



PHYSICS

BOOKS - MBD -HARYANA BOARD

OPTICS

Very Short Answer Type Questions

1. What is the focal length of common looking glass?



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2. A light of wavelength 6000 \AA , in air, enters, a medium with refractive index 1.5. Inside the medium, its frequency is _____ Hz and its wavelength is _____ \AA



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3. Light of wavelength 6000 \AA in air enters a medium of refractive index 1.5. What will be its wavelength in the medium ?



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4. How can you distinguish between a plane mirror, a concave mirror and convex mirror just by looking at them ?



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5. Name the phenomenon which justifies the transverse nature of em waves.



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6. The phenomenon of interference is shown by



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7. Write the conditions for total internal reflection.



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8. What is critical angle? Give one application of total internal reflection.



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9. A substance has critical angle of 45° for yellow light. What is its refractive index ?



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10. Determine refractive index of a substance if critical angle is 45° .



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11. What is a wavefront ? State its relation with ray of light.



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12. WAVEFRONT



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13. What are the essential conditions for two light waves to be coherent ?



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14. What do you understand by coherent sources ?



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15. What is the geometrical shape of wavefront emitted from a source in the form of narrow slit ?



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16. Which of the following condition of path difference represent destructive interference?



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17. State the condition for constructive interference.



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18. what should be the order of size of obstacle/aperture for diffraction of light ?



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19. What is the condition for first minimum in case of diffraction due to a single slit ?



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20. What is the phase difference between any two points on a wavefront ?



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21. A lens immersed in a transparent liquid becomes invisible. Under what condition does it happen ?



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22. What is the cause of refraction of light ?



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23. The velocity of light in air is $3 \times 10^8 \text{ms}^{-1}$ and that in water is $2.2 \times 10^8 \text{ms}^{-1}$. Find the polarising angle of incidence.



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24. When a wave undergoes reflection at a denser medium, what happens to its phase ?



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25. Out of speed, frequency and wavelength, name the parameter (s) which remain the same on refraction.



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26. State Brewster's Law

The value of Brewster angle for a transparent medium is different for light of different colours .

Give reason.





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27. Light can travel in vacuum whereas sound can not do so. Why?



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28. What is polarisation ?



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29. Which among X-rays, sound waves and radio waves can be polarized ?



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30. DIFFRACTION



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31. Write amplitude of resultant wave produced by the superposition of two waves

of the same frequency and amplitude a_1 and a_2 when phase difference between them π .



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32. The ratio of intensities of two waves is 9 :

25. What is the ratio of their amplitude ?



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33. Does the value of polarising angle i_p for a transparent medium depend upon the

wavelength of the light?



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34. Coloured spectrum is seen when we look through a muslin cloth. Why ?



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35. Define power of lens and give its relation with focal length.



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36. Which phenomenon leads us to the conclusion that light is transverse in nature ?



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37. Out of speed, frequency and wavelength, name the parameter (s) which remain the same on reflection.



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38. The phase difference between light waves from two slits of Young's experiment is π radian. Will the central fringe be bright or dark ?



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39. If a wave undergoes refraction, what happens to its phase ?



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40. The refractive index of glass is 1.5 for light waves of $\lambda = 6000\text{\AA}$ in vacuum. Calculate their wave length in glass.



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41. Which phenomena establish the wave nature of light ?



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42. Width of two slits in an interference arrangement are in the ratio 9 : 1. What is the ratio of amplitude and intensities of light wave from them?



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43. Two thin lenses of power + 5D and - 3D are in contact. What is the focal length of the combination ?



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44. A small telescope has an objective lens of focal length 144cm and an eye-piece of focal length 6.0cm . What is the magnifying power of the telescope ? What is the separation between the objective and the eye-piece ?



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45. State the conditions to get steady interference pattern.



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46. What is the shape of the wavefront in each of the following cases ?

(a) light diverging from point source.

(b) light emerging out of a convex lens when a point source is placed at its focus.

(c) the portion of the wavefront of light from a distant star intercepted by earth.



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47. Define absolute refractive index.



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48. What is the significance of modulation index?



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49. How do the frequency and wavelength of light change when it goes from a rarer to a

denser medium ?



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50. Define focal length of a lens and calculate focal length of the lens having radius of curvature 30 cm.



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51. What is the shape of wavefront for the light diverging from a point source ?



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52. Name the optoelectronic device used to detect optical signals.



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53. What is meant by dispersion of light ?



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Short Answer Type Questions

1. Why are the 'danger signal' lights red in colour ?



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2. The blue colour of sky is due to :



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3. Why does the sky appear blue on a clear day ?



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4. Show by drawing ray diagrams how a totally reflecting glass prism can be used to deviate a ray of light through (i) 90° (ii) 180° and invert it.



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5. What are optical fibers ? Give three applications of these fibres.



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6. A biconvex lens with both faces of the same radius of curvature is to be manufactured from a glass of refractive index 1.55. What should be the radius of curvature for the focal length of the lens to be 20 cm ?



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7. An astronomical telescope of magnifying power 10 consists of two thin lenses 55 cm apart. Calculate the focal length of the lenses.



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8. Why the sun glasses reduce the glare of intense light?



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9. What is interference of light waves ? State two essential conditions to observe it.

In Young's double slit experiment, light of wavelength 6000\AA is used to get an interference pattern on a screen. The fringe width changes by 1.5 mm when the screen is brought towards the double slit by 50 cm. Find the distance between the two slits.



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10. What is polarization by reflection ? Deduce Brewster'S Law.



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11. Find the critical angle for a ray of light going from paraffin oil to air. Given that the refractive index of paraffin oil with respect to air is 1.44.



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12. What is total internal reflection ? Under what conditions it takes place ?



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13. TOTAL INTERNAL REFLECTION



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14. Diffraction is common in sound but not comon in light waves. Why ?





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15. Calculate fringe width in Young's experiment, if screen is placed at 1.5 m distance from the slits separated by 0.5 mm and wavelength of light used is 500 nm.



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16. What is polarisation of light ? What is its most important significance ?



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17. Oil floating on water looks cloured due to interference of light. What should be the approximate thickness of the film for such effects to be visible ?



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18. Define critical angle for a given pair of medium and find the relation between critical angle and refractive index.



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19. Define critical angle and give its relation with refractive index.



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20. Define critical angle for total internal reflection and write its relation with refractive index.



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21. Explain the phenomenon of Dispersion. Red and blue light rays are incident on a given prism. Explain which will have greater value of minimum deviation.



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22. What is dispersion of light ?



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23. In an optical fibre



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24. Why sun appears reddish at sunset and sunrise.



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25. Draw a labelled diagram showing the formation of image of a distant object using

an astronomical telescope in the normal adjustment.



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26. Two coherent sources whose intensity ratio is 81:1 produce interference fringes. Calculate the ratio of intensity of maxima and minima in the fringe system.



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27. What is meant by plane polarised light?

What type of waves show the property of polarisation ? Briefly discuss polarisation by reflection.



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28. What is polarization of light ? Explain the polarization by reflection.



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29. What is meant by plane polarised light ?

Can sound waves be polarised ? Briefly discuss polarisation by scattering.



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30. What is a polaroid ? How is plane polarised light obtained with its help ? Mention two devices which use polarised light.



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31. State and explain Brewster's law of polarization.



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32. What is Brewster's law ? What will be the refractive index of a transparent medium with a polarising angle of 60° ?



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33. Describe an experiment to demonstrate transverse nature of light.



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34. How can you detect a polarized light?



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35. State Huygens' wave principle and describe the formation of primary wavefront and

secondary wavelets geometrically.



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36. Huygen's principle states that



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37. Using Huygen's construction, explain reflection of a plane wave by a plane surface.



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38. State Huygens' principle and prove the laws of reflection on the basis of wave theory.



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39. Huygens wave theory is used



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40. What do you understand by fringe width ?

Derive an expression for fringe width in the

interference pattern.



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41. What is the combined focal length of a convex lens of focal length 30 cm in contact with a concave lens of focal length 20 cm ?
What is the nature of the combined lens ?



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42. Two thin lenses of focal lengths f_1 and f_2 are in contact. The focal length of this combination is



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43. A glass slab is placed over a page in which letters are printed in different colours. Will the image of all the letters lie in the same plane ?



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44. The light of wavelength 6000\AA falls normally on a slit of width 2 mm . Calculate the linear width of central maxima on a screen kept 4 m away from the slit.



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45. A converging lens has a focal length of 20 cm in air. It is made of a material of refractive index 1.6 . If it is immersed in a liquid of refractive index 1.3 , what will be its new focal length ?



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46. Brilliance of diamond is due to



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Long Answer Type Questions

1. The refractive index of a medium 'x' with respect to a medium 'y' is $\frac{2}{3}$ and the refractive index of medium 'y' with respect to medium 'z'

is $\frac{4}{3}$. Find the refractive index of medium 'z' with respect to medium 'x'. If the speed of light in medium 'x' is $3 \times 10^8 \text{ m s}^{-1}$, Calculate the speed of light in medium 'y'.



