Periscope

General information			
Respective blueprint	Periscope		
Description	In this lesson, pupils will build a periscope. 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 periscope and, therefore understand the principles of light reflection using a mirror • Put the invention and development of the periscope into a historical context		
Related curricular subjects	Sciences – Mathematics – History – Engineering		
Duration	4 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, draw 3 columns 5 centimetres wide and 20 centimetres long. • When you give instructions (written), make sure to highlight the word of action so pupils know what they are expected to do → In this example, start by **drawing 3 columns** 5 centimetres wide and 20 centimetres long. • When it's 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 much 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 periscopes. They can present their findings to the class orally or with a poster.		

Step-by-step description of the lesson

Step 1: Introduction	**Estimated time: 30 minutes**

- **Class discussion** on the word "periscope". What could you imagine from this word? What does it evoke for you? Have you ever heard the word? If so, in what context? – 10 min
- **Interactive presentation** – 20 minutes

The teacher shows images showing different types of periscope and different uses (see document Periscope_Introduction). Guided discussion on what the students observe in the images. For each image, ask in which field the periscope is used (military, construction, animal observation, rescue services, entertainment, space) so that the pupils realise the variety of periscope uses.

Example of questions for the guided discussion:

1. What do you see in these periscope images/videos?
2. Can you identify the parts of the periscope in these images/videos?
3. How do you think the periscope works to allow us to see things outside our direct view?
4. In what ways could the periscope be useful in everyday life or specific situations?
5. Do you see any similarities between the different types of periscope shown in the images? Are there any differences?
6. How would you explain to someone who doesn't know how a periscope works?
7. What are the advantages of using a periscope compared with simply observing with the naked eye?
8. Do you think you could build your own periscope? What steps would you need to take to build one?

Step 2: History of the periscope	**Estimated time: 30 minutes**

- **Interactive presentation** of the history of the periscope, from its first uses to modern developments. Highlighting historical figures linked to the development of the periscope.

The teacher briefly explains the history of the periscope, using important historical figures and explaining how it has been used throughout the ages.

Johannes Gutenberg (German) is said to have invented the first periscope in 1430 (Middle Ages). Then, in 1854, Hippolyte Marié-Davy (French) proposed the concept of the periscope for use on submarines. Irish physicist Sir William Crookes perfected the periscope for use during the First World War. Periscopes subsequently evolved, with the addition of a rotation or telescope system.

- **Locating** the invention in time and space

On a timeline of the different periods in history, place the development of the periscope. Then, on a map of Europe, locate the countries where the different inventors of the periscope were born.

Step 3: Scientific operation of the periscope	**Estimated time: 1 hour**

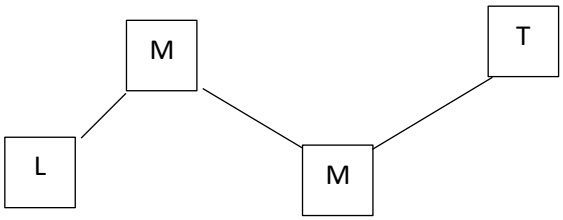
- **Open class discussion – 10min**

Open a discussion with the students: Now that you know the history and the different uses of a periscope, how do you think it works?
Accept all the pupils' hypotheses and write them down if necessary so that you can return to them later (see document Periscope_How does a periscope works).
Students will naturally mention the use of mirrors.

- **Small activity to understand light reflection – 20 min**

The students have to position a mirror and a target to collect the light from a laser deflected onto the target.
They try by trial and error. The activity provides an initial approach to light deflection on a mirror.

1. Form several groups and distribute the equipment (groups of at least three children).
2. One child holds the mirror at navel height; another holds the target at the same height, the third holds the laser. The target and mirror must be held vertically in a fixed position.
3. The children position themselves in the classroom so that the light reflects off the mirror and the laser and hit the target. The children move, not the objects (target, laser and mirror). Several solutions to the challenge are explored.



