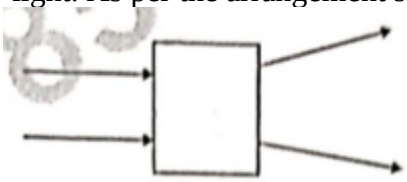
	INDIAN SCHOOL AL WADI AL KABIR	
Class: X	**Department: SCIENCE 2025 – 26** **SUBJECT: PHYSICS**	**Date: 26/05/2025**
Worksheet No: 2 **WITH ANSWERS**	**CHAPTER: LIGHT REFLECTION AND REFRACTION -PART 2**	**Note:** **A4 FILE FORMAT**
NAME OF THE STUDENT	**CLASS & SEC:**	**ROLL NO.**

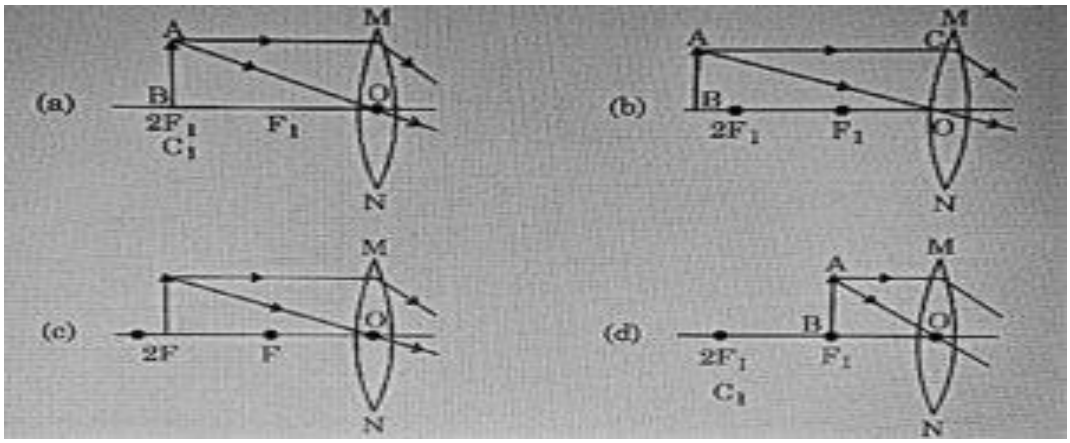
OBJECTIVE TYPE QUESTIONS

1. How will the image formed by a convex lens be affected, if the upper half of the lens is wrapped with a back paper?
   (a) The size of the image formed will be one-half of the size of the image due to complete lens.
   (b) The image of upper half of the object will not be formed.
   (c) The brightness of the image will reduce.
   (d) The lower half of the inverted image will not be formed.
2. The colour of light for which the refractive index of glass is minimum, is:
   (a) Red (b) Yellow (c) Green (d) Violet
3. The following diagram shows the use of an optical device to perform an experiment of light. As per the arrangement shown, the optical device is likely to be a;



   (a) Concave mirror (b) Concave lens
   (c) Convex mirror (d) Convex lens

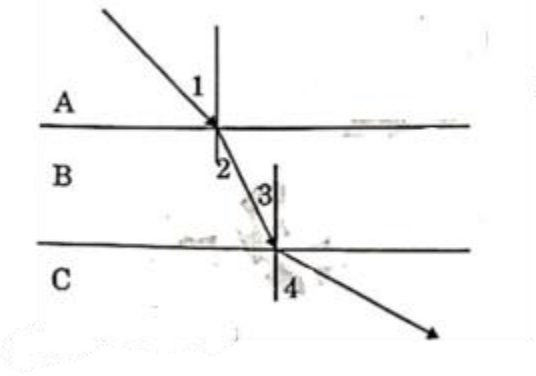
4. A student wants to obtain magnified image of an object AB as on a Screen. Which one of the following arrangements shows the correct position of AB for him/her to be successful?



5. A ray of light starting from air passes through medium A of refractive index 1.50, enters medium B of refractive index 1.33 and finally enters medium C of refractive index 2.42. If this ray emerges out in air from C, then for which of the following pairs of media the bending of light least?

   (a) air-A (b) A-B (c) B-C (d) C-air

6. A ray of light is incident as shown. If A, B and C are three different transparent media, then which among the following options is true for the given diagram?



   (a) ∠ 1 > ∠ 4
   (b) ∠ 1 < ∠ 2
   (c) ∠ 3 = ