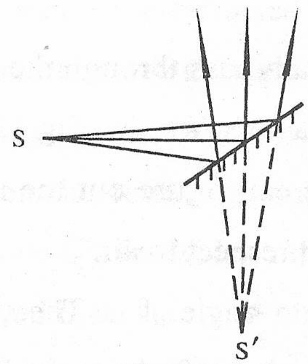
(10)Relation between deflection angle of the rays and the angle the mirror turned.

Required accessories: mirror

1)Put the mirror into hole of the dial.

2)Adjust the upper reflector to make the light strike the mirror along radial direction. Put down the value of reflection angle θ r.

3)Turn the dial. When the dial turns angle θ ,the reflected ray will also change angle2 θ as shown in Fig.10.



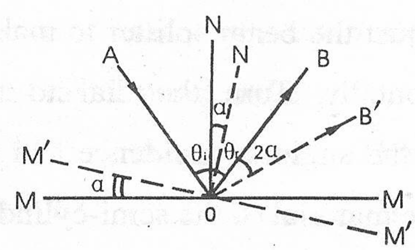


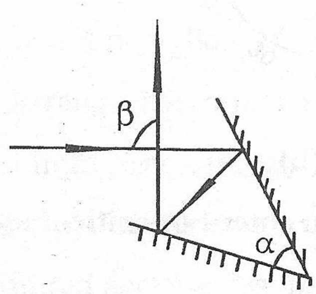
Fig. 9　　　Fig. 10

(11) Image forming properties by double mirror

Required accessories: double mirror

1) Put the double mirror into hole of the dial.

2) Adjust the upper reflector to make the light beam strike the double mirror as shown in Fig.11. The emerging light will remain unmoved when the dial is turned. Find out the relationship between angle α and β



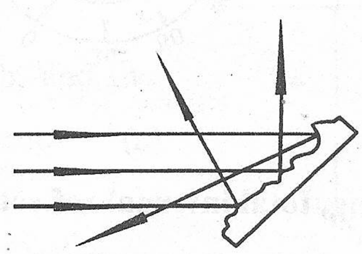


Fig. 11　　　Fig. 12

(12) Diffuse reflection

Required accessories: diffuse reflector

1) Put the diffuse reflector into the hole of the dial.

2) Adjust the reflectors of the beam splitter to make the light pencils parallel. Observe the directions of reflected light rays.

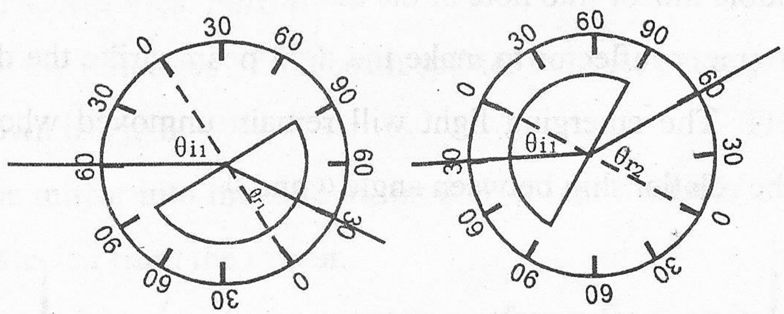
(13) Refraction, law of refraction and the reversibility of light rays.

Required accessories: semi-cylindrical lens

1)Put the semi-cylindrical lens into the hole of the dial with its plane perpendicular to line0—0.

2) Adjust the beam splitter to make the light beam pass through the centre of dial horizontally. Turn the dial to the position as shown in Fig.13a. After measuring the angle of incidence and refraction, we can figure out the refractive index of the material of the semi-cylindrical lens with respect to air.

3)Record the incidence angle θ_{i1} and refraction angle θ_{r1}. Then, turn the dial to the position as shown in Fig.13b.The light ray also refracts at the boundary. If the incidence angle θ_{i2} the same as the refraction angle θ_{r1} in the previous situation, the refraction angle θ_{r2} is exactly equal to the incidence angle θ_{i1}. This illustrates the reversibility of light rays.



(a) Fig. 13 (b)

(14) Grazing, total internal reflection and the measurement of critical angle.

Required accessories: semi-cylindrical lens

1) Adjust the beam splitter to make the laser beam pass through the centre of the dial as in Fig.14.

2)Put the semi-cylindrical lens into the hole of the dial with its plane perpendicular to line 0—0.Direct the semi-cylindrical surface at the incident laser beam.

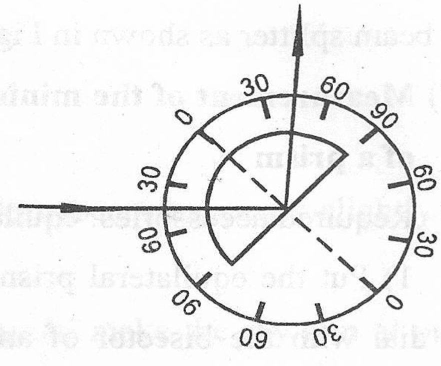


Fig. 14

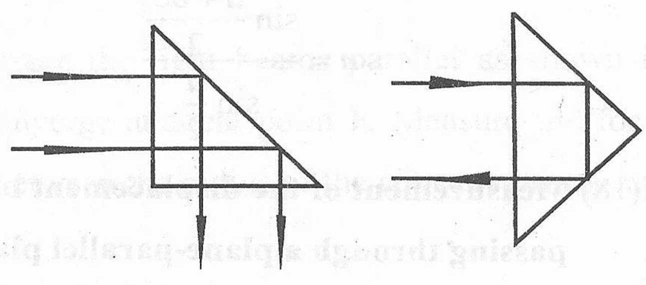
3) Turn the dial slowly. When the incident angle is small, the reflected ray is rather dim while the refracted ray is bright. As the incident angle increases the incident and refracting angles increase as well. Meantime, the reflected ray becomes brighter and brighter, and the refracted ray dimmer and dimmer.

