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Answers to NCERT/CBSE PHYSICS Class 12(Class XII)textbook Exercise and Additional exercise

CHAPTER Eight

ELECTROMAGNETIC WAVES

EXERCISES

(For simplicity in numerical calculations, take $g = 10 \text{ m s}^{-2}$)

10.17 Answer the following questions:

- In a single slit diffraction experiment, the width of the slit is made double the original width. How does this affect the size and intensity of the central diffraction band?
- In what way is diffraction from each slit related to the interference pattern in a double-slit experiment?
- When a tiny circular obstacle is placed in the path of light from a distant source, a bright spot is seen at the centre of the shadow of the obstacle. Explain why?
- Two students are separated by a 7 m partition wall in a room 10 m high. If both light and sound waves can bend around

obstacles, how is it that the students are unable to see each other even though they can converse easily.

- Ray optics is based on the assumption that light travels in a straight line. Diffraction effects (observed when light propagates through small apertures/slits or around small obstacles) disprove this assumption. Yet the ray optics assumption is so commonly used in understanding location and several other properties of images in optical instruments. What is the justification?

10.17 (a) If width is doubled, d is twice. Then width is halved as width is given

by $\frac{\lambda}{d}$. Intensity will increase 4 times.

(b) At each slit light spreads out due to diffraction. Interference between these diffracted beams produces the pattern on the screen.

(c) This is due to diffraction of light around the edges of the obstacle. Light bends and reaches the shadow again.

(d) The size of the slit is 3 m. This is comparable with the wavelength of sound. But this is \gg wavelength of light. So diffraction of sound is noticeable, and not light.

(e) Ray optics is a good enough assumption because diffraction effects are observable at distances $> \frac{d^2}{\lambda}$. Normally, for most experiments this has a few large value. So diffraction effects can be neglected.

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