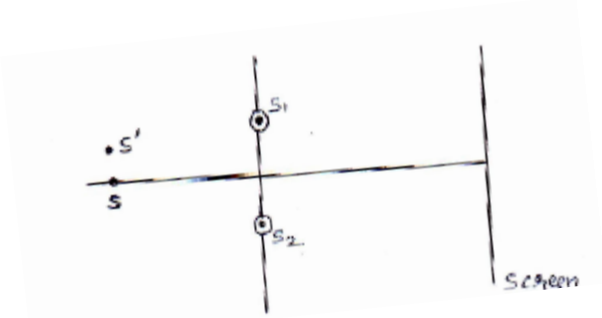
PRACTICE TEST PAPER BASED ON BOARD QUESTION PAPERS OF PREVIOUS YEARS (WAVE OPTICS)

1.	Which of these waves can be polarised? (a) Heat Waves (b) Sound Waves. Justify your answer	1
2.	Draw the shape of the wavefront coming out of a convex lens when a plane wave is incident on it.	1
3.	Draw the shape of the wavefront coming out of a concave mirror when a plane wave is incident on it.	1
4.	Good quality sun-glasses made of polaroids are preferred over ordinary coloured glasses. Justifying your answer.	1
5.	In Young's double slit experiment, using monochromatic light of wavelength λ, the intensity of light at a point on the screen where path difference is λ, is K units. Find out the intensity of light at a point where path difference is $\lambda/3$.	1
6.	Name the phenomenon which proves transverse wave nature of light. Give two uses of the devices whose functioning is based on this phenomenon.	2
7.	Name the phenomenon which is responsible for bending of light around sharp corners of an obstacle. Under what conditions does this phenomenon take place? Give one application of this phenomenon in everyday life.	2
8.	(a) The ratio of the widths of two slits in Young's double slit experiment is 4 : 1. Evaluate the ratio of intensities at maxima and minima in the interference pattern. (b) Does the appearance of bright and dark fringes in the interference pattern violate, in any way, conservation of energy ? Explain.	2
9.	A beam of unpolarised light is incident on a glass-air interface. Show, using a suitable ray diagram, that light reflected from the interface is totally polarised, when $\mu = \tan i_B$, where μ is the refractive index of glass with respect to air and i_B is the Brewster's angle.	2
10.	Define the term 'coherent sources' which are required to produce interference pattern in Young's double slit experiment.	2
11.	Why does light from a clear blue portion of the sky show a rise and fall of intensity when viewed through a polaroid which is rotated ? Explain by drawing the necessary diagram.	2
12.	(a) Unpolarised light of intensity I_0 passes through two polaroids P_1 and P_2 such that pass axis of P_2 makes an angle θ with the pass axis of P_1. Plot a graph showing the variation of intensity of light transmitted through P_2 as the angle θ varies from zero to 180°. (b) A third polaroid P_3 is placed between P_1 and P_2 with pass axis of P_3 making an angle β with that of P1. If I_1, I_2 and I_3 represent the intensities of light transmitted by P_1, P_2 and P_3, determine the values of angle θ and β for which $I_1 = I_2 = I_3$.	3
13.	(a) Two monochromatic waves emanating from two coherent sources have the displacements represented by $y_1 = a\cos\omega t$ and $y_2 = a\cos(\omega t + \phi)$, where ϕ is the phase difference between the two displacements. Show that the resultant intensity at a point due to their superposition is given by $I = 4 I_o \cos^2 \phi/2$, where $I_o = a^2$. (b) Hence obtain the conditions for constructive and destructive interference.	3
14.	In what way is diffraction from each slit related to the interference pattern in a double slit experiment	3

