

## PHYSICS

### BOOKS - MHTCET PREVIOUS YEAR PAPERS AND PRACTICE PAPERS

### REFRACTION OF LIGHT

#### Example

1. When a glass slab is placed on a cross made on a sheet, the cross appears to be raised by

1cm. The thickness of the glass is 3cm. The critical angle for glass is

A.  $\sin^{-1}(0.33)$

B.  $\sin^{-1}(0.5)$

C.  $\sin^{-1}(0.67)$

D.  $\sin^{-1}\left(\frac{\sqrt{3}}{2}\right)$

**Answer: C**



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## Exercise 1

1. A light wave has a frequency of  $4 \times 10^{14} \text{ Hz}$  and a wavelength of  $5 \times 10^{-7}$  meters in a medium. The refractive index of the medium is

A. 1.5

B. 1.33

C. 1.25

D. 1.75

**Answer:**



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2. Absolute refractive indices of glass and water are  $\frac{3}{2}$  and  $\frac{4}{3}$ . The ratio of velocity of light in glass and water will be

A. 4 : 3

B. 9 : 8

C. 8 : 9

D. 3 : 4

**Answer:**



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3. Wavelength of light in vacuum is  $5890 \text{ \AA}$ , then its wavelength in glass ( $\mu = 1.5$ ) will be

A.  $9372 \text{ \AA}$

B.  $7932 \text{ \AA}$

C.  $7548 \text{ \AA}$

D.  $3927 \text{ \AA}$

**Answer:**



4. A ray of light is incident on a glass plate at  $60^\circ$ . The reflected and refracted rays are found to be mutually perpendicular. The refractive index of the glass is

A.  $\frac{\sqrt{3}}{2}$

B. 1.5

C. 1.732

D. 2

**Answer:**



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5. A ray of light, travelling in a medium of refractive index  $\mu$ , is incident at an angle  $i$  on a composite transparent plate consisting of three plates of refractive indices  $\mu_1, \mu_2$  and  $\mu_3$ . The ray emerges from the composite plate into a medium of refractive index  $\mu_4$ , at angle  $x$ . Then,

A.  $\sin x = \sin i$

B.  $\sin x = \frac{\mu}{\mu_4} \sin i$

C.  $\sin x = \frac{\mu_4}{\mu} \sin i$

D.  $\sin x = \frac{\mu_1}{\mu_2} \frac{\mu_3}{\mu_2} \frac{\mu}{\mu_4} \sin i$

**Answer:**



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6. The optical density of turpentine is higher than that of water while its mass density is lower. Figure shows, a layer of turpentine



floating over water in a container. For which one of the four rays incident on turpentine in figure, the path shown is correct?



A. 1

B. 2

C. 3

D. 4

**Answer:**



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7. The  $xz$  plane separates two media  $A$  and  $B$  with refractive indices  $\mu_1$  &  $\mu_2$  respectively. A ray of light travels from  $A$  to  $B$ . Its directions in the two media are given by the unit vectors,  $\vec{r}_A = a\hat{i} + b\hat{j}$  &  $\vec{r}_B = \alpha\hat{i} + \beta\hat{j}$  respectively where  $\hat{i}$  &  $\hat{j}$  are unit vectors in the  $x$  &  $y$  directions. Then :

A.  $\mu_1 a = \mu_2 \alpha$

B.  $\mu_1 \alpha = \mu_2 a$

C.  $\mu_1 b = \mu_2 \beta$

D. None of these

**Answer:**



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**8.** If refractive indices of glass and water with respect to air are  $\frac{3}{2}$  and  $\frac{4}{3}$  respectively, what is the refractive index of glass with respect to water ?

A.  $\frac{8}{9}$

B.  $9/8$

C.  $7/6$

D. None of these

**Answer:**



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9. How does refractive ( $\mu$ ) of a material vary with respect to wavelength ( $\lambda$ )? A and B are constants

A.  $\mu = A + \frac{B}{\lambda^2}$

B.  $\mu = A + B\lambda^2$

C.  $\mu = A + \frac{B}{\lambda}$

D.  $\mu = A + B\lambda$

**Answer:**



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**10.** If  ${}_{i}\mu_j$  represents refractive index when a light ray goes from medium  $i$  to medium  $j$ ,

then the product  $.2 \mu_1 \times .3 \mu_2 \times .4 \mu_3$  is equal to

A.  $.3 \mu_1$

B.  $.3 \mu_2$

C.  $\frac{1}{.1 \mu_4}$

D.  $.4 \mu_2$

**Answer:**



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11.  $\mu_1$  and  $\mu_2$  are the refractive index of two mediums and  $v_1$  and  $v_2$  are the velocity of light in these in two mediums respectively. Then, the relation connecting these quantities is