4)When the refracting angle is exactly 90°, grazing occurs. This specific incident angle i_0, for which refracting angle is 90°, is called the critical angle. It can be proved that $\sin i_0 = \frac{1}{n}$, where n is the refractive index.

(15) Application of total internal reflection Required accessories: right angle prism

1) Put the right angle prism into the hole of the dial as shown in Fig.15a.

2) Adjust the reflectors 1# and2# to make two light pencils parallel. The emergent light pencils travel with an angle of 90° to the incident pencils.



(a) Fig. 15 (b)

3) Arrange the prism as shown in Fig.15b, and the emergent light pencil travels parallel to the incident.

(16) Principle of periscope

Required accessories: periscope

Put the periscope into the hole of the dial, and adjust

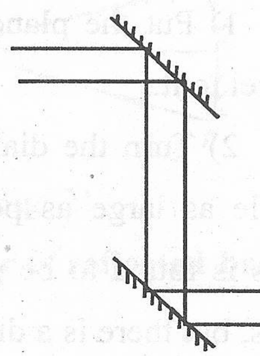


Fig. 16

the beam splitter as shown in Fig.16. It shows the principle of periscope.

(17) Measurement of the minimum deviation angle and the refractive index n of a prism

Required accessories: equilateral prism

1) Put the equilateral prism into the hole of the dial with the bisector of angle α coinciding with line 0—0.

2) Adjust the beam splitter to make the light beam strike the prism in radial direction.

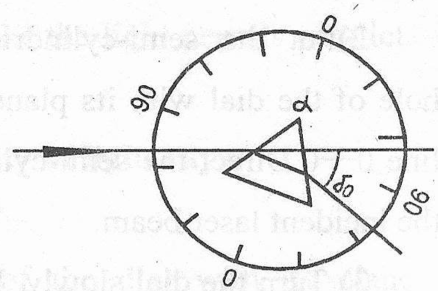


Fig. 17

3) The direction of emergent ray varies as the dial turns, however, at a certain position the emergent ray will remain unmoved when the dial turns slightly. Meanwhile, the angle between incident ray and emergent ray reach the minimum that is the minimum deviation δ_0. When minimum deviation occurs, the refracted ray inside the prism is parallel to the base surface of the prism.

4) The refraction index can be obtained by

$$n=\frac{\sin\frac{a+\delta o}{2}}{\sin\frac{a}{2}}$$

(18) Measurement of the displacement between incident ray and emergent ray passing through a plane-parallel plate.

Required accessories: plane-parallel plate.

1) Put the plane-parallel plate into the hole of the dial, and make the light travel to it.

2) Turn the dial to make the incident angle as large as possible. The emergent rays is found to be parallel to the incident rays, but there is a displacement D between them.

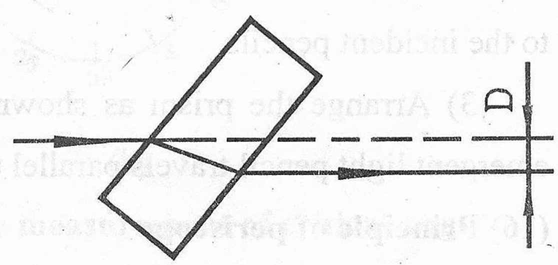


Fig. 18

(19) Principle of optical fiber

Required accessories: plastic optical fiber

1) Manage to fix the plastic optical fiber.

2) Initiate the laser. Move the cylindrical lens beam expander slightly.(The beam expander is not used.)

3) Adjust the upper reflector of beam splitter to make the ray aim at one of the ends of the fiber. The ray passes through the fiber by internal reflecting and emerges from another end, illuminating the screen nearby.

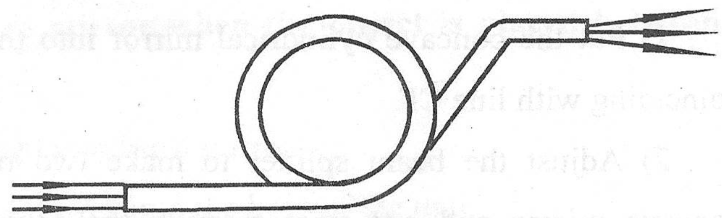


Fig. 19

(20) Convergence of light by a concave mirror, measurements of focal point and focal length.

Required accessories: concave cylindrical mirror

1) Put the concave cylindrical mirror into the hole of the dial with its axis coinciding with line0—0.

2) Adjust the beam splitter to make the light beams parallel as shown in Fig.20. After reflecting, the beams converge at focal point F. Measure the focal length f' and find out the relationship between the radius of the concave mirror and focal length f'.

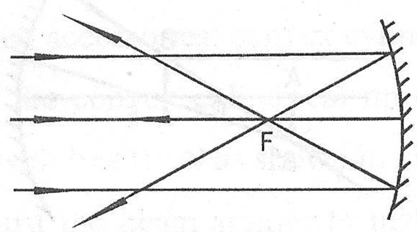


Fig. 20

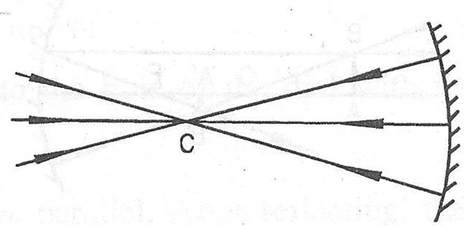


Fig. 21

(21) Ray passing through the centre of a concave mirror is reflected back on itself.

Required accessories: concave cylindrical mirror