	Two wavelengths of sodium light 590 nm and 596 nm are used, in turn, to study the diffraction taking place at a single slit of aperture 2×10^{-4} m. The distance between the slit and the screen is 1.5 m. Calculate the separation between the positions of the first maxima of the diffraction pattern obtained in the two cases.	
15.	The arrangement used by Thomas Young to produce an interference pattern is shown in the given diagram. Justify why there would be no change in the 'fringe width' when the main illuminated slit (S) is shifted to the position *S'* as shown. 	3
16.	State Huygen's principle in wave-optics. How did Huygen 'explain' the absence of the backwave? Use this principle to draw the refracted wave front for a plane wave incident from a denser to a rarer medium. Hence obtain Snell's law of refraction.	3
17.	When Puja, a student of 10^{th} class, watched her mother washing clothes in the open, she observed coloured soap bubbles and was curious to know why the soap bubbles appear coloured. In the evening when her father, an engineer by profession, came home, she asked him this question. Her father explained to her the basic phenomenon of physics due to which the soap bubbles appear coloured. (a) What according to you are the values displayed by Puja and her father ? (b) State the phenomenon of light involved in the formation of coloured soap bubbles.	3
18.	(a) Distinguish between unpolarised and linearly polarised light. (b) A partially plane polarised beam of light is passed through a polaroid. Show graphically the variation of the transmitted light intensity with angle of rotation of the polaroid. (c) Explain with the help of a diagram how sunlight is polarised by scattering through atmospheric particles.	3

19.	(a) State Huygen's principle. Using this principle draw a diagram to show how a plane wave front incident at the interface of the two media gets refracted when it propagates from a rarer to a denser medium. Hence verify Snell's law of refraction. (b) When monochromatic light travels from a rarer to a denser medium, explain the following, giving reasons : (i) Is the frequency of reflected and refracted light same as the frequency of incident light ? (ii) Does the decrease in speed imply a reduction in the energy carried by light wave ?	3
20.	The ratio of the widths of two slits in Young's double slit experiment is 4 : 1. Evaluate the ratio of intensities at maxima and minima in the interference pattern. (b) Does the appearance of bright and dark fringes in the interference pattern violate, in any way, conservation of energy ? Explain.	3
21.	(a) Define a wavefront. How is it different from a ray ? (b) Depict the shape of a wavefront in each of the following cases. (i) Light diverging from point source. (ii) Light emerging out of a convex lens when a point source is placed at its focus. (iii) Using Huygen's construction of secondary wavelets, draw a diagram showing the passage of a plane wavefront from a denser into a rarer medium.	3
22.	(a) Show, giving a suitable diagram, how unpolarized light can be polarised by reflection (b) Two polaroids P1 and P2 are placed with their pass axes perpendicular to each other. Unpolarised light of intensity Io is incident on P1. A third polaroid P3 is kept in between P1 and P2 such that its pass axis makes an angle of 60 □ w that of P1. Determine the intensity of light transmitted through P1, P2 and P3.	3
23.	(a) In Young's double slit experiment, describe briefly how bright and dark fringes are obtained on the screen kept in front of a double slit. Hence obtain the expression for the fringe width. (b) The ratio of the intensities at minima to the maxima in the Young's double slit experiment is 9 : 25. Find the ratio of the widths of the two slits.	5
24.	(a) Describe briefly how a diffraction pattern is obtained on a screen due to a single narrow slit illuminated by a monochromatic source of light. Hence obtain the conditions for the angular width of secondary maxima and secondary minima. (b) Two wavelengths of sodium light of 590 nm and 596 nm are used in turn to study the diffraction taking place at a single slit of aperture 2 □ 60m. The distance between the slit and the screen is 1.5 m. Calculate the separation between the positions of first maxima of the diffraction pattern obtained in the two cases.	5
25.	(a) Write three characteristic features to distinguish between the interference fringes in Young's double slit experiment and the diffraction pattern obtained due to a narrow single slit. (b) A parallel beam of light of wavelength 500 nm falls on a narrow slit and the resulting diffraction pattern is observed on a screen 1 m away. It is observed that the first minimum is a distance of 2·5 mm away from the centre. Find the width of the slit.	5