INDIAN SCHOOL MUSCAT

Department of Physics

Class : XII Physics Worksheet - 6 (2017 -2018)

Chapter 9 and 10 : Ray Optics and wave Optics

Section A Conceptual and application type questions

1	Which is more observable diffraction of light or sound ? Justify.	(1)
2	Name the Phenomenon of light which proved that light propagates as transverse waves.	(1)
3	What is the effect of doubling the power of objective lens on the resolving power of an astronomical telescope?	(1)FAQ
4	Parallel rays of red and blue wavelengths enter a convex lens . Will they converge at the same point? Justify	(1)
5	A glass lens of refractive index 1.5 is placed in a through of liquid. What must be the refractive index of the liquid in order to make the lens disappear ?	(1) 2008
6	How does the fringe width of interference fringes change, when the whole apparatus of Young's experiment is kept in a liquid of refractive index 1.3 ?	(1) 2008
7	Show that the radius of curvature of a spherical mirror is twice the focal length of the spherical mirror	(2)
8	Define wavefront . Using Huygen's construction draw a figure showing the propagation of a plane wave refracting at a plane surface separating two media. Hence verify Snell's law of refraction.	(3) 2008
9	Mention the advantages of total reflecting prisms over lenses in optical instruments?	(2)
10	Mention the advantages of total reflecting prisms over plane mirrors in optical instruments?	(1)

11 For a ray of light travelling from a denser medium of refractive index n1 to a rarer medium of refractive index n_2 , prove that $n_2/n_1 = \sin i_c$, where i_c is the critical angle of incidence for the media. 5

2008

Explain with the help of a diagram, how the above principle is used for transmission of video signals using optical fibres.

12 What is plane polarised light? Two polaroids are placed at 90° to each other and the transmitted intensity is zero. What happens when one more polaroid is placed between these two, bisecting the angle between them ? How will the intensity of transmitted light vary on further rotating the third polaroid? (2)

If a light beam shows no intensity variation when transmitted through a polaroid which is rotated through 90°, does it mean that the light is un polarised ? Explain briefly.

13 What type of wavefront will emerge from a (i) point source, and (ii) distant light source? (1)2009

14 (a) The bluish colour predominates in clear sky. (2)

(b) Violet colour is seen at the bottom of the spectrum when white light is dispersed by a prism. State reason to explain these observations 2010

15 State Huygen's principle. Show, with the help of a suitable diagram, how this principle is used to obtain the diffraction pattern by a single slit. (5) (2010)

Draw a plot of intensity distribution and explain clearly why the secondary maxima become weaker with increasing order (n) of the secondary maxima.

16 The radii of curvature of the faces of a double convex lens are 10 cm and 15 cm. If focal length of the lens is 12 cm, find the refractive index of the material of the lens. (2)2010

17 (2) FAQ

You are given following three lenses. Which two lenses will you use as an eyepiece and as an objective to construct an astronomical telescope?

Lenses	Power (P)	Aperture (A)
L_1	3 D	8 cm
L_2	6 D	1 cm
L_3	10 D	1 cm

18 With the help of a suitable ray diagram, derive the mirror formula for a concave mirror. (3)2009

19 a) (i) Draw a labelled ray diagram to show the formation of image in an astronomical telescope for a distant object. (5) 2009

(ii) Write three distinct advantages of a reflecting type telescope over a refracting type telescope.

(b) A convex lens of focal length 10 cm is placed coaxially 5 cm away form a concave lens

of focal length 10 cm. If an object is placed 30 cm in front of the convex lens, find the position of the final image formed by the combined system.

20 In Young's double slit experiment, monochromatic light of wavelength 630 nm illuminates the pair of slits and produces an interference pattern in which two consecutive bright fringes are separated by 8 . 1 mm. Another source of monochromatic light produces the interference pattern in which the two consecutive bright fringes are separated by 7 . 2 mm. Find the wavelength of light from the second source. (3) 2009
What is the effect on the interference fringes if the monochromatic source is replaced by a source of white light?

