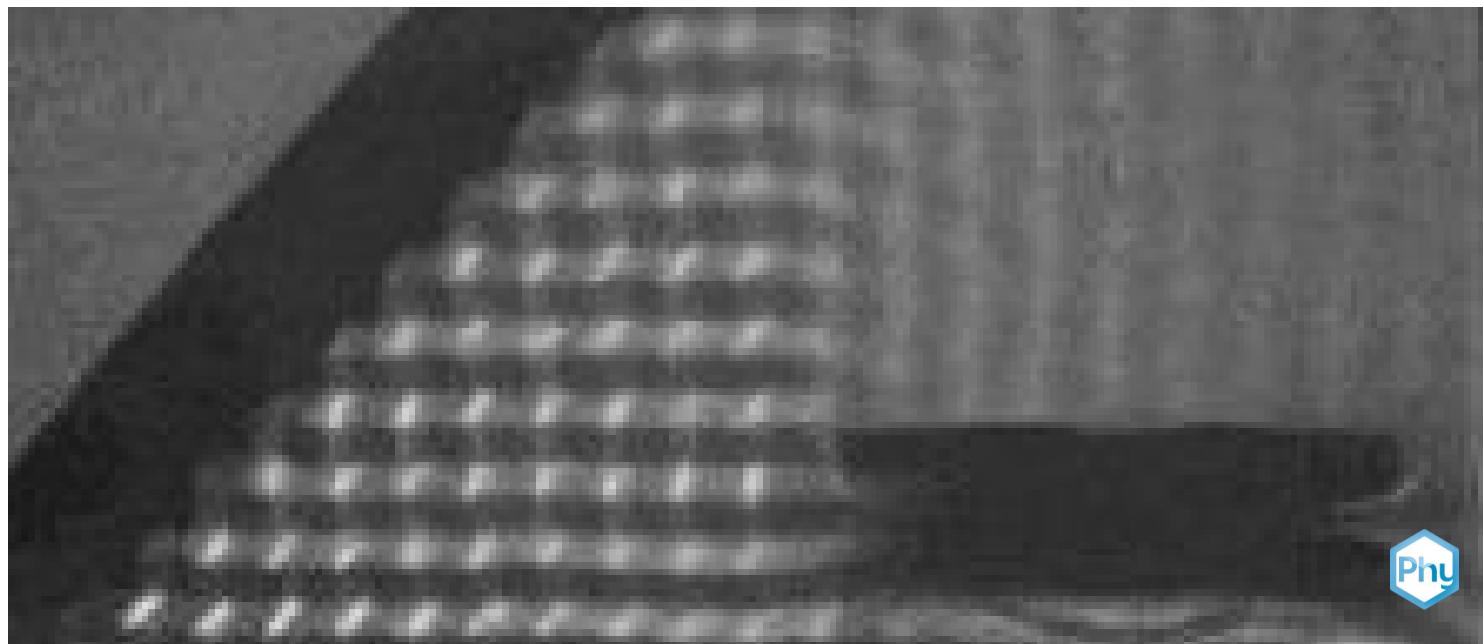


Reflection by various obstacles



Physics

Mechanics

Vibrations & waves



Difficulty level

medium



Group size

2



Preparation time

10 minutes



Execution time

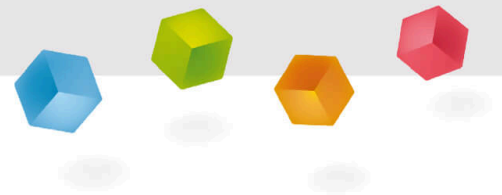
20 minutes

This content can also be found online at:



<http://localhost:1337/c/6002cf93eefa9f0003fe6055>

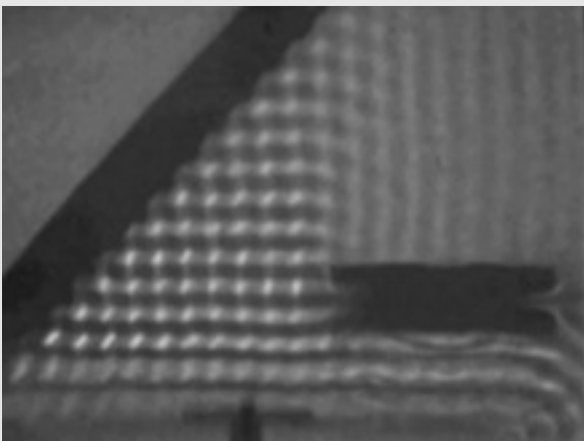
PHYWE



Teacher information

Application

PHYWE



Reflection on various obstacles

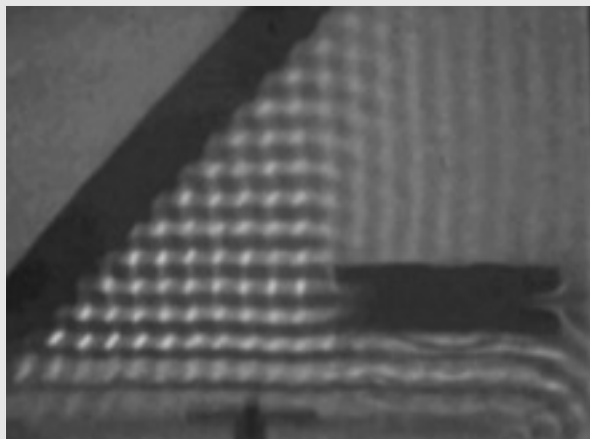
In this experiment, the reflection of water waves from a flat wall and from a concave reflector is investigated.

The reflection laws known from geometrical optics can be observed.

With the help of the concave reflector it can be shown that plane waves are approximately united in one point, the focal point. Circular waves emanating from this focal point are reflected approximately as plane waves.

Application

PHYWE



Reflection on various obstacles

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Teacher information

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Prior knowledge



Learning objective



The following applies to the reflection of light **Law of reflection**:

If light is reflected from a surface, the angle of incidence is equal to the angle of reflection. Incident ray, incident perpendicular and reflected ray lie in one plane. The **Law of reflection** is used in many optical systems.

For this reason, the student is introduced to the phenomenon of reflection in detail in this experiment.

Safety instructions

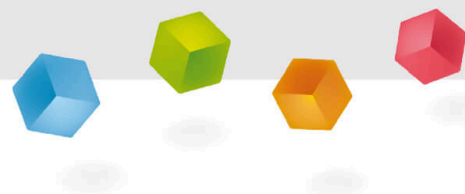
PHYWE



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

PHYWE

Student Information



Equipment

Position	Material	Item No.	Quantity
1	PHYWE Ripple Tank with LED light source, complete set	11260-88	1

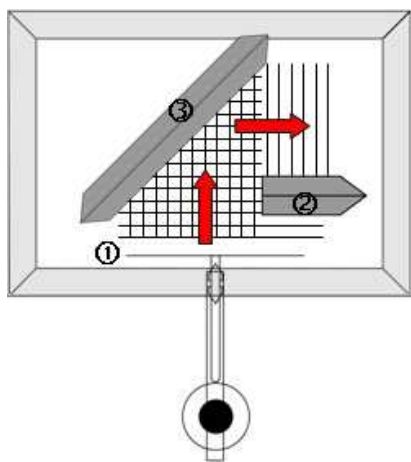
Equipment

PHYWE

Position	Material	Item No.	Quantity
1	PHYWE Ripple Tank with LED light source, complete set	11260-88	1

Set-up - Experiment 1

PHYWE



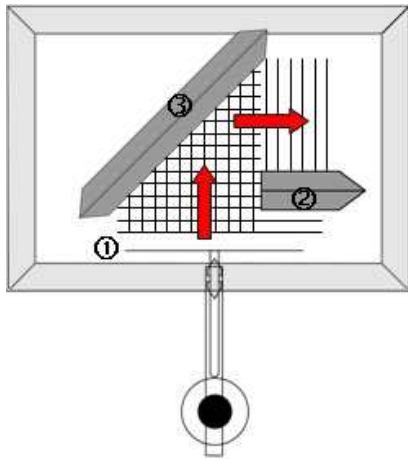
Arrangement for the reflection of plane water waves from a mirror

The wavefront (1) generated by the plane wave exciter is partially shadowed by the obstacle (2) and impinges on the reflecting planar object (3).

- The plane wave exciter is attached to the internal exciter unit, brought to the lower wave tub edge and carefully adjusted (plane wave exciter and water surface parallel).
- The two barriers (190 mm and 71 mm) are placed in the shaft trough as shown in the illustration.