1. The teacher can then define the position of the mirror and the laser and ask the students to anticipate the target's position and then check whether the proposal is correct. Finally, the children are asked to mark out the light beam using a yellow thread.

- **What to remember ?**

When light hits a mirror, it is deflected by it. It is said to be reflected by the mirror. If the light strikes the mirror at a right angle, it is reflected back on itself. If the light is oblique the more the person holding the laser moves to one side, the more the person holding the target the target will have to move to the other side.

Point out to the students that the angle at which the ray hits the mirror is the same as the angle at which the ray reflects off the mirror.
Complete the summary (document Periscope_How does a periscope works)
Introduce more precise vocabulary words:
When light is reflected by a mirror, the angle of incidence, formed by the incident ray and the perpendicular to the mirror, is equal to the angle of reflection, formed by the reflected ray and the perpendicular to the mirror (i = r).

Step 3: Group construction of the periscope	**Estimated time: 1 hour 30**

- **Discussion – 10 min**

Ask the students what materials we need, and how we will have to place the mirrors.
Form groups of 2-3 students and distribute the materials and construction plan.

- **Construction – 50 min**

The pupils follow the construction plan, with the teacher moving between the different groups to help the pupils if necessary.

- **Testing – 30 min**

Students test their periscopes in different situations and share their observations with the class.
Students discuss the advantages and limitations of using a periscope.
Completing the summary (document Periscope_How does a periscope works).

Step 3: Feedback and/or evaluation	**Estimated time: 30 min**

- **Feedback – 10 min**

Students complete a document to self-assess their ability to participate in group work and to give feedback on the activity they have experienced.

- **Evaluation – 20 min**

The teacher may decide to mark (formatively or certifiably) participation in the group activity.
An assessment of the knowledge acquired during the sequence may also be carried out.

Assessment activities

Activity 1: Feedback and Self-assessment

After construction, distribute the self-assessment sheet (Self-assessment grid) to the students and invite them to reflect on their behaviour and involvement during the activity. This can also be a good time to gather their feedback on the activity.

Activity 2: Assessment of knowledge acquired

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

1. Explain in a few sentences how a periscope works and allows you to see objects that are not in direct view.
2. Give two examples of real-life situations where using a periscope would be advantageous. Explain why a periscope would be useful in each of these situations.
3. Explain the concept of light reflection and how this property is used to operate a periscope.
4. Name three different areas where periscopes are used or have been used. For each area, briefly explain how the periscope is used.
5. What are the advantages of using a periscope rather than looking directly? Give at least three reasons why a periscope might be preferable in certain situations.

Attachments

- Introduction: different types of periscopes (Periscope_Introduction)
- How does a periscope work
- Self-assessment grid

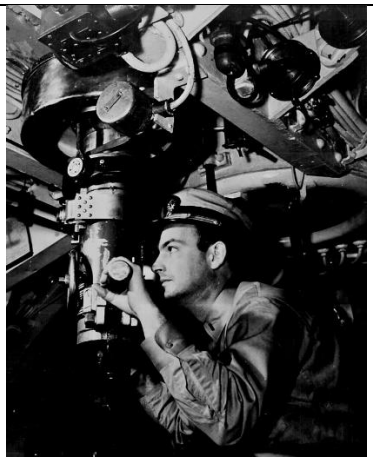
References

Where Does the Periscope Originate? (s. d.). ThoughtCo. Consulté 16 août 2023, à l'adresse https://www.thoughtco.com/history-of-the-periscope-4072717

Periscope. (2023). In Wikipedia. https://en.wikipedia.org/w/index.php?title=Periscope&oldid=1169097920#cite_note-3

Education énergie. (s. d.). https://www.educationenergie.be/wp-content/uploads/2018/12/apprendre_lumiere_20.09.11.pdf