A.  $v_1 = v_2$

B.  $\mu_2 v_1 = \mu_1 v_2$

C.  $\mu_1^2 v_1 = \mu_2^2 v_2$

D.  $\mu_1 v_1 = \mu_2 v_2$

**Answer:**



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12. When light is refracted into a medium from vacuum

A. its wavelength and frequency both increases

B. its wavelength increases but frequency remains unchanged

C. its wavelength decreases but frequency remains unchanged



D. its wavelength and frequency both decreases

**Answer:**



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**13.** An under water swimmer is at a depth of 12 m below the surface of water. A bird is at a height of 18 m from the surface of water, directly above his eyes. For the swimmer the bird appears to be at a distance from the

surface of water equal to (Refractive Index of water is  $\frac{4}{3}$ )

A. 24 m

B. 12 m

C. 18 m

D. 9 m

**Answer:**



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14. A vessel of depth  $2d$  cm is half filled with a liquid of refractive index  $\mu_1$  and the upper half with a liquid of refractive index  $\mu_2$ . The apparent depth of the vessel seen perpendicularly is

A.  $d \left[ \frac{\mu_1 \mu_2}{\mu_1 + \mu_2} \right]$

B.  $d \left[ \frac{1}{\mu_1} + \frac{1}{\mu_2} \right]$

C.  $2d \left[ \frac{1}{\mu_1} + \frac{1}{\mu_2} \right]$

D.  $2d \left[ \frac{1}{\mu_1 \mu_2} \right]$

**Answer:**



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**15.** Three immiscible transparent liquids with refractive indices  $\frac{3}{2}$ ,  $\frac{4}{3}$  and  $\frac{6}{5}$  are arranged one on top of another. The depth of the liquid are 3 cm, 4 cm and 6 cm respectively.

The apparent depth of the vessel is

A. 10 cm

B. 9 cm

C. 8 cm

D. 7 cm

**Answer:**



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**16.** The optical path of a monochromatic light is same if it goes through 4.0 cm of glass or 4.5 cm of water. If the refractive index of glass is 1.53, the refractive index of the water is

A. 1.30

B. 1.36

C. 1.42

D. 1.46

**Answer:**



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**17.** A diver at a depth of 12 m in water ( $\mu = 4/3$ ) sees the sky in a cone of semi-vertical angle

A.  $\sin^{-1}\left(\frac{4}{3}\right)$

B.  $\tan^{-1}\left(\frac{4}{3}\right)$

C.  $\sin^{-1}\left(\frac{3}{4}\right)$

D.  $90^\circ$

**Answer:**



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**18.** In a lake, a fish rising vertically to the surface of water uniformly at the rate of 3 m/s, observes a bird diving vertically towards the

water at the rate of 9 m/s. The actual velocity of the dive of the bird is (given, refractive index of water =  $\frac{4}{3}$ )

A. 3.6 m/s

B. 4.5 m/s

C. 6.0 m/s

D. 12.0 m/s

**Answer:**



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19. A circular beam of light (diameter  $d$ ) falls on a plane surface of a liquid. The angle of incidence is  $45^\circ$  and refractive index of the liquid is  $\mu$ . The diameter of the refracted beam is

A.  $d$

B.  $(\mu - 1)d$

C.  $\frac{\sqrt{2\mu^2 - 1}}{\mu}d$

D.  $\frac{\sqrt{\mu^2 - 1}}{\mu}d$

**Answer:**



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20. Which one of the following is not associated with the total internal reflection?

