PHYSICS

BOOKS - CHETANA PHYSICS (MARATHI ENGLISH)

OPTICS

Exercise

1. What is light?

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2. What are the three categories, into which phenomena of light can be split?

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3. What is nature of light? Wave optics and particle nature of light are used to explain which phenomena of light respectively?

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4. Which phenomena can be satisfactorily explained using ray optics? State the assumptions on which ray optics is based.

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5. What is Ray optics or geometrical optics?

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6. State the laws of reflection.

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7. State the Laws of Refraction.

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8. Thickness of the glass of a spectacle is 2mm and refractive index of glass is1.5.Calculate the time taken by light to cross this thickness

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9. What are the Cartesian sign convention?

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10. A monochromatic ray of light strike the water $(n = 4/3)$ surface in a cylindrical vessel at angle of incidence 53°. Depth of water is 36 cm. After striking the water surface, how long will the light take to reach the bottom of the vessel?[Angles of the most popular Pythagorean triangle of sidesin the ratio $3:4:5$ are nearly $37^\circ, 53^\circ$ and 90°]

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11. Explain Reflection from a plane surface?

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12. A small object is kept symmetrically between 2 plane mirrors inclined at 38°. The angle is now gradually increased to 41°, the object being symmetrical, all the time.

Determine the no of images visible using the process.

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13. A rectangular sheet of length 30 cm and breadth 3 cm is kept on the principal axis midway off & 2f of a concave mirror of focal length 30 cm. Draw the image formed by the mirror on the same diagram, as far as possible on scale.

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14. Explain Reflection from curved mirrors.

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15. What is the relation between f, u, and v.

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16. What isfocal power of a spherical mirror or a lens? What may be the reason for using

$P = \frac{1}{f}$ as its expression ?

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17. Explain Lateral Magnification

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18. At which positions of the objects do spherical mirrors produce

(i) diminished image,

(ii) magnified image ?

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19. State the restrictions for having images produced by spherical mirrors to be appreciably clear.

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20. A thin pencil of length 20 cms is kept along the principal axis of a concave mirror of curvature 30 cm. Nearest end of the pencil is

20 cm from the pole of the mirror. What will be the size of the image of the pencil?

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21. What are defects or aberration of images?

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22. What is spherical aberration?

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23. Estimate the number of images produced, if a tiny object, is kept in between 2 plane mirrors inclined at $35^\circ, 36^\circ, 40^\circ$ and 45°.

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24. A car uses a convex mirror of curvature 1.2 m as its rear-view mirror. A minimum of cross section $2.2m \times 2.2m \times 6.6m$ away from the mirror. Estimate the image size.

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25. What is refraction?

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26. What is absolute refractive index?

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27. What is relative refractive index?

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28. Explain refractive index using water.

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29. Define absolute refractive index and relative refractive index. Explain in brief with an illustration for each.

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30. Explain refractive index using a plane glass slab.

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31. A crane flying 6 m above a still clear water lake sees a fish under water. For the crane the fish appears 6 cm below the water surface. How much deep should the crane immerse its beak to pick that fish?

For the fish, how much above the water

surface does the crane appear?

R.I. of water $=\frac{4}{3}$

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32. A glass slab of thickness 2.5 cm having refractive index $5/3$ is kept on an ink spot. A transparent beaker of very thin bottom containing water of R.I. $4/3$ upto 8 cm is kept on the glass block.

Calculate the apparent depth of the ink spot, when seen from outside air.

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33. Explain Total internal reflection

OR

Under what conditionsistotal internal reflection possible? Explain it with a suitable example.

Define critical angle of incidence and obtain an expression for it.

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34. Name some applications based on Total Internal Reflection.

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35. Write a note on optical fibre with necessary. Diagram essential. State its Advantages.

OR

Describe construction and working of an optical fibre. What are the advantages of

optical fibre communicationover electronic communication?

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36. Why is a prism binocular preferred over traditional binocular? Describe it in brief.

OR

Write a note on prism binoculars.

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37. Write a note on periscope.

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38. There is a tiny LED bulb, at the centre of the bottom of a cylindrical vessel of diameter 6 cm. Height of the vessel is 4 cm

The beaker is filled completely with an optically dense liquid. The bulb is visible from any inclined position but just visible, if seen

along the edge of the beaker. Determine the reflective index of the liquid.

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39. What are Lenses? Draw Diagrams for different types of lenses.

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40. Derive an expression for refraction at a single spherical surface

OR

A spherical surface separates two transparent media. Derive an expression that relates object and image distances with the radius of curvature for a point object. Clearly state the assumptions, if any.

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41. A glass paper weight (n = 1.5) of radius 3 cm has a tiny air bubble trapped inside it. Closest distance of the bubble from the surface is 2

cm. Where will it appear, when seen from the other end from where it is the farthest?

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42. Derive the Lens Makers equation

OR

Derive lens makers' equation. Why is it called so? Under which conditions focal length f and radii of curvature R are numerically equal for a lens?

