Clepsydra or water clock

General information			
Respective blueprint	Clepsydra		
Description	In this lesson, pupils will build a clepsydra. Students will discover how it works and the historical background of its invention.		
Learning objectives	At the end of this session, pupils will be able to : • Understand the basic workings of a clepsydra • Put the invention and development of the clepsydra into a historical context		
Related curricular subjects	Mathematics – Sciences - History		
Duration	3 hours		
Level of difficulty	Basic ☐	Medium ☑	Advanced ☐
Inclusivity guidelines			
How to integrate students with SLD	• Formulate short, simple instructions that only require one action at a time. For example, make a small hole in the cap using a pair of compasses. • When you give instructions (written), highlight the word of action so pupils know what they are expected to do. → In this example, using a pair of compasses, **make** a small **hole** in the cap. • When possible, you can show the expected result of the manipulation. • When creating groups, try to place students who are having difficulties with students who are generally more advanced so that they can help each other (a dyspraxic student will have a lot of difficulty with cutting tasks).		
How to integrate students who work faster	• Ask the pupils who finished their tasks earlier to research the current uses of clepsydra and/or their use over time. They can present their findings to the class orally or with a poster.		

Step-by-step description of the lesson

Step 1: Introduction Activity	**Estimated time: 25 min**

- **Introduction – 10 min**

Ask two volunteers to run a course one after the other.

We don't have a stopwatch. How do we know which of the two children ran the fastest?

- **How can you compare durations without a "traditional" measuring device? - 15 minutes**

Examples of answers:

1 "We can count while each child does their run.

2 "Start each child at the beginning of a song (tape recorder).

3 "You have to pour the tap water into a jug.

It's this last statement that starts the work on the clepsydra. If they don't, you can bring in equipment the children will have to use or guide them by suggesting they use the water.

Step 2: First experiences	**Estimated time: 1 hour**

- **Counting – 5 min**

Each child counts silently during the first race. The results are compared.

The answers varied widely for the same child (from 15 to 32 seconds). This suggests that the method is not satisfying.

- **Identifying the time taken to listen to a song – 10 min**

The first pupil's run made it possible to listen to the music further than the second pupil's run, so the second pupil ran faster than the first. This solution is valid but requires audio equipment.

➔ Need to find a more reliable solution.

- **Tap – 10 min**

A child stands at the tap and sets the flow rate at a medium level.

A child starts the race: when the child starts running, the jug is placed under the tap and removed at the end of the race. The water level is marked.

The experiment is repeated with another child.

As the water level is higher for the first child, we can deduce that the second was faster.

➔ The teacher asks how to measure race times more accurately while still using water. – 30 min

The children are given a graduated container and a stopwatch to measure the duration of the races. Several children complete the circuit in succession. During each race, the water that runs off during the race is collected, and the quantity of water obtained is measured. At the same time, the race is timed. The results are recorded as they are received and then organised in a table (see document Clepsydra_Experiment measuring time)
The table is completed according to the running order. The lines are then sorted from the fastest to the slowest. You can see less water in the container of the person who ran the fastest.

Possible extension:
Ask the pupils whether the obtained table corresponds to a proportionality table and do the necessary calculations.
You should find that the coefficients found are very close.
So, we almost have a proportionality table: the quantity of water flowing is "practically" proportional to the duration of the race.
Ask the students: "Why didn't we get a strict proportionality table?

Step 3: Making a clepsydra	**Estimated time: 30 min**

- And without a tap?

How can a similar experiment be carried out without a tap while still using the equipment provided (water, stopwatch)?

➔ Proposal for building a clepsydra.

The children are placed in groups of 2-3 and follow the instructions in the handling plan to build their keystone. The groups have different types of bottles (different heights and widths).

Findings:

- Not all bottles are calibrated in the same way: it depends on the hole size.

Conclusion: The bigger the hole, the faster the water flows.

- The graduation lines are tighter at the bottom of the bottle.

Conclusion: When the level in the bottle drops, the water flows more slowly.

