SimplifiedMinds SSLC
Light Reflection & Refraction
Solution of Previous years Papers (2019-2024)

To obtain a diminished image of an object from a concave mirror, position of the object should be

(F = principal focus, C = centre of curvature, P = pole)

(A) between C and F (B) beyond C

(C) between P and F (D) at F

Ans. :

(B) — beyond C

1. **(2019 Mains)(1M)**
2. Convex mirror is commonly used as rear-view mirror in vehicles. Why? **(2019 Mains)(1M)**
   Ans.:
   They always give an erect diminished image.
   Also, they have a wider field of view as they are curved outwards.

3. The focal length of a concave lens is 30 cm. At what distance should the object be placed from the lens so that it forms an image at 20 cm from the lens? **(2019 Mains)(2M)**

Ans. :

$$\frac{1}{v} - \frac{1}{u} = \frac{1}{f} \quad \text{or,} \quad \frac{1}{u} = \frac{1}{v} - \frac{1}{f} \qquad \frac{1}{2}$$

$$\frac{1}{u} = \frac{1}{-20} - \frac{1}{(-30)} = -\frac{1}{20} + \frac{1}{30} \qquad \frac{1}{2}$$

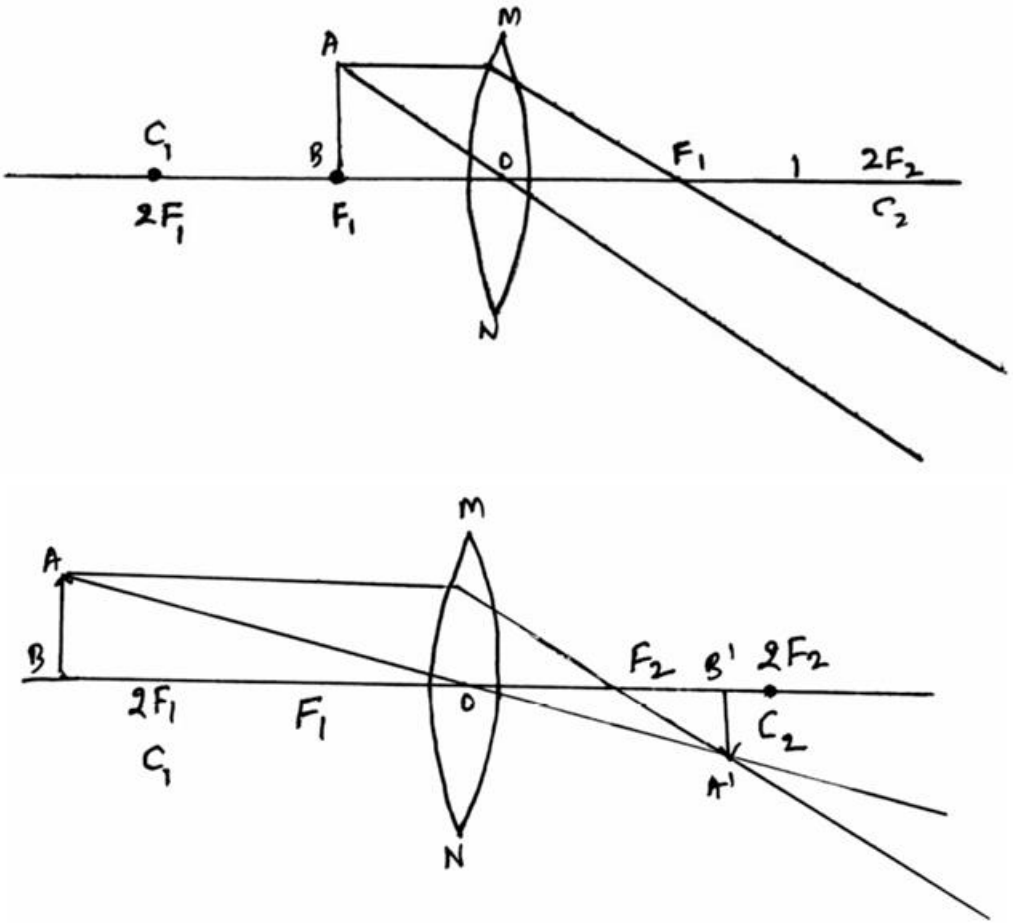
$$\frac{1}{u} = \frac{-3+2}{60} \qquad \frac{1}{2}$$

$$\frac{1}{u} = \frac{1}{-60} \quad \text{or} \quad u = -60 \text{ cm} \qquad \frac{1}{2}$$

