RAY OPTICS
CLASSXII

MCQ and reasoning questions

1) A ling thin rod is placed along the axis of a concave mirror, why do u get distorted image?

2) If the lower half of the concave mirror's reflecting surface is covered with an opaque (non-reflective) material then the image obtained is

A) full image is obtained with same intensity B) top part of the image is obtained but intensity of image decreases C) Full image is obtained with less intensity D) Bottom part of the image is obtained but intensity of image decreases

3) The magnification of the curved mirror is given as

A) f/(f-u) B) f/(u-f) C) u/(f-u) D) V/(f-u)

4) When a ray of light travels from rarer to denser medium, which one of the physical quantity remains same?

A) speed of light in medium B) Frequency of light C) wavelength of light D) angle of refraction

5) If $n_{21}<1$, when the ray of light travels from medium 1 to medium 2 then which one of the following is correct?

A) speed of light decreases B) refracted ray bends towards the normal C) Frequency of light increases D) refracted ray bends away from the normal

6) Snell's law is not valid when

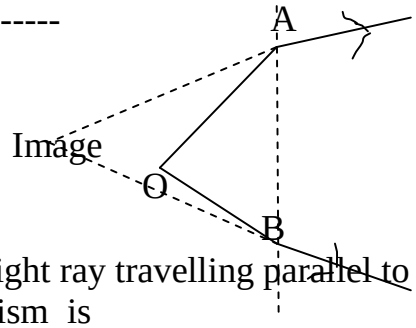
a) Ray travels from rarer to denser and i > C b) Ray travels from rarer to denser and i < C

c)) Ray travels from denser to rarer and i > C d)) Ray travels from denser to rarer and i < C

7) Which one of the colour of light has greater magnifying power in simple microscope?

a) Red b) Blue c) Green d) Yellow

8) The nature of lens AB is -------



9) The value of refraction of light ray travelling parallel to the base of the equilateral prism inside the prism is

a) 60 ° b) 120 ° c) 30 ° d) 45 °

10) An image produced by mirror can not be caught on the screen whose linear magnification is 3 then

a) concave mirror and m =3 b) convex mirror and m = 3

c) concave mirror and m = -3 d) plane mirror and m = 3

11) The focal length of the concave lens is 40cm. The power of the lens is -----

12) Two lenses one is concave lens of focal length f_1 and other one is concave lens of focal length f_2 are made in contact. If $f_1 > f_2$ then the combination behave as -------

13) The phenomenon involved in early sunrise and delayed sun set is

A) Refraction of light B) Scattering of light C) dispersion of light D) Diffraction of light

14) The distance through which the object appears to be raised is given by

A) $A)\ (1-\frac{1}{\mu})t\ \ B)(1+\frac{1}{\mu})t\ \ \ C)(1-\frac{\mu}{1})t\ \ D)(\frac{\mu}{1}-1)t$

15) Time does the sun take to shift by 1º when viewed from the earth is

A) 2min B) 1 min C) 2second D) 1 second

16) A lens of focal length f and refractive index μ =1.5 is dipped in water of μ = 4/3. The focal length of lens in water is

1) f 2) 2f 3) 4f 4) f/2

17)The magnifying power of astronomical telescope when final image is formed at D is given as

1) $\frac{f_0}{f_e}(1+\frac{D}{f_e})$ 2) $\frac{f_0}{f_e}(1+\frac{f_e}{D})$ 3) $\frac{f_0}{f_e}$ 4) $\frac{f_0}{f_e}(1+\frac{f_0}{D})$

18) clouds which have droplets of water with $a >> \lambda$ are generally white due to

1) Scattering light 2) Dispersion of light 3) Refraction of light

19.For a concave mirror, the minimum distance between the object and its real image is

A. f B. $2f$ C. $4f$ D. zero

20.A beam of monochromatic light is refracted from vaccum into a medium of refractive index 1.5. The wavelength of the refracted light will be

A. same
B. dependent on intensity of refracted light
C. larger
D. smaller

21To a fish in water ($\mu = 4/3$), a bird in air appears to be 60 cm above the water surface. The real height of the bird is

A. 40 cm B. 50 cm

C. 45 cm D. 30 cm

22A ray of light travelling in a transparent medium falls on a surface separating the medium from air at an

angle of incidence of 45°. The ray under goes 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. 1.3 B. 1.4

C. 1.5 D. 1.6

23.When monochromatic red light is used instead of blue light in convex lens, its focal length will:

A. decrease B. remain same

C. not depend on colour of light D. increase

24.The magnifying power of an astronomical telescope is 8 and the distance between the two lenses is 54 cm. The focal length of the eye lens and objective lens will be respectively.

