PHYSICS
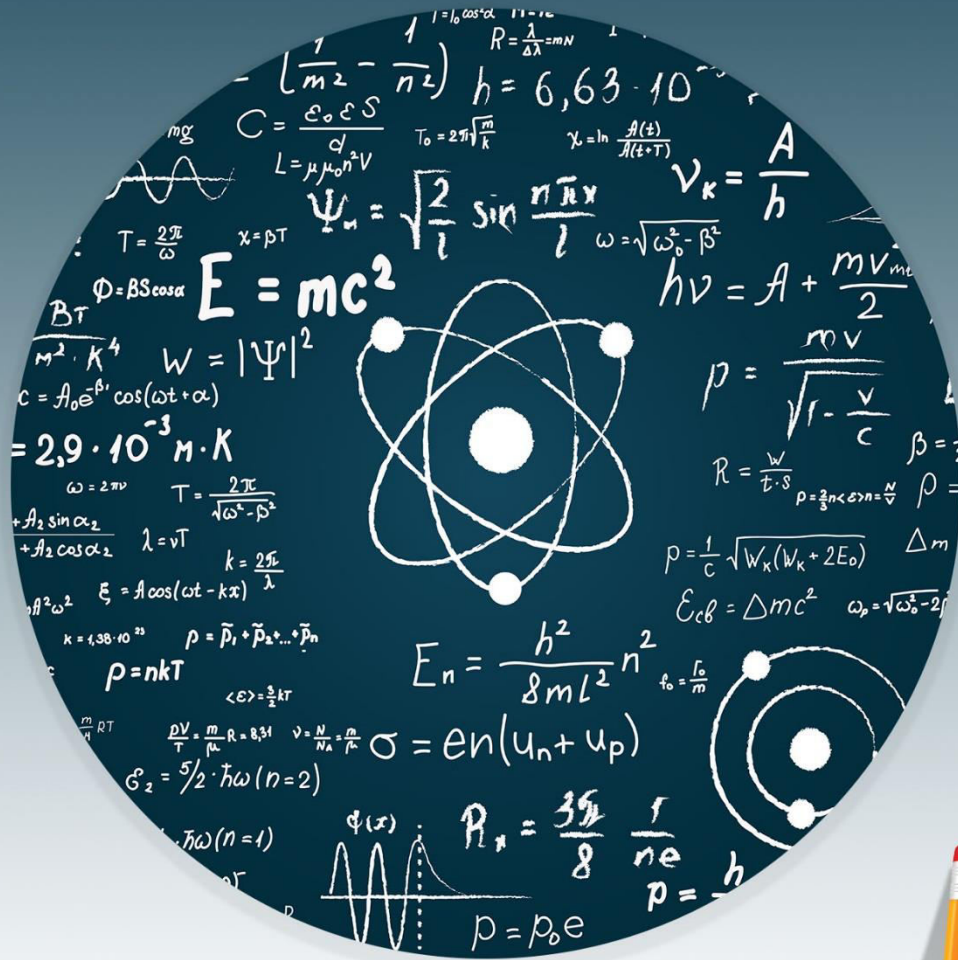
WORKSHEET-17

Worksheet-17

Topics:- Interference of Light Waves, Young's Double Slit Experiment, Diffraction Grating

Q.1 **The wave nature of light was proposed by:**
A) Thomas Young   C) Newton
B) Maxwell   D) Huygens

Q.2 **Huygens principle states that:**
A) Light travels in straight line
B) Light travels as electromagnetic waves
C) Light has dual nature
D) All points on primary wave front are sources of secondary wavelets

Q.3 **The distance between any two consecutive dark or bright fringes is called:**
A) Wavelength   C) Amplitude
B) Wavelet   D) Fringe spacing

Q.4 **In Young's double slit experiment the condition for constructive interference (bright fringes) is:**
A) $d\sin\theta = \left(m + \dfrac{1}{2}\right)\lambda$ C) $d\sin\theta = \left(m - \dfrac{1}{2}\right)\dfrac{\lambda}{2}$

B) $d\sin\theta = m\lambda$ D) $2d\sin\theta = m\lambda$

Q.5 **In Young's double slit experiment the condition for destructive interference is:**
A) $d\sin\theta = m\lambda$ C) $d\sin\theta = \left(\dfrac{m}{2} - \dfrac{1}{2}\right)\lambda$

B) $d\sin\theta = \dfrac{m\lambda}{2}$ D) $d\sin\theta = \left(m + \dfrac{1}{2}\right)\lambda$

Q.6 **In Young's double slit experiment fringe spacing is equal to:**
A) $\dfrac{d}{\lambda L}$ C) $\dfrac{\lambda d}{L}$

B) $\dfrac{\lambda L}{d}$ D) $\dfrac{2\lambda d}{L}$

Q.7 **The diffraction phenomena is found to be prominent if:**
A) Size of obstacle is smaller than wavelength of light
B) Wavelength of light is greater than size of slit
C) Size of slit is smaller than wavelength of light
D) All of these

Q.8 **Diffraction is a special type of:**

Your STEP Towards A Brighter Future!

