Objective Questions

(For Complete Chapter)

Multiple Choice Questions (MCQs)

1. When a wave undergoes reflection at an interface from rarer to denser medium, then change in its phase is **All India 2020**

(a) $\frac{\pi}{2}$ (b) zero (c) π (d) $\frac{\pi}{4}$

2. Wavefront of a wave has direction with wave motion

(a) parallel
(b) perpendicular
(c) opposite
(d) at an angle of θ

3. Huygen's principle of secondary wavelets may be used to

(a) find the velocity of light in vacuum
(b) explain the particle's behaviour of light
(c) find the new position of a wavefront
(d) explain photoelectric effect

4. The speed of light in vacuum depends on

(a) wavelength
(b) frequency
(c) velocity of the light source
(d) None of the above

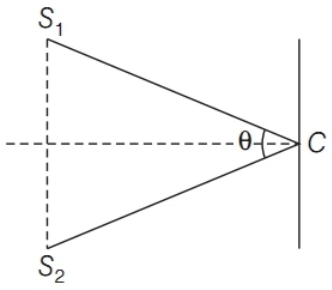
5. The wavefront due to a source situated at infinity is

(a) spherical
(b) cylindrical
(c) planar
(d) None of the above

6. Colours appear on a thin soap film and soap bubbles due to the phenomenon of

(a) interference
(b) scattering
(c) diffraction
(d) dispersion

7. The Young's double slit experimental arrangement is shown in figure below. If λ is the wavelength of light used and $\angle S_1CS_2 = \theta$, then the fringe width will be



(a) $\frac{\lambda}{\theta}$ (b) $\frac{\lambda}{2\theta}$

(c) $\lambda\theta$ (d) $\frac{2\lambda}{\theta}$

8. In Young's double slit experiment, the slits are 2 mm apart and are illuminated by photons of two wavelengths $\lambda_1 = 12000$ Å and $\lambda_2 = 10000$ Å. At what minimum distance from the common central bright fringe on the screen 2 m from the slit will a bright fringe from one interference pattern coincide with a bright fringe from the other?

(a) 8 mm (b) 6 mm
(c) 4 mm (d) 3 mm

9. In Young's double slit experiment with monochromatic light, the central fringe will be

(a) coloured (b) white
(c) bright (d) black

10. In the phenomenon of interference, energy is

(a) destroyed at bright fringes
(b) created at dark fringes
(c) conserved but it is redistributed
(d) same at all points

11. In single slit diffraction pattern

(a) central fringe has negligible width than others
(b) all fringes are of same width
(c) central fringes do not exist
(d) None of the above

12. In a single slit diffraction experiment, the width of the slit is made double its original width. Then, the central maxima on the diffraction pattern will become

(a) narrower and fainter
(b) narrower and brighter
(c) broader and fainter
(d) broader and brighter

Assertion-Reason Questions

Directions (Q. Nos. 13-18) *In the following questions, two statements are given- one labelled Assertion (A) and the other labelled Reason (R). Select the correct answer to these questions from the codes (a), (b), (c) and (d) as given below*

(a) If both Assertion and Reason are correct and Reason is the correct explanation of Assertion.
(b) If both Assertion and Reason are correct but Reason is not the correct explanation of Assertion.
(c) If Assertion is correct but Reason is incorrect.
(d) If both Assertion and Reason are incorrect.

13. **Assertion** The emergent plane wavefront is tilted on refraction of a plane wave by a thin prism.
Reason The speed of light waves is more in glass and the base of the prism is thicker than the top.

14. **Assertion** Two coherent sources transmit waves of equal intensity I_0. Resultant intensity at a point where path difference is $\frac{\lambda}{3}$ is also I_0.

Reason In interference resultant intensity at any point is the average intensity of two individual intensities.

15. **Assertion** No interference pattern is detected when two coherent sources are infinitely close to each other.

Reason The fringe width is inversely proportional to the distance between the two slits.

16. **Assertion** The intensity at the bright band on the screen is maximum and equal to $4I_0$, where I_0 is the intensity of light from each sources.

Reason The intensity at the dark band is always zero irrespective of the intensity of light waves coming from the two sources.

17. **Assertion** In Young's double slit experiment, ratio $\frac{I_{max}}{I_{min}}$ is infinite.

Reason If width of any one of the slits is slightly increased, then this ratio will decrease.

18. **Assertion** Diffraction determines the limitations of the concepts of light rays.

Reason A beam of width a starts to spread out due to diffraction after it has travelled a distance $2a^2/\lambda$.

Case Based Questions

Directions (Q.No. 19) *This question is case study based question. Attempt any 4 sub-parts from this question. Each question carries 1 mark.*

19. The Wavefront

In 1678, a Dutch scientist, Christian Huygens' propounded the wave theory of light. According to him, wave theory introduced the concepts of wavefront. Light travels in the form of waves. A wavefront is the locus of points (wavelets) having the same phase (a surface of constant phase) of oscillations. A wavelet is the point of disturbance due to propagation of light. Wavefront may also be defined as the hypothetical surface on which the light waves are in the same phase.

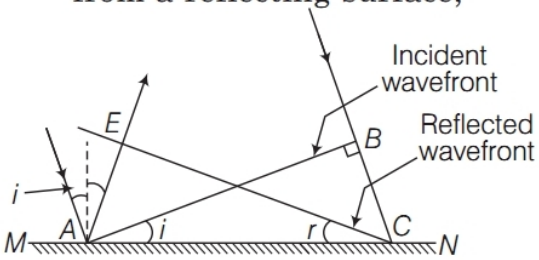
(i) According to Huygens' original wave theory of light, it is assumed that
(a) minute elastic particles
(b) transverse electromagnetic wave
(c) transverse mechanical wave
(d) longitudinal mechanical wave

(ii) A ray of light wave perpendicular to wavefront
(a) is parallel to a surface at the point of incidence of a wavefront
(b) is the line joining the source of light and an observer
(c) gives the direction of propagation of a wavefront at a given point
(d) is the envelope that is tangential to the secondary wavelets

(iii) A linear source of light produces
(a) cylindrical wavefront
(b) spherical wavefront
(c) plane wavefront
(d) cubical wavefront

(iv) Huygen's principle of secondary wavelets may be used to
(a) find the velocity of light in vacuum
(b) explain the particle behaviour of light
(c) find the new position of the wavefront
(d) explain photoelectric effect

(v) In case of relection of a wavefront from a reflecting surface,



I. points A and E are in phase difference of 90°.

II. points A and C are in phase difference of 0°.

III. points A and B are in phase difference of 0°.

IV. points C and E are in phase difference of 0°.

Which of the following is correct?
(a) Both I and II (b) Both II and III
(c) Both III and IV (d) Both I and IV