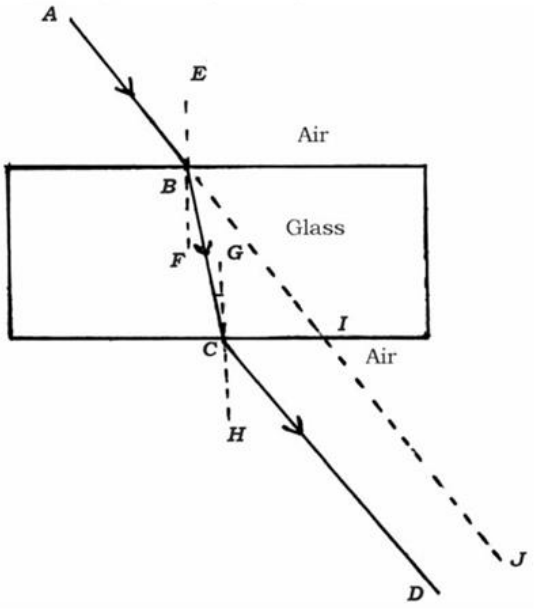
4. State the two laws of reflection of light. **(2019 Mains)(2M)**
   Ans.:
   (i) The angle of incidence is equal to the angle of reflection.
   (ii) The incident ray, the normal to the mirror at the point of incidence and the reflected ray, all lie in the same plane.
5. Write the properties of image formed in a plane mirror. **(2019 Mains)(2M)**
   Ans.:
   Image formed by a plane mirror is always virtual and erect.
   The size of the image is equal to that of the object.
   The image formed is as far behind the mirror as the object is in front of it.
   The image is laterally inverted.

6. Draw the ray diagrams for the image formation in a convex lens when an object is placed (i) at focus F (ii) beyond 2F **(2019 Mains)(3M)**

Ans. :



Identify the emergent ray in the given figure.



(A) CD (B) BC

(C) AB (D) IJ.

Ans. :

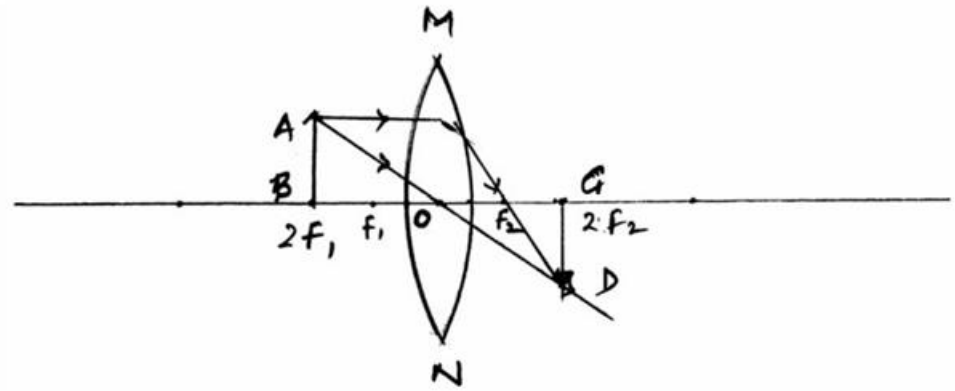
7. (A) — CD **(2019 Sup)(1M)**

8. What is the centre of curvature of a spherical mirror? **(2019 Sup)(1M)**

Ans.:
The reflecting surface of a spherical mirror forms a part of sphere. The centre of this sphere is called the centre of curvature.

9. Draw the ray diagram to show the formation of image by a convex lens when the object is at 2F

Ans. :



10. A concave lens has focal length 30 cm. At what distance should the object be placed from the lens so that it forms an image at 20 cm from the lens? Also, find the magnification produced by the lens. **(2019 Sup)(3M)**

Ans. :

$\frac{1}{v} - \frac{1}{u} = \frac{1}{f}$ $\frac{1}{2}$

$\therefore \quad \frac{1}{u} = \frac{1}{v} - \frac{1}{f}$

$= \frac{1}{-20} - \frac{1}{-30}$

$= \frac{1}{-20} + \frac{1}{30}$ $\frac{1}{2}$

$= \frac{-3+2}{60}$

$\frac{1}{u} = -\frac{1}{60}$ $\frac{1}{2}$

$\therefore \quad u = -60$

$\therefore$ Object distance is 60 cm $\frac{1}{2}$

Magnification : $m = \frac{v}{u}$ $\frac{1}{2}$

$= \frac{-20}{-60}$

$= \frac{1}{3}$ $\frac{1}{2}$

$m \simeq 0{\cdot}33.$

11. An object is kept at the centre of curvature of a concave mirror. The position and nature of the image formed is **(2020 Mains)(1M)**
(A) between F and C and inverted
(B) behind the mirror and erect
(C) between F and P and erect
(D) at the centre of curvature and inverted.
Ans.: (D) — at the centre of curvature and inverted.