- A. The mirage communication
- B. Optical fibre communication
- C. The glittering of diamond
- D. Dispersion of light

**Answer:**



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21. The wavelength of light in two liquids ' x ' and ' y ' is  $3500 \text{ \AA}$  and  $7000 \text{ \AA}$ , then the critical angle of x relative to y will be

A.  $60^\circ$

B.  $45^\circ$

C.  $30^\circ$

D.  $15^\circ$

**Answer:**



22. White light is incident on the interface of glass and air as shown in the figure. If green light is just totally internally reflected, then the emerging ray in air contains



- A. yellow, orange, red
- B. violet, indigo, blue
- C. all colours
- D. all colours except green

**Answer:**



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**23.** The critical angle of a prism is  $30^\circ$ . The velocity of light in the medium is

A.  $1.5 \times 10^8 \text{ m/s}$

B.  $3 \times 10^8 \text{ m/s}$

C.  $4.5 \times 10^8 \text{ m/s}$

D. None of these

**Answer:**



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**24.** A ray of light travelling in a transparent medium falls on a surface separating the medium from air at an angle of incidence of  $45^\circ$ . The ray undergoes total internal reflection. If  $n$  is the refractive index of the medium with respect to air, select the possible value of  $n$  from the following.

A. 1.2

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

C. 1.4

D. 1.5

**Answer:**



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**25.** A glass slab has a critical angle of  $30^\circ$  when placed in air. What will be the criticle

angle when it is placed in liquid of refractive index  $\frac{6}{5}$  index?

A.  $45^\circ$

B.  $37^\circ$

C.  $53^\circ$

D.  $60^\circ$

**Answer:**



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26. When a ray is refracted from one medium into another, the wavelegths changes from  $6000\text{\AA}$  to  $4000\text{\AA}$ . The critical angle for a ray from the second medium will be

A.  $\cos^{-1}\left(\frac{2}{3}\right)$

B.  $\sin^{-1}\left(\frac{2}{\sqrt{3}}\right)$

C.  $\sin^{-1}\left(\frac{2}{3}\right)$

D.  $\cos^{-1}\left(\frac{2}{\sqrt{3}}\right)$

**Answer:**



27. If a ray of light in a denser medium strikes a rarer medium at an angle of incidence  $i$ , the angles of reflection and refraction are respectively,  $r$  and  $r'$ . If the reflected and refraction rays are at right angles to each other, the critical angle for the given pair of media is

A.  $\sin^{-1}(\tan r')$

B.  $\sin^{-1}(\tan r)$

C.  $\tan^{-1}(\sin i)$

D.  $\cot^{-1}(\tan i)$

**Answer:**



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**28.** A ray of light is incident at an angle of  $60^\circ$  on one face of a prism of angle  $30^\circ$ . The ray emerging out of the prism makes an angle of  $30^\circ$  with the incident ray. The emergent ray is

A. normal to the face through which it emerges

B. inclined at  $30^\circ$  to the face through which it emerges

C. inclined at  $60^\circ$  to the face through which it emerges

D. None of these

**Answer:**



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29. When light rays are incident on a prism at an angle of  $45^\circ$ , the minimum deviation is obtained. If refractive index of the material of prism is  $\sqrt{2}$ , then the angle of prism will be

A.  $30^\circ$

B.  $75^\circ$

C.  $90^\circ$

D.  $60^\circ$

**Answer:**



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**30.** A ray of light passes through an equilateral glass prism in such a manner that the angle of incidence is equal to the angle of emergence and each of these angles is equal to  $\frac{3}{4}$  of the angle of the prism. The angle of deviation is

A.  $45^\circ$

B.  $39^\circ$

C.  $20^\circ$

D.  $30^\circ$

**Answer:**



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**31.** A ray of light is incident on an equilateral glass prism placed on a horizontal table. For minimum deviation which of the following is true?



A. PQ is horizontal

B. QR is horizontal

C. RS is horizontal

D. Either PQ or RS is horizontal

**Answer:**



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**32.** In a thin prism of glass (refractive index 1.5), which of the following relations between the angle of minimum deviations  $\delta_m$  and angle of prism  $r$  will be correct?



A.  $\delta_m = r$

B.  $\delta_m = 1.5$

C.  $\delta_m = 2r$

D.  $\delta_m = r / 2$

**Answer:**



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**33.** The refractive index of a prism for a monochromatic wave is  $\sqrt{2}$  and its refracting

angle is  $60^\circ$  for minimum deviation, the angle of incidence will be

A.  $30^\circ$

B.  $45^\circ$

C.  $60^\circ$

D.  $75^\circ$

**Answer:**



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34. Angle of minimum deviation for a prism of refractive index 1.5 is equal to the angle of prism The angle of prism is ( $\cos 41^\circ = 0.75$ )

