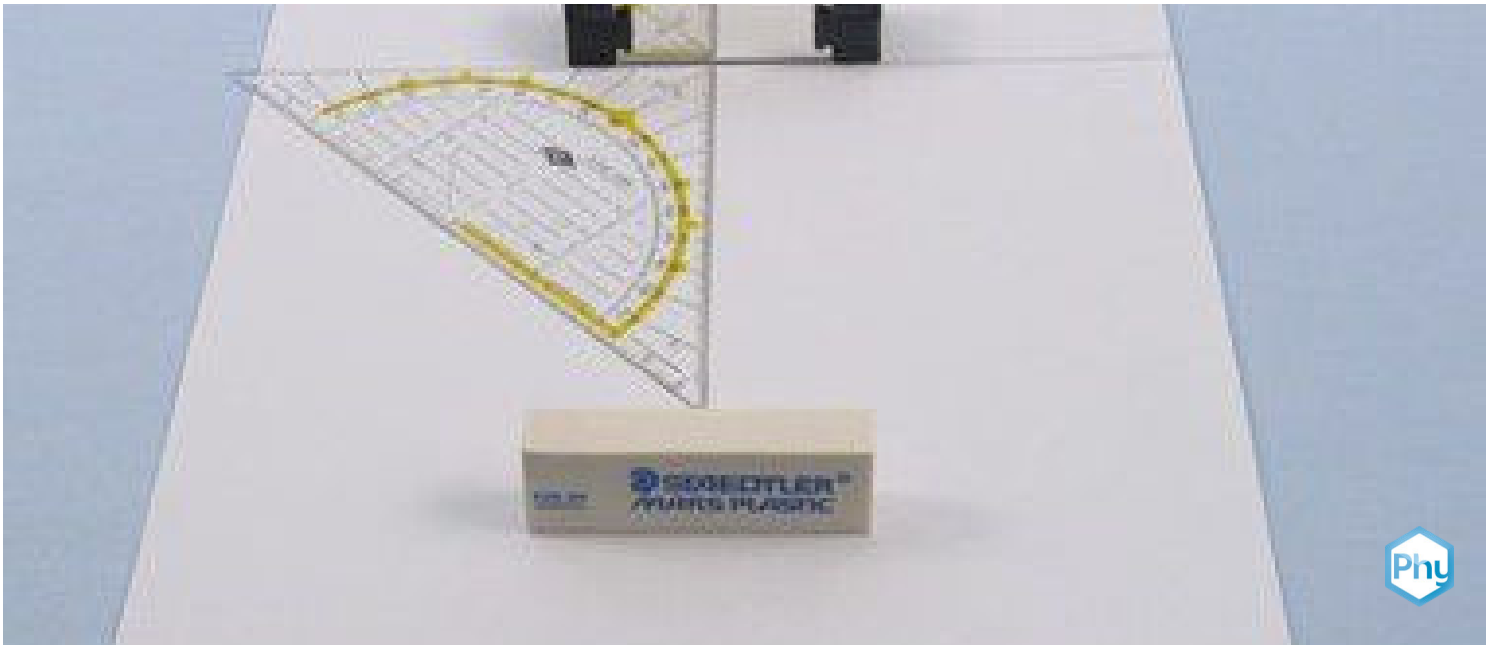
Images in a plane mirror



Physics > Light & Optics > Reflection & refraction of light

Difficulty level	Group size	Preparation time	Execution time
easy	2	10 minutes	10 minutes