A. 6 cm and 48 cm B. 48 cm and 6 cm

C. 8 cm and 64 cm D. 64 cm and 8 cm

25.An astronomical telescope has an angular magnification of magnitude 5 for distant objects, the separation between the objective and the eye piece is 36 cm, and the final image is formed at infinity. The focal length of the objective

(f_o) and that of eye piece (f_e) are:

A. $f_0 = 45\ cm$ and $f_e = -9\ cm$

B. $f = 50\ cm$ and $f_e = 10cm$

C. $f_0 = 7.2$ and $f_e = 5\ cm$

D. $f_0 = 30\ cm$ and $f_e = 6\ cm$

One mark Questions:

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

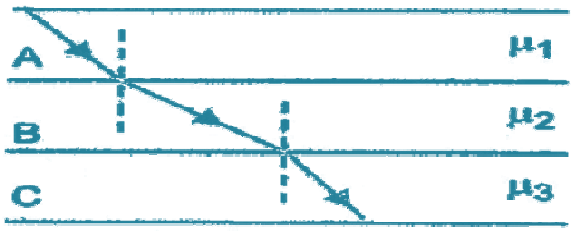
2.A concave mirror is held in water. What would be the change in the focal length of the mirror?

3.Explain why The bubbles of air rising up in a water tank appear silvery

4.when viewed from top

Path of a ray of light passing through three liquid of refractive indices μ_1, μ_2, μ_3 is as shown.

Which liquid has the smallest index of refraction?



5.A ray of light after refraction through a concave lens becomes parallel to the principal axis after refraction through the concave lens. Explain with a ray diagram when this can happen.

6.The surfaces of the sun glasses (goggles) are curved, yet their power may be zero. Why?

7.The refractive index of the material of a concave lens is n. It is immersed in a medium of refractive indexn_1. A parallel beam of light is incident on the lens. Trace the path of emergent rays in each of the following cases: $(a) n_1 > n (b) n_1 < n (c) n_1 = n.$

8.A beam of light is converging towards a certain point. A parallel sided glass plate is introduced in the path of the converging beam. How will the point of convergence be shifted?

9.What is the ratio of velocities of two light waves travelling in vacuum and having wavelengths 4000 A^0 and 8000 A^0

10.For the same value of angle of 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?

How does focal length of a lens change when red light is replaced by blue light?

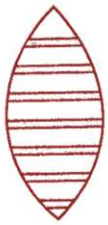
11.A diverging lens of focal length F is cut into two identical parts, each forming a Plano concave lens, what is the focal length of each part?

12.Draw a plot showing the variation of power of a lens with the wavelength of incident light.

13.A convex lens forms the image of the sun at a distance of 10 cm. Where will be the image when (i) another lens of same power but double the aperture is used?

(ii) another lens of same aperture but double the power is used?

14.A lens shown is made of two different materials. A point object is placed on the principle axis of the lens. How many images will be obtained?

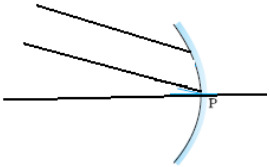


15.For which colour, μ *of material of a prism is* (i) *minimum* (ii) *maximum? Which colour deviates* (i) *most* (ii)*least on passing through a prism?*

16. How does the speed of light in glass change

(a) on increasing the wavelength of light? on increasing the intensity of light?

*17.*Complete the above ray diagram



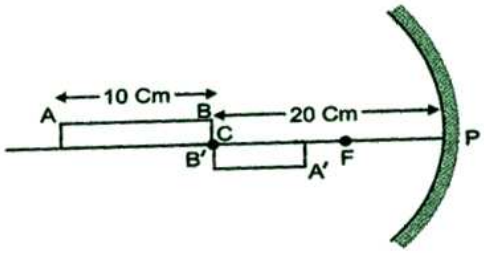
Numericals :

1. When an object is placed at a distance of 60 cm from a convex spherical mirror, the magnification produced is 1/2. *Where should be placed to get a magnification of* 1/3 *?*

2. An object is placed at a distance of 36 cm from a convex mirror. A plane mirror is placed in between so that the two virtual images so formed coincide. If the plane mirror is at a distance of 24 cm from the object, find the radius of curvature of convex mirror.

3.An object is placed 0.4 m *from a convex mirror and a plane mirror is placed at a distance of* 0.3 m *from the object. The images formed in the two mirrors coincide without parallex. What is the focal length of the convex mirror?*

4.A rod AB = 10 cm *in length is placed along the principal axis of a concave mirror having focal length equal to 10 cm as shown. The distance* PB = 20 cm. *What is the length of the image of the rod* AB*?*



10.A mark placed on the surface of a sphere is viewed through glass from a position directly opposite. If the diameter of the sphere is 10 cm *and refractive index of glass is* 1.5*, find the position of the image.*

10.Light from a point source in air falls on a spherical glass of μ = 1.5 *and* R = 0.2 m. *The image is formed at a distance of* 100 cm *from the glass surface in the direction of incident light. Calculate the object distance from the centre of curvature of the spherical surface.*

11.An empty spherical flask of diameter 15 cm *is placed in water of* μ = 4/3. *A parallel beam of light strikes the flask. Where does it get focused, when observed from within the flask?*

12.Light from a point source in air falls on a spherical glass surface. If μ = 1.5*, and radius of curvature* = 20 cm*, the distance of light source from the glass surface is* 100 cm*; at what position will the image be formed?*

13.Find the radius of curvature of convex surface of a plano convex lens, whose focal length is 0.3 m *and* μ = 1.5.