12. An object is kept on the principal axis of a concave mirror of focal length 12 cm. If the object is at a distance of 18 cm from the mirror, calculate the image distance. Determine the nature of the image formed by calculating the magnification produced by the mirror. **(2020 Mains)(3M)**

Ans. :

Focal length of concave mirror $f = -12$ cm

Object distance $u = -18$ cm

$\frac{1}{f} = \frac{1}{u} + \frac{1}{v}$ $\frac{1}{2}$

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

$= -\frac{1}{12} - \left(-\frac{1}{18}\right)$ $\frac{1}{2}$

$= -\frac{1}{12} + \frac{1}{18}$

$= \frac{-3+2}{36}$

$\therefore \quad \frac{1}{v} = -\frac{1}{36} \quad \Rightarrow \quad v = -36$ cm $\frac{1}{2}$

Magnification $m = \frac{-v}{u}$ $\frac{1}{2}$

$= -\left(\frac{-36}{-18}\right)$

$= -2$ $\frac{1}{2}$

The image formed is inverted real and enlarged. $\frac{1}{2}$

13. A doctor prescribes a corrective lens of power – 0·5 D to a person. Find the focal length of the lens. Is this lens diverging or converging? Give reason. How does the property of this lens can be used to correct eye defects? **(2020 Mains)(3M)**

Ans.:

$p = \frac{1}{f}$, here $p = -0{\cdot}5$ D

$f = \frac{1}{p} \Rightarrow f = -\frac{1}{0{\cdot}5} = -2$ m 1

This lens is diverging ·

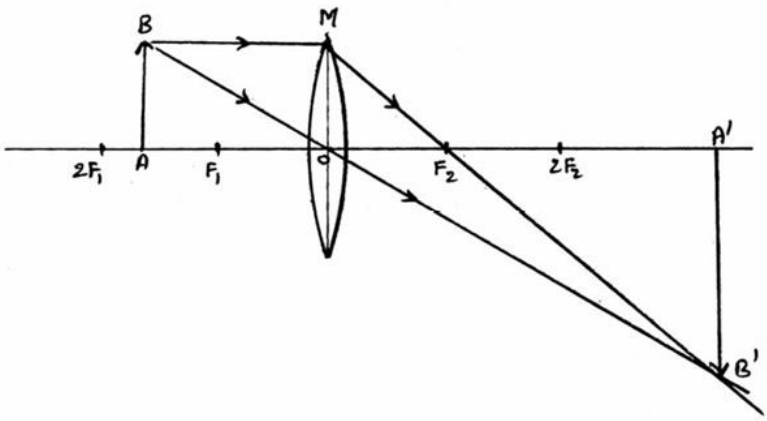
Because power of a lens is negative means the given lens is concave.

The diverging property of the lens is used to correct myopia. In myopic eye the image of a distant object is formed in front of the retina and not on the retina.

A concave lens of suitable power diverges the light rays and brings the image back on the retina.

14. Draw the ray diagram when the object is kept between F_1 and $2F_1$ of the convex lens. With the help of the diagram mention the position and nature of the image formed. [F_1: Principal focus of the lens] **(2020 Mains)(3M)**

Ans. :

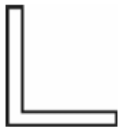


Position of the image-beyond $2F_2$ 2

Nature-real inverted and enlarged. $\frac{1}{2}+\frac{1}{2}$

The image of the English letter  in convex mirror looks like

(A)  (B) 

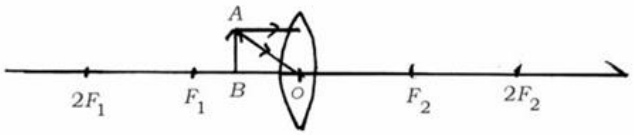
(C)  (D) 

Ans. :

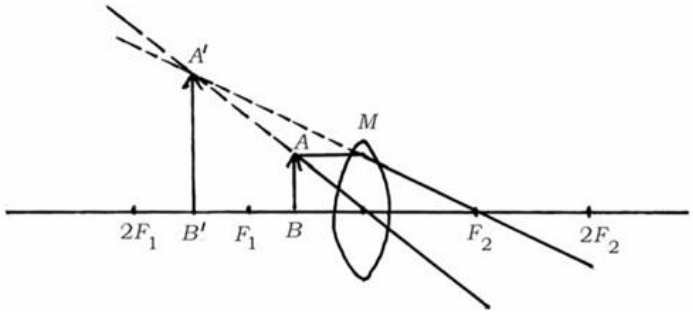
(B) 

15. **(2020 Sup)(1M)**

Observe the given incomplete diagram.