This content can also be found online at:

http://localhost:1337/c/631a3614bce9830003710438

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Teacher information

Application

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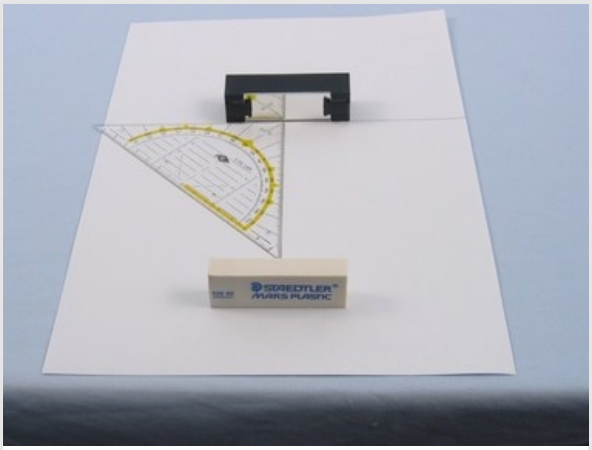

Images on the plane mirror

Mirrors have become an indispensable part of our everyday lives. We encounter them everywhere, for example in the form of a smooth water surface, a polished metal surface or in the classic bathroom.

It is assumed that the first mirrors created by humans were already created in the Copper Age or Bronze Age. These were metals that were polished for this purpose.

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Other teacher information (1/3)

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Prior knowledge

The students should have previously learned the basics of the rectilinear propagation of light. In addition, they should be able to designate and measure angles. The concept of the perpendicular or the central perpendicularis important.

Principle

A plane mirror reflects the incident light rays in an orderly manner. Sizes and distances are preserved. The image is laterally reversed compared to the original.

Other teacher information (2/3)

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Learning objective

The aim of this experiment is to lead the students to insights that are already known to them in a qualitative form but probably unconsciously (daily observation in the mirror).

Tasks

In the first subtest, the qualitative investigation of the properties of a mirror image in comparison to the original is conducted.

The second sub-task is intended to show the connection between the subject g and image width b on the plane mirror. Furthermore, the student gets to know a first possibility of constructing images with the help of light rays.

The second part of the experiment is thus more demanding in terms of the students' abilities and experimental skills. Both experiments can be seen as a unit, but it is also possible to carry them out seperately.

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Other teacher information (3/3)

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Notes on set-up and procedure

For the first partial experiment, it is also possible to use a pocket mirror instead of the mirror on the block. In this case, the observation of the mirror images is made somewhat easier.

When carrying out the second task, it is essential to make sure that the mirror is not placed too far away (approx. 10 cm) during the respective readjustment of the light box. Otherwise, the still existing slight divergence of the light beams would make exact marking difficult.

The procedure of marking the course of several light beams is unfamiliar to the students. To avoid confusion, help should be given (e.g. use different colours or distinguishable markings).

A small tolerance at the intersection of the three extended reflected light beams is possible, but larger deviations are due to inaccuracy during experimentation.

Safety instructions

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The general instructions for safe experimentation in science lessons apply to this experiment.

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Student information

Motivation

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Image and reflection

We encounter mirrors every day in many different forms, be it in the form of a water surface, a smoothly polished metal surface or the classic bathroom mirror. Since mirrors are so present in our everyday lives, we no longer even question their functional principle. But how do mirror images actually come into being and why does my reflection raise its right hand, although I myself actually raise my left?

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Tasks

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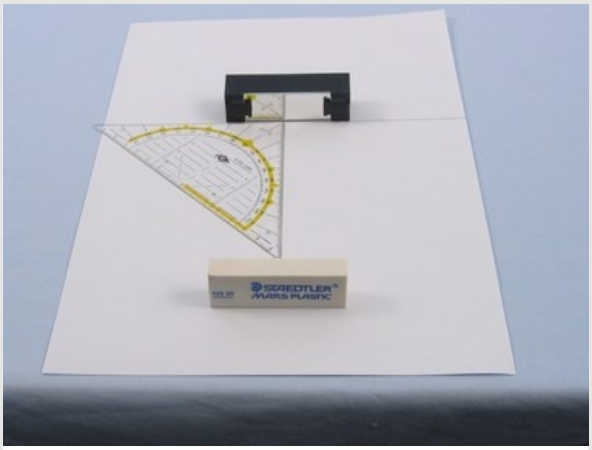

Experimental setup

How are mirror images created?

In this experiment, properties of mirror images are determined. You will learn how the image is created in a mirror.

