Snell’s Law and Critical Angles

1. A light wave traveling in air passes into the water in a swimming pool at an angle of incidence of 35°. Calculate the angle of refraction of the light in water.

2. Light entering a block of glass at an angle of incidence of 18.5° leaves the boundary between the air and the glass at an angle of 12.0°. What is the index of refraction of this type of glass?

3. Light is incident on diamond at an angle of 10.0°. At what angle will it refract?

4. A transparent material has a refractive index of 1.27. What is the angle of incidence in air when the angle of refraction in the substance is 43°?

5. What is the index of refraction of a material if the angle of incidence in air is 50° and the angle of refraction in the material is 40°?

6. A ray of light passes from water into carbon disulphide \( (n_r = 1.63) \) with an angle of incidence of 30°. What is the angle of refraction in the carbon disulphide?

7. Green light traveling in air has an angle of incidence of 50° as it passes into a certain glass. The refracted angle in the glass is 33°. What is the index of refraction for this type of glass?

8. A ray of light travels from air into water then into glass \( (n = 1.50) \) as shown in the diagram. Find the angle of refraction in the glass.

For questions 9 – 11, assume the other medium is air.

9. Calculate the critical angle for diamond.

10. What is the critical angle for a glass that has an index of refraction of 1.500?

11. A certain material has a critical angle of 52.0°. What is its index of refraction?

Answers:

1. \( \theta_r = 26° \)  
2. \( n_r = 1.53 \)  
3. \( \theta_r = 4° \)  
4. \( \theta_i = 60° \)  
5. \( n_r = 1.19 \)

6. \( \theta_r = 24° \)  
7. \( n_r = 1.41 \)  
8. \( \theta_r = 31° \)  
9. \( \theta_c = 24° \)  
10. \( \theta_c = 42° \)

11. \( \theta = 1.27 \)