Ans. :



16. **(2020 Sup)(1M)**

17. Object distance and image distance of a lens are –30 cm and –10 cm respectively. Find the magnification and decide the type of lens used and nature of the image. **(2020 Sup)(2M)**

Ans. :

★ Here, object distance $u = -30$ cm

image distance $v = -10$ cm

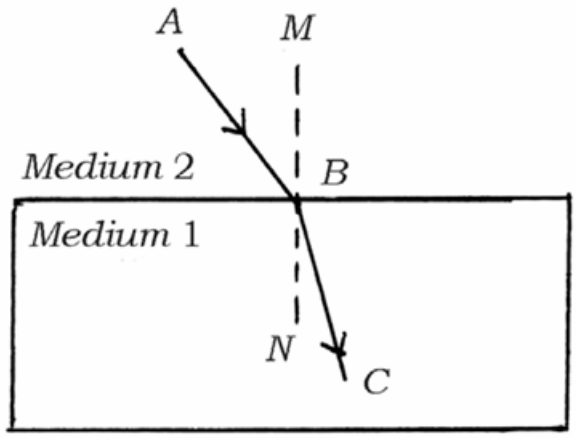
$\therefore$ Magnification, $m = \frac{v}{u}$

$= \frac{-10 \text{ cm}}{-30 \text{ cm}}$

$= \frac{1}{3} = +0{\cdot}33.$

Here, as v is negative, the used lens is concave lens.
As the magnification is positive and less than one [having positive sign] the image formed is erect, virtual and diminished.

18. State the laws of refraction of light.
In the given figure, AB is the incident ray, BC is the refracted ray and MN is the normal at the point of incidence. Which medium is more denser? Why? **(2020 Sup)(3M)**



Laws of refraction of light:
The incident ray, the refracted ray and the normal to the interface of two transparent media at the point of incidence, all lie in the same plane.
The ratio of sine of angle of incidence to the sine of angle of refraction is a constant for the light of a given colour and for the given pair of media

b) Medium 1 is more denser.
When a ray of light travels from rarer medium to denser medium, it always bends towards the normal

19. Differentiate between convex mirror and concave mirror.
Define the principal focus of a convex lens. **(2020 Sup)(3M)**

a) *Convex mirror*	*Concave mirror*
★ Reflecting surface is curved outwards	★ Reflecting surface is curved inwards
★ Always forms virtual and erect images	★ Forms real and inverted images. (Except the case when object is kept between *P* and *F*)
★ 	★ 
★ Diverges the light rays	★ Converges the light rays.

b) The rays of light falling on a convex lens parallel to the principal axis, after refraction from the lens converge to a point on the principal axis. This point on principal axis is called the 'principal focus' of the convex lens.

20. The focal length of a lens is + 0.50 m. The power of the lens and type are **(2021 Mains)(1M)**
(A) + 2.0 D and convex lens (B) + 2.0 D and concave lens
(C) – 2.0 D and concave lens (D) – 2.0 D and convex lens
Ans.: (A) + 2.0 D and convex lens

21. The nature and the size of the image formed when an object is kept between the principal focus F and optical centre O of a convex lens are **(2021 Mains)(1M)**
(A) virtual, erect and enlarged (B) real, inverted and small size
(C) virtual, inverted and small size (D) real, inverted and enlarged
Ans.: (A) virtual, erect and enlarged

Observe the following table :

Material medium	*Refractive index*
P	1.52
Q	1.44
R	2.42
S	1.33

In which material medium the speed of light is very high ?

(A) *Q* (B) *P*
(C) *S* (D) *R*

22. *Ans.* : (C) *S* **(2021 Mains)(1M)**

23. One property of a convex lens among the following is that it **(2021 Mains)(1M)**
(A) diverges the light rays
(B) is thicker at the edges and thinner at the middle

(C) forms real and erect image
(D) is thinner at the edges and thicker at the middle
Ans.: (D) is thinner at the edges and thicker at the middle

24. If the power of a lens is – 2.5 D, the focal length of the lens and type is
(A) + 0.40 m and convex lens
(B) – 0.40 m and convex lens
(C) + 0.40 m and concave lens
(D) – 0.40 m and concave lens
Ans.: (D) – 0.40 m and concave lens **(2021 Sup)(1M)**

25. One property of concave lens among the following is, that **(2021 Sup)(1M)**
(A) it converges the light rays
(B) is thicker at the edges and thinner at the middle
(C) is thinner at the edges and thicker at the middle
(D) it forms real and inverted image
Ans.: (B) is thicker at the edges and thinner at the middle

26. If an image is to be formed between F_2 and $2F_2$ in a convex lens, then the object should be placed **(2021 Sup)(1M)**
(A) beyond $2F_1$ (B) at $2F_1$
(C) between F_1 and $2F_1$ (D) at focus F_1