14.A concave lens is placed in contact with a convex lens of focal length 25 cm. *The combination produces e real image at a distance of* 80 cm*, when an object is at a distance of* 40 cm. *What is the focal length of concave lens?* (i)

15.If f = 0.5m, what is the power of the lens? ii)The radii of curvature of the faces of a double

convex lens are 9 cm *and* 15 cm. *Its focal length is* 12 cm. *What is the refractive index of glass? iii) A convex lens has* 20 cm *focal length in air. What is the focal length in water? (Refractive index of air – water* $= 1.33$*, refractive index of air-glass* $= 1.5$)

16.A real image of an object is formed at a distance of 20 cm *from a lens. On putting another lens in contact with it, the image is shifted* 10 cm *towards the combination. Determine the power of the second lens.*

17.A convex lens is placed in contact with a plane mirror. An axial point object at a distance of 20 cm *from this combination, has its image coinciding with itself. What is the focal length of the convex lens?*

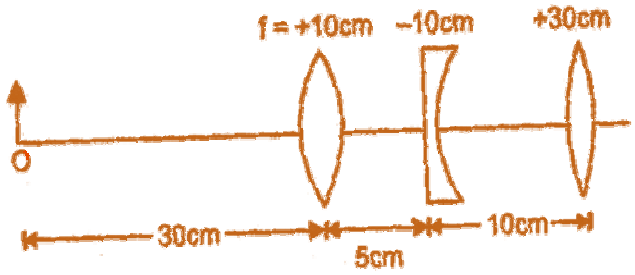
18.A convex lens and a convex mirror of radius of curvature 20 cm *are placed coaxially with the convex mirror placed at a distance of* 30 cm *from the lens. For a point object at a distance of* 25 cm *from the lens, the final image due to this combination coincides with the object itself. What is the focal length of convex lens?*

19.A convex lens of focal length 20 cm *is placed co – axially with a convex mirror of radius of curvature* 20 cm. *The two are kept* 15 cm *apart from each other. A point object is placed* 60 cm *in front of the convex lens. Find the position of the image formed by the combination.*

20.A convex lens of focal length 20 cm *and a convex mirror of focal length* 10 cm *are placed co - axially* 50 cm *apart from each other. An incident beam parallel to its principal axis is incident on the convex lens. Locate the position of final image formed due to the combination.*

21.The power of a thin convex lens of glass is 5 *dioptre. When it is immersed in a liquid of refractive index* μ*, it is behaves like a divergent lens of focal length* 1m. *Calculate* μ *of liquid, if* μ *of glass* $= 3/2$.

22.Find the position of the image formed by the lens combination given in



23.A convex lens made up of glass of refractive index 1.5 *is dipped in turn*
(i) *in a medium of refractive index* 1.65
(ii) *in a medium of refractive index* 1.33
(a) *Will it behave as converging or diverging lens ijn the two cases?*
(b) *How will its focal length change in the two media?*

24.A converging lens of refractive index 1.5m *and of focal length* 15 cm *in air, has the same radii of curvature for both sides. If it is immersed in a liquid of refractive index* 1.7, *find the focal length of the lens in the liquid.*

25.A convex lens of focal length 20 cm *and made of glass* $(\mu = 1.5)$ *is immersed in water of* $\mu = 1.33$. *Calculate change in focal length of the lens.*

26.A convex lens of focal length 25 cm *is placed coaxially in contact with a concave lens of focal length* 20 cm. *Determine the power of the combination. Will the system be converging or diverging in nature?*

27.The angle of minimum deviation for prism of angle $\pi/3$ *is* $\pi/6$. *Calculate the velocity of light in the material of the prism, if the velocity of light in vacuum is* $3 \times 10^8 \mathrm{ms}^{-1}$.

28.A ray of light passes through an equilateral prism (refractive index 1.5*) such that angle of incidence is equal to angle of emergence and the latter is equal to* $3/4$*th of the angle of prism. Calculate the angle of deviation.*

29.A60° *prism has a refractive index of1.5. Calculate (a) the angle of incidence for minimum deviation (b) angle of minimum deviation (c) the angle of emergence of light at maximum deviation (d) angle of maximum deviation.*

30. The focal lengths of the objective and eye piece of an astronomical telescope are 25 cm *and* 2.5 cm *respectively. The telescope is focused on an object* 1.5 m *from objective, the final image being formed* 25 cm *from eye of the observer. Calculate the length of the telescope.*

31.Using the data given below, state which two of the given lenses will you prefer to construct a best possible (i) telescope (ii) microscope. Also, indicate which of the selected lenses is to be used as an objective and as an eye piece in each case.

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

32.Four double convex lenses with following specifications are available

Lens	*focal length*	*aperture*
A	100 cm	10cm
B	100 cm	5cm
C	10 cm	2 cm
D	5 cm	2 cm

Which of the given four lenses should be selected as objective and eyepiece to construct an astronomical telescope and why? What will be the magnifying power and length of the tube of the telescope?