Length of shadows

Principle and equipment

Principle

Show that the length of a shadow behind an opaque object is dependent on the light's angle of incidence.

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	Optical disk, magnet held	08270-09	1
5	Plane mirror, magnet held	08270-13	1
6	Diaphragm w. holder, magnet held	08270-10	2
Additional material:			
	Opaque ruler		

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Set-up and procedure

- Place the optical disk in the middle of the lower half of the magnetic optics panel.
- Place the plane mirror, which is to be the object throwing a shadow, so that its upper right corner in the centre of the optical disk.
- Using the two diaphragms with holder, fix the ruler at the lower end of the shading object (Fig. 2).
- Place the magnet-held lamp so that a parallel light beam is incident from above (angle of incidence = 0°) (Fig. 1).
- Move the magnet-held lamp so that the light beam is incident at different angles. While doing so, record the respective angles of incidence and the corresponding shadow length l (Fig. 2) in a table.

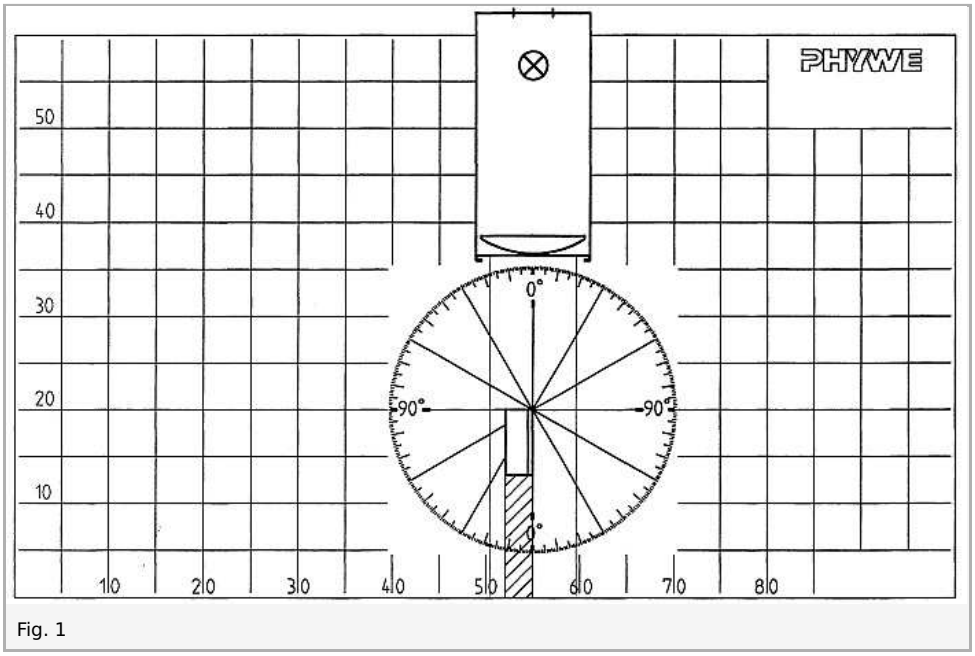

Fig. 1

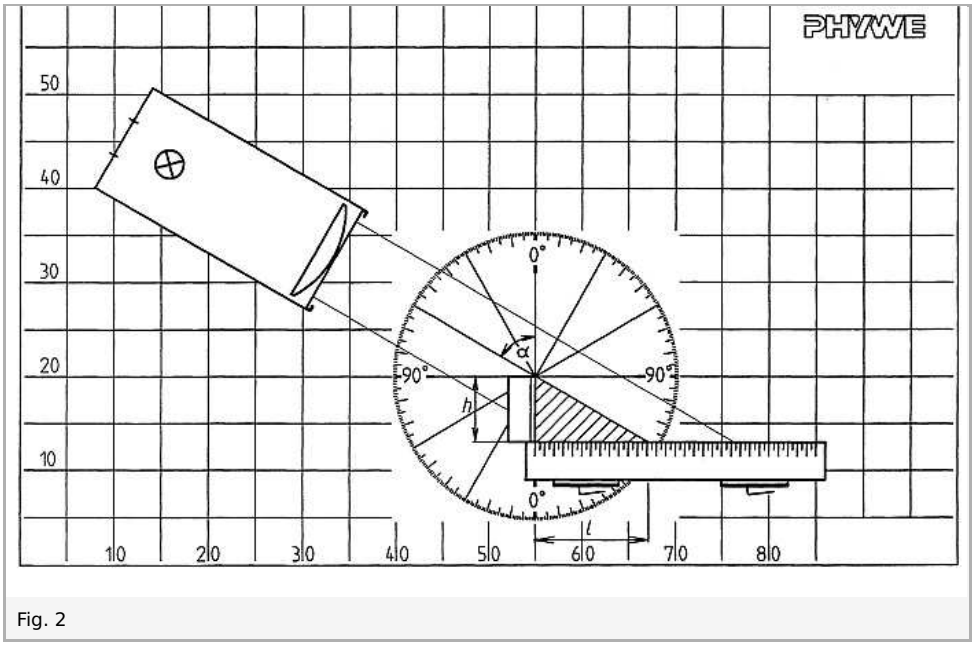

Fig. 2

Observation and evaluation

Observation

With increasing angles of incidence, the shadows become longer. Table 1 includes specific measured values for α and l.

Results
Table 1

α	l/cm
0°	0
15°	2
30°	4
45°	7
60°	12
75°	26

Evaluation

If light strikes an opaque object at an angle, a shadow is created behind the object; the greater the light's angle of incidence, the greater the shadow's length.

Remark
Generally, a semi-quantitative version of the experimental results are sufficient for classroom work. The experiment also allows a quantitative version of the results.

$$\tan\alpha = l/h$$

where h = the height of the shading body
and l = the length of the shadow;

$$l = h \cdot \tan\alpha$$

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