27. The distance between the principal focus and the optical centre of a lens is **(2021 Sup)(1M)**
(A) principal axis (B) object distance
(C) image distance (D) focal length
Ans.: (D) focal length

28. To get diminished and real image of an object from a convex lens, the object should be placed **(2022 Main)(1M)**
(A) at principal focus F_1
(B) between principal focus F_1 & $2F_1$
(C) beyond $2F_1$
(D) between principal focus F_1 and optical centre O.
Ans.: (C) beyond $2F_1$

29. An object is placed at 25 cm in front of a concave mirror of focal length 15 cm. At what distance from the mirror should a screen be placed in order to obtain a sharp image? **(2022 Main)(2M)**

Ans. :

$\frac{1}{v}+\frac{1}{u}=\frac{1}{f}$ $\frac{1}{2}$

$\frac{1}{v}=\frac{1}{f}-\frac{1}{u}=\frac{1}{-15}-\frac{1}{-25}$ $\frac{1}{2}$

$\frac{1}{v}=\frac{-5+3}{75}=\frac{-2}{75}$ $\frac{1}{2}$

$v=\frac{75}{-2}=-37{\cdot}5$ cm $\frac{1}{2}$

The screen should be placed at a distance of 37·5 cm, in front of the concave mirror

30. A concave lens has focal length of 15 cm. At what distance should the object from the lens be placed so that it forms an image at 10 cm from the lens? **(2022 Main)(2M)**

$\frac{1}{v}-\frac{1}{u}=\frac{1}{f}$ $\frac{1}{2}$

$\frac{1}{u}=\frac{1}{v}-\frac{1}{f}=\frac{1}{-10}-\frac{1}{-15}$ $\frac{1}{2}$

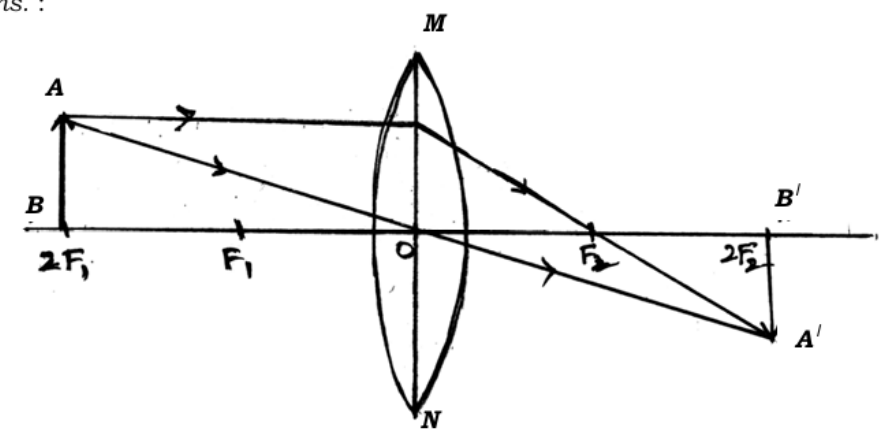
$\frac{1}{u}=\frac{-3+2}{30}=\frac{-1}{30}$ $\frac{1}{2}$

$u=-30$ cm $\frac{1}{2}$

The object is placed at a distance of 30 cm from the concave lens.

31. Draw the ray diagram to show the image formation by a convex lens, when the object is kept at $2F_1$ of the lens. With the help of the ray diagram mention the position and nature of the image formed. **(2022 Main)(3M)**

Ans. :



Position of the image — At $2F_2$ $\frac{1}{2}$

Nature of the image — Real and inverted $\frac{1}{2}$

(Figure) 2

32. a) What is refraction of light? State two laws of refraction of light.

b) What is refractive index of light? "The refractive index of diamond is 2·42." What is the meaning of this statement? **(2022 Main, Sup)(5M)**

Ans. :

a) Light travelling obliquely from one medium to another, the direction of propagation of light in the second medium changes.
The incident ray, the refracted ray and the normal to the interface of two transparent media at the point of incidence all lie in the same plan.
The ratio of sine of angle of incidence to the sine of angle of refraction is constant, for the light of given colour and for the given pair of media
sin i/ sin r = constant

b) The ratio of speed of light in air and the speed of light in medium. The ratio of speed of light in air and the speed of light in diamond is 2·42

33. The correct statement among the following related to the concave lens is **(2022 Sup)(1M)**
(A) converges the light rays
(B) diverges the light rays
(C) forms inverted image
(D) forms real image.
Ans.: (B) diverges the light rays

