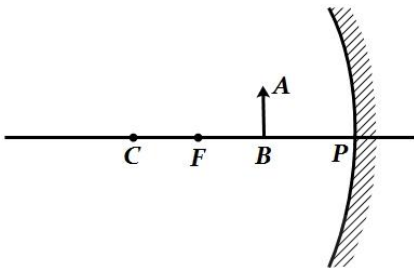# Light – Reflection and Refraction

1 Marks

1. Draw the following diagram in your answer-book and show the formation of image of the object AB with the help of suitable rays. **[CBSE, 2008]**

2. Explain why a ray of light passing through the centre of curvature of a concave mirror gets reflected along the same path. **[CBSE,2010]**

3. What is the nature of the image formed by a concave mirror if the magnification produced by the mirror is +3? **[CBSE,2010]**

2 Marks

4. Draw ray diagrams to represent the nature, position and relative size of the image formed by a convex lens for the object placed :

    A)   at $2F_1$

    B)   between F_1 and the optical centre O of lens **[CBSE,2008]**

5. The absolute refractive indices of glass and water are 4/3 and 3/2 respectively. If the speed of light in glass is $2 \times 10^8 \, m/s$, calculate the speed of light in.

    I.   vacuum

    II.   water **[CBSE,2015]**

6. Name the type of mirrors used in the design of solar furnaces. Explain how high temperature is achieved by this device. **[CBSE,2016]**

7. An object is placed at a distance of $30 \, cm$ from a concave lens of focal length $15 \, cm$. List four characteristics (nature, position, etc.) of the image formed by the lens.. **[CBSE,2017]**

3 Marks

8. For which position of the object does a convex lens form a virtual and erect image? Explain with the help of a ray diagram.. **[CBSE,2009]**

9. At what distance should an object be placed from a convex lens of focal length $18 \, cm$ to obtain an image at $24 \, cm$ from it on the other side. What will be the magnification produced in this case? **[CBSE,2010]**

10. If the image formed by a mirror for all positions of the object placed in front of it is always erect and diminished, what type of mirror is it? Draw a ray diagram to justify your answer. Where and why do we generally use this type of mirror? **[CBSE,2015]**

11. The image of an object formed by a mirror is real, inverted and is of magnification -1. If the image is at a distance of $40 \, cm$ from the mirror, where is the object placed? Where would the image be if the object is moved $20 \, cm$ towards the mirror? State reason and also draw ray diagram for the new position of the object to justify your answer. **[CBSE,2016]**

12. If the image formed by a lens for all positions of an object placed in front of it is always erect and diminished, what is the nature of this lens? Draw a ray diagram to justify your answer. If the numerical value of the power of this lens is $10 \, D$, what is its focal length in the Cartesian system? **[CBSE,2017]**

5 Marks

13. What is meant by power of a lens? Define its S.I. unit. You have two lenses A and B of focal lengths $+10\ cm$ and $-10\ cm$ respectively. State the nature and power of each lens. Which of the two lenses will form a virtual and magnified image of an object placed 8 cm from the lens? Draw a ray diagram to justify your answer. **[CBSE,2015]**

14. One half of a convex lens of focal length 10 cm is covered with a black paper. Can such a lens produce an image of a complete object placed at a distance of 30 cm from the lens? Draw a ray diagram to justify your answer. A 4 cm tall object is placed perpendicular to the principal axis of a convex lens of focal length 20 cm. The distance of the object from the lens is 15 cm. Find the nature, position and size of the image. **[CBSE,2015]**

15. It is desired to obtain an erect image of an object, using concave mirror of focal length of 12 cm.

    I.   What should be the range of distance of an object placed in front of the mirror?

    II.   Will the image be smaller or larger than the object. Draw ray diagram to show the formation of image in this case.

    III.   Where will the image of this object be, if it is placed 24 cm in front of the mirror? Draw ray diagram for this situation also to justify your answer. Show the positions of pole, principal focus and the centre of curvature in the above ray diagrams. **[CBSE,2016]**

S. No.	Object-Distance $u\ (cm)$	Image-Distance $v\ (cm)$
1	-100	$+25$
2	-60	$+30$
3	-40	$+40$
4	-30	$+60$
5	-25	$+100$
6	-15	$+120$

16. A.   Define optical centre of a spherical lens.

    B.   A divergent lens has a focal length of 20 cm. At what distance should an object of height 4 cm from the optical centre of the lens be placed so that its image is formed 10 cm away from the lens. Find the size of the image also.

    C.   Draw a ray diagram to show the formation of image in above situation. **[CBSE,2016]**

17. A.   In the image formed by a mirror for all positions of the object placed in front of it is always diminished, erect and virtual, state the type of the mirror and also draw a ray diagram to justify your answer. Write one use such mirrors are put to and why.