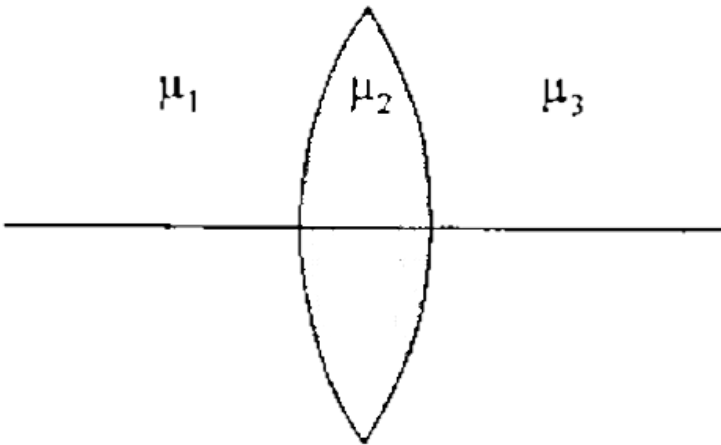
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2. Prove that $\frac{-\mu_1}{u} + \frac{\mu_2}{v} = \frac{\mu_2 - \mu_1}{R}$ when refraction occurs from rarer to denser medium at a concave spherical refracting surface.



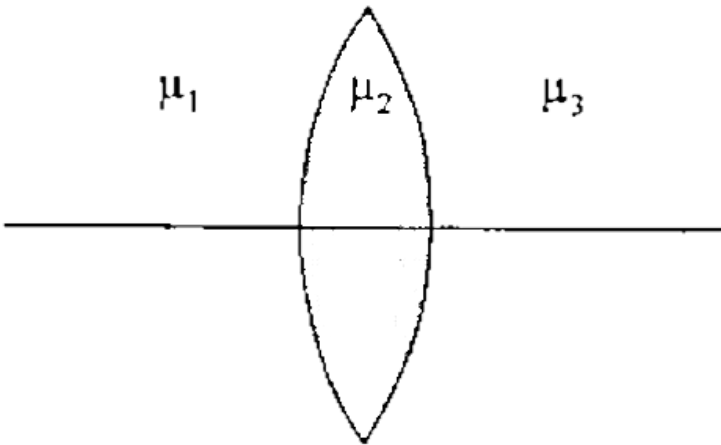
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3. An equiconvex lens of refractive index μ_2 is placed such that the refractive index of the surrounding media is as shown :



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4. An equiconvex lens of refractive index μ_2 is placed such that the refractive index of the surrounding media is as shown :



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5. Derive lens maker's formula for a thin biconvex lens.



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6. Draw a ray diagram to show the formation of the image of an object placed between the optical centre and focus of a convex lens. Deduce the relationship between object distance, image distance and focal length of lens.





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7. State and prove prism formula.



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8. Discuss the phenomenon of refraction through a prism. Prove that $\delta = (\mu - 1)A$ where the symbols have their usual meaning.



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9. Draw the ray diagram for simple microscope.

Write expression for its magnifying power.



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10. Draw a labelled diagram of compound microscope. Derive expression for its magnifying power.



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11. The magnifying power of a compound microscope is



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12. Draw a labelled ray diagram showing the image formation in an astronomical telescope. Define its magnifying power and write expression for it.



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13. Draw ray diagram for an astronomical telescope. Define magnification and write its relation.



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14. Derive formula for fringe width using Young's double slit method for interference of light. What will happen if the distance between the two slits becomes nearly zero ?



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15. Define fringe width in interference and derive its expression.



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16. The fringe width in Young's double slit experiment increases when



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17. Explain two methods of Polarisation.



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18. MALUS LAW



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Objective Type Questions

1. The focal length of a thin lens in vacuum is f . If the material of the lens has $\mu = 3/2$, its

focal length when immersed in water of refractive index $\frac{4}{3}$ will be.

A. f

B. $\frac{4f}{3}$

C. $2f$

D. $4f$

Answer: D



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2. Blue colour of sky is due to phenomenon of :

A. Reflection

B. Refraction

C. Scattering

D. Dispersion.

Answer: C



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3. The power of a lens of focal length 0.5 m is :

A. + 5 D

B. + 2D

C. - 5D

D. + 1D

Answer: B



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4. Two lens of power - 12D and + 7D are in contact with each other, the focal length of combination is :

A. 10 cm

B. - 20 cm

C. - 10 cm

D. 20 cm

Answer: B



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5. Optical fibre are based on

A. Reflection

B. Total internal reflection

C. Refraction

D. None.

Answer: B



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6. What is f in mirror formula $\frac{1}{u} + \frac{1}{v} = \frac{1}{f}$?