34. Calculate the power of convex lens with a focal length of + 0·5 m. **(2022 Sup)(1M)**

Ans. :

Focal length (f) = + 0·5 m

$$\text{Power of lens} = \frac{1}{\text{focal length}}$$

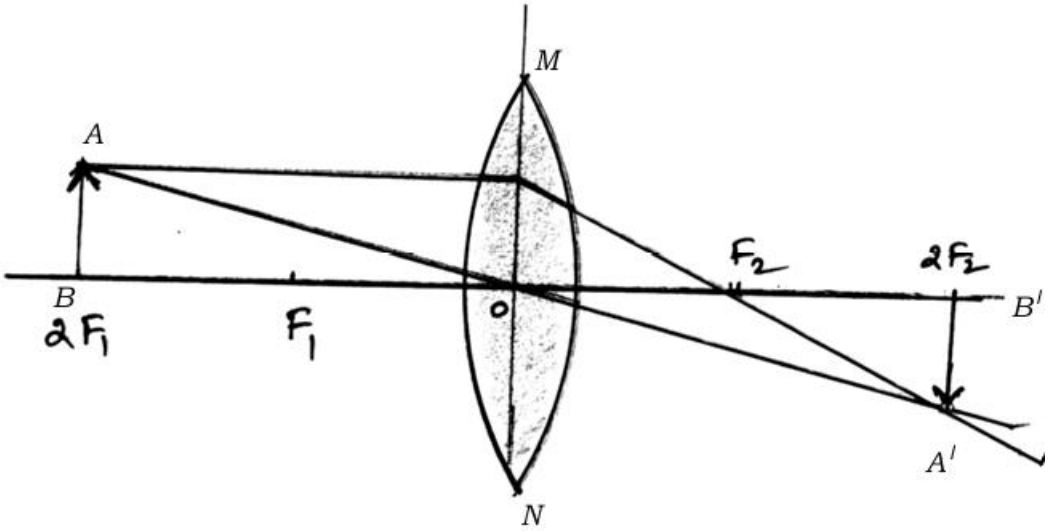
$$P = \frac{1}{f}$$

$$P = \frac{1}{0.5}$$

$$P = +2 \text{ D}$$

35. Draw the ray diagram of image formation when the object is kept at $2F_1$ of the convex lens. With the help of the ray diagram, mention the position and nature of the image formed. **(2022 Sup)(3M)**

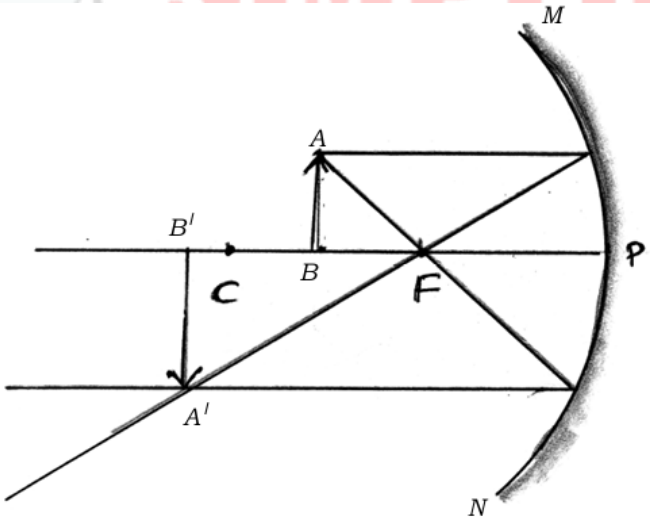
Ans. :



Position of the image : At $2F_2$

Nature of the image : Real and inverted 1

36. Draw the ray diagram of image formation when the object is kept between C and F of the concave mirror. With the help of the ray diagram mention the position and the nature of the image formed. (2022 Sup)(3M)



Position of the image : Beyond *C*

Nature of the image : read and inverted. 1

[$2 + \frac{1}{2} + \frac{1}{2}$]

37. a) Write any four uses of concave mirror. (2022 Sup)(4M)
b) An object is placed at a distance of 15 cm on the principal axis in front of a concave lens with a focal length of 10 cm. Find the image distance.

a) Uses of concave mirror.
i) Used in torches, search-lights
ii) Used in vehicles head lights
iii) Used as shaving mirrors
iv) The dentists used to test / examine teeth of patients
v) Used in solar furnace.

