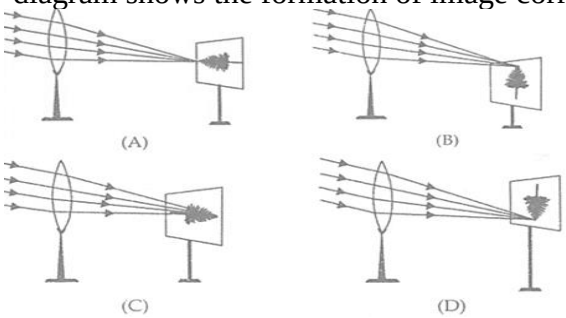
INDIAN SCHOOL AL WADI AL KABIR		
Class: X	DEPARTMENT OF SCIENCE -2021-22 SUBJECT: PHYSICS	DATE OF COMPLETION: 10.06.2021
WORKSHEET NO:2 WITH ANSWERS	TOPIC: LIGHT -REFLECTION AND REFRACTION-PART 2	A4 FILE FORMAT (PORTFOLIO)
CLASS & SEC:	NAME OF THE STUDENT:	ROLL NO.

OBJECTIVE TYPE QUESTIONS

1. While performing an experiment on determination of focal length of a convex lens, four students obtained the image of the same distant tree on the screen as follows. Which diagram shows the formation of image correctly?



2. Convex lens focus a real, point sized image at focus, the object is placed
a. At focus b. Between F and 2F
c. At infinity d. At 2F

3. Light from the Sun falling on a convex lens will converge at a point called
(a) centre of curvature (b) focus
(c) radius of curvature (d) optical centre

4. Power of the lens is -4D, its focal length is
(a) 4 m (b) -40m
(c) -0.25 m (d) -25 m

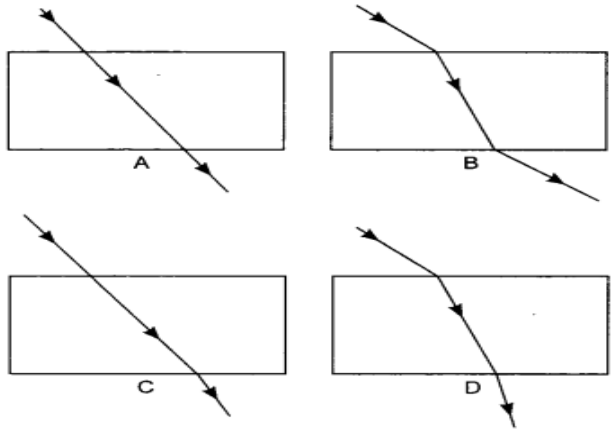
5. The SI unit of power of lens is
(a) Metre (b) Centimetre
(c) dioptre (d) m^{-1}

6. The refractive index of transparent medium is greater than one because
(a) Speed of light in vacuum < speed of light in transparent medium (b) Speed of light in vacuum > speed of light in transparent medium
(c) Speed flight in vacuum = speed of light in transparent medium
(d) Frequency of light wave changes when it moves from rarer to denser medium

7. A divergent lens will produce
(a) always real image

(b) always virtual image
(c) both real and virtual image
(d) none of these

8. The path of a ray of light coming from air passing through a rectangular glass slab traced by four students are shown as A, B, C and D in figure. Which one of them is correct?



(a) A (b) B
(c) C (d) D

ASSERTION AND REASONING

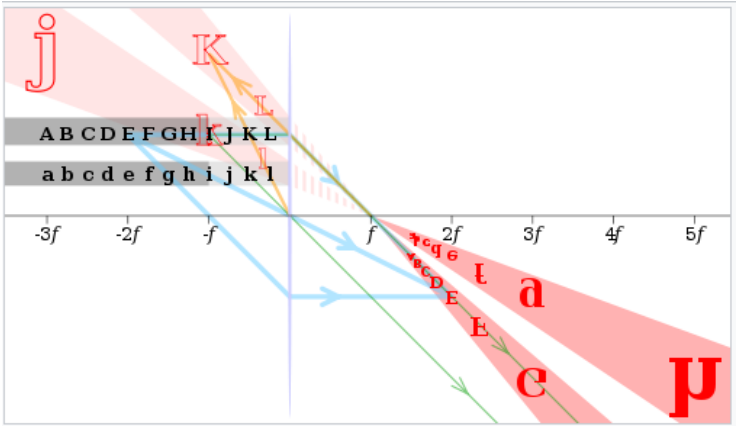
DIRECTION: In the following questions, a statement of assertion (A) is followed by a statement of reason (R). Mark the correct choice as:
(a) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A).
(b) Both assertion (A) and reason (R) are true but reason (R) is not the correct explanation of assertion (A).
(c) Assertion (A) is true but reason (R) is false.
(d) Assertion (A) is false but reason (R) is true.
(e) Both Assertion and Reason are false.

