



PHYSICS

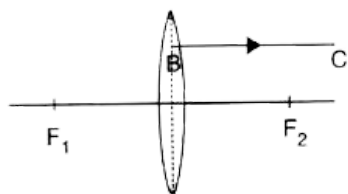
BOOKS - SELINA PHYSICS (ENGLISH)

REFRACTION THROUGH A LENS

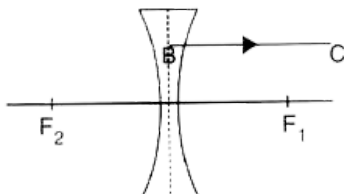
Example

1. Fig (a) and (b) show the refracted ray BC through a convex and a concave lens respectively and their foci marked as F_1 and

F_2 . Complete the diagram by drawing each corresponding incident ray.



(a) Convex



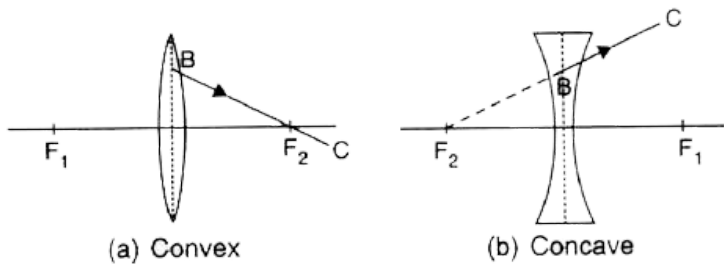
(b) Concave



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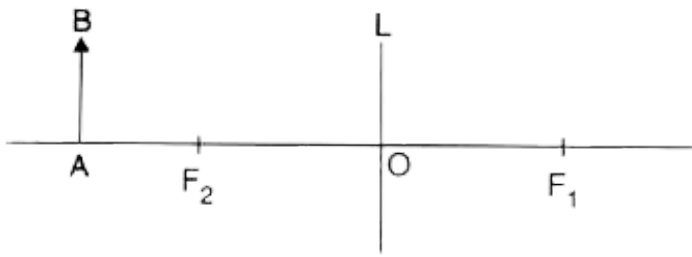
2. Fig (a) and (b) show the refracted ray BC through a convex and concave lens respectively. Complete each diagram by drawing the incident ray if F_1 and F_2 are the

principal foci of the lens.



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3. The diagram ahead shows an object AB placed on the principal axis of a lens L. The two foci of the lens are F_1 and F_2 . The image formed by the lens is erect, virtual and diminished.



(i) Draw the outline of the lens L used and name it.

(ii) Draw a ray of light starting from B and passing through O. Show the same ray after refraction by the lens.

(iii) Draw another ray from B which is incident parallel to the principal axis and show how does it emerge after refraction from the lens.

(iv) Locate the final image formed.



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4. Is it possible to burn a piece of paper using a convex lens in day light without using a match-box or any direct flame ? Draw a diagram to support your answer.



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5. An object of height 4.0 cm is placed at a distance 24 cm in front of a convex lens of focal length 8 cm. (a) Find the position and

size of the image. (b) State the characteristics of the image.



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6. The focal length of a camera lens is 20 cm. Find how far away from the film must the lens be set in order to photograph an object located at a distance 100 cm from the lens.



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7. A convex lens forms an image 16.0 cm long of an object 4.0 cm long kept at a distance 6 cm from the lens. The object and the image are on the same side of the lens.

(a) What is the nature of the image ?

(b) Find : (i) the position of the image, and (ii) the focal length of the lens.



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8. An object is placed at a distance of 10 cm in front of a concave lens of focal length 10 cm.

Find :

(a) the position of the image, and

(b) the size of the image in relation to the object.



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9. Where must an object be placed in front of a convex lens of focal length 20 cm to obtain a

real and four times magnified image ? Where will the image form ?



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10. A convex lens forms an erect and three times magnified image of an object placed at a distance 10 cm in front of it. Find :

- (a) the position of the image,
- (b) the focal length of the lens.



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Exercise 5 A

1. Which lens is converging: (i) an equiconcave lens or an equiconvex lens. (ii) a concavo-convex lens or a convexo-concave lens ?



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2. Define the terms pole, principal axis and centre of curvature with reference to a spherical mirror.