A.  $21^\circ$

B.  $42^\circ$

C.  $60^\circ$

D.  $82^\circ$

**Answer:**



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35. When light of wavelength  $\lambda$  on an equilateral prism, kept on its minimum deviation position, it is found that the angle of deviation equals the angle the angle of the prism itself. The refractive index of the material of the prism for the wavelength  $\lambda$  is

A.  $\sqrt{3}$

B.  $\frac{\sqrt{3}}{2}$

C. 2

D.  $\frac{2}{\sqrt{2}}$

**Answer:**



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**36.** Under minimum deviation condition in a prism, if a ray is incident at an angle  $30^\circ$ , the angle between the emergent ray and the second refracting surface of the prism is

A.  $0^\circ$

B.  $30^\circ$

C.  $45^\circ$

D.  $60^\circ$

**Answer:**



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**37.** Two beam of red and violet colors are made to pass separately through a prism (angle of the prism is  $60^\circ$ ). In the position of minimum deviation, the angle of refraction will be

A. greater for red colour

B. equal but not  $30^\circ$  for both the colours

C. greater for violet colour

D.  $30^\circ$  for both the colours

**Answer:**



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**38.** A ray of light passing through a prism of refraction angle  $60^\circ$  has to deviate by atleast  $30^\circ$ . Then, refractive index of prism should be

A.  $\leq \sqrt{2}$

B.  $\geq \sqrt{2}$

C.  $\leq \sqrt{3}$

D.  $\leq \sqrt{3}$

**Answer:**



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**39.** A ray of light is incident at  $60^\circ$  on one face of a prism of angle  $30^\circ$  and the emergent ray



makes  $30^\circ$  with the incident ray. The refractive index of the prism is

A. 1.732

B. 1.414

C. 1.5

D. 1.33

**Answer:**



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**40.** One face of prism of refracting angle  $30^\circ$  and refractive index 1.414 is silvered. At what angle must a ray of light fall on the unsilvered face so that it retraces its path out of the prism ?

A.  $0^\circ$

B.  $30^\circ$

C.  $60^\circ$

D.  $45^\circ$

**Answer:**



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41. What is the angle of incidence for an equilateral prism of refractive index  $\sqrt{3}$  so that the ray is parallel to the base inside the prism?

A.  $30^\circ$

B.  $45^\circ$

C.  $60^\circ$

D.  $75^\circ$

**Answer:**



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**42.** An equilateral prism deviates a ray through  $45^\circ$  for the two angles of incidence differing by  $20^\circ$ . The angle of incidence is

A.  $62.5^\circ$

B.  $42.5^\circ$


C. Both are correct

D. Both are wrong

**Answer:**



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**43.** The face PR of a prism PQR of angle  $30^\circ$  is silvered. A ray is incident on face PQ at an angle of  $45^\circ$  as shown in figure. The refracted ray undergoes reflection on face PR and retraces its path. The refractive index of the prism is 

A.  $\sqrt{2}$

B.  $3/\sqrt{2}$

C. 1.5

D. 1.33

**Answer:**



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**44.** Dispersive power depends upon

A. the angle of prism

B. material of prism

C. deviation produced by prism

D. height of the prism

**Answer:**



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**45.** A thin prism  $P_1$  with angle  $6^\circ$  and made from glass of refractive index 1.54 is combined with another thin prism  $P_2$  of refractive index 1.72 to produce dispersion without deviation.

The angle of prism  $P_2$  will be

A.  $5^{\circ} 24'$

B.  $4^{\circ} 30'$

C.  $6^{\circ}$

D.  $8^{\circ}$

**Answer:**



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**46.** A thin prism P with angle  $4^{\circ}$  and made from glass of refractive index 1.54 is combined with another thin prism P made from glass of



refractive index 1.72 to produce dispersion without deviation The angle of prism P is

A.  $5.33^\circ$

B.  $4^\circ$

C.  $2.6^\circ$

D.  $3^\circ$

**Answer:**



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47. The rainbow is formed due to

A. refraction

B. reflection

C. dispersion

D. All of the above

**Answer:**



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**48.** Phenomena associated with scattering is/are

A. blue colour of the sky

B. appearance of reddish sun during sunset and sunrise

C. both a. and b.

D. None of the above

**Answer:**



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**49.** In Raman effect, the scattering of light beams shows

- A. elastic scattering
- B. inelastic scattering
- C. no scattering actually takes place
- D. None of the above

**Answer:**



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## Exercise 2

1. When light is passed through a prism when.....colour shows maximum deviation.

A. red

B. violet

C. yellow

D. green

**Answer:**



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2. The phenomena involved in the reflected of radiowaves by ionosphere is similar to.

