

Wave Optics — Assignment 1

Class 12 Physics · Topic-wise question bank covering every concept of the chapter · Narayan Gurukul Academy

Instructions: (1) Attempt all questions. This worksheet walks through every concept of the chapter, topic by topic.
(2) The interactive MCQ version of these questions (with instant answer reveal) is available on the notes page.
(3) Universal values: $g = 10 \text{ m/s}^2$ unless stated. Give answers with correct SI units.

Huygens' Principle

MCQ Questions (choose the correct option)

- Huygens' principle states that every point on a wavefront acts as a
 - source of secondary wavelets
 - sink of energy
 - node
 - antinode
- The shape of a wavefront from a point source is
 - spherical
 - cylindrical
 - plane
 - elliptical
- The wavefront from a distant source is
 - plane
 - spherical
 - cylindrical
 - conical
- Huygens' principle is used to explain
 - reflection and refraction
 - resonance
 - photoelectric effect
 - interference only

1 Mark Questions

- State Huygens' principle.
- What is a wavefront?
- What is the shape of the wavefront from a point source?

2 Mark Questions

- State Huygens' principle and use it to explain the laws of reflection.
- Draw the wavefronts from (i) a point source and (ii) a distant source, and state Huygens' principle.

3 Mark Questions

- State Huygens' principle and use it to prove the laws of refraction (Snell's law).
- Using Huygens' principle, derive Snell's law of refraction and explain why the frequency of light does not change on refraction.

Interference of Light

MCQ Questions (choose the correct option)

1. For sustained interference, the two sources must be
 - (A) coherent
 - (B) incoherent
 - (C) of different frequencies
 - (D) of different amplitudes
2. At a bright fringe, the path difference is
 - (A) an integral multiple of λ
 - (B) an odd multiple of $\lambda/2$
 - (C) zero only
 - (D) always $\lambda/4$
3. At a dark fringe, the path difference is
 - (A) an odd multiple of $\lambda/2$
 - (B) an integral multiple of λ
 - (C) zero
 - (D) always λ
4. The fringe width in an interference pattern is
 - (A) $\beta = \lambda D/d$
 - (B) $\beta = \lambda d/D$
 - (C) $\beta = Dd/\lambda$
 - (D) $\beta = \lambda dD$

1 Mark Questions

1. What are coherent sources?
2. Write the condition for a bright fringe in terms of path difference.
3. Write the expression for fringe width.

2 Mark Questions

1. State the conditions for a bright and a dark fringe in terms of path difference.
2. Write the expression for fringe width and state how it changes when the wavelength of light is increased.

3 Mark Questions

1. Derive the expression for the path difference between two interfering waves and hence obtain the conditions for bright and dark fringes.
2. What is interference of light? Derive the expression for the fringe width in a double-slit interference pattern.

Young's Double-Slit Experiment**MCQ Questions (choose the correct option)**

1. In Young's double-slit experiment, the fringe width is directly proportional to
 - (A) the wavelength of light
 - (B) the slit separation
 - (C) $1/D$
 - (D) the intensity

2. If the slit separation is doubled, the fringe width
 - (A) halves
 - (B) doubles
 - (C) remains the same
 - (D) becomes four times
3. If the whole apparatus is immersed in water, the fringe width
 - (A) decreases
 - (B) increases
 - (C) remains the same
 - (D) becomes zero
4. In YDSE the central fringe is
 - (A) bright
 - (B) dark
 - (C) always red
 - (D) absent

1 Mark Questions

1. Write the expression for the fringe width in Young's double-slit experiment.
2. What happens to the fringe width when the separation between the slits is increased?
3. What is the nature of the central fringe in Young's double-slit experiment?

2 Mark Questions

1. In Young's double-slit experiment, state how the fringe width changes when (i) the wavelength is decreased and (ii) the screen distance is increased.
2. In YDSE the slits are 2 mm apart and the screen is 1 m away. If the wavelength is 600 nm, find the fringe width. (Ans: 0.3 mm)

3 Mark Questions

1. Describe Young's double-slit experiment and derive the expression for the fringe width.
2. In Young's double-slit experiment, derive the condition for constructive and destructive interference and hence the fringe width.

Diffraction

MCQ Questions (choose the correct option)

1. Diffraction is the bending of light around
 - (A) the edges of an obstacle
 - (B) a prism
 - (C) a lens
 - (D) a mirror
2. The condition for a secondary maximum in single-slit diffraction is
 - (A) $a \sin\theta = (2m+1)\lambda/2$
 - (B) $a \sin\theta = m\lambda$
 - (C) $a \sin\theta = m\lambda/2$
 - (D) $a \sin\theta = 0$

3. The condition for a minimum in single-slit diffraction is
 - (A) $a \sin \theta = m\lambda$
 - (B) $a \sin \theta = (2m+1)\lambda/2$
 - (C) $a \cos \theta = m\lambda$
 - (D) $a \sin \theta = \lambda$
4. The width of the central maximum in single-slit diffraction is
 - (A) $2\lambda D/a$
 - (B) $\lambda D/a$
 - (C) $\lambda D/2a$
 - (D) aD/λ

1 Mark Questions

1. What is diffraction of light?
2. Write the condition for the minima in single-slit diffraction.
3. Write the expression for the width of the central maximum in single-slit diffraction.

2 Mark Questions

1. Distinguish between interference and diffraction.
2. A single slit of width 0.1 mm is illuminated by light of wavelength 500 nm. Find the angular width of the central maximum. (Ans: 0.01 rad)

3 Mark Questions

1. Derive the conditions for minima and secondary maxima in the diffraction pattern of a single slit.
2. Describe the diffraction of light at a single slit and derive the expression for the width of the central maximum.

Polarisation

MCQ Questions (choose the correct option)

1. Polarisation of light shows that light waves are
 - (A) transverse
 - (B) longitudinal
 - (C) stationary
 - (D) mechanical
2. A polaroid is used to
 - (A) produce polarised light
 - (B) produce interference
 - (C) produce diffraction
 - (D) disperse light
3. When unpolarised light passes through a polariser, its intensity
 - (A) becomes half
 - (B) remains the same
 - (C) doubles
 - (D) becomes zero
4. Brewster's law states that at polarising incidence, $\tan i_p =$
 - (A) n

(B) $1/n$

(C) n^2

(D) $\sqrt{n}$

1 Mark Questions

1. What is polarisation of light?
2. What does polarisation show about the nature of light?
3. State Brewster's law.

2 Mark Questions

1. What is polarisation? Explain how a polaroid produces polarised light.
2. State Brewster's law and write the relation between the polarising angle and the refractive index.

3 Mark Questions

1. Explain polarisation by reflection and derive Brewster's law.
2. What is polarisation? Describe polarisation by scattering and by reflection, and state Brewster's law.