

Honors Physics – Ch 13-14 Practice Problems

1. A typical compact disc stores information in tiny pits on the disc's surface. A typical pit size is $1.2\ \mu\text{m}$. What is the frequency of electromagnetic waves that have a wavelength equal to the typical CD pit size?
2. A stalagmite that is 32 m tall can be found in a cave in Slovakia. If a concave mirror with a focal length of 120 m is placed 180 m from this stalagmite, how far from the mirror will the image form? What is the size of the image? Is it upright or inverted? real or virtual?
3. *Quick Bird* is the first commercial satellite designed for forming high resolution images of objects on Earth. Suppose the satellite is 100 km above the ground and uses a concave mirror to form an image of a 1.00 m object. If the image size is $4.00\ \mu\text{m}$ and the image is inverted, what is the mirror's radius of curvature?
4. The radius of Earth is 6.40×10^3 km. The moon is about 3.84×10^4 km away from Earth and has a diameter of 3475 km. The Pacific Ocean surface, which can be considered a convex mirror, forms a virtual image of the moon. What is the diameter of that image?
5. Among the many discoveries made with the Hubble Space Telescope are four new moons of Saturn, the largest being just about 70.0 km in diameter. Suppose this moon is covered by a highly reflective coating, thus forming a spherical convex mirror. Another moon happens to pass by at a distance of 100 km. What is the image distance?
6. Someone on a glass-bottom boat shines a light through the glass into the water below. A scuba diver beneath the boat sees the light at an angle of 17° with respect to the normal. If the glass's index of refraction is 1.5 and the water's index of refraction is 1.33, what is the angle of incidence with which the light passes from the glass into the water? What is the angle of incidence with which the light passes from the air into the glass?
7. An arrangement of three glass blocks with indices of refraction of 1.5, 1.6, and 1.7 are sandwiched together. A beam of light enters the first block from air at an angle of 48° with respect to the normal. What is the angle of refraction after the light enters the third block?
8. The National Museum of Photography, Film & Television, in England, has a huge converging lens with a diameter of 1.37 m and a focal length of 8.45 m. Suppose you use this lens as a magnifying glass. At what distance would a friend have to stand for the friend's image to appear 25 m in front of the lens? What is the image magnification?
9. The common musk turtle, also called a "stinkpot," has a length of 7.60 cm at maturity. Suppose a turtle with this length is placed in front of a diverging lens that has a 14.0 cm focal length. If the turtle's image is 4.00 cm across, how far is the turtle from the lens? How far is the turtle's image from the lens?
10. Hummingbirds' eggs, which have an average size of 10.0 mm, are the smallest eggs laid by any bird. Suppose an egg is placed 12.0 cm from a magnifying glass. A virtual image with a magnification of 3.0 is produced. What is the focal length of the lens?