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Equipment

Position	Material	Item No.	Quantity
1	Light box, halogen 12V/20 W	09801-00	1
2	Mirror on block, 50 mm x 20 mm	08318-00	1
3	PHYWE Power supply, 230 V, DC: 0...12 V, 2 A / AC: 6 V, 12 V, 5 A	13506-93	1

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Additional equipment

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Position	Material	Quantity
1	Ruler (approx. 30cm)	1
2	White paper (DIN A4)	1
3	Eraser	1

Set-up

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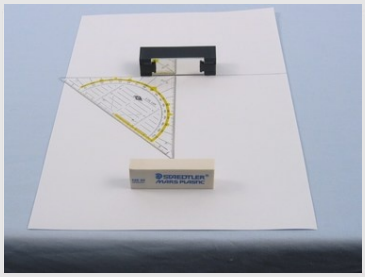

- Write any word on the largest surface of the eraser.
- Divide the sheet of paper into two parts with a pencil line. The pencil line should be parallel to the narrow side of the sheet. The parts should be in a ratio of 2:1. Place the mirror on the pencil line. Place the triangle and the eraser on the sheet as shown in the illustration below left.

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Procedure (1/6)

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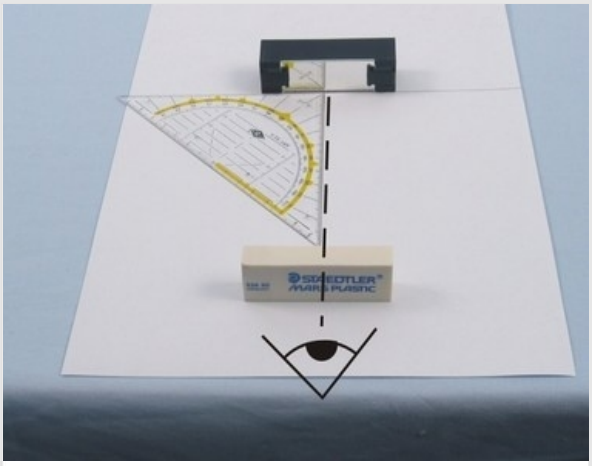

Observation of the mirror image

Experiment part 1: Properties of mirror images

- Observe the mirror image of the triangle and the eraser.
- Compare the picture with the original. Write down your observations.

Procedure (2/6)

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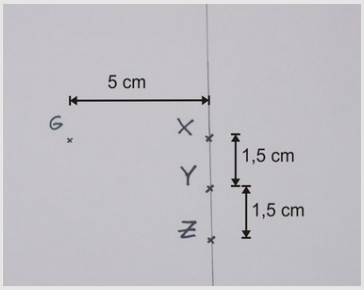

Experiment part 2: Image formation on a plane mirror

- Draw the points X, Y and Z as shown in the picture on the left, onto the pencil line. At right angles to X additionally mark the point G at the specified distance).
- Connect the light box to the power supply unit (12 V ~).

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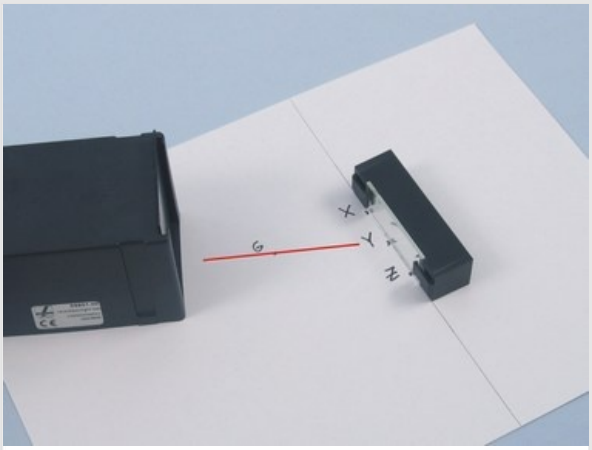
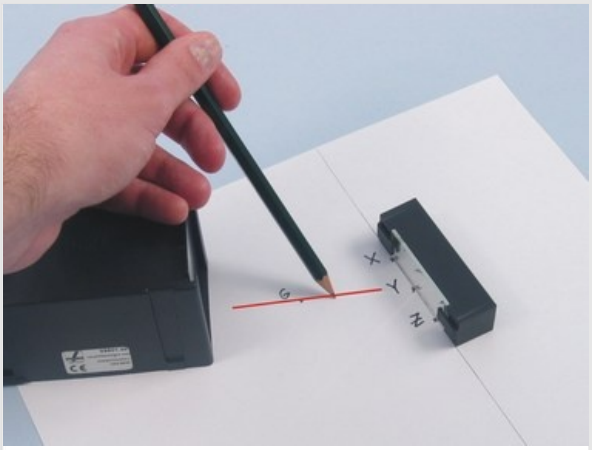
Procedure (3/6)