    B.   Define the radius of curvature of spherical mirrors. Find the nature and focal length of a spherical mirror whose radius of curvature is $+24\ cm$. **[CBSE,2017]**

18. Analyse the following observation table showing variation of image-distance (v) with object-distance (u) in case of a convex lens and answer the questions that follow without doing any calculations

    A.   What is the focal length of the convex lens? Give reason to justify your answer.

    B.   Write the serial number of the observation which is not correct. On what basis have you arrived at this conclusion?

    C.   Select an appropriate scale and draw a ray diagram for the observation at S. No. 2. Also find the approximate value of magnification. **[CBSE,2017]**

Practical Based Questions

1 Mark

19. A student obtains a sharp image of the distant window (W) of the school laboratory on the screen (S) using the given concave mirror (M) to determine its focal length. Which of the following distances should he measure to get the focal length of the mirror? **[CBSE,2015]**
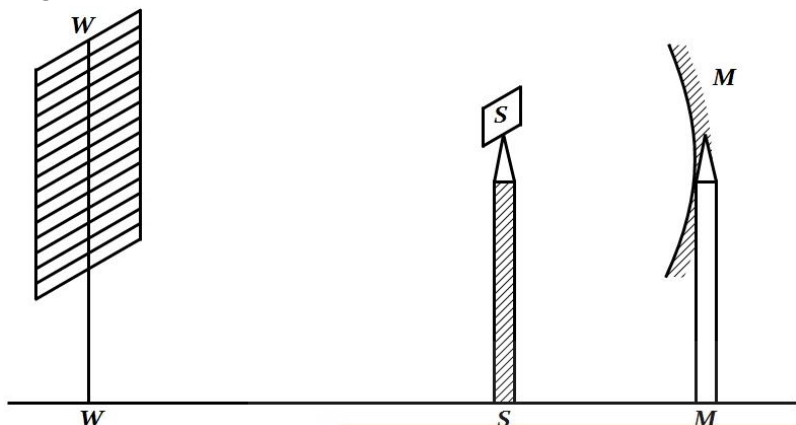
A) MW B) MS C) SW D) $MW - MS$

20. A student used a device (X) to obtain/focus the image of a well illuminated distant building on a screen (S) as shown below in the diagram. Select the correct statement about the device (X).
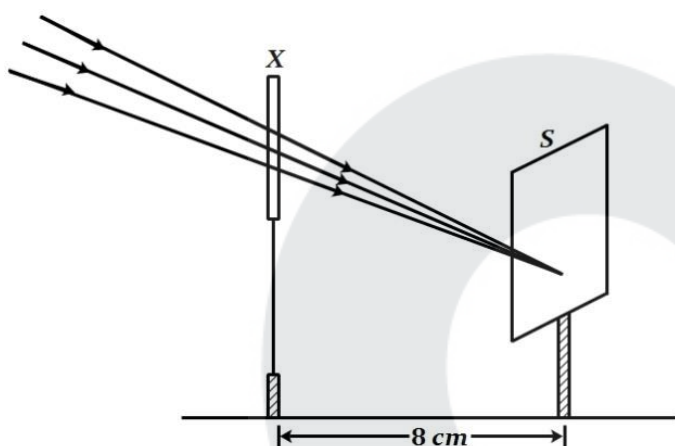

A) This device is a concave lens of focal length 8 cm.

B) This device is a convex mirror of focal length 8 cm.

C) This device is a convex lens of focal length 4 cm.

D) This device is a convex lens of focal length 8 cm.

21. A student traces the path of a ray of light through a rectangular glass slab for the different values of angle of incidence. He observes all possible precautions at each step of the experiment. At the end of the experiment, on analyzing the measurements, which of the following conclusions is he likely to draw? **[CBSE,2015]**

A) $\angle i = \angle e < \angle r$ B) $\angle i < \angle e < \angle r$ C) $\angle i > \angle e > \angle r$ D) $\angle i = \angle e > \angle r$

22. To determine the approximate value of the focal length of a given concave mirror, you focus the image of a distant object formed by the mirror on a screen. The image obtained on the screen, as compared to the object is always : **[CBSE,2016]**

A) Laterally inverted and diminished   B) Inverted and diminished

C) Erect and diminished   D) Erect and highly diminished

23. Suppose you have focused on a screen the image of candle flame placed at the farthest end of the laboratory table using a convex lens. If your teacher suggests you to focus the parallel rays of the sun, reaching your laboratory table, on the same screen, what you are expected to do is to move the : **[CBSE,2016]**

A) lens slightly towards the screen   B) lens slightly away from the screen

C) lens slightly towards the sun   D) lens and screen both towards the sun

24. In your laboratory, you trace the path of light rays through a glass slab for different values of angle of incidence ($\angle i$) and in each case measure the values of the corresponding angle of refraction ($\angle r$) and angle of emergence ($\angle e$). On the basis of your observations your correct conclusion is : **[CBSE,2016]**