A. reflection of light by a plane mirror

B. total internal reflection of light in air during a mirage

C. dispersion of light by water molecules during the formation of a rainbow

D. scattering of light by the particles of air

**Answer:**



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**3. A passenger in an aeroplane shall**

A. should see a rainbow

B. may see a primary and a secondary  
rainbow as concentric circles

C. may see a primary and a secondary  
rainbow as concentric arcs

D. should never see a secondary rainbow

**Answer:**



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4. When light wave suffers reflection at the interface from air to glass, then the change in phase of the reflected wave is equal to

A. zero

B.  $\frac{\pi}{2}$



C.  $\pi$

D.  $2\pi$

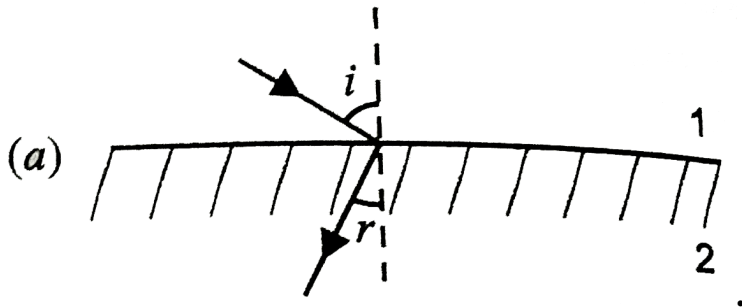
**Answer:**



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5. There are certain materials developed in laboratories which have a negative refractive index, Fig. A ray incident from air (medium 1) into such a medium (medium 2) shall follow a

path given by



A. 

B. 

C. 

D. 

**Answer:**



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6. The reason for shining of air bubble in water is

A. diffraction of light

B. dispersion of light

C. scattering of light

D. total internal reflection of light

**Answer:**



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7. Rainbow is observed when the sun is

- A. in front of the observer
- B. behind the observer
- C. vertically above the observer
- D. in any of these positions

**Answer:**



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8. Sun is visible a little before the actual sunrise and until a little after a actual sunset.

This is due to

A. total internal reflection

B. reflection

C. refraction

D. polarisation

**Answer:**



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9. A mark at the bottom of a liquid appears to rise by  $0.1m$ . The depth of the liquid is  $1m$ .

The refractive index of the liquid is

A. 1.33

B.  $9/10$

C.  $\frac{10}{9}$

D. 1.5

**Answer:**



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10. A prism can have a maximum refracting angle of ( $C$  = critical angle for the material of the prism)

A.  $60^\circ$

B.  $C$

C.  $2C$

D. slightly less than  $180^\circ$

**Answer:**



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**11.** You are given four sources of light each one providing a light of a single colour-red, blue, green and yellow. Suppose the angle of refraction for a beam of yellow light corresponding to a particular angle of incidence at the interface of two media is  $90^\circ$ . Which of the following statements is correct if the source of yellow light is replaced with that of other lights without changing the angle of incidence ?



- A. The beam of red light would undergo total internal reflection
- B. The beam of red light would bend towards normal while it gets refracted through the second medium
- C. The beam of blue light would undergo total internal reflection
- D. The beam of green light would bend away from the normal as it gets refracted through the second medium

**Answer:**



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**12.** When a lens of refractive index  $n_1$ , then the lens looks to be disappeared only, if

A.  $\mu_1 = \mu_2 / 2$

B.  $\mu_1 = 3\mu_2 / 2$

C.  $\mu_1 = \mu_2$

D.  $\mu_1 = 5\mu_2 / 2$

**Answer:**



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**13.** When sun light is scattered by minute particles of atmosphere, then the intensity of light scattered away is proportional to

A.  $(\text{wavelength of light})^4$

B.  $(\text{frequency of light})^4$

C.  $(\text{wavelength of light})^2$

D.  $(\text{frequency of light})^2$

**Answer:**



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**14.** Match Column I (Phenomenon) with Column II (Principle) and select the correct answer using the codes given below the Column.



Mark the correct option from the codes given below

- A. 

A	B	C	D
<i>s</i>	<i>q</i>	<i>r</i>	<i>p</i>
- B. 

A	B	C	D
<i>r</i>	<i>q</i>	<i>p</i>	<i>r</i>
- C. 