Structure light box and mirror

- Place the mirror against the vertical line so that the marks are X, Y, Z lie within the mirror surface. Place the slit diaphragm in the light box and let the light beam fall on the mirror.

Procedure (4/6)



Positioning the light box

- Position the light box in such a way that the light beam first hits the point G and then meets the point Y . Mark the incident and reflected light beams with two crosses each.
- Move the light box (the mirror must not be moved) until the light beam reaches the dots G and X. Again, mark the light path of the incident and reflected light beam. Use different colours.
- Repeat this with G and Z.

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Procedure (5/6)

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- Switch off the power supply and remove the light box and the mirror from the paper.
- Connect the marks that belong together. Make sure that all the incident rays of light pass through the dot G. Extend the reflected light rays beyond the vertical line (mirror plane) with dashed pencil lines.

  What can you determine?
- Write down your observations.

Procedure (6/6)

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- Measure the distance g between the points G and X.
- Write down your reading.
- Designate the intersection of the dashed extensions with B and measure the distance b between the points X and B.
- Write down your reading.

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Report

Task 1

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Draw the beam path from experiment part 2. on an extra sheet of paper.

What can you determine?

- The extensions of the reflected rays intersect at a point (the image point) behind the mirror.
- The extension of the reflected beams does not follow any particular pattern.
- The extensions of the reflected beams run approximately parallel to each other.

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Task 2

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The reflection of an object that is in front of a plane mirror has the following properties:

- [ ] It is laterally reversed.
- [ ] It has the same size as the object
- [ ] It has the same distance to the mirror plane as the object.
- [ ] It has a different size than the object
- [ ] It is the right way round. For example, you can read a writing in the mirror.

Check

Task 3

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Compare the distance g of the point G from the mirror with the distance b of point B from the mirror and with your observations during the first partial experiment.

The distance g of the point G from the mirror is also called _____. It is _____ as the distance b of point B from the mirror. This distance is called _____. Accordingly, the image and the original are _____ from a plane mirror.

exactly the same
image distance
object distance
equal distance

Check

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Task 4

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Why do you see yourself in a shop window on a sunny day?

The light of the _____ is _____ (scattered) to a greater or lesser extent by every object in the environment. Thus the light reflected (scattered) by the _____ also reaches, among other things, the shop window pane, which represents a smooth, _____. The image is then composed of the multitude of _____ of the pedestrian depicted according to the experimentally examined procedure.

pedestrian
reflected
reflecting surface
sun
object points

Check

Task 5

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What are applications of plane mirrors?

- [ ] Distance measurement
- [ ] reflective traffic signs
- [ ] Overhead projector
- [ ] Bicycle reflector
- [ ] Television

Check

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Slide	Score / Total
Slide 20: Beam path on the mirror	0/1
Slide 21: Properties of the mirror image on a plane mirror	0/3
Slide 22: Subject and image range	0/4
Slide 23: Mirror image in the shop window	0/5
Slide 24: Applications of plane mirrors	0/4

Total 0 / 17

Solutions Repeat

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