A) Polarization   C) Reflection

B) Interference   D) Dispersion

Q.9   **The appearance of colours in thin film is due to:**

A) Diffraction   C) Interference

B) Dispersion   D) Polarization

Q.10   **Newton's rings are formed due to:**

A) Diffraction of light   C) Polarization of light

B) Interference of light   D) Reflection of light

Q.11   **When Newton's rings interference is seen from above by means of reflected light the central spot is?**

A) Red   C) Bright

B) Blue   D) Dark

Q.12   **Bending of light around the edges of an obstacle is called:**

A) Refraction   C) Polarization

B) Interference   D) Diffraction

Q.13   **In YDSE the process taking place was:**

A) Interference   C) Both "A" and "B"

B) Diffraction   D) Polarization

Q.14   **To observe interference of light interfering beams must:**

A) Be monochromatic   C) Of same color

B) Be coherent   D) All of these

Q.15   **In "YDSE" the centre is:**

A) Always bright   C) May be bright or dark

B) Always dark   D) None of these

Q.16   **The centre of Newton's rings in case of transmitted light is:**

A) Bright   C) May be bright or dark

B) Dark   D) None of these

Q.17   **The blue colour of sky is due to _____ of light:**

A) Diffraction   C) Interference

B) Scattering   D) None of these

Q.18   **A diffraction pattern is obtained using a beam of red light. If the red light is replaced by blue light, then:**

A) The diffraction pattern remains unchanged

B) Diffraction bands become narrower and crowded together

C) Bands become broader and farther apart

D) Bands disappear

Q.19   **Two coherent sources produce a dark fringe when the phase difference between interfering waves is:**

A) $(2n-2)\pi$, n= 1, 2, 3 …   C) $2n\pi$, n = 1, 2, 3, 4.....

B) $n\pi$, n = 1, 2, 3,.....   D) $(2n – 1)\pi$, n = 1, 2, 3, 4

Q.20 **In Young's double slit experiment the distance between the slits is gradually increased. The width of the fringes:**

A) Increases

B) Remains same

C) Decreases

D) First increases and then decreases

Q.21 **The image of the tip of a needle is never sharp because of:**

A) Polarization of light   C) Diffraction of light

B) Interference of light   D) Reflection of light

Q.22 **When interference of light takes place?**

A) Energy is created at the position of maxima

B) Energy is destroyed at the position of minima

C) Energy is neither created nor destroyed but it is merely redistributed

D) All of these

Q.23 **If the apparatus of Newton's rings is moved from air to water, the rings spacing:**

A) Remains same   C) Decreases

B) Increases   D) Becomes maximum

Q.24 **In YDSE the process under observation is:**

A) Interference   C) Both "A" & "B"

B) Diffraction   D) Polarization

Q.25 **A student bought two identical lamps with same colour of bulbs and allowed to fall light of both lamps after passing through two narrow openings at screen but found no interference pattern, this is due to the reason that:**

A) Rays were not monochromatic

B) Rays were coherent

C) Rays were monochromatic

D) Rays were not coherent

Q.26 **In YDSE the centre is always a maxima, it's order is:**

A) 1st order   C) 0th order

B) 2nd order   D) 3rd order

Q.27 **As we know that relation for distance of any minima**

from centre is written as $y_m = \left(m + \dfrac{1}{2} \right) \dfrac{\lambda L}{d}$. To find the closest minima to centre we:

A) Put m=0, Call it zeroth order minima

B) Put m=1, Call it 1st order minima

C) Put m=0, Call it 1st order minima

D) Put m=1, Call it 2nd order minima

Q.28 **If in YDSE four fringes are observed above the centre then total number of fringes present on screen will be:**

A) 4   C) 5

B) 9   D) Can't be predicted

Q.29 **If instead of monochromatic light one uses white light in YDSE then:**

A) No interference pattern will be observed

B) Centre will be white and coloured fringes will be observed on both sides

C) Same results will be observed as with monochromatic light

D) All of these

Q.30 **If we use white light in YDSE then the coloured fringe closer to the central maxima will be:**

A) Red   C) Blue

B) Green   D) Yellow

Q.31 **A light wave has intensity I_o at 2 cm distance from source, what would be intensity at 4 cm?**

A) Increases by factor 2   C) Increases by factor 3

B) Decreases by factor $\dfrac{1}{2}$ D) Decreases by factor $\dfrac{1}{4}$

Q.32 **The diffraction pattern of single slit is best represented as:**

A)

B)

C)

D) None of these

ANSWER KEY (Worksheet-17)

1	D	11	D	21	C	31	D	
2	D	12	D	22	C	32	B	
3	D	13	C	23	C	33		
4	B	14	D	24	A	34		
5	D	15	A	25	D	35		
6	B	16	A	26	C	36		
7	D	17	B	27	C	37		
8	B	18	B	28	B	38		
9	C	19	D	29	B	39		
10	B	20	C	30	C	40		

SOLUTIONS

Unit – 5 (WS-17)

Q.1   **Answer is "D"**

Solution:- The wave nature of light was proposed by Huygens in 1678 and it was experimentally proven by Thomas Young in 1801.