A	B	C	D
<i>r</i>	<i>p</i>	<i>q</i>	<i>s</i>
- D. 

A	B	C	D
<i>s</i>	<i>p</i>	<i>q</i>	<i>s</i>

**Answer:**



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**15.** Light travels in two media A and B with speeds  $1.8 \times 10^8 \text{ms}^{-1}$  and  $2.4 \times 10^8 \text{ms}^{-1}$

respectively. Then the critical angle between them is

A.  $\sin^{-1}\left(\frac{2}{3}\right)$

B.  $\tan^{-1}\left(\frac{3}{4}\right)$

C.  $\tan^{-1}\left(\frac{2}{3}\right)$

D.  $\sin^{-1}\left(\frac{3}{4}\right)$

**Answer:**



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**16.** A ray of light falls on a denser-rarer boundary from denser side. The critical angle is  $45^\circ$ . The maximum deviation the ray can undergo is

A.  $30^\circ$

B.  $45^\circ$

C.  $90^\circ$

D.  $120^\circ$

**Answer:**



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17. If light travels a distance  $x$  in  $t_1$  sec in air and  $10x$  distance in  $t_2$  sec in a medium, the critical angle of the medium will be

A.  $\tan^{-1} \left( \frac{t_1}{t_2} \right)$

B.  $\sin^{-1} \left( \frac{t_1}{t_2} \right)$

C.  $\sin^{-1} \left( \frac{10t_1}{t_2} \right)$

D.  $\tan^{-1} \left( \frac{10t_1}{t_2} \right)$

**Answer:**







**18.** A thin prism of angle  $6^\circ$  made up of glass of refractive index 1.5 is combined with another prism made up of glass of refractive index 1.75 to produce dispersion without deviation. The angle of second prism is

A.  $7^\circ$

B.  $9^\circ$

C.  $4^\circ$

D.  $5^\circ$

**Answer:**



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**19.** When sunlight is scattered by atmospheric atoms and molecules, the amount of scattering of light of wavelength 440 nm is  $A$ . The amount of scattering for the light of wavelength 660 nm is approximately

A.  $\frac{4}{9}A$

B.  $2.25A$

C.  $1.5A$

D.  $\frac{A}{6}$

**Answer:**



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**20.** When a ray of light is incident normally on one refracting surface of an equilateral prism (Refractive index of the material of the prism = 1.5

A. emerging ray is deviated by  $30^\circ$

B. emerging ray is deviated by  $45^\circ$

C. emerging ray just grazes the second  
refracting surface

D. the ray undergoes total internal  
reflection at the second refracting  
surface

**Answer:**



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21. A glass prism has a refractive angle of  $90^\circ$  and a refractive index of 1.5. A ray is incident at an angle of  $30^\circ$ . The ray emerges from an adjacent face at an angle of

A.  $60^\circ$

B.  $30^\circ$

C.  $45^\circ$

D. the ray does not emerge

**Answer:**



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**22.** A ray falls on a prism ABC ( $AB = BC$ ) and travels as shown in figure. The minimum refractive index of the prism material should be



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**23.** In the measurement of the angle of a prism using a spectrometer, the readings of first

reflected image are vernier I :  $320^{\circ} 40'$  , vernier II :  $140^{\circ} 30'$  and those of the second reflected image are vernier I :  $80^{\circ} 38'$  , vernier II :  $260^{\circ} 24'$ . Then, the angle of the prism is

A.  $60^{\circ} 58'$

B.  $59^{\circ} 58'$

C.  $60^{\circ} 2'$

D.  $60^{\circ} 4'$

**Answer:**



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24. A ray incident at a point at an angle of incidence of  $60^\circ$  enters a glass sphere with refractive index  $\sqrt{3}$  and it is reflected and refracted at the farther surface of the sphere. The angle between the reflected and refracted rays at this surface is:

A.  $50^\circ$

B.  $60^\circ$

C.  $90^\circ$

D.  $40^\circ$



**Answer:**



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**25.** A ray PQ incident on the refracting face BA is refracted in the prism BAC as shown in the figure and emerges from the other refracting face AC as RS, such that  $AQ = AR$ . If the angle of prism  $A = 60^\circ$  and the refractive index of the material of prism is  $\sqrt{3}$ , then the angle of deviation of the ray is



A.  $60^\circ$

B.  $45^\circ$

C.  $30^\circ$

D. None of these

**Answer:**



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