A. distance of object

B. distance of image

C. focal length

D. None.

Answer: C



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7. For a normal eye, the least distance of distinct vision is

A. 25 cm

B. 25 m

C. 2.5 m

D. 1 m.

Answer: A



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8. On which principle optical fibre is based ?

A. Reflection

B. Diffraction

C. Total internal reflection

D. Refraction.

Answer: C



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9. The ratio of intensities of two waves are given by 4:1. The ratio of the amplitudes of the two waves is

A. 2 : 1

B. 1 : 2

C. 4 : 1

D. 1 : 4

Answer: A



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10. For the sustained interference of light, the necessary condition is that the two sources should

A. have constant phase difference

B. be narrow

C. be close to each other

D. have the same amplitude.

Answer: A



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11. If two waves of intensity I and $4I$ are superimpose, then the minimum and maximum intensities will be

A. $5I$ and $3I$

B. $9I$ and I

C. $9I$ and $3I$

D. $5I$ and I .

Answer: B



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12. RAINBOW

- A. Reflection
- B. Refraction
- C. Dispersion
- D. All of these.

Answer: D



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13. Which of the following represents correct mirror formula ?

A. $\frac{1}{f} = \frac{1}{v} - \frac{1}{u}$

B. $f = v + u$

C. $\frac{1}{f} = v + u$

D. $\frac{1}{f} = \frac{1}{v} + \frac{1}{u}$

Answer: D



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14. What is the unit of focal length ?

A. None

B. Meter

C. Dioptre

D. Degree

Answer: B



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15. The focal length of a lens of power + 4D is :

A. - 25 cm

B. + 25 m

C. - 4 cm

D. + 4 m

Answer: B



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16. Derive lens maker's formula for a thin convex lens.

$$\text{A. } \frac{1}{f} = \left(\frac{1}{R_1} - \frac{1}{R_2} \right) \left(\frac{n_1}{n_1 - n_2} \right)$$

$$\text{B. } \frac{1}{f} = \frac{1}{u} - \frac{1}{v}$$

$$\text{C. } \frac{1}{f} = \frac{1}{u} + \frac{1}{v}$$

$$\text{D. } \frac{1}{f} = \frac{n_2 - n_1}{n_1} \left[\frac{1}{R_1} - \frac{1}{R_2} \right]$$

Answer: D



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17. The velocity of light in vacuum can be changed by changing

A. Frequency

B. Amplitude

C. Wavelength

D. None of these

Answer: D



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18. The focal length of a lens of power $-2D$ is :

A. $+50\text{ cm}$

B. - 50 cm

C. + 2 cm

D. - 2 cm.

Answer: B



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19. Polarisation can be produced by

A. Dispersion

B. Scattering

C. Interference

D. Diffraction

Answer: B



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20. The refractive index of water is 1.33. What will be the speed of light in water

A. $3 \times 10^8 \text{ms}^{-1}$

B. $2.26 \times 10^8 \text{ms}^{-1}$

C. $4 \times 10^8 \text{ms}^{-1}$

D. $1.33 \times 10^8 \text{ms}^{-1}$

Answer: B



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21. Mirage' is a phenomenon due to

A. Reflection

B. Refraction

C. Total internal reflection

D. Diffraction.

Answer: C



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22. In Young's double slit experiment, the ratio of maximum and minimum intensities in the fringe system is 9: 1 the ratio of amplitudes of coherent sources is

A. 9 : 1

B. 3 : 1

C. 2 : 1

D. 1 : 1

Answer: C



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23. Pencil in a beaker filled with water seems broken due to :

A. Reflection

B. Diffraction

C. Refraction

D. None.

Answer: C



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24. One diopetre is the power of a lens of focal length

A. Focal length

B. Power of lens

C. Refractive index

D. None.

Answer: B



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25. The splitting up of white light into seven colours on passing through a glass prism is called :

A. Reflection

B. Refraction

C. Dispersion

D. Diffraction.

Answer: C



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26. The phenomenon which proves the particle nature of electromagnetic wave is

A. Interference

B. Diffraction

C. Polarization

D. None of the above.

Answer: D



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