PHYSICS

BOOKS - JEEVITH PUBLICATIONS PHYSICS (KANNADA ENGLISH)

RAY OPTICS AND OPTICAL INSTRUMENTS

One Mark Questions With Answers

1. Which, among frequency, wave length and velocity of light, will remain constant as light enters from air into glass ?

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2. As light is transmitted through a parallel sided glass slab, what relation holds good between the angle of incidence and angle of emergence?

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3. How does lateral shift depend on thickness of the medium?

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4. What is lateral refraction of light ?

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5. Can lateral shift be zero?

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6. When will lateral shift be maximum or equal to the thickness of the medium?

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7. What is lateral shift?

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8. What is normal shift of light?

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9. What is normal shift?

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10. Does normal shift produced by a medium depend on the position of an object below the surface?

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11. Define critical angle for a pair of media.

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12. What is light ?

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13. What does optics deal with ?

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14. What is an optical medium?

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15. Define a ray of light?

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16. Is glass an isotropic medium?

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17. What is an isotropic medium?

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18. Is quartz crystal an isotropic medium?

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19. Define anisotropic medium.

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20. A ray of light in a medium (1) bends towards the normal as it passes through a medium (2). Is medium (1) a rarer or denser than (2)?

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21. A ray of light in a medium (1) bends away from the normal as it passes out through a

medium (2). Which of the two is a denser medium?

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22. A ray of light in the denser medium grazes the interface after refraction through it. What is the angle of incidence in the denser medium called?

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23. The velocity of light decreases while traveling from medium (1) into medium (2). Which of the two is a rarer medium ?

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24. Define refractive index between a pair of media in terms of velocities of light in them.

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25. What is real depth?

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26. What is apparent depth?

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27. An object in air is viewed through a denser medium. Does the object appear closer to the surface?

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28. Why is that the outside world appears limited for any marine creatures?

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29. A ray of light grazes the top surface of a glass slab. Can it be traced along the opposite bottom surface of the glass slab?

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30. What will be the lateral shift for a normal incidence of light on a glass slab?

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31. Explain why there is an early sunrise or a late sunset.

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32. Will there be an early sunrise or sunset on the surface of the moon?

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33. Out of two cables, one of copper and the other of optical fibre of same thickness, one is to the selected for transmission of larger bandwidth of signals. Which one of the two do you prefer?

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34. What is a prism?

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35. What is meant by base of a prism?

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36. Under symmetric refraction of light through a prism, how does the refracted ray

appear with respect to the base of the prism?

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37. Define angle of minimum deviation.

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38. How is angle of incidence related to the angle of minimum deviation?

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39. What is dispersion of light?

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40. Define the term angle of deviation.

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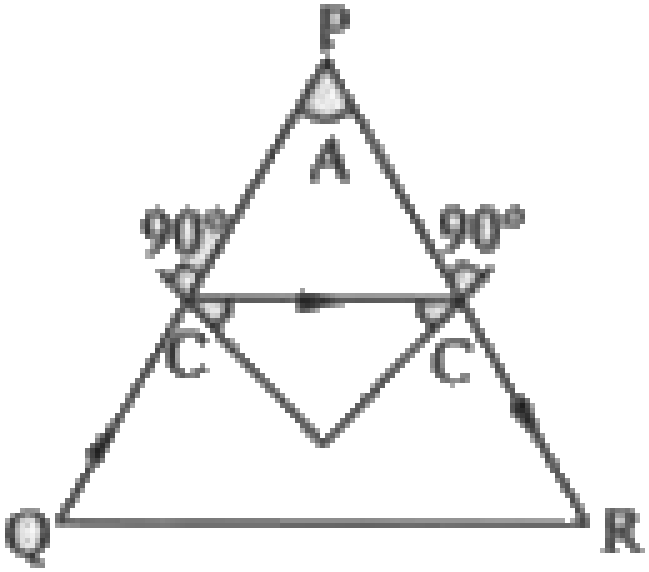
41. Given the limiting angle of a prism in which grazing incidence results in grazing emergence of a ray of light then how are 'A'

and 'C' related?



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42. What is a spectrum?