21 Define the term 'linearly polarised light.' (2) 2009
When does the intensity of transmitted light become maximum, when a polaroid sheet is rotated between two crossed polaroids?

22 How would the angular separation of interference fringes in Young's double slit experiment change when the distance between the slits and screen is doubled? (1) 2009

23 Define refractive index of a transparent medium. (2)
A ray of light passes through a triangular prism. Plot a graph showing the variation of the angle of deviation with the angle of incidence. (2009)

24 Out of blue and red light which is deviated more by a prism? Give reason. (1) 2010

25 How does an unpolarised light get polarised when passed through polaroid? (5) 2010
Two polaroids are set in crossed positions. A third polaroid is placed between the two making an angle θ with the pass axis of the first polaroid. Write the expression of the intensity of light
transmitted from the second polaroid. In what orientations will the transmitted intensity be (i) minimum and (ii) maximum?

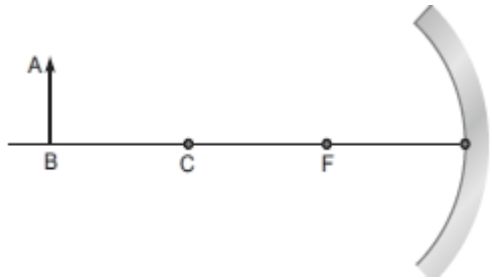
26 (a) Draw a ray diagram to show refraction of a ray of monochromatic light passing through a glass prism. (5) 2011
Deduce the expression for the refractive index of glass in terms of angle of prism and angle of minimum deviation.
(b) Explain briefly how the phenomenon of total internal reflection is used in fibre optics.

27 (a) Obtain lens makers formula using the expression (5) 2011

$$\frac{n_2}{v} - \frac{n_1}{u} = \frac{(n_2 - n_1)}{R}$$

Here the ray of light propagating from a rarer medium of refractive index (n_1) to a denser medium of refractive index (n_2), is incident on the convex side of spherical refracting surface of radius of curvature R.
(b) Draw a ray diagram to show the image formation by a concave mirror when the object is kept between its focus and the pole. Using this diagram, derive the magnification formula for the image formed.

28 An object AB is kept in front of a concave mirror as shown in the figure. (3) 2012

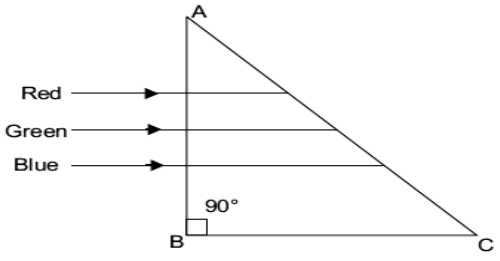


(i) Complete the ray diagram showing the image formation of the object.
(ii) How will the position and intensity of the image be affected if the lower half of the mirror's reflecting surface is painted black?

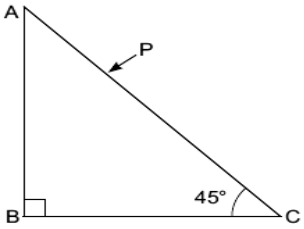
29 For the same value of angle incidence, the angles of refraction in three media A, B and C are 15°, 25° and 35° respectively. In which medium would the velocity of light be minimum? (1) 2012

30 In a single-slit diffraction experiment, the width of the slit is made double the original width. How does this affect the size and intensity of the central diffraction band? (3) 2013
In what way is diffraction from each slit related to the interference pattern in a double slit experiment?

31 In the figure given below, light rays of blue, green, red wavelengths are incident on an isosceles right-angled prism. Explain with reason, which ray of light will be transmitted through the face AC. The refractive index of the prism for red, green, blue light are 1.39, 1.424, 1. 476 respectively.



