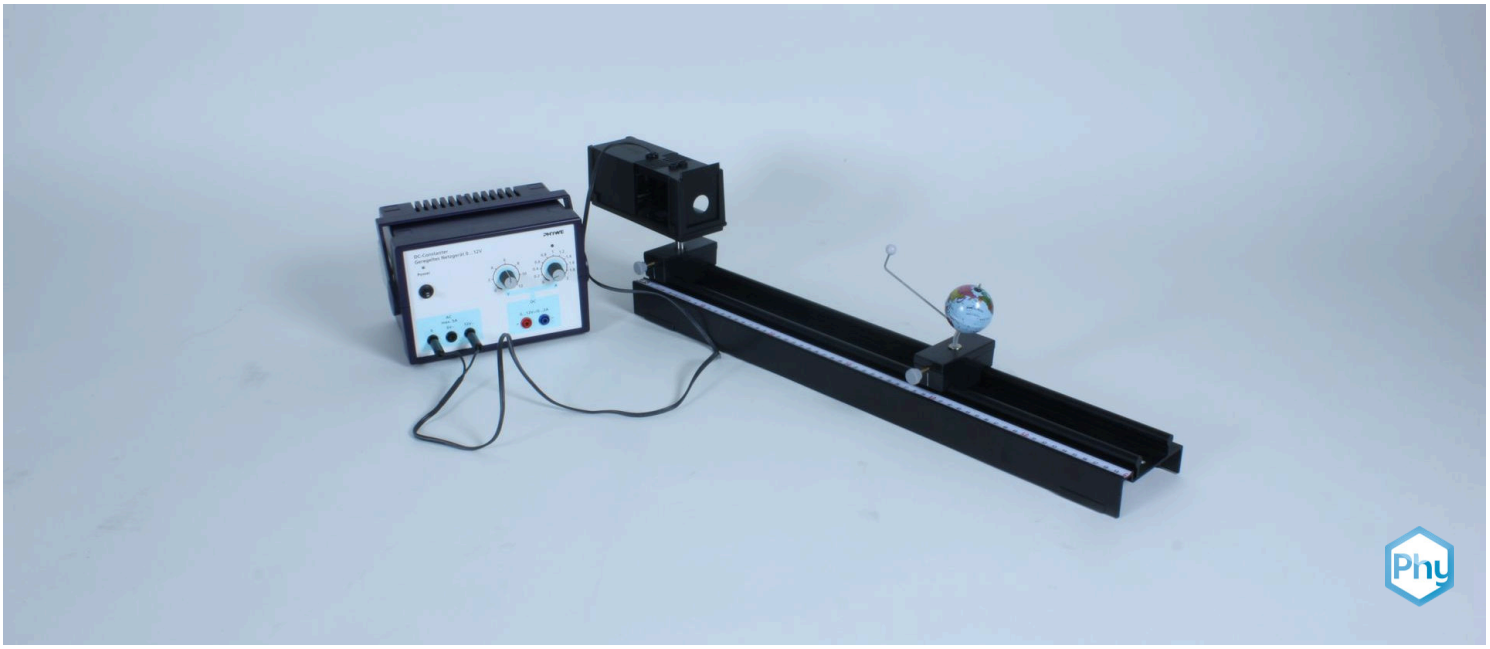
# Solar and lunar eclipses (with the earth-moon model)



Physics | Light & Optics | Dispersion of light

| Difficulty level | Group size | Preparation time | Execution time |
|---|---|---|---|
| easy | 1 | 10 minutes | 10 minutes |