A) $\angle i$ is more than $\angle r$, but nearly equal to $\angle e$
B) $\angle i$ is less than $\angle r$, but nearly equal to $\angle e$
C) $\angle i$ is more than $\angle e$, but nearly equal to $\angle r$
D) $\angle i$ is less than $\angle e$, but nearly equal to $\angle r$

25. Study the given ray diagrams and select the correct statement from the following : **[CBSE,2017]**
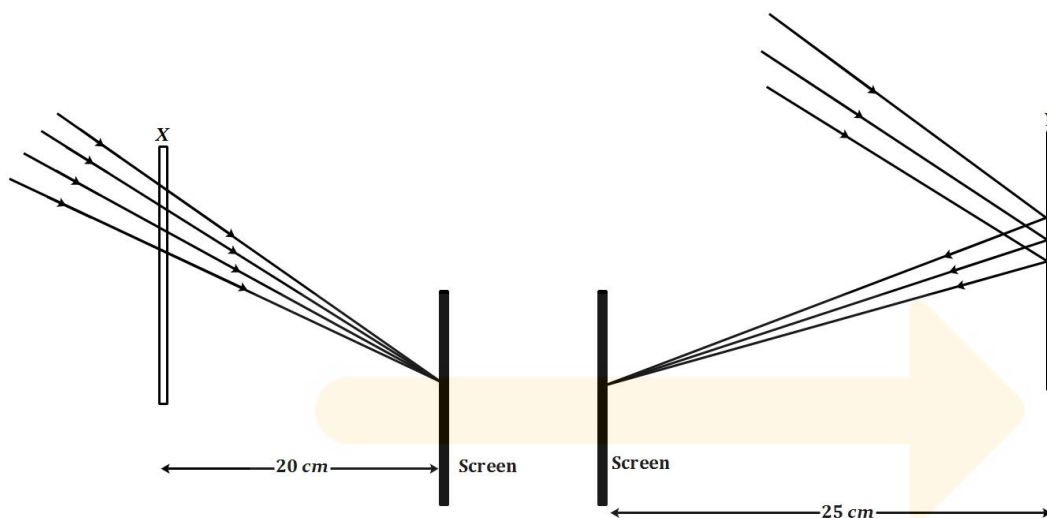
A) Device X is a concave mirror and device Y is a convex lens, whose focal lengths are 20 cm and 25 cm respectively.
B) Device X is a convex lens and device Y is a concave mirror, whose focal lengths are 10 cm and 25 cm respectively.
C) Device X is a concave lens and device Y is a convex mirror, whose focal lengths are 20 cm and 25 cm respectively.
D) Device X is a convex lens and device Y is a concave mirror, whose focal lengths are 20 cm and 25 cm respectively.

26. A student obtains a blurred image of a distant object on a screen using a convex lens. To obtain a distinct image on the screen he should move the lens **[CBSE,2017]**

A) away from the screen
B) towards the screen
C) to a position very far away from the screen
D) either towards or away from the screen depending upon the position of the object

27. A student very cautiously traces the path of a ray through a glass slab for different values of the angle of incidence ($\angle i$). He then measures the corresponding values of the angle of refraction ($\angle r$) and the angle of emergence ($\angle e$) for every value of the angle of incidence. On analysing these measurements of angles, his conclusion would be **[CBSE,2017]**

A) $\angle i > \angle r > \angle e$ 　　 B) $\angle i = \angle e > \angle r$ 　　 C) $\angle i < \angle r < \angle e$ 　　 D) $\angle i = \angle e < \angle r$

2 Marks

28. A 4 cm tall object is placed on the principal axis of a convex lens. The distance of the object form the optical centre of the lens is 12 cm and its sharp image is formed at a distance of 24 cm from it on a screen on the other side of the lens. If the object is now moved a little away from the lens, in which way (towards the lens or away from the lens) will he have to move the screen to get a sharp image of the object on it again? How will the magnification of the image be affected? **[CBSE,2015]**

29. An object of height 2.5 cm is placed at a distance of 15 cm from the optical centre 'O' of a convex lens of focal length 10 cm. Draw a ray diagram to find the position and size of the image formed. Mark optical centre 'O', principal focus F and height of the image on the diagram. **[CBSE,2016]**

30. A student focuses the image of a candle flame, placed at about 2 m from a convex lens of focal length 10 cm, on a screen. After that he moves gradually the flame towards the lens and each time focuses its image on the screen. **[CBSE,2017]**

A) In which direction does he move the lens to focus the flame on the screen?
B) What happens to the size of the image of the flame formed on the screen?
C) What difference is seen in the intensity (brightness) of the image of the flame on the screen?
D) What is seen on the screen when the flame is very close (at about 5 cm) to the lens?