9. Assertion : Higher is the refractive index of a medium or denser the medium, lesser if the velocity of light in that medium.
Reason : Refractive index is directly proportional to velocity.

10. Assertion : Refractive index has no units.
Reason : The refractive index is a ratio of two similar quantities.

11. Assertion : The speed of light in glass depends on colour of light.
Reason : The speed of light in glass $v_g=\frac{c}{n_g}$,the refractive index (ng) of glass is different for different colours.

CASE STUDY BASED QUESTION



In the figure, images of black letters in a thin convex lens of focal length f are shown in red. Selected rays are shown for letters E, I and K in blue, green and orange, respectively. Note that E (at 2f) has an equal-size, real and inverted image; I (at f) has its image at infinity; and K (at f/2) has a double-size, virtual and upright image.

12. The image formed by a convex lens can be

a) virtual and magnified b) virtual and diminished

c) virtual and of same size d) virtual image is not formed

13. When the object is placed between f and 2f of a convex lens, the image formed is

a) at f b) at 2f

c) beyond 2f d) between O and f

14. If an object is placed 21 cm from a converging lens, the image formed is slightly smaller than the object. If the object is placed at a distance of 19 cm from the lens, the image formed is slightly larger than the object. The approximate focal length of the lens is:

a) 20 cm b) 18 cm

c) 10 cm d) 5 cm

15. Which of the following statements is true?

a) A convex lens has 4 dioptre power having a focal length 0.25 m

b) A convex lens has -4 dioptre power having a focal length 0.25 m

c) A concave lens has 4 dioptre power having a focal length 0.25 m

d) A concave lens has -4 dioptre power having a focal length 0.25 m

TWO MARKS TYPE QUESTIONS

16. Find the power of a convex lens which forms a real and inverted image of magnification -1 of an object placed at a distance of 20 cm from its optical centre.

17. What is the velocity of light in a glass slab of refractive index 1.5?

THREE MARKS TYPE QUESTIONS

18. One student uses a lens of focal length +50 cm and another −50 cm. State the nature and find the power of each lens. Which of the two lenses will always give a virtual and diminished image irrespective of the position of the object?

19. A student wants to project the image of a candle flame on the walls of school laboratory by using a lens:

(a) Which type of lens should he use and why?

(b) At what distance in terms of focal length 'F' of the lens should he place the candle

flame so as to get (i) a magnified, and (ii) a diminished image respectively on the wall?

(c) Draw ray diagram to show the formation of the image in each case?

FIVE MARKS TYPE QUESTIONS

20. (i) Define the following terms:

(a) Power of a lens

(b) Principal focus of a concave mirror

(ii) Write the relationship among the object distance (u), image distance (v) and the focal length (f) of a

(a) Spherical lens

(b) Spherical mirror

(iii) An object is placed at a distance of 10 cm from optical centre of a convex lens of focal length 15 cm. Draw a labelled ray diagram to show the formation of image in this case.

21. State the law of refraction of light that defines the refractive index of a medium with respect to the other. Express it mathematically. How is the refractive index of any medium 'A' with respect to a medium 'B' related to the speed of propagation of light in two media A and B? State the name of this constant when one medium is vacuum or air.

The refractive indices of glass and water with respect to vacuum are 3/2 and 4/3 respectively. If the speed of light in glass is 2×10^8, find the speed of light in(i) vacuum, (ii)water.

PREVIOUS YEAR BOARD QUESTIONS

22. Analyse the following observation table showing a 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: CBSE 2016

S. No.	Object distance u (cm)	Image distance v (cm)
1	-90	+18
2	-60	+20
3	-30	+30
4	-20	+60
5	-18	90
6	-10	100

(a) What is the focal length of the convex lens? Give a 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.4. Also, find the approximate value of magnification.

23. Draw a ray diagram to show the path of the refracted ray in each of the following cases. A ray of light incident on a concave lens is: CBSE 2014

(i) passing through its optical centre.
(ii) parallel to its principal axis.
(iii) directed towards its principal focus.