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43. What is the function of the achromatic lens used in the spectrometer?

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44. What is the thin prism?

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45. In what way a refracting prism is different from a reflecting prism?

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46. What kind of prisms are used in the binoculars for turning light at right angles?

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47. Is dispersion in the prism due to a property of light?

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48. Can two prisms be arranged to get dispersion without deviation?

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49. Why refraction of light through lenses causes convergence or divergence?

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50. Why do we see violet light ray bending the most?

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51. Name the type of prisms that can be used in direct vision spectroscopes.

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52. Out of crown and flint glass prisms which has the larger refrangibility?

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53. For what purpose is a refracting prism used along with a spectrometer?

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54. What is the deviation produced by a thin prism of angle 8° and of R.I. 1.5?

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55. Is the expression $n = \frac{\sin\left(\frac{A+D}{2}\right)}{\sin(A/2)}$ true for all the positions of the prism?

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56. What is a spherical surface?

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57. What is an aperture?

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58. Define pole of a spherical refracting surface.

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59. Define object space.

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60. Define image space.

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61. Define radius of curvature of a spherical surface.

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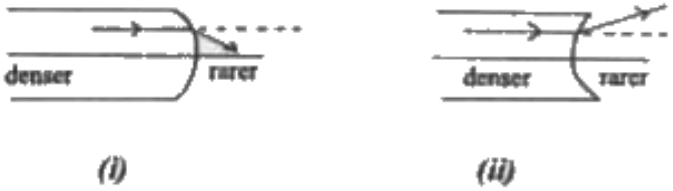
62. In which of the following spherical surfaces, the radius of curvature is taken as positive.



(i) (ii)

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63. In which of the following spherical surfaces the radius of curvature is taken as negative.

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64. On a spherical surface, a line is drawn normal to it. Where will it meet when extended to the principal axis?

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65. Define power of a refracting surface. (Define the power of a lens).

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66. What is the unit of measurement of refracting power of a spherical surface?

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67. A parallel beam of light after refraction through a lens, converges toward its principal focus. What kind of lens is it?

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68. A parallel beam of light after refraction appears to diverge from the principal focus. What kind of lens is it?

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69. What is the refracting power of a plane refracting surface?

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70. How is the power of lens related to its focal length ?

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71. Define 1 dioptre of power of a lens.

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72. Can power of a lens be negative?

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73. What kind of lens is an air bubble in water?

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74. A liquid of higher refractive index forms a bubble inside water. What kind of lens does it act like?

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75. What is meant by linear magnification?

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76. A plano concave lens is silvered at the plane surface. How does it behave?

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77. What is cladding?

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78. Does normal shift produced by a medium depend on the position of an object below the

surface?

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Two Marks Questions With Answers

1. State the laws of reflection of light.

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2. Define the terms of pole and centre of curvature of a spherical mirror.

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3. Define the terms of pole and centre of curvature of a spherical mirror.

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4. Define the terms of radius of curvature.

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5. Define the terms of principal axis of a mirror.

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6. Give the Cartesian sign convention for measuring distances in spherical mirrors and lenses.

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7. Identify the terms of paraxial rays .

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8. Identify the terms of marginal rays of light.

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9. Define the terms of principal focus F.

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10. Define the terms of focal plane of the mirror.

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11. Draw ray diagrams to show rays of light converging or appear diverging from a point due to reflection in a spherical mirror.

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12. Define focal length of a mirror and hence relate focal length and radius of curvature of a mirror.

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13. Why do thick lenses show more chromatic aberration than thin lenses?

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14. Explain why convex lenses converge incident beam of light whereas concave lenses diverge light.

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15. Draw a neat labelled diagram to show (i) primary rainbow and (ii) secondary rainbow.

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16. Explain why the colour of the sky is blue (Cyan).

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17. Define angular magnification.

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18. Draw a neat labelled diagram of Cassegrain reflecting telescope.

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19. Can plane and convex mirrors produce real images? Give an explanation to your answer.

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20. Answer the following questions:

(b) A virtual image, we always say, cannot be caught on a screen. Yet when we 'see' a virtual image, we are obviously bringing it on to the

'screen' (i.e., the retina) of our eye. Is there a contradiction?

