/posts/?feedView=all>
- Instagram: [https://www.instagram.com/steambrace\\_eu/](https://www.instagram.com/steambrace_eu/)
- X: [https://www.instagram.com/steambrace\\_eu/](https://www.instagram.com/steambrace_eu/)



## KEEP ON LEARNING



### How can I make a similar project by myself?

Reflection Questions:

- Would you be able to make your own sundial without help?
- How would you improve the design suggested today?
- Although we have a lot of technology now, do you think it might be useful to teach devices like this in schools?
- What challenges have women faced in the history of timekeeping and science?
- How can we make sure all voices are heard in STEAM today?"

Inspiration: In 2019, indian artist Daku created an artistic intervention in the streets of Goa, where suspended letters casted shadows on the street that moved with the Sun, as a reflection of the passage of time itself. Check it out here:

<https://www.thisiscolossal.com/2019/01/theory-of-time-by-daku/>

<https://www.instagram.com/p/BszbJ50n8EW/>

Choose an issue you care about (e.g., environmental change, gender equity, local culture) and design a sundial-based artwork or intervention to raise awareness about it. Share the intent of your piece with your group or on social media with a caption explaining its message.



## Which are other connected projects?

If you're interested in this topic, you can continue exploring it. Below are some examples of things you can use to continue learning about how to measure time and the importance of the sun in your lives.

- What types of clocks do you know? A sundial, a wristwatch, a smartwatch, an hourglass, etc.
- Observe what the shadow looks like throughout the day. If you place a stick or any other object on the ground, does the shadow it cast change position? Shape? What do you think this means?
- Both the sun and the stars have always been used for orientation. Would you know how to do this yourself?



## LINKS FOR FURTHER INFORMATION

Here you can find links to different activities related to the topic:

- Here is an interesting video on how to orient yourself with the sun or the stars:  
<https://www.youtube.com/watch?v=Bh5kHTBr0gU>
- How to make a sand clock:  
<https://www.youtube.com/shorts/AzQErzLWdro>

## Disclaimer

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