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43. Starting from lensmakers equation explain how it gets modified in case of

(a) doubly convex symmetric lens.

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44. Starting from lensmakers equation explain how it gets modified in case of

(b) doubly concave symmetric lens.

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45. Starting from lensmakers equation explain how it gets modified in case of

(c) piano convex lens.

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46. A dense glass double convex lens (n = 2) designed to reduce spherical aberration has $|R_1| : |R_2| = 1:5$ if a point object is kept 15 cms from this lens, it produces its real image at 7.5 cm. Determine R_1 and R_2.

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47. A convex lens held some distance above a 6 cm long pencil produces its image of same size. One shifting the lens by a distance equal to its focal length, it again produces an image of the same size as earlier. Determine the image size.

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48. A point object is kept 10 cm away from one of the surfaces of a thick double convex lens of refractive index 1.5 and radii of curvature 10 cm and 8 cm. Central thickness of the lens is 2 cm. Determine location of the final image considering paraxial rays only

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49. What are different types of dispersion of light?

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50. Explain angular dispersion at a single surface.

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51. Define dispersion of light.

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52. Which colour deviates maximum and which colour deviates minimum on dispersion? Why?

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53. Explain lateral dispersion due to a plane parallel slab.

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54. A fine beam of white light is incident upon the longer side of a plane parallel glass slab of breadth 5 cm at an angle of incidence 60°. Calculate lateral deviation of red and violet rays and lateral dispersion between them, as they emerge from the opposite side. Refractive indices of glass for red and violet are 1.51 and 1.53 resp.

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55. Show that

(i) $A + \delta = i + e$

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56. Derive the prism formula. Show that

(i) $n = \dfrac{\sin\left(\dfrac{A+\delta_m}{2}\right)}{\sin\left(\dfrac{A}{2}\right)}$

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57. For a glass prism (n = 1.5), having refracting angle 60°. Determine the range of the angle of incidence, for which emergent ray is possible from the opposite surface and the corresponding angles of emergence.

Also calculate the angle of incidence for which i = e.

How much is the corresponding angle of minimum deviation?

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58. Derive an expression for thin prism.

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59. Define angular dispersion for a prism. Obtain its expression for a thin prism.Relate it with the refractive indices of the material of the prism for corresponding colours.

OR

Derive an expression for angular dispersion and mean deviation.

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60. Explain and define dispersive power of a transparent material. Obtain its expressions in terms of angles of deviation and refractive indices.

OR

Define Dispersive Power. Derive an expression for the same.

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61. For a dense flint glass prism of refracting angle is 10°, obtain angular deviation for extreme colours and dispersive power for dense flint glass. $(n_{red} = 1.712, n_{violet} = 1.792)$

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62. A manochromatic ray of light is incident at 37° on an equilateral prism of refractive index $3/2$. Determine the angle of energence and

the angle of deviation. It the angle of the prism is adjustable, what should be its value for the emergent ray, to be just possible, for the same angle of incidence.

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63. From the given data set, determine angular dispersion by the prism and dispersive power of the material for extreme colours. $n_R = 1.62, n_v = 1.66, s_R = 3.1^\circ$

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64. Explain 'mirage' as an illustration of refraction

OR

What is a mirage?

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65. What is a rainbow?

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66. What are the condition necessary for the formation of a rainbow?

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67. What is the optical phenomena involved in a rainbow?

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68. Write a note on Primary Rainbow.

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69. Write a note on Secondary Rainbow

OR

Explain the formation of a secondary rainbow. For which angular range with the horizontal is it visible.

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70. Explain Chromatic aberration with proper diagram.

OR

What is chromatic aberration?

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71. What is achromatism? Derive a condition to achieve achromatism for a lens combination. State the conditions for it to be converging

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72. After cataract operation, a person is recommended with concave - convex, spectacles of curvatures 10 cms and 50 cm. Crown glass of refractive indices (1.51) for red and (1.53) for violet colours is used for this. Calculate the lateral chromatic aberration occurring due to these glasses.

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73. What is spherical aberration?

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74. State the methods to reduce / eliminate spherical aberration of lenses.

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75. Refractive index of a flint glass varier from 1.60 to 1.66 for visible range. Radii of curvature of a thin convex lens are 10 cm and 15 cm. Calculate the chromatic aberration between extreme colours.

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76. Derive an expression for Magnifying power of a simple microscope.

Discuss cases for maximum and minimum magnifying power.

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77. Define and describe magnifying power of an optical instrument. How does it differ from

Linear Magnification.

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78. What are the limitation for increasing the magnifying power of a simple microscope?

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79. A magnifying glass of focal length 10 cms is used to read letters of thickness 0.5 mm held 8 cm away from the lens. Calculate the image

size. How big will the letters appear?

Can you read the lettersif held 5 cms away from the lens? If yes what size would they appear. If No, why not.

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80. Derive an expression for Magnifying power of a compound microscope using two convex lens.

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