This content can also be found online at:

http://localhost:1337/c/62d6f81b9ae57200034904d9

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# Teacher information

## Application

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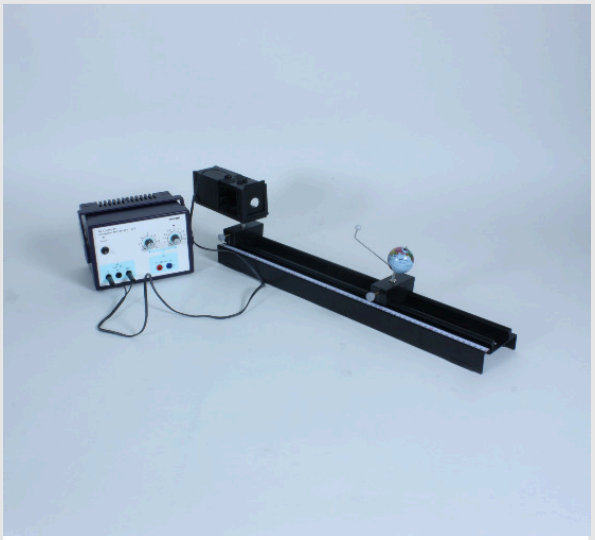

Experimental setup

Solar and lunar eclipses are rare astronomical events that can only occur under certain conditions. Since the Sun and Moon have a similar diameter when viewed from Earth, a total solar eclipse can occur. A total solar eclipse occurs about once every 375 years at a specific location. In parts of Germany, the event will not be visible again until 2081.



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## Other teacher information (1/4)

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**Principle**

In the experiment, the appropriate constellations for a solar/moon eclipse are modelled. A light source serves as the sun.

**Learning objective**

The students should derive the conditions for a solar/moon eclipse.

## Other teacher information (2/4)

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**Task**

- Students should use the Earth-Moon model to investigate how solar and lunar eclipses occur.



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# Other teacher information (3/4)

The experiment on the formation of solar and lunar eclipses takes little time and makes relatively few demands on the pupils' experimental skills.

# Other teacher information (4/4)

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## Notes on set-up and procedure

- It is methodologically advantageous to proceed as the step sequence suggests, i.e. students should not start with a constellation of Sun, Earth and Moon model that results in an eclipse.
- Make sure that the students also set up the globe so that the Earth's axis is tilted towards them. To avoid complicating the experiment unnecessarily, the teacher should make sure beforehand that the guide for the moon model is positioned in such a way that its shadow is certain to fall on the earth model when it is positioned between the sun model (lamp) and the earth model.



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## 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



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## Motivation

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Partial solar eclipse

Solar and lunar eclipses are rare astronomical events. As the Sun and Moon have a similar diameter when viewed from Earth, a total solar eclipse can occur. A total solar eclipse occurs about once every 375 years at a particular location. In parts of Germany, the event will not be visible again until 2081.

**Under what conditions can a solar/moon eclipse occur?**

## Tasks

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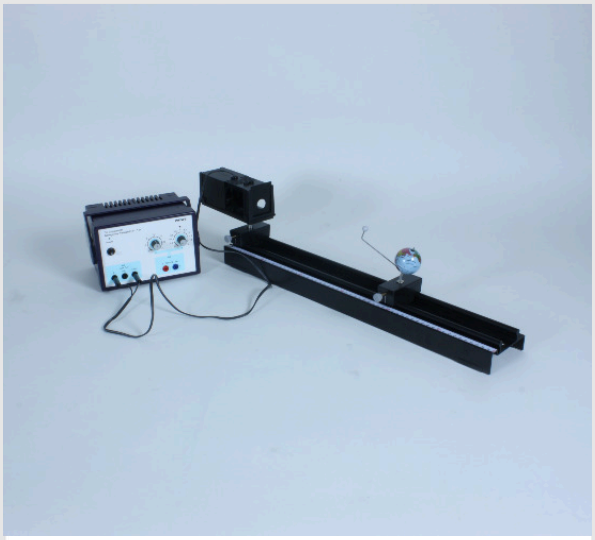

Experimental setup

- Use the Earth-Moon model to investigate how solar and lunar eclipses occur.



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# Equipment

| Position | Material | Item No. | Quantity |
|---|---|---|---|
| 1 | Optical profile-bench for student experiments, l = 600 mm | 08376-00 | 1 |
| 2 | Light box, halogen 12V/20 W | 09801-00 | 1 |
| 3 | Bottom with stem for light box | 09802-20 | 1 |
| 4 | Diaphragm with hole, d=20mm | 09816-01 | 1 |
| 5 | Slide mount for optical bench | 09822-00 | 1 |
| 6 | Model earth/moon | 09825-00 | 1 |
| 7 | 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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## Set-up (1/3)

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- Assemble the optical bench from the two tripod rods and the variable tripod foot.
- Place the base with stem under the light box.

