

Exam 3

1. An object is 20 cm to the left of a lens with a focal length of +10 cm. A second lens is placed 30 cm to the right of the first lens. This lens has a focal length of -15 cm.

- a. Find the location of the final image.
- b. Is the image real or virtual ?
- c. Find the overall magnification of the system.
- d. Make a careful ray diagram and use it to (approximately) verify the results of part a and b.

2. Make a sketch that shows the arrangement for the Young double slit experiment. Label all appropriate distances and angles (i.e. θ , ΔL , d).

a. If light of wavelength 650 nm is incident on the double slit and the $m=1$ maximum in light intensity is found at an angle of 2.2 degrees away from the central maxima, what is the separation distance of the two slits?

3. A ray of light traveling in air strikes a glass plate at an angle of incidence of 60° . If the reflected and refracted rays are perpendicular to each other, find the index of refraction of the glass.

4. Light traveling in air enters a liquid with an angle of incidence of 46° . The angle of refraction in the liquid is 31° . Find the speed of light in the liquid.

5. Explain the phenomenon of dispersion. Give an example.

6. An object is placed in front of a spherical concave mirror. Show, by tracing light rays how:

- a. a real image could be formed
- b. a virtual image could be formed

7. A cylindrical tank with an open top has a diameter of 3 m and is completely filled with water ($n=1.33$). When the setting sun reaches an angle of 28° above the horizon, sunlight ceases to illuminate the bottom of the tank. How deep is the tank?

8. The wavelength of a red helium-neon laser (like the one used in class demonstrations) is 632.8 nm.

- a. What is the frequency?
- b. What is the wavelength in glass with an index of refraction of 1.50?
- c. What is its speed in glass?