

HOMEWORK FOR TUESDAY, JULY 19, 2005

In this problem we will consider the path of light rays from air into glass and vice versa. The glass has a flat, horizontal surface, and the air is above it. We want to determine the angles for the reflected and refracted rays.

(a) Consider a horizontal interface between air and glass, as shown below. Suppose a light ray is incident from the air at an angle of incidence of 30° . Determine the angles of, and show on the diagram, the reflected and refracted rays.

air ($n = 1.00$)



glass ($n = 1.55$)

(b) Suppose instead that the light ray is incident from the glass at an angle of incidence of 30° . Determine the angles of, and show on the diagram, the reflected and refracted rays.

(c) For light rays incident from the air into the glass, determine the angles of reflection and of refraction for angles of incidence at 10° intervals from 0° to 90° . Do the same for light rays incident from the glass into the air. Enter the results on the table on the next page.

From air into glass, angles of:
incidence reflection refraction

0°

10°

20°

30°

40°

50°

60°

70°

80°

90°

From glass into air, angles of:
incidence reflection refraction

0°

10°

20°

30°

40°

50°

60°

70°

80°

90°

(d) In part (c) there is a particular angle of incidence from glass into air for which something interesting occurs. Determine what that angle is. Name the phenomenon involved and describe the physical difference between light rays from glass into air that have a smaller angle of incidence than this special angle, and light rays that have a greater angle of incidence.

(e) Suppose the index of refraction of the glass were greater than 1.55; how would this affect the refraction angles from air into glass and those from glass into air: would they be the same, or larger, or smaller, or what? Would the special angle in (d) be greater or smaller?