Law of imagery and magnification of a convex mirror

Principle and equipment

Principle

Show that the equations $1/f = 1/g + 1/b$ and $B/G = -b/g$ are valid for convex mirrors.

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:			
	Circular template (see master) or a drawing compass		
	Ruler		
	Water-soluble white board pen		

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 and the focal point (r = 200 mm f = 100 mm).
- Draw an object arrow, e.g., G = 100 mm, g = 75 mm. Position the magnet-held lamp and the light box, each with a one-slit diaphragm, so that a midpoint beam and a vertex beam pass through the arrow head (Fig. 1).
- Draw all the light beams during the experiment as completely as possible.
- Remove the mirror and the lamps.
- Draw the light paths in front of the mirror and the extensions of the reflected beams behind the mirror to their intersection point (Fig. 1 shows two examples). Draw in the image arrows.
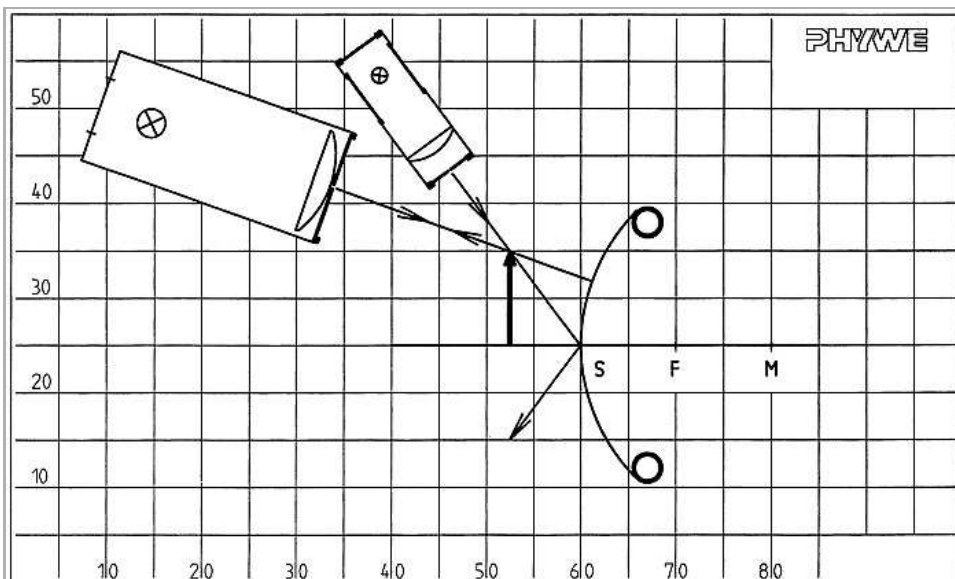- Mark $g, -b, -f, G$ and B in the drawing (Fig. 2).
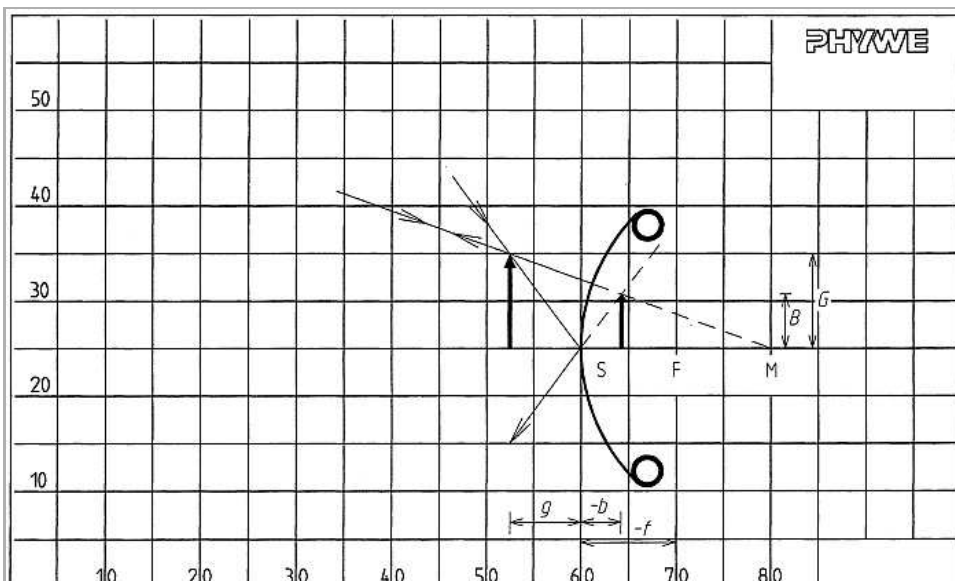- Measure g, b, f, G and B.

Abb. 1

Abb. 2

Observation and evaluation

Observation

g = 75 mm
b = -42 mm
f = -100 mm
G = 100 mm
B = 57 mm

Evaluation

$1/g$ = 0.013 mm^{-1}
$1/b$ = -0.023 mm^{-1}
$1/f$ = -0.010 mm^{-1}

Therefore, $1/f = 1/g + 1/b$.

B/G = 57 mm/100 mm = 0.57
b/g = -42mm/75mm = -0.56
Therefore, $B/G = -b/g$ also.

Remark
The object arrow should not be smaller than the values given above, so that the (always reduced) image does not become too small.
For image construction it is advisable to use midpoint and vertex rays, as a parallel ray would have to be relatively far away from the axis due to the size of the object arrow. 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.