

For each of these questions use GRESS to provide a complete solution. For the lens problems, be sure to include a sketch of the ray diagram to check your answer.

INDEX OF REFRACTION

- The speed of light in vinegar is 2.30×10^8 m/s. Determine the index of refraction of vinegar.
- An 80% sugar solution has an index of refraction of 1.49. Calculate the speed of light in this solution.
- Suppose you calculated the speed of light in an unknown substance to be 4.00×10^8 m/s. How could you tell you made an error in your calculation?

SNELL'S LAW

- Light passes from diamond ($n = 2.42$) into air ($n = 1.00$). The angle of refraction as the light emerges from the diamond is 25° . What was the angle of incidence?
- A block of amber is placed in water ($n = 1.33$), and a laser beam travels from the water through the amber. The angle of incidence is 35° while the angle of refraction is 24° . What is the index of refraction of amber?
- When light travels from an unknown material into glycerine ($n = 1.47$), the critical angle is found to be 50° . What is the index of refraction of the first material?

CURVED LENS

- A converging lens has a focal length of +23 cm. A frog is located +32 cm from the lens.
 - Where is the image of the frog located?
 - What is the magnification of the lens?
 - If the frog is 10 cm high, what is the height of its image?
- A pencil is located +53 cm from a diverging lens. An upright, virtual image of the pencil is observed -18 cm from the lens.
 - What is the focal length of the lens?
 - What is the magnification of the lens?
 - If the pencil is 15 cm long, how long is its image?
- A small fork is placed +9.4 cm in front of a lens. An upright virtual image of the fork with a magnification of +5.6 is observed.
 - Where is the image of the fork located?
 - What is the focal length of this lens?
 - What kind of lens is this? Explain.

ANSWERS

- | | | |
|--|---|---|
| 1. 1.30
(1.304...) | 5. 1.88
(1.875...) | 8. (a) -27 cm
(-27.257...)
(b) +0.34X
(+0.3396...)
(c) +5.1 cm
(+5.094...) |
| 2. 2.01×10^8 m/s
($2.0134... \times 10^8$) | 6. 1.92
(1.918...) | |
| 3. ... because $c = 3.00 \times 10^8$ m/s | 7. (a) +82 cm
(+81.777...)
(b) -2.6X
(-2.555...)
(c) -26 cm
(-25.555...) | 9. (a) -53 cm
(-52.64)
(b) +11 cm
(+11.443...)
(c) converging, f is +ve |
| 4. 10°
(10.057...) | | |