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3. A ray of light incident at a point on the principal axis of a convex lens passes undeviated through the lens. (a) What special name is given to this point on the principal axis ? (b) Draw a labelled diagram to support your answer in part (a).



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4. State the condition when a lens is called equiconvex or equi-concave.



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5. A ray of light, after refraction through a concave lens emerges parallel to the principal axis. (a) Draw a ray diagram to show the incident ray and its corresponding emergent ray. (b) The incident ray when produced meets

the principal axis at a point F. Name the point

F.



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6. A ray of light after refraction through a convex lens emerges parallel to the principal axis. (a) Draw a ray diagram to show it. (b) The incident ray passes through a point F on the principal axis. Name the point F.



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7. A beam of light incident on a convex lens parallel to its principal axis converges at a point F on the principal axis. Name the point F. Draw a ray diagram to show it.



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8. A beam of light incident on a thin concave lens parallel to its principal axis diverges and appears to come from a point F on the principal axis. Name the point F. Draw a ray diagram to show it.



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9. State the condition for each of the following:

a lens has both its focal lengths equal.



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10. State the condition for each of the following:

a ray passes undeviated through the lens.





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11. Complete the following sentences :

If half part of a convex lens is covered, the focal length change, but the intensity of the image



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12. Complete the following sentences :

A convex lens is placed in water. Its focal length will



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Exercise 5 A Multiple Choice Type

1. A ray of light after refraction through a lens emerges parallel to the principal axis of the lens. The incident ray passes through :

A. its optical centre

B. its first focus

C. its second focus

D. the centre of curvature of the first surface.

Answer: B



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2. A ray of light incident on a lens parallel to its principal axis, after refraction passes through or appears to come from :

A. its first focus

B. its optical centre

C. its second focus

D. the centre of curvature of its second surface.

Answer: C



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Exercise 5 B

1. Where must a point source of light be placed in front of a convex lens so as to obtain a parallel beam of light?



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2. (a) Name the lens which always forms an erect and virtual image.

(b) State whether the image in part (a) is magnified or diminished.



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3. Can a concave lens form an image of size two times that of the object ? Give reason.



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4. Give two characteristics of the image formed by a concave lens.



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5. Give two characteristics of the virtual image formed by a convex lens.



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6. In each of the following cases, where must an object be placed in front of a convex lens so that the image formed is

(a) at infinity?

(b) of the same size as the object ?

(c) inverted and enlarged ?

(d) upright and enlarged ?



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7. Complete the following sentences :

An object is placed at a distance of more than 40 cm from a convex lens of focal length 20 cm. The image formed is real, inverted and.....



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8. Complete the following sentences :

An object is placed at a distance $2f$ from a convex lens of focal length f . The size of the image formed is that of the object.



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9. Complete the following sentences :

An object is placed at a distance 5 cm from a convex lens of focal length 10 cm. The image formed is virtual, upright and





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10. State whether the following statements are 'true' or 'false' by writing T/F against them.

A convex lens has a divergent action and a concave lens has a convergent action.



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11. State whether the following statements are 'true' or 'false' by writing T/F against them.

A concave lens, if kept at a proper distance from an object, can form its real image.



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12. State whether the following statements are 'true' or 'false' by writing T/F against them.

A ray of light incident parallel to the principal axis of a lens, passes undeviated after refraction.



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13. State whether the following statements are 'true' or 'false' by writing T/F against them.

A ray of light incident at the optical centre of a lens, passes undeviated after refraction.



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14. State whether the following statements are 'true' or 'false' by writing T/F against them.

A concave lens forms a magnified or diminished image depending on the distance of an object from it.



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Exercise 5 B Multiple Choice Type

1. For an object placed at a distance 20 cm in front of a convex lens, the image is at a distance 20 cm behind the lens. The focal length of the convex lens is:

A. 20 cm

B. 10 cm

C. 15 cm

D. 40 cm

Answer: B



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2. For the object placed between the optical centre and focus of a convex lens, the image is

:

A. real and enlarged

B. real and diminished

C. virtual and enlarged

D. virtual and diminished

Answer: C



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3. A concave lens forms the image of an object

which is :

A. virtual, inverted, and diminished

B. virtual, upright, and diminished

C. virtual, inverted, and enlarged

D. virtual, upright, and enlarged.

Answer: b



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Exercise 5 C

1. The focal length of a lens is (i) positive, (ii) negative. In each case, state the kind of lens.



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2. What information about the nature of image (i) real or virtual, (ii) erect or inverted, do you get from the sign of magnification + or - ?



