Properties of a convex mirror

Principle and equipment

Principle

Determine the properties of a convex mirror. Introduce the essential terms analogously to the method used for convex mirrors and demonstrate the characteristic light paths.

Equipment

Position No.	Material	Order No.	Quantity
1	Demo Physics board with stand	02150-00	1
2	PHYWE Multitap transformer, DC: 2/4/6/8/10/12 V, 5 A / AC: 2/4/6/8/10/12/14 V, 5 A	13533-93	1
3	Lamp,halogen,mag.held,12V/50W	08270-20	1
4	Light box 12V/20W,w.magn.base	09804-00	1
5	Concave/convex mirror,magnet held	08270-12	1
Additional material:			
	Ruler		
	Circular template (see master) or a drawing compass		
	Water-soluble white board pen		

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Set-up and procedure

- Draw the optical axis.
- Using the circular template or a drawing compass, draw a circle with radius r = 200 mm on the magnet optics panel.
- Place the mirror on the circular arc.
- Mark the centre of curvature (r= 200 mm).
- Place the magnet-held lamp with a one-slit diaphragm so that the light beam travels along the optical axis and is reflected back on itself. Readjust the mirror if necessary.
- Use the three-slit diaphragm and allow two beams to be incident parallel to the optical axis (along which the middle beam travels) Fig. 1, (1).
- Using the one-slit diaphragm, allow the light beam to be incident to the optical axis at an angle so that it strikes the vertex Fig. 1, (2).
- Allow the light beam to strike the convex mirror perpendicularly at another location so this it is reflected back on itself Fig. 1, (3).
- Mark the light paths as completely as possible. It is best to use different colours.
- Remove the magnet-held lamp and the mirror.
- Finish drawing the light paths in front of the mirror and extend the reflected light rays behind the mirror. - Label the vertex S and the focal point F (Fig. 1).
- Measure the distances $\bar{SF}$ and $\bar{SM}$.

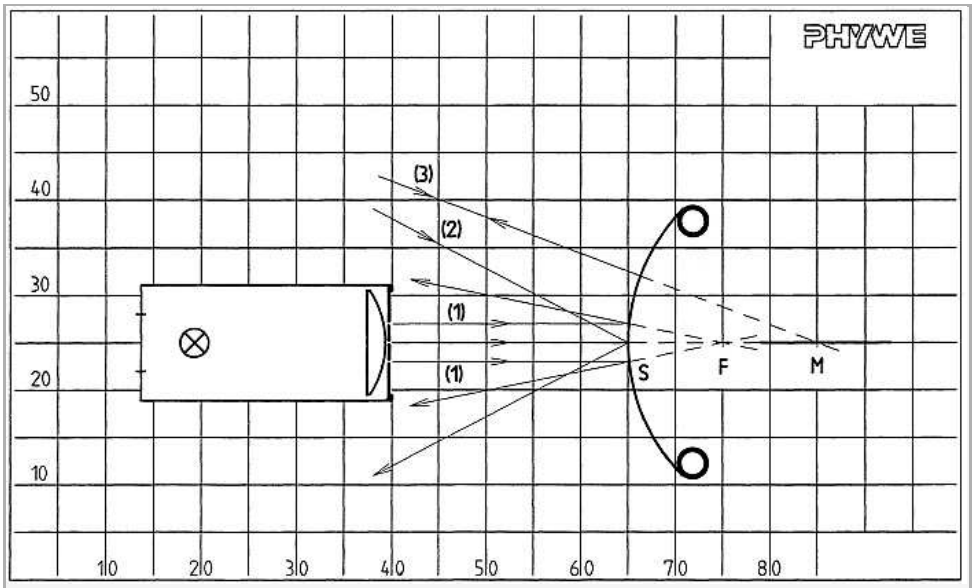

Fig. 1

Observation and evaluation

Observation

Incident light rays which are parallel to the optical axis are reflected as if the reflected rays originated from a point behind the convex mirror on the optical axis between M and S.
After reflection, rays which strike the vertex retain the same angle to the optical axis as before reflection. Rays which strike a convex mirror perpendicularly are reflected as if the reflected rays had originated at the centre of curvature. The distance SF is half as large as the distance SM.

Evaluation

Using the terms introduced for the convex mirror (underlined), the following principles are valid for reflection by a concave mirror (the numbers in round brackets refer to Fig. 1):

Parallel rays (1)
are reflected as if they originated from a point behind the mirror on the optical axis, which is called the virtual focal point F.

Vertex rays (2)
are reflected so that the reflected rays have the same angle as the incident rays with the optical axis.

Midpoint rays (4)
travel at an angle to the optical axis and strike the mirror perpendicularly. They are reflected back upon themselves, as if the reflected rays originated from the mirror's centre of curvature M.
The distance SM is termed the radius of curvature rand the distance SFthe focal length f of the convex mirror, where r= 2f; Since M and F lie behind the convex mirror, they are termed virtual points. In calculations the values for f and r have negative signs.

Remark
To make a circular template the master copy (see Fig. 1 in the Foreword) can be copied, pasted on thin cardboard and cut to size.

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