Procedure (1/3)

PHYWE

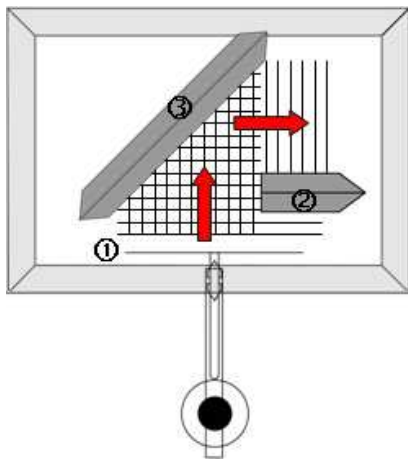


Arrangement for the reflection of plane water waves from a concave mirror

- On the water wave device, a frequency f from about 20 Hz to 25 Hz.
- The amplitude should be chosen in such a way that a clear and undistorted wave image is obtained.
- The wave pattern is first observed for the case where the reflecting obstacle (barrier 190 mm) forms an angle of 45° to the incoming waves (figure).
- Then move the reflector to other positions and observe the wave pattern again.

Procedure (2/3)

PHYWE



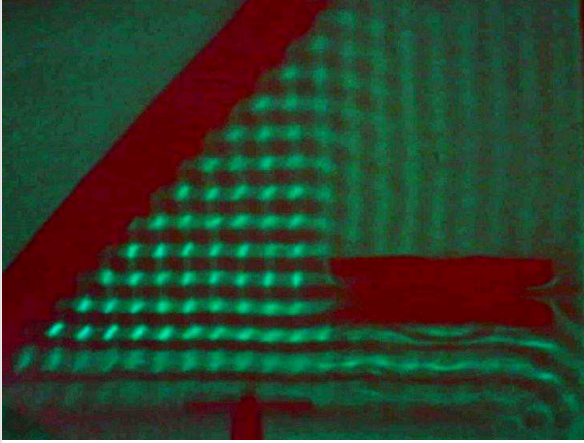
Arrangement for the reflection of plane water waves from a concave mirror

Optional:

For a better clarification of the validity it is recommended to cut a transparent foil according to the inner dimensions of the wave tub. The position of the obstacles as well as the angles of incidence and reflection are marked on the foil with a foil pen according to the law of reflection and the foil is placed under the wave tub. Then place the reflecting obstacle exactly on the marking on the foil. The correspondence of the geometrically constructed wave propagation directions with the observed directions becomes particularly clear in this way.

Procedure (3/3)

PHYWE

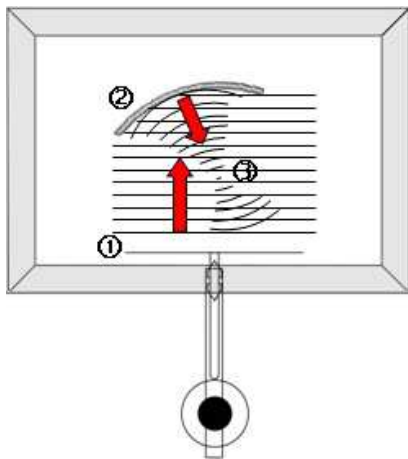


Single shot according to the arrangement

- In the case where the reflecting obstacle is rotated 45° with respect to the incoming waves, the waves are reflected perpendicularly (90°) to the direction of their incidence.
- Also for other orientations of the reflecting wall the angle of incidence and the angle of reflection are equal according to the law of reflection of geometrical optics.
- The zone of interference between incident and outgoing plane wave is clearly visible and it is valid that the angle of incidence corresponds to the angle of reflection of the wave train.

Set-up - Experiment 2

PHYWE



Arrangement for the reflection of plane water waves from a concave mirror

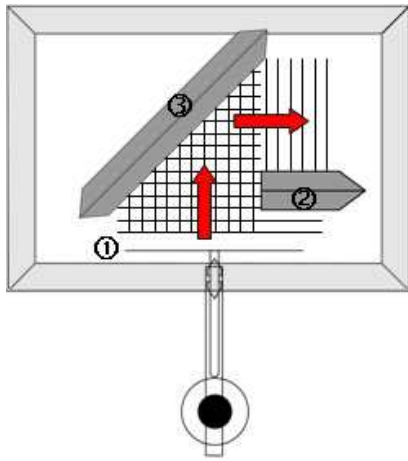
The wave front (1) generated by the plane wave exciter hits the concave obstacle (2) and is reflected in the form of circular waves.

These circular waves converge at a focal point (3).