General conclusion :

Time can be measured by observing the flow of water. If the flow of water is regular, the quantity of water is proportional to the time elapsed. When we use the flow of water from a pierced bottle, the water flows more slowly as the level in the tank drops. The larger the hole, the faster the water flows.

Step 3: History of the clepsydra	**Estimated time: 30 min**

Ask the pupils when they think the clepsydra was used.

1. The first clepsydras were invented by the Egyptians around 1600 BC. They consisted of a simple conical bowl with a hole at the base to allow water flow. The time was measured on graduations that could be read inside the bowl.
2. Around 270 BC, the Greeks improved the accuracy of clepsydra. It was they who invented the hourglass-shaped clepsydra.
3. Clepsydra continued to be perfected thanks to the Persians (around 800) and the Chinese (around 1000), who built a giant clepsydra.

Place the different developments of the clepsydra on a timeline to review the different historical periods. You can also place the countries mentioned on a world map and create an extension lesson on the continents or countries of the world.

Assessment activities

Activity 1: Self-assessment activity

Ask the students to self-assess their performance during the group activity using the grid (document Self-Assessment grid).
Self-assessment encourages learning and improves performance. Self-evaluation is systematically formative. It aims to highlight areas for improvement.

Activity 2: Assessment of knowledge acquired

After a long sequence (of several sessions), it may be useful to carry out a formative (or certificate) assessment of the knowledge acquired. Here are some examples of questions you could ask.

1. Explain in a few sentences the evolution of the clepsydra.
2. Who invented the clepsydra?
   The Persians – The Greeks – The Egyptians
3. The clepsydra was invented after the birth of Jesus Christ. True/False
4. If we build a very large hole when building a clepsydra, will the water flow quickly or slowly?
5. In a few sentences, explain how a clepsydra works and how it can be used to measure time.

Attachments

- Self-assessment grid
- Experiments: measuring time page

References

- Fondation La main à la pâte. (s. d.). Expériences sur la mesure du temps : La clepsydre | La Fondation La main à la pâte. Consulté 18 août 2023, à l'adresse https://fondation-lamap.org/temoignage-d-enseignant/experiences-sur-la-mesure-du-temps-la-clepsydre
- Wikipédia. (2023). Clepsydre. In Wikipédia. https://fr.wikipedia.org/w/index.php?title=Clepsydre&oldid=206589320

Experiments: measuring time

First method: counting

Observations and conclusions :

……

……

……

……

……

……

Second method: listen to a song

Observations and conclusions :

……

……

……

……

……

……

Third method: tap

Take note of the time, the amount of water and the first names of the people running.

Name	Quantity of water in ml	Time in second
……	……	……
……	……	……
……	……	……
……	……	……
……	……	……
……	……	……

Rearrange the table from fastest to slowest.

Name	Quantity of water in ml	Time in second
……	……	……
……	……	……
……	……	……
……	……	……
……	……	……
……	……	……

Observations and conclusions :

……

……

……

……

……

……

Fourth method: Build a clepsydra

Observations and conclusions :

……

……

……

……

……

……

Summary of the evolution of the clepsydra

Co-funded by the European Union

Self-assessment grid

Work in group

	☺	😐	☹
I took part in organising and carrying out the task.			
I cooperated actively within the group.			
I respected the other group members at all times.			
I was able to recognise and accept the skills and knowledge of the other members of the group.			
Everyone took part in our group discussions			
We asked the other members of our group for help when we needed it.			
I respected the deadlines			
I've finished my work.			
I've made an effort and I did my best			
I knew how to ask for help when I needed it			
The manipulation helped me understand the concepts			
I'm proud of my work and the result I've achieved			
I enjoyed taking part of this activity !			

☺ = Absolutely / 😐 = Partially / ☹ = Not at all

Teacher's comments :

……

……

……

……

……

……

……

……

STEAM IN TIMES

DiSCLAIMER

Funded by the European Union. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or the European Education and Culture Executive Agency (EACEA). Neither the European Union nor EACEA can be held responsible for them.

Co-funded by the European Union