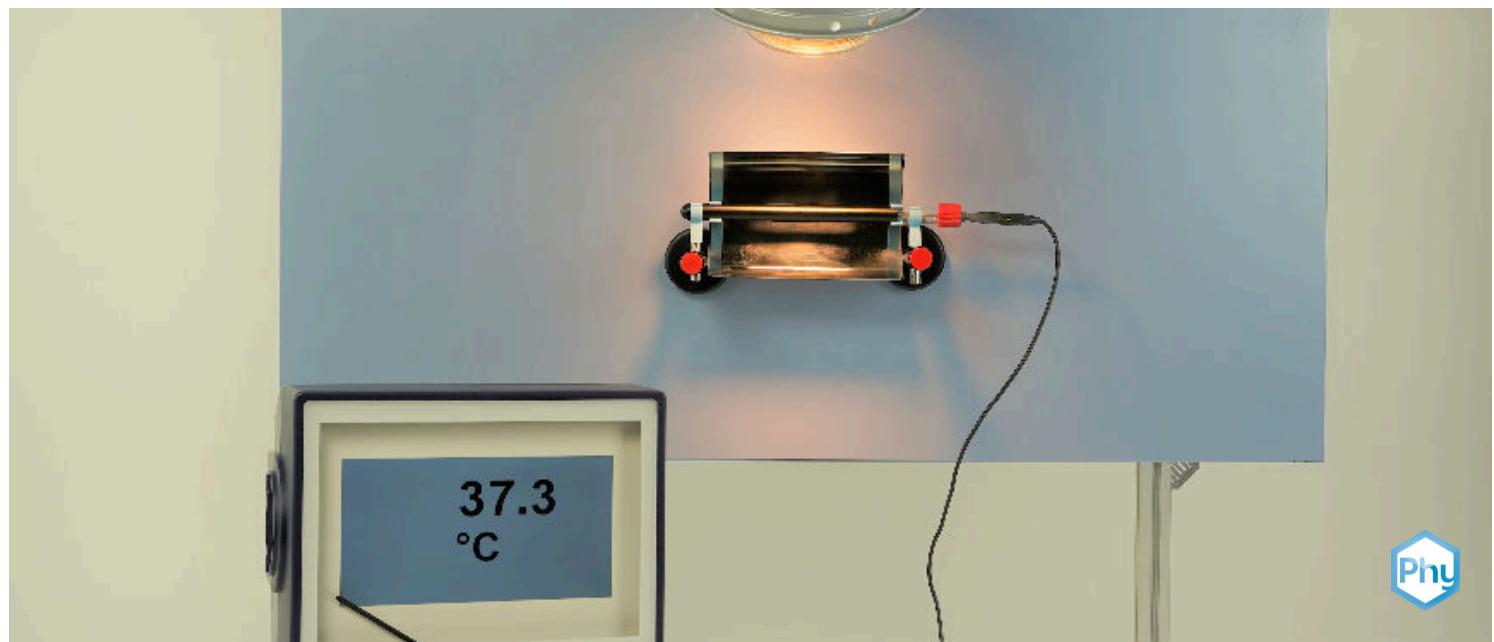


# Model of a field of a parabolic troughs



Model of a parabolic trough field

Physics

Energy

Renewable energies: Sun



Difficulty level

medium



Group size

-



Preparation time

10 minutes



Execution time

20 minutes

This content can also be found online at:



<http://localhost:1337/c/64a55b8582c76400021b5be3>



## General information

### Application

**PHYWE**  
excellence in science



Parabolic trough unit

#### Model of a parabolic trough field

From the experiment "Heating water with a parabolic trough" it is already known that the absorption and thus the heating of the water strongly depends on the focal line.

In this experiment, the set-up of the parabolic trough field is not changed and instead a longer measured value recording is carried out. With a water quantity of 4 ml, it is achieved that the experiment runs relatively quickly.

## Other information

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### Prior knowledge



The basic concepts of thermodynamics should be known for this experiment.

### Principle



Parabolic mirrors concentrate the light of the sun in a focal point. Parabolic troughs, on the other hand, have a focal line in which tubes, for example, are heated very effectively.

The possibility of generating high temperatures and choosing a suitable fluid gives the pupils an impression of how a parabolic trough power plant works.