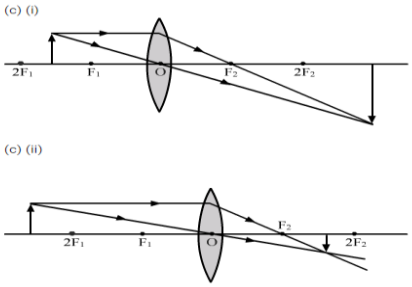
EXEMPLAR QUESTIONS

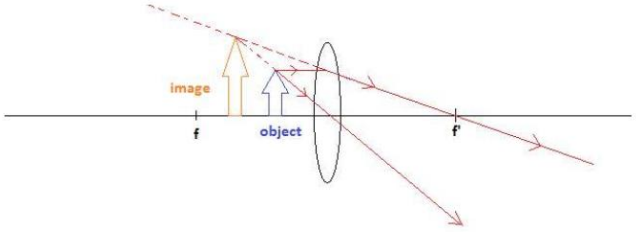
24. A concave lens of focal length 15 cm forms an image 10 cm from the lens. How far is the object placed from the lens? Draw the ray diagram.

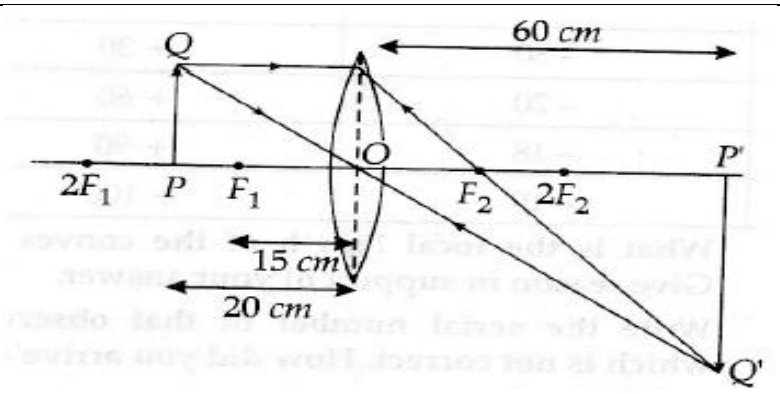
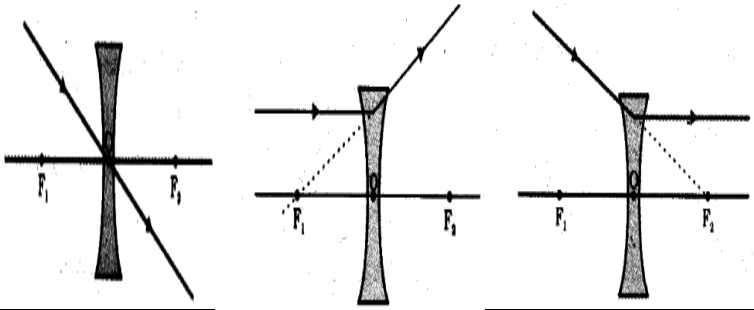
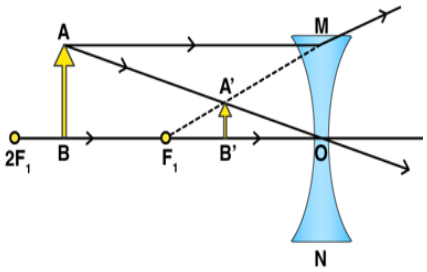
25. A doctor has prescribed a corrective lens of power +1.5 D. Find the focal length of the lens. Is the prescribed lens diverging or converging?

ANSWERS

QN NO	ANSWER	MARKS
1.	D	1
2.	c. At infinity	1
3.	(b) focus	1
4.	(c)-0.25m	1
5.	(c)dioptre	1
6.	(b) Speed of light in vacuum > speed of light in transparent medium	1
7.	(b) always virtual image	1
8.	(b) B	1
9.	(c)Assertion (A) is true but reason (R) is false.	1
10.	(a) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A).	1
11.	(a) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A).	1
12.	a) virtual and magnified	1
13.	c) beyond 2f	1
14.	c) 10 cm	1
15.	a) A convex lens has 4 dioptre power having a focal length 0.25 m	1
16.	Ans: A convex lens forms an image of magnification -1 when the object is placed at 2F, . For focal length, f, we have, 2f=20cm f=10cm=0.1m Power of lens, P=1/f =1/0.1=10 D	2
17.	we know that refractive index $n = \frac{speed\ of\ light\ in\ vacuum}{speed\ of\ light\ in\ medium}$ where $c = 3 \times 10^8 m/s$ $1.5 = \frac{c}{v}$ $v = \frac{3 \times 10^8}{1.5}$ $v = 2 \times 10^8 m/s$	2
18.	Ans:- The first lens of focal length f =+50 cm, is a convex lens.	3