b) Given $f = -10$ cm, $u = -15$ cm

$$\frac{1}{f} = \frac{1}{v} - \frac{1}{u} \qquad \frac{1}{2}$$

$$\frac{-1}{10} = \frac{1}{v} + \frac{1}{15}$$

$$\frac{1}{v} = -\frac{1}{10} - \frac{1}{15} \qquad \frac{1}{2}$$

$$\frac{1}{v} = \frac{-3-2}{30}$$

$$\frac{1}{v} = \frac{-5}{30} \qquad \frac{1}{2}$$

$$\frac{1}{v} = \frac{-1}{6}$$

$$v = -6 \text{ cm.} \qquad \frac{1}{2}$$

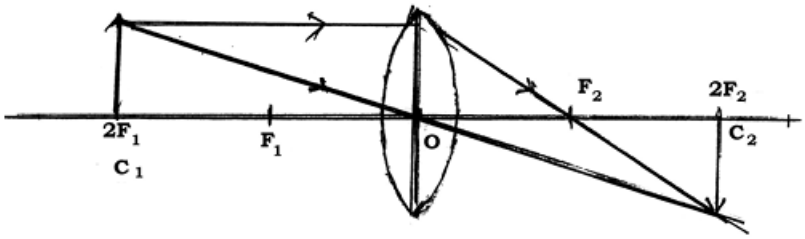
Image distance = – 6 cm.

38. A light ray enters to rarer medium from a denser medium. Then the speed of that light ray **(2023 Main)(1M)**
    (A) decreases and bends towards the normal
    (B) increases and bends away from the normal
    (C) decreases and bends away from the normal
    (D) increases and bends towards the normal
39. Light enters from air to benzene having refractive index 1·50. Calculate the speed of light in benzene. **(2023 Main)(2M)**
    (Speed of light in air: 3×10^8 ms^{-1})
40. A concave lens has focal length of 12 cm. At what distance should the object from the lens be placed so that it forms an image at 9 cm from the lens? **(2023 Main)(2M)**
41. Draw the ray diagram for the image formation in a convex lens when the object is placed beyond $2F_1$. Mention the position and nature of the image formed. **(2023 Main)(3M)**
42. A mirror forms an erect and enlarged image of an object. Then the type of the mirror and the nature of the image respectively are
    (A) convex mirror and virtual image
    (B) concave mirror and real image
    (C) plane mirror and real image

(D) concave mirror and virtual image

43. What is meant by the 'aperture' of a spherical mirror? Mention the four uses of a concave mirror. **(2023 Sup)(3M)**
44. A) What is a) What is meant by the power of a lens? Write the formula used to find the power of a lens. What is the SI unit of power of a lens?
    b) If the focal lengths of two lenses 'A' and 'B' are + 0·50 m and – 0·40 m respectively. Mention the types of these lenses in the same order. **(2023 Sup)(3M)**
45. Draw the ray diagram for the image formation by a convex lens, when the object is placed at $2F_1$. With the help of the ray diagram mention the position and the nature of the image formed. **(2023 Sup)(3M)**
46. Draw the ray diagram for the image formation in a convex lens when the object is placed beyond $2F_1$. With the help of the ray diagram mention the position and the nature of the image formed. **(2023 Sup)(3M)**
47. Draw the ray diagram of image formation when the object is kept at $2F_1$ of the convex lens. With the help of ray diagram mention the position and the nature of the image formed. **(2024 Exam 1)(3M)**

Ans. :



2

Position of the image : at $2F_2$ — $\frac{1}{2}$

Nature of the image : Real and inverted — $\frac{1}{2}$

48. a) State two laws of reflection of light. **(2024 Exam 1)(4M)**
    b) Write any two differences between concave mirror and convex mirror.

Ans.:

a) Laws of reflection of light:
   The angle of incidence is equal to the angle of reflection
   The incident ray, the normal to the mirror at the point of incidence and the reflected ray all lie in the same plane.

b)

Concave mirror	*Convex mirror*
★ Reflecting surface is curved inwards	★ Reflecting surface is curved outwards
★ Size of the image may be small, big and equal to that of the object.	★ Size of the image is always small and erect.
★ Virtual and real images are formed	★ Always virtual image is formed
★ It is used in torches, search lights and vehicles' headlight, shaving mirror etc.	★ It is used in rear-view side mirror of vehicles.

(Any *two*) 1 + 1

49. To get virtual and erect image by a convex lens, an object is to be placed
(A) beyond $2F_1$
(B) between F_1 and $2F_1$
(C) at focus F_1
(D) between focus F_1 and optical centre O **(2024 Exam 2)(1M)**
Ans.: (D) between focus 1 F and optical centre O

50. A concave lens has focal length of 25 cm. At what distance should the object from the lens be placed so that it forms an image at 20 cm from the lens? Find the magnification of the image produced by the lens. **(2024 Exam 2)(3M)**

Ans. :