## Set-up (2/3)

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- Clamp the light box in the left part of the tripod base so that the lens side faces away from the optical bench.
- Slide an opaque screen in front of the lens and the pinhole into the shaft at the other end of the light.



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## Set-up (3/3)

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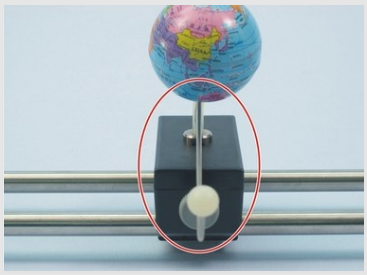

- Attach the Earth-Moon model to the slide and place it about 15 cm from the end of the optical bench.
- The earth axis should tilt towards you and the moon model should stand between you and the earth model.

## Procedure (1/2)

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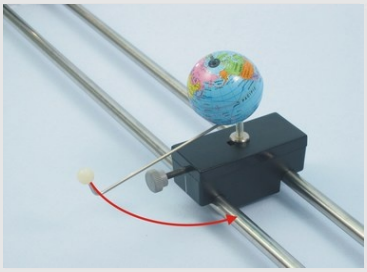

- Connect the lamp to the power supply unit (12 V~) and switch it on.
- Slowly rotate the moon counterclockwise around the earth.



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## Procedure (2/2)

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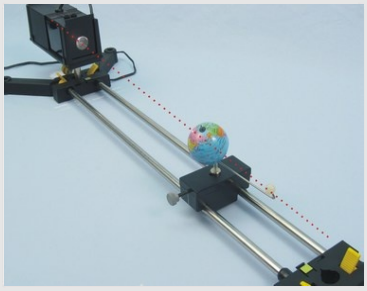

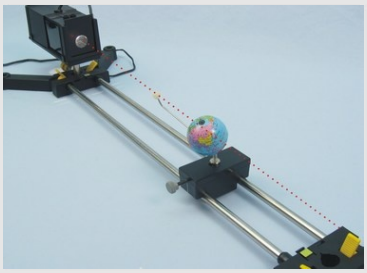

- If the sun (luminary), the earth and the moon are approximately on a straight line, note your observations in the "Observations and measurement results" section.
- Slowly rotate the moon further around the earth until the sun, the moon and the earth (in this order) are again on a straight line. Write down your observations in the record.
- Switch off the power supply unit.

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# Report



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## Table 1

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Write down your observations in the table.

| Order of the celestial bodies | Observation |
| --- | --- |
| Sun - Earth - Moon | |
| Sun - Moon - Earth | |

## Task 1

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Under what conditions does a solar eclipse occur? (Fill in the blanks!)

A solar eclipse is the (total or partial) disappearance of the Sun behind the [ ] - as seen from a certain area of the [ ]. It occurs under the condition that the moon is [ ] the sun and the earth and all three celestial bodies lie on a [ ].

Check



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## Task 2

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Which statements are true in the case of a lunar eclipse?

- [ ] The sun disappears behind the moon - as seen from Earth.
- [ ] The Earth is located between the Sun and the Moon.
- [ ] The moon disappears behind the earth - as seen from the sun.
- [ ] All celestial bodies lie on a straight line.
- [ ] The moon is located between the sun and the earth.

Check

## Task 3

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Solar and lunar eclipses can only occur when certain lunar phases are given. Which eclipse can only occur at which lunar phase?

- [ ] Solar eclipse at new moon
- [ ] Solar eclipse at full moon
- [ ] Lunar eclipse at new moon
- [ ] Lunar eclipse at full moon

Check



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| Slide | Score / Total |
|---|---|
| Slide 19: Solar eclipse | 0/4 |
| Slide 20: Lunar eclipse | 0/3 |
| Slide 21: Conditions for eclipses | 0/2 |

**Total** 0 / 9

Solutions | Repeat | Export text



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