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21. Write the formula for the lateral shift and explain the symbols used.

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22. Write the formula for the normal shift and explain the symbols used.

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23. Explain why there is an early sunrise or a late sunset.

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24. Give any two consequences of refraction of light.

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25. Write any two practical applications of optical fibres.

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26. What is an optical fibre? Name the principle on which it works.

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27. Distinguish between a pure and an impure spectrum.

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28. Define power of a refracting surface. (Define the power of a lens).

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29. Draw a neat diagram to show dispersion of light in a prism.

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30. Why vaccum is a non-dispersive medium?

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31. Can dispersive power of a prism be negative? Give reason for your answer.

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32. Is the dispersive power independent on the angle of the prism? Give reason.

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33. Draw a graph of angle of deviation versus the angle of incidence in a refracting prism.

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34. Define dispersive power of the material of a prism. How can it be measured?

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35. Draw a neat labeled diagram of a prism.

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36. A ray of light incident at 60° on a prism undergoes a deviation of 20°. If the angle of

the prism is 40, S.T. the emergent ray is normal to the second face of the prism.

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37. Draw a neat labeled diagram to obtain an inverted image in the case of a total reflecting prism.

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38. Draw a neat labeled diagram to show the turning of light rays through 90° in a total reflecting prism.

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39. Draw a neat labeled diagram to show the reflected rays turned through 180°

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40. Write the expression for R.I. of the material of the prism for symmetric refraction.

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41. Write the expression for the power of a lens in terms of powers of its refracting surfaces.

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42. Write the formula for the equivalent focal length of two thin lenses separated by a small distance and explain the symbols used.

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43. How can the power of the combination expressed, if two lenses are equibiconcave and separated by a distance?

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44. Two lenses having focal lengths +0.20 m and -0.30 m are separated by a distance of 0.15 m. Find the resultant power of the combination.

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45. An extended object is placed at the principal focus of a lens. Where will the final image be formed? Comment on the nature of the image.

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46. State Snell's law of refraction of light?

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47. Write Snell's law in general mathematical terms.

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48. Define the term angle of deviation.

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49. A riding glass though formed by spherical surfaces has zero power. Give reason.

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50. What advantages has optical fibre communication over cable communication?

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51. Draw a neat labelled diagram of a compound microscope and give the expression for its overall magnification.

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52. Give any three differences between a compound microscope and a telescope.

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53. Draw a neat labelled diagram of image formed in a refracting telescope. Give the expression for magnification of an object, for an image formed at infinity.

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54. Show that $n = \frac{1}{\sin C}$ where symbols have their usual notation.

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55. Mention the three factors affecting lateral shift.

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56. State the conditions for dispersion without deviation.

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57. Show that $m = \frac{f - v}{f}$ for a lens.

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58. Show that $m = \frac{f}{u + f}$ for a lens.

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59. On what factors does the focal length of a lens depend?

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Five Marks Questions With Answers

1. S.T f=$\frac{R}{2}$ in the case of a spherical mirror where symbols have their usual notations

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2. Draw a ray diagram to obtain the virtual image formation in (i) a concave mirror and (ii) a convex mirror.

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3. Derive mirror equation.

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4. Explain the phenomenon of total internal reflection.

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5. Write a short note on optical fibres.

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6. Derive referaction formula (for object in air and image in the denser medium) for refraction of light at a spherical surface

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7. Derive th lens maker's formula.

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8. Derive the expression for effective focal length of two thin lenses kept in contact.

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9. Express the combined power of two lenses, one of focal length $+f_1$ and of the other $-f_2$ in contact with each other.

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10. Show that $n = \frac{\sin\left(\frac{A+D}{2}\right)}{\sin\left(\frac{A}{2}\right)}$ where symbols have their usual notations.

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Numericals With Solutions

1. Show that lateral shift is equal to the thickness of the slab for grazing incidence.

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2. Refractive index of a prism of angle 8° is 1.55. Find the angle of deviation of a monochromatic light passing through it.

