

Homework Assignment #4

1. Light rays from the Sun, which is at an angle of 35° above the western horizon, strike the still surface of a pond. (a) What is the angle of incidence of the Sun's rays on the pond? (b) What is the angle of reflection of the rays that leave the pond surface? (c) In what direction and at what angle from the pond surface are the reflected rays traveling? What angle would the rays have to hit for the reflected rays to be fully polarized ?
2. Sunlight strikes the surface of a lake at an angle of incidence of 30.0° . At what angle with respect to the normal would a fish see the Sun? (assume index of refraction of water is 1.33)
3. An object is placed at a distance of 5 cm from a diverging lens of focal length 20 cm. Find the image location and magnification. Is the image upright or inverted ? Real or virtual ?
4. A beam of light in air is incident upon a flat transparent material with indices of refraction 1.20. If the angle of incidence for the beam on the material is 60.0° , what angle does the beam make with the normal when it emerges into the air after passing through the material?
5. (a) Calculate the critical angle for a diamond surrounded by air. (b) Calculate the critical angle for a diamond under water. (c) Explain why a diamond sparkles less under water than in air.
6. Is there a critical angle for a light ray coming from a medium with an index of refraction 1.2 and incident on a medium that has an index of refraction 1.4? If so, what is the critical angle that allows total internal reflection in the first medium?
7. Calculate the thermal energy radiated by the Sun every second assuming its surface temperature is 5000K. Assume the radius of the Sun is 695,000 km.
8. A diverging mirror has a focal length of 10 cm. A pencil of height 10 cm is placed at a distance of distance of 5 cm from the mirror. Compute the distance of the image from the mirror and its size. Is the image virtual or real ?