## Safety instructions

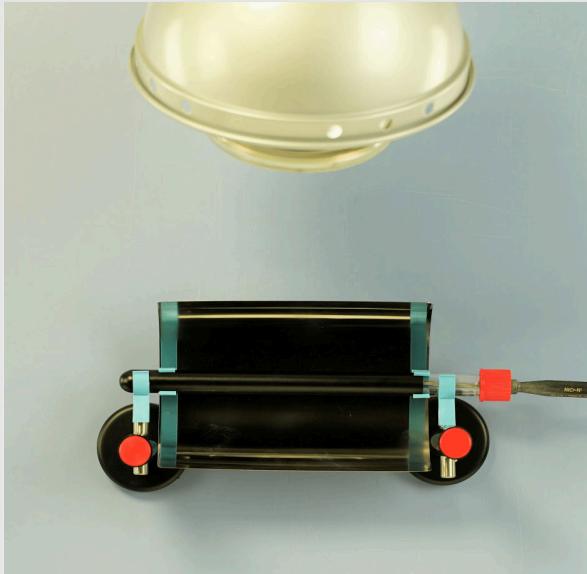
PHYWE

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

Be careful, the concentration of the light makes the test tube very hot!

For H and P phrases, please refer to the safety data sheet of the respective chemical.

## Theory



- Parabolic troughs collect the sunlight and concentrate it on a focal line.
- There is an absorber tube on the focal line.
- In this pipe, the medium can be heated to a very high temperature.
- The steam obtained from the process can be used to generate electricity.

## Equipment

Position	Material	Item No.	Quantity
1	PHYWE Demo Physics board with stand	02150-00	1
2	PHYWE Demo Multimeter ADM 3: current, voltage, resistance, temperature	13840-00	1
3	Immersion probe NiCr-Ni, steel, -50...400 °C	13615-03	1
4	Clamping holder with 2 clamping possilit, 0-13 mm,fixing magnet	02151-08	2
5	Clamp on holder	02164-00	1
6	Concentrated solar power unit, 180 mm	02168-00	1
7	clamp, d = 16 mm, with mounting rod	05764-00	2
8	Beaker, Borosilicate, low-form, 400 ml	46055-00	1
9	Syringe 20ml, Luer, 100 pcs	02591-10	1
10	Support rod, stainless steel, 750 mm	02033-00	1
11	Ceramic lamp socket E27, with reflector, switch and security plug	06751-01	1
12	Filament lamp, 220V/120W, with reflector	06759-93	1
13	G-clamp	02014-01	2



## Setup and procedure

### Setup (1/2)



- Fix the clamping holder with 2 clamping points at a distance of about 21 cm and insert the clamps.
- Fill 4 ml of water into the test tube using the syringe, then put on the screw cap with seal and screw it down slightly. Insert the glass tube so that it protrudes 2 cm from the cap. Then tighten the screw cap.
- Attach the mirror to the test tube and insert the test tube into the clamps using the clamps with mounting rod
- Insert the immersion probe into the tube.

## Setup (2/2)

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- Carefully clamp the sleeve to the upper edge of the demo board and fix the support rod in it. Hold the reflector lamp at the end of the support rod.
- Align the reflector lamp centrally on the test tube, the distance to the test tube should be approx. 28 cm.
- Adjust the mirror of the parabolic trough as parallel as possible to the incident light.



Experiment setup

## Procedure



- Switch on the lamp. Note the initial temperature in the evaluation.
- During the experiment, observe whether and where condensation occurs.
- Enter a measured value in the chart every 2 minutes.
- After 20 minutes, switch off the lamp and stop taking readings.
- Allow the test tube to cool, remove from the holders and remove the parabolic trough. Pour out the water from the test tube.

## Evaluation (1/2)

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Enter the measured values here!



Initial temp. 2 minutes 4 minutes

--	--	--

6 minutes 8 minutes 10 minutes

--	--	--

12 minutes 14 minutes 16 minutes

--	--	--

18 minutes Final temperature

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The water temperature rises to 80°C within about 8 minutes.

True

False

Check

## Evaluation (2/2)

PHYWE

Drag the words into the correct boxes!

The black test tube filled with water [ ] the incident light so that the water is heated. Through the mirror, which [ ] additional light onto the glass, a much greater heating can be achieved. The test tube is directly in the [ ] of the parabolic trough when it is clamped to the glass. In the [ ], light is then reflected from every point of the mirror onto the glass and absorbed there. The condensation that becomes visible after a few minutes illustrates the high temperature inside the tube. The water that evaporates in the middle [ ] again on the cold outer edge.

absorbs

condenses

ideal case

focal line

reflects

Check

Slide	Score / Total
Slide 11: Temperature rise	<b>0/1</b>
Slide 12: Absorption and reflection	<b>0/5</b>

Total score

 0/6

Show solutions



Repeat



Export text

9/9