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3. How does the power of a lens change if its focal length is doubled ?



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4. How is the sign (+ or -) of power of a lens related to its divergent or convergent action ?



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5. Which lens has more power : a thick lens or a thin lens ?



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Exercise 5 C Multiple Choice Type

1. If the magnification produced by a lens is - 0.5, the correct statement is :

A. the lens is concave

B. the image is virtual

C. the image is magnified

D. the image is real and diminished formed
by a convex lens

Answer: D



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2. The correct lens formula is

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

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

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

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

Answer: C



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3. On reducing the focal length of a lens, its power :

A. decreases

B. increases

C. does not change

D. first increases then decreases.

Answer: B



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4. The lens of power + 1.0 D is :

A. convex of focal length 1.0 cm

B. convex of focal length 1.0 m

C. concave of focal length 1.0 cm

D. concave of focal length 1.0 m.

Answer: B



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1. (a) At what position a candle of length 3 cm be placed in front of a convex lens so that its image of length 6 cm be obtained on a screen placed at a distance 30 cm behind the lens ?

(b) What is the focal length of the lens in part (a)?



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2. A concave lens forms the image of an object kept at a distance 20 cm in front of it, at a

distance 10 cm on the side of the object. (a)

What is the nature of the image ? (b) Find the focal length of the lens.



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3. The focal length of a convex lens is 25 cm. At what distance from the optical centre of the lens an object be placed to obtain a virtual image of twice the size ?



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4. Where should an object be placed in front of a convex lens of focal length 0.12 m to obtain a real image of size three times the size of the object, on the screen ?



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5. An illuminated object lies at a distance 1.0 m from a screen. A convex lens is used to form an image of the object on a screen placed at a distance of 75 cm from the lens. Find : (i) the

focal length of the lens, and (ii) the magnification.



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6. A lens forms the image of an object placed at a distance of 15 cm from it, at a distance of 60 cm in front of it. Find : (i) the focal length, (ii) the magnification, and (iii) the nature of image.



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7. A lens forms the image of an object placed at a distance of 45 cm from it on a screen placed at a distance 90 cm on the other side of it. (a) Name the kind of lens. (b) Find : (i) the focal length of the lens, and (ii) the magnification of the image.



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8. An object is placed at a distance of 20 cm in front of a concave lens of focal length 20 cm. Find :

(a) the position of the image, and

(b) the magnification of the image.



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9. A convex lens forms an inverted image of size same as that of the object which is placed at a distance 60 cm in front of the lens. Find :

(a) the position of the image, and

(b) the focal length of the lens



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10. A concave lens forms an erect image of $\frac{1}{3}$ rd the size of the object which is placed at a distance 30 cm in front of the lens. Find :

(a) the position of the image, and

(b) the focal length of the lens.



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11. The power of a lens is + 2.0 D. Find its focal length and state the kind of the lens.



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12. Express the power (with sign) of a concave lens of focal length 20 cm.



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13. The focal length of a convex lens is 25 cm.
Express its power with sign.



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14. The power of a lens is -2.0 D. Find its focal length and its kind.



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15. The magnification by a lens is -3 . Name the lens and state how are u and v related ?



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16. The magnification by a lens is $+0.5$. Name the lens and state how are u and v related ?



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17. A concave lens has a focal length of 30 cm. Find the position and magnification (m) of the image for an object placed in front of it at a distance of 30 cm. State whether the image is real or virtual ?



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18. Find the position and magnification of the image of an object placed at a distance of 8.0 cm in front of a convex lens of focal length 100 cm. Is the image erect or inverted ?



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Exercise 5 D Multiple Choice Type

1. A magnifying glass forms:

- A. a real and diminished image
- B. a real and magnified image
- C. a virtual and magnified image
- D. a virtual and diminished image.

Answer: C



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2. The maximum magnifying power of a convex lens of focal length 5 cm can be :

A. 25

B. 10

C. 1

D. 6

Answer: D



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