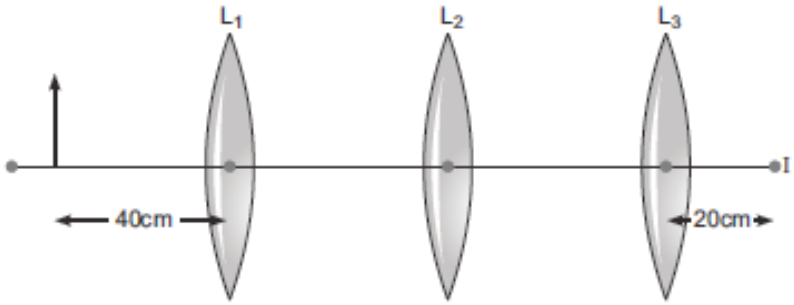
32 Trace the path of ray (P) of light passing through the glass prism as shown in the figure. The prism is made of glass with critical angle ic= 40°.



Section B Numerical problems

1 A biconvex lens has a focal length2/3 times the radius of curvature of either surface. Calculate the refractive index of lens material. 2010

2	The radii of curvature of the faces of a double convex lens are 10 cm and 15 cm. If focal length of the lens is 12 cm, find the refractive index of the material of the lens.	2010
3	A ray passes through an equilateral prism such that the angle of incidence is equal to the angle of emergence and the later is equal to 3/4 of the angle of prism. Find the angle of deviation	2008
4	Light of wavelength 5000 Å falls on a plane reflecting surface. Calculate the wavelength and frequency of reflected light. For what angle of incidence, the reflected ray is normal to the incident ray?	(2)
5	If the refractive index of diamond be 2.5 and glass 1.5, then how faster does light travel in glass than in diamond?	(2)
6	What is the focal length of a thin lens if the lens is in contact with 2.0 dioptre lens to form a combination lens which has a focal length of − 80 cm?	(2)
7	A needle of size 5 cm is placed 45 cm from a lens produced an image on a screen placed 90 cm away from the lens. Identify the type of the lens and calculate its focal length and size of the image.	(2)
8	The radii of curvature of two surfaces of a double convex lens are 10 cm each. Calculate its focal length and power of the lens in air and liquid. Refractive indices of glass and liquid are 1.5 and 1.8 respectively.	(3)
9	At what distance from a convex mirror of focal length 2.5 m should a boy stand, so that his image has a height equal to half the original height?	(2)
10	Find the radius of curvature of the convex surface of a plano-convex lens, whose focal length is 0.3 m and the refractive index of the material of the lens is 1.5.	(2) 2010
11	You are given three lenses L1, L2 and L3 each of focal length 20 cm. An object is kept at 40 cm in front of L1, as shown. The final real image is formed at the focus ‘I’ of L3. Find the separations between L1, L2 and L3.	2012



12 A beam of light consisting of two wavelengths, 800 nm and 600 nm is used to obtain the interference fringes in a Young's double slit experiment on a screen placed 1.4 m away. If the two slits are separated by 0.28 mm, calculate the least distance from the central bright maximum where the bright fringes of the two wavelengths coincide. (2)2012

13 An illuminated object and a screen are placed 90 cm apart. Determine the focal length and nature of the lens required to produce a clear image on the screen, twice the size of the object. An illuminated object and a screen are placed 90 cm apart. Determine the focal length and nature (1) 2010

14 A small telescope has an objective lens of focal length 144cm and an eyepiece of focal length 6.0cm. What is the magnifying power of the telescope? What is the separation between the objective and the eyepiece? 2

15 An object of size 3.0cm is placed 14cm in front of a concave lens of focal length 21cm. Describe the image produced by the lens. What happens if the object is moved further away from the lens? 2

16 A small bulb is placed at the bottom of a tank containing water to a depth of 80cm. What is the area of the surface of water through which light from the bulb can emerge out? Refractive index of water is 1.33. (Consider the bulb to be a point source) (3)

17 Two thin lenses of power +6 D and – 2 D are in contact. What is the focal length of the combination? (2) 2010

18 Two polaroids 'A' and 'B' are kept in crossed position. How should a third polaroid 'C' be placed between them so that the intensity of polarised light transmitted by polaroid B reduces to 1/8th of the intensity of unpolarised light incident on A? (2) 2012

19 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. (2) 2013