1. A ray strikes a mirror at 30° to the normal. At what angle to the normal does it reflect, in degrees?

   _____ °

2. You stand 0.5 m in front of a flat mirror. How far behind the mirror is your image, in metres?

   _____ m

3. Light goes from air ($n_1 = 1$) into glass ($n_2 = 1.5$) at $\theta_1 = 30°$ ($\sin 30° = 0.5$). What is $\sin\theta_2$? (Give a decimal.)

   _____

4. An object is 6 cm from a converging lens of $f = 2$ cm. What is the image distance v, in cm?

   _____ cm

5. The law of reflection states that:

   ☐ light does not reflect

   ☐ the angle of incidence is twice the angle of reflection

   ☐ the angle of incidence equals the angle of reflection

   ☐ the angles are measured from the surface

6. A plane mirror image is:

   ☐ real, inverted and the same size

   ☐ real, upright and diminished

   ☐ virtual, upright and the same size

   ☐ virtual, upright and magnified

7. A light ray enters higher-index glass from air at a nonzero incidence angle. It bends:

   ☐ toward the normal

   ☐ away from the normal

   ☐ not at all

   ☐ straight back

8. A converging (convex) lens is:

   ☐ thinner in the middle

   ☐ thicker in the middle

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   ☐ always tiny

9. The angles of incidence and reflection are measured from the _____ (the line perpendicular to the surface).

   _____

10. Which type of image can be projected onto a screen?

    ☐ both equally

    ☐ a real image

    ☐ a virtual image

    ☐ neither

1. **30 °**

   $\theta_r = \theta_i = 30°$ by the law of reflection.

2. **0.5 m**

   A plane mirror puts the image as far behind as the object is in front: 0.5 m.

3. **0.33**

   $\sin\theta_2 = n_1 \sin\theta_1 / n_2 = 0.5/1.5 = 0.33$.

4. **3 cm**

   $1/v = 1/2 - 1/6 = 2/6 \Rightarrow v = 3$ cm.

5. **the angle of incidence equals the angle of reflection**

   $\theta_i = \theta_r$, both measured from the normal.

6. **virtual, upright and the same size**

   It is virtual, upright and the same size as the object.

7. **toward the normal**

   At nonzero incidence into a higher-index medium, light slows and bends toward the normal.

8. **thicker in the middle**

   A converging lens is thicker in the middle and bends parallel rays to a focus.

9. **normal**

   The normal is perpendicular to the surface; incidence and reflection angles use it.

10. **a real image**

    A real image forms where rays actually cross, so it can be caught on a screen.

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