UNIVERSITY IBN TOFAIL

Optics

Problem Set III

Exercise 1:

1. A convex spherical diopter with a radius of curvature SC = 10 cm separates two media with indices n = 1 and n' = 3/2. Determine the positions of the focal points. Calculate and draw the position and size of the image of an object AB placed at:
   - 60 cm from the vertex
   - 10 cm from the vertex
   - 5 cm behind the diopter (virtual object)
2. Same question if the indices are reversed.

Correction

Exercise 2:

Combination of a spherical diopter and a spherical mirror:

Consider a convex spherical diopter D, with optical axis Δ, center C_1, vertex S_1 and radius R = 0.5 m, separating air with index 1 from a medium with index n = 3/2. A concave spherical mirror M, with the same axis Δ, center C_2, vertex S_2 and radius R' = 2R, is placed in the medium with index n.

1. The center C_2 of mirror M is placed at a distance R from C_1. Trace the path of a ray incident parallel to the axis Δ.
2. The mirror M is moved. What should be the position of center C_2 relative to C_1 so that a ray incident parallel to the axis Δ emerges from the medium with index n coincident with itself?

Correction

Exercise 3:

Consider a spherical diopter with vertex S and center C separating air with index $n_1 = 1$ from a medium with index $n_2 = 1.5$. A small virtual object AB is located at a distance d = 10 cm from the vertex of the diopter. Determine:

1. The radius of curvature R = SC of this diopter when it produces a real image A'B' located at a distance:
   (a) d' = 30 cm
   (b) d' = 15 cm
   (c) d' = 10 cm
2. The corresponding linear transverse magnifications for each case.

Correction