Here, $v = -20$ cm, $f = -25$ cm, $u = ?$

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

$$\therefore \quad -\frac{1}{u} = \frac{1}{f} - \frac{1}{v}$$

$$\therefore \quad \frac{1}{u} = -\frac{1}{f} + \frac{1}{v}$$

$$\therefore \quad \frac{1}{u} = \frac{1}{v} - \frac{1}{f}$$

$$\therefore \quad \frac{1}{u} = \frac{1}{-20} - \frac{1}{-25}$$

$$\therefore \quad \frac{1}{u} = -\frac{1}{20} + \frac{1}{25}$$

$$\therefore \quad \frac{1}{u} = \frac{-5+4}{100}$$

$$\therefore \quad \frac{1}{u} = -\frac{1}{100}$$

$$\therefore \quad u = -100 \text{ cm}$$ 2

$\therefore$ Object distance = 100 cm

Magnification, $m = \frac{v}{u}$

$$= \frac{-20}{-100}$$

$$= \frac{1}{5}$$ 1

$$\therefore \quad m = +0{\cdot}2$$

51. State two laws of reflection of light. **(2024 Exam 2)(2M)**

Ans.:

i) 1 The angle of incidence is equal to the angle of reflection.

ii) The incident ray, the normal to the mirror at the point of incidence and the reflected ray, all lie in the same plane

52. Type of the mirror used in vehicles as rear view mirror is **(2024 Exam 3)(1M)**

(A) plane mirror (B) concave mirror

(C) convex mirror (D) planoconcave mirror

Ans.: (C) convex mirror

53. A concave lens has focal length of 30 cm. At what distance should the object from the lens be placed so that it forms an image at 20 cm from the lens? **(2024 Exam 3)(3M)**

Ans.:

v = – 20 (concave lens forms virtual and erect image)

f = – 30 (Image is on the same side of object in concave lens)

u = ?

Since $\frac{1}{v} - \frac{1}{u} = \frac{1}{f}$ $\frac{1}{2}$

$\frac{1}{u} = \frac{1}{v} - \frac{1}{f}$ $\frac{1}{2}$

$= \frac{1}{-20} - \frac{1}{(-30)}$ $\frac{1}{2}$

$= \frac{1}{-20} + \frac{1}{30}$ $\frac{1}{2}$

$= \frac{3-2}{-60}$ $\frac{1}{2}$

$= \frac{1}{-60}$

$\therefore \quad u = -60$ cm $\frac{1}{2}$

Thus the object distance is 60 cm.

54. a) Find the focal length of a convex mirror whose radius of curvature is 6 cm.
    b) Find the power of convex lens of focal length 0.2 m. **(2024 Exam 3)(3M)**

a) $R = +6.00$ cm (for convex mirror)

$f = ?$

$f = \frac{R}{2}$ $\frac{1}{2}$

$= \frac{6}{2}$ $\frac{1}{2}$

$= 3$ cm. $\frac{1}{2}$

b) $f = 0{\cdot}2$ m (convex lens)

$P = ?$

$P = \frac{1}{f}$ $\frac{1}{2}$

$= \frac{1}{0{\cdot}2}$ $\frac{1}{2}$

$= +5$ D $\frac{1}{2}$

55. Draw the ray diagram for the image formation in a convex lens when the object is placed between $2F_1$ and F_1. Mention the position and nature of the image formed.

Ans. :

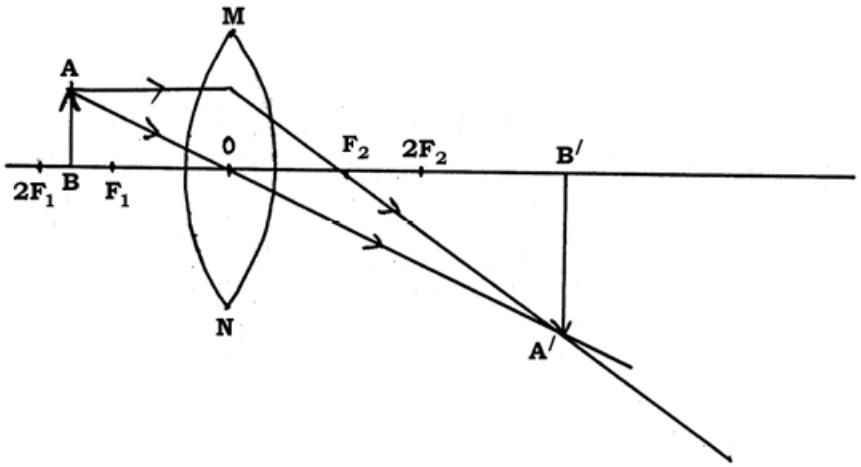


Diagram — 2

The nature of image is — Real and inverted — $\frac{1}{2}$

Position of image is — Beyond $2F_2$ — $\frac{1}{2}$