Q.2   **Answer is "D"**

Solution:- Huygen principle says all the points on a wavefront are the sources of secondary wavelets.

Q.3   **Answer is "D"**

Solution:- The distance between any two consecutive dark or bright fringes is called fringe spacing.

Q.4   **Answer is "B"**

Solution:- Conditions for constructive interference is;

Path difference = mλ where
$m = 0, \pm 1, \pm 2....$

i.e Path difference = $0, \pm \lambda, \pm 2\lambda.....$

also Phase difference = $0, 2\pi, 4\pi, 6\pi,....$

Q.5   **Answer is "D"**

Solution:- For destructive interference

Path difference $= \left(m + \dfrac{1}{2} \right) \lambda$

Where $m = 0, \pm 1, \pm 2.....$

i.e Path difference $= \pm \dfrac{1\lambda}{2}, \pm \dfrac{3\lambda}{2}, \pm \dfrac{5\lambda}{2}.....$

Also

Phase difference $= \pm \pi, \pm 3\pi, \pm 5\pi......$

Q.6   **Answer is "B"**

Solution:- Fringe spacing or the distance between adjacent bright or dark fringes is given as:

$$\Delta y = \frac{\lambda L}{d}$$

Q.7   **Answer is "D"**

Solution:- The diffraction phenomena is found to be prominent when; (size of obstacle/slit) $\leq \lambda$

Q.8   **Answer is "B"**

Solution:- Diffraction is merely the bending of light around the edges of obstacle, after the bending the diffraction pattern is formed due to interference of light beams.

Q.9   **Answer is "C"**

Solution:- The beautiful colours in thin film are due to the interference of light.

Q.10   **Answer is "B"**

Solution:- Newton's rings are formed due to interference of light.

Q.11   **Answer is "D"**

Solution:- For reflected light

$x = \dfrac{\lambda}{2}, \phi = 180°$ so minima is formed.

Q.12   **Answer is "D"**

Solution:-"The bending of light around the edges of an obstacle and spreading of light into the geometrical shadow of obstacle is called diffraction."

Q.13   **Answer is "C"**

Solution:- First bending then interference takes place.

Q.14   **Answer is "D"**

Solution:- Basic conditions for interference.

Q.15 **Answer is "A"**

Solution:- At the centre of screen the path difference of the superposing light waves is zero which is a condition of constructive interference.

Q.16 **Answer is "A"**

Solution:- For transmitted light maxima is formed.

Q.17 **Answer is "B"**

Solution:- Scattering $\propto \dfrac{1}{\lambda}$

Q.18 **Answer is "B"**

Solution:- Fringe spacing $\propto \lambda$

Q.19 **Answer is "D"**

Solution:- For destructive interference

Path difference $= \left(m + \dfrac{1}{2} \right) \lambda$

Where $m = 0, \pm 1, \pm 2 .....$

i.e Path difference $= \pm \dfrac{1\lambda}{2}, \pm \dfrac{3\lambda}{2}, \pm \dfrac{5\lambda}{2} .....$

Also

Phase difference $= \pm \pi, \pm 3\pi, \pm 5\pi ......$

This phase difference can be generalized as: phase difference=$(2n-1)\pi$, n=1, 2, 3, ……..

Q.20 **Answer is "C"**

Solution:- $\Delta y \propto \dfrac{1}{d}$

Q.21 **Answer is "C"**

Solution:- Due to prominent diffraction of light from needle tip its image is never sharp.

Q.22 **Answer is "C"**

Solution:- We can't go against law of conservation of energy.

Q.23 **Answer is "C"**

Solution:- $\Delta y \propto \lambda$; as "λ" decreases so fringe spacing also decreases.

Q.24 **Answer is "A"**

Solution:- Different lamps can't produce coherent beams.

Q.25 **Answer is "D"**

Solution:- When lamps changes the beams cannot be coherent

Q.26 **Answer is "C"**

Solution:- The central maxima is 0th order maxima, generally;

Order of maxima = m

And

Order of minima = m+1

Q.27 **Answer is "C"**

Solution:- The central maxima is 0th order maxima, generally;

Order of maxima = m

And

Order of minima = m+1

Q.28 **Answer is "B"**

Solution:- There are equal number of fringes above and below the central maxima on screen. So including the central fringe, four fringes above and four fringe below central fringe, total fringes are nine.

Q.29 **Answer is "B"**

Solution:- For white light in YDSE

- Central maxima will be white

- Moving away from central maxima, colored pattern is observed.

- That color is observed first whose wavelength is smaller.

Q.30 **Answer is "C"**

Solution:- Blue color is least diffracted or bended.

Q.31 **Answer is "D"**

Solution:- $I \propto \dfrac{1}{x^2}$

Q.32 **Answer is "B"**

Solution:- For diffraction Pattern

i. Centre of screen is a maxima with maximum width and intensity.

ii. Moving away from centre, width of maxima decreases and width of minima increases.

STEP

A PROGRAM BY PUNJAB GROUP