	The second lens of focal length f=−50 cm is a concave lens. Power of the convex lens, $P_1 = \frac{1}{f_1} = \frac{1}{+0.5\ \text{m}} = +2\ \text{D}$ Power of the concave lens, $P_2 = \frac{1}{f_2} = \frac{1}{-0.5\ \text{m}} = -2\ \text{D}$ The concave lens always gives a virtual and diminished image irrespective of the object's position.	
19.	Ans:- a) The student should use a convex lens because with the help of convex lens, he would be able to project image on the walls because convex lens will form a real image. b) (i) In order to form a magnified image on the wall, the candle flame should be placed between F and 2F from the lens. (ii) In order to form a diminished image on the wall, the candle flame should be placed at a distance greater than 2F from the lens. 	3
20.	i. a) The power of a lens is defined as the reciprocal of the focal length. b) Light rays that are parallel to the principal axis of a concave mirror converge at a specific point on its principal axis after reflecting from the mirror. This point is known as the principal focus of the concave mirror. ii. a. 1/f=1/v- 1/u b. 1/f=1/v+1/u iii. Given: u=-10cm $f = 15\ m$ Now the distance of the image formed: 1/f=1/v- 1/u 1/15=1/v+1/10 v=-30cm negative sign denotes that the image is formed on the same side of the object and is virtual erect and magnified	5

		
21.	Ans:-The second law of refraction is also known as Snell's law of refraction and it states that the ratio of sine of the angle of incidence to the sine of refraction is constant for a given pair of media. It establishes a relation between angle of incidence and angle of refraction. It can be expressed mathematically as follows : $\frac{\sin i}{\sin r} = n$ n is constant and is known as refractive index. The refractive index of any medium 'A' with respect to a medium 'B' related to the speed of propagation of light in two media A and B can be written as follows: $_{B}n_{A} = \frac{v_B}{v_A}$ Let, absolute refractive index of glass, $n_g = \frac{3}{2}$. Absolute refractive index of water, $n_w = \frac{4}{3}$ Speed of light in glass, $v_g = 2 \times 10^8$ m/s (*i*) Speed of light in vacuum, $n_g = \frac{c}{v_g}$ $c = n_g \times v_g = \frac{3}{2} \times 2 \times 10^8 = 3 \times 10^8$ m/s. (*ii*) Speed of light in water, $n_w = \frac{c}{v_w}$ $v_w = \frac{c}{n_w} = \frac{3 \times 10^8}{\left(\frac{4}{3}\right)} = 2.25 \times 10^8$ m/s.	5
22.	(a) From S. No- 3, we can say that the radius of curvature of the lens is 30 cm because when an object is placed at the centre of curvature of a convex lens, its image is formed on the other side of the lens at the same distance from the lens. And, we know that focal length is half of the radius of curvature. Thus, the focal length of the lens is +15 cm. (b) S. No- 6 is not correct as the object distance is between focus and pole so for such lenses the image formed. is always virtual but in this case, a real image is forming as the image distance is positive. (c) Approximate value magnification for distance object - 20 cm and image distance +60 cm is 3.	5

		
23.	(i) Passing through its optical centre. (ii) parallel to its principal axis. (iii) Directed towards its principal focus. 	3
24.	Focal length (f) = -15 cm Distance of image (v) = -10 cm $\frac{1}{v} - \frac{1}{u} = \frac{1}{f}$ 1/u = -(1/10) – (1/- 15) 1/u =1/15 – 1/10 1/u = -0.033 u = -30 cm so the object is placed 30 cm away from the concave lens. 	3
25.	Here, P = + 1.5 D ∴ $f = \frac{1}{P} = \frac{1}{+1.5\ D} = +\frac{10}{15}$ m = + 0.67 cm Ans. As the focal length is positive, the prescribed lens is converging.	2

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