Introduction : different types of periscopes

Picture	Field of use
 *Figure 1 Agence de photographie. (1915). Periscope tranchée française. Bibliothèque Nationale De France. https://gallica.bnf.fr/ark:/12148/btv1b6933290q/#*	.....
 *Figure 2 Official U.S. Navy Photograph, now in the collections of the National Archives. (1942). Officer at periscope in control room of submarine., ca. 1942. United States National Archives and Records Administration. https://commons.wikimedia.org/wiki/File:Sub*	.....
 *Figure 3 Remoleur, M.-M. (2016). Périscope du Mont Saint-Michel. Ouest France. https://www.ouest-france.fr/normandie/normandie-le-mont-saint-michel-vu-au-periscope-4333707*	.....

Picture	Field of use
 *Figure 4 Todd, D. (2017, November 30). Where have all the periscopes gone? They are in orbit and on the golf course. . .of course - Seradata. Seradata. https://www.seradata.com/where-have-all-the-periscopes-gone-they-are-in-orbit-and-on-the-golf-course-of-course*	.....
 *Figure 5 Up Periscope - Great Lakes Children's Museum. (2022, July 13). Great Lakes Children's Museum. https://www.greatlakeskids.org/exhibits/up-periscope/*	.....

How does a periscope work?

Initials conceptions :

explain in your own words how you think a periscope works

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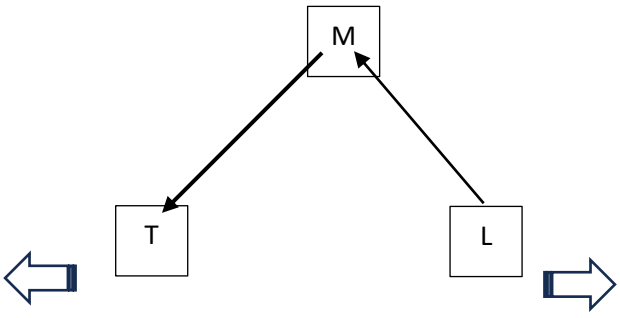
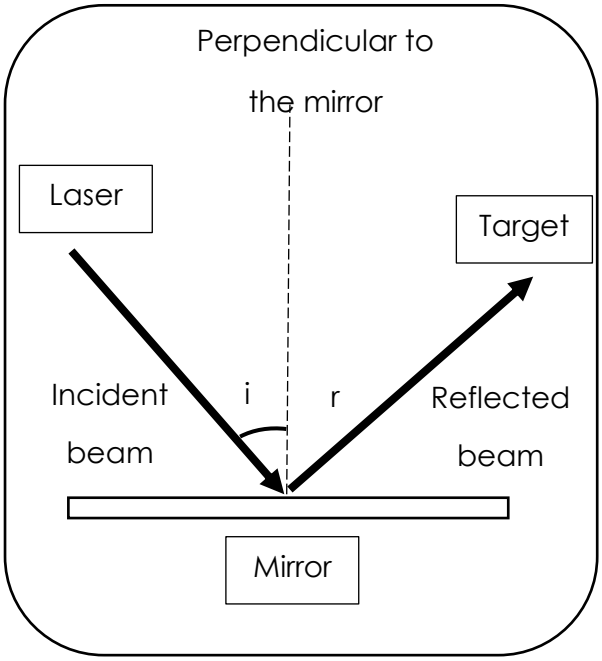
Small experiments: mirrors, lasers and targets

Complete the text

When light hits a ……., it is deflected by it. If the light strikes the mirror at a ……angle, it is reflected back on itself. If the light is …… the more the person holding the laser moves to one side, the …….. the person holding the target will have to move to the other side.



In more precise terms :



Complete the text

When light is reflected by a mirror, the angle of incidence, formed by the ……. ray and the perpendicular to the mirror, is …….. to the angle of reflection, formed by the reflected ray and the …….. to the mirror (i = r).

Advantages and limitations of periscopes:

☺	☹
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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 :

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STEAM IN TIMES

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