Physics 40  
Ms. Smith

Refraction Review

1. Define/Illustrate:
   1. Refraction

* 1. Normal Line
  2. Index of refraction
  3. Snell’s Law
  4. Total Internal Reflection

* 1. Polarization
  2. Glare
  3. Dispersion
  4. Lenses
  5. Converging Lens
  6. Diverging Lens
  7. Focal length

1. Short Answer:
   1. How is a rainbow formed?
   2. Explain the phenomena of Total Internal Reflection: How it occurs, when it occurs, and how we can find out if it is occurring.
   3. Explain why light travels at a slower speed in a medium than it does in a vacuum.
   4. Explain how polarized sunglasses work

* 1. Explain why dispersion occurs

* 1. Under what specific conditions will light pass from one medium to another *without* refracting? Explain this phenomena.

1. Solve the following problems:
   1. Use a protractor to measure the angle of incidence where the ray strikes the glass. Use Snell’s Law and calculate the angle of refraction, then draw it in. Use that as the new incident ray on the opposite side of the shape and find & draw in the final angle of refraction when the light leaves the glass.

N=1.45

N=1.45

N=2.419

1. Using the Thin Lens Equation & Magnification Equation, fill in the following chart (all blank spots)

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Type of Lens | Focal Length (f) | Object Distance (dO) | Image Distance (di) | Object Height (hO) | Image Height (hi) | Magnification (M) | Upright/ inverted | Real/ Virtual |
| Converging | 15 | 60 | 20 | 7 | -2.3 | -0.3333 | Inverted | Real |
| Converging | 13.1 | 7.4 | -17 | 8 | 18.4 | 2.3 |  |  |
| Diverging | -12 | 4 |  | 4 |  |  |  |  |
| Converging | 10 | 5 |  |  | 4 |  |  |  |
| Diverging |  | 12 | -9 | 2 |  |  |  |  |
|  | -25 |  | -10 |  | 3 |  |  |  |

5. When an object 5 cm. tall is placed 12 cm. from a converging (convex) lens, an image is produced on the same side of the lens as the object, but 61 cm. from the lens. Find the focal length of the lens, and the size of the image.

6. An object is placed 12 cm. from a diverging lens whose focal length is -8.5 cm. Using the lens/mirror equation, find the location and the magnification of the image.

7. A certain type of plastic has a critical angle of 52° in air. Find the index of refraction of the plastic, and then find the critical angle for light *in the plastic* when it is submerged in water.

8. Consider the following two lens system: A converging lens (f1 = 10 cm) is 49 cm. to the left of another converging lens (f2 = 15 cm.) The final image is formed 32 cm. to the right of the second lens (15cm. focal length). If the original object is located left of the first lens, find how far the object is from the lens. Also find the magnification and orientation of the final image. Assume all images are real.

9. Light is traveling from air into a piece of glass (nglass = 1.57). If the angle of incidence is 44°, find the angle at which the light refracts in the glass.

10. Light travels through a diamond (n=2.419) and strikes the interface of the diamond and several different mediums (below) at an angle of incidence of 33˚. Determine if the light refracts for each, and if it does, find the angle of refraction.

a. Diamond to air (n=1)

b. Diamond to water (n=1.33)

c. Diamond to silicone (n=1.4)

d. Diamond to Zircon (n=1.92)

11. Light enters air from water (n=1.33) with an angle of refraction of 45˚. Find the angle of incidence.

17. Draw a ray diagram for the following scenarios