- The setup is the same as experiment 1, only this time the concave reflector is placed in the wave trough as shown in the figure.

Procedure (1/3)

PHYWE

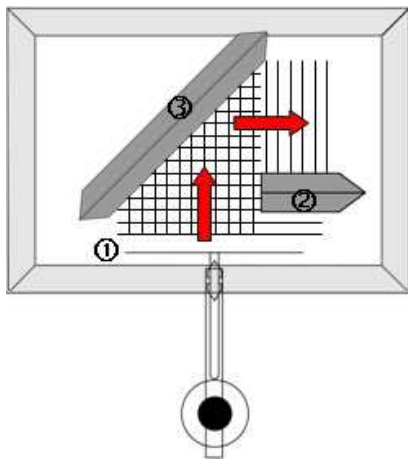


Arrangement for the reflection of plane water waves on a plane mirror

- After the plane wave exciter has been carefully adjusted, a single wave train is generated by pressing the "Pulse" button on the water wave device.
- The focal point of the concave reflector can be determined on the basis of this wave train.
- The reflector should now be moved in such a way that the focal point of the reflected waves lies on the imaginary extension of the exciter arm.

Procedure (2/3)

PHYWE

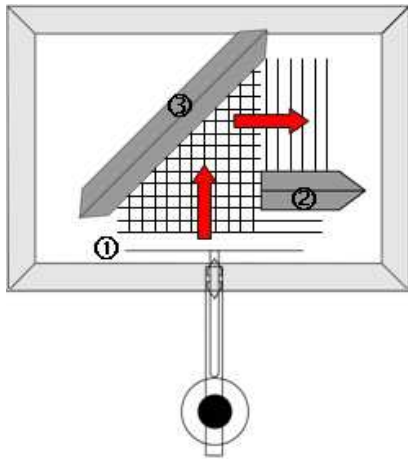


Arrangement for the reflection of plane water waves on a plane mirror

- The planar wave exciter is then removed and replaced by the circular wave excitation swab, which is now positioned at the location of the previously determined focal point.
- You now generate some wave trains again by pressing the "Pulse" button and observe the waves reflected at the obstacle.

Procedure (3/3)

PHYWE

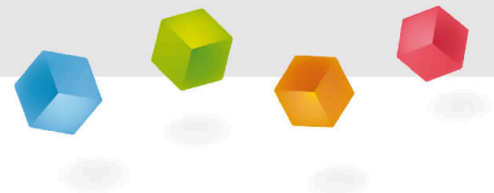


Arrangement for the reflection of plane water waves on a plane mirror

- Plane waves are reflected at the concave mirror as circular waves.
- The crests and troughs of the waves run as concentric circles towards a centre.
- Circular waves emanating from this center leave the mirror after reflection approximately as plane waves.

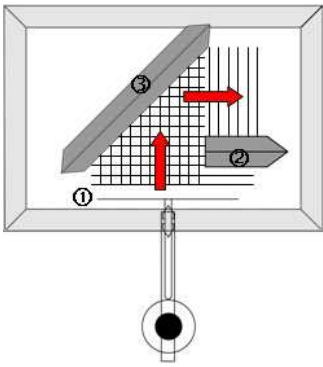
PHYWE

Report



Task 1

PHYWE



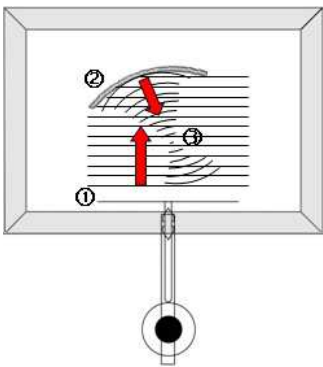
Arrangement for the reflection of plane water waves on a plane mirror

Complete.

The [] confirmed in experiment 1 can be explained by Huygens' principle, by considering each point of the reflector as a wave exciter oscillating [] with the incoming wave. If you see an apparent phase jump between the incoming and reflected waves, it is due to [] at the water surface, causing the contours of the reflector to appear [].

Task 2

PHYWE



Arrangement for the reflection of plane water waves from a concave mirror

Drag the correct words into the gaps!

Experiment 2 illustrates the union of parallel rays at the [] of a concave mirror and the [] of rays coming from the focal point of the concave mirror in the wave image. The distance between the focal point and the reflector is equal to half the [] of the reflecting obstacle. The concave mirror can also be used here as a [] to demonstrate the divergence of the reflected waves.