INDIAN SCHOOL AL WADI AL KABIR

Class: XII	Department: SCIENCE 2020 -21 SUBJECT: PHYSICS	DATE : 14.10.2020
Worksheet No:06 WITH ANSWERS	Topic: WAVE OPTICS	Note: A4 FILE FORMAT
NAME OF THE STUDENT-	CLASS & SECTION	ROLL NO.

Multiple choice questions: [based on board papers]

[1] The idea of secondary wavelets for the. propagation of a wave was first given by
(a) Newton
(b) Huygens
(c) Maxwell
(d) Fresnel

Answer: b

[2] Two slits in Young's double slit experiment have widths in the ratio 81 :1. The ratio of the amplitudes of light waves is
(a) 3 :1
(b) 3 : 2
(c) 9 :1
(d) 6:1

Answer: c

[3] When interference of light takes place
(a) energy is created in the region of maximum intensity
(b) energy is destroyed in the region of maximum intensity
(c) conservation of energy holds good and energy is redistributed
(d) conservation of energy does not hold good

Answer: c

[4] In a double slit interference pattern, the first maxima for infrared light would be
(a) at the same place as the first maxima for green light
(b) closer to the centre than the first maxima for green light
(c) farther from the centre than the first maxima for green light
(d) infrared light does not produce an interference pattern

Answer: c

[5]To observe diffraction, the size of the obstacle
(a) should be X/2, where X is the wavelength.
(b) should be of the order of wavelength.
(c) has no relation to wavelength.
(d) should be much larger than the wavelength.

Answer: b

[6] Which of the following effects was NOT one of the things predicted by the wave theory of light?

a. Interference
b. Refraction
c. Diffraction
d. The Photoelectric Effect

Answer: d

[7] A narrow slit is taken and a parallel beam of moving electrons is incident normally on it. At a larger distance from the slit, a fluorescent screen is placed. Which of the following statement is true if the size of the slit is further narrowed?

a. The diffraction pattern cannot be observed on the screen
b. The angular width of the central maxima of the diffraction pattern will increase
c. The angular width of the central maxima of the diffraction pattern will decrease
d. The angular width of the central maxima of the diffraction pattern remains the same

Answer: [b]

[8] How does the diffraction band of blue light look in comparison with the red light?

a. No changes
b. Diffraction pattern becomes narrower
c. Diffraction pattern becomes broader
d. Diffraction pattern disappears

Answer: (b)

[9] Two coherent sources of light can be obtained from

a. Two different lamps
b. Two different lamps but of the same colour
c. Two different lamps of the same colour and having the same colour
d. None of these

Answer: (d)

[10] Which of the following phenomenon is not explained by Huygen's wave theory?

a. Diffraction
b. Interference

c. Polarisation
d. Photoelectric effect

Answer: (d)

[11] The ratio of the amplitude of the two sources producing interference 3 : 5, the ratio of intensities at maxima and minima is

a. 25:6
b. 5:3
c. 16:1
d. 25:9

Answer: (c)

[12] The colours on the soap bubble is due to

a. Interference
b. Polarisation
c. Diffraction
d. Reflection

Answer: (a)

[13] In Young's double-slit experiment, the phase difference between the light waves reaching the third bright fringe from the central fringe will be (λ=6000 Å)

a. Zero
b. 2π
c. 4π
d. 6π

Answer: [d]

[14] When Two waves of same amplitude add constructively, the intensity becomes _____
a) Double
b) Half

c) Four Times
d) One-Fourth

Answer: [c]

[15]Two beams of coherent light travel different paths arriving at point P. If the maximum
constructive interference is to occur at point P, the two beams must

a. arrive 180degree out of phase.
b. arrive 90 degree out of phase.
c. travel paths that differ by a whole number of wavelengths.
d. travel paths that differ by an odd number of half-wavelengths.

[c]

Short answer type questions[based on board papers]

[16] 633 nm laser light is passed through a narrow slit and a diffraction pattern is observed on a screen 6.0 m away. The distance on the screen between the centers of the first minima outside the central bright fringe is 32 mm. What is the slit width?

$$\theta = \frac{\frac{\beta o}{2}}{D} = \frac{16}{6}$$

$$\frac{16}{6} = \frac{n\lambda}{d} \text{ OR d} = 2.37 \text{ x } 10^{-4} m$$

[17] What changes are observed in a diffraction pattern if the whole apparatus is immersed in water?
The width of central maximum decreases
d) Frequency of light decreases

Explanation: As the whole apparatus is now immersed in water, the wavelength of the light will change.
Therefore, as the refractive index of water is greater than the air, the wavelength of light will decrease.
As the wavelength decreases, the width of the central maxima decreases.

[18] How shall a diffraction pattern change when white light is used instead of a monochromatic light?
The coloured pattern will be observed with a white bright fringe at the center
[19] What will be the angular separation of the first order fringe from the central maximum, when a light of wavelength 500 nm is diffracted at a slit of width 0.5 mm?
$\sin\theta = \lambda/d = 0.001$
$\sin\theta \approx \theta$
$\theta = 0.001$ radian
$\theta = 3.4$ minute.

[20] A screen is placed 2m away from the lens to obtain the diffraction pattern in the focal plane of the lens in a single slit diffraction experiment. What will be the slit width if the first minimum lies 5 mm on either side of the central maximum when plane light waves of wavelength 4000 Å are incident on the slit?
a) 0.16 mm
b) 0.26 mm
c) 0.36 mm
d) 0.46 mm
$d = n\lambda/\sin\theta$
$= 1.6 \text{ X } 10^{-4}\text{m}$
= 0.16 mm.

Long answer type questions[based on board papers

[21] Derive an expression for path difference in Young's double slit experiment and obtain the conditions for constructive and destructive interference at a point on the screen.

[22] Derive an expression to find the path difference in Young's double slit experiment and obtain the expression for the intensity of resultant wave a t a point on the screen

[23] Derive an expression to find the band width in Young's

double slit experiment.

[24] Explain the reflection and refraction of light using Huygen's wave theory of light

[25][i] With the help of a ray diagram, explain diffraction of light due to a narrow single slit and the formation of pattern of fringes on the screen

[ii]Derive the relation to find the width of central maxima in terms of wavelength, slit width and the distance between the screen and the slit

[26][i] With the help of a ray diagram, explain diffraction of light due to a narrow single slit and the formation of pattern of fringes on the screen

[ii] Obtain the condition for maxim and minima in terms of wavelength and slit width

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