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3. A transparent cube of side 0.18 m has an air bubble in it. When viewed normally through one face the bubble appears to be at a distance of 0.08 m from that surface. When viewed normally through the opposite face,

the distance of the bubble appears to be 0.04 m. Find the actual distance of the air bubble from the first face and refractive index of the material of the cube.

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4. A ray of light is incident an angle of 50° on one face of a cube of side 0.10 m. If the refractive index of the material of the glass cube is 1.55 then calculate the amount of lateral shift produced by it.

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5. Show that area of circular patch of light on water as seen from a water medium is $A = \pi h^2 / \left(n^2 - 1\right)$ where symbols haves their usual meaning.

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6. Given that the angle of minimum deviation for a colour is $43^\circ 48'$ and its RI = 1.588, Calculate refracting angle of the prism.

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7. Given that the angle of the prism is 60° and its RI for a certain colour 1.645. Calculate the angle of minimum deviation.

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8. A ray of light is incident on a prism at an angle 50° and angle of prism is 60° and RI 1.5.

Calculate the angle of total deviation (for non symmetric refraction).

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9. An air bubble is situated at a distance of 0.08 m from the centre of a sphere of radius 0.12 m. When viewed from the nearest side it appears to be distance of 0.09 m from the centre. Find the refractive index of the material of the sphere. Where will the bubble

appear to be when viewed from the farther side?

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10. An equibiconvex lens of radius of curvature 0.20 and refractive index 1.5 immersed half inside water of RI $4/3$ and the rest outside in air. A parallel beam of light in air is incident on it. Find the final position of the image.

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11. A parallel beam of light strikes the first surface of a glass sphere of R.I 1.5 and radius of curvature 0.10 m. Find the position of the final image.

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12. An angular magnification of 30 X is desired using an object lens of focal length 1.25 cm and an eyepiece of focal length 5 cm. How will you set up the compound microscope?

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13. Two lenses of focal lengths 0.20 m and 0.30 m are kept in contact with each other. Calculate the resultant focal length of the combination. Also calculate the powers of the individual lenses and that of the equivalent lens.

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14. An equibiconvex lens has a focal length of 20 cm. A ball pin of length 5 cm is placed on one side of the lens, such that the mid point of the pin is at a distance of 30 cm from the centre of the lens. Calculate the size of the image of the pin and its magnification f = 20 cm l = 5 cm.

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15. A convex lens has a focal length of 0.1 m in air. Calculate its power. If the lens is completely dipped in CS_2 of refractive index 1.66, then what will be the change in power of the lens? Given R.I of the convex lens = 1.50.

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16. A plano - convex lens has a focal length of 0.25 m and is made of glass of refractive index 1.5. Find the radius of curvature of its curved

surface. If two such lenses are placed with their curved surfaces in contact then what will be the focal length of the combination? If the space between them is filled with a liquid of refractive index 1.7, what will be the focal length of the combination?

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17. A point object is placed at a distance of 12 cm on the axis of a convex lens of focal length 10 cm. On the other side of the lens, a convex

mirror is placed at a distance of 10 cm from the lens such that the image formed by the combination coincides with the object itself. What is the focal length of convex mirror ?

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18. Photographs of the ground are taken from an aircraft at an altitude of 2000 m by a camera with a lens of focal length 0.50m. The size of the film in the camera is $0.18m \times 0.18m$. What area of the ground can

be photographed by this camera in a single shot?

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19. The image of a small electric bulb fixed on the wall of a room is to be obtained on the opposite wall 3m away by means of a large convex lens. What is the maximum possible focal length of the lens required for the purpose?

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20. 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?

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21. (a) A giant refracting telescope at an observatory has an objective lens of focal length 15m. If an eyepiece of focal length 1.0cm

is used, what is the angular magnification of the telescope?

(b) If this telescope is used to view the moon, what is the diameter of the image of the moon formed by the objective lens? The diameter of the moon is $3.48 \times 10^6 m$, and the radius of lunar orbit is $3.8 \times 10^8 m$.

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22. A Cassegrain telescope uses two mirrors of radii of curvature 220 mm and 140 mm. The

distance b/w the two mirrors is 20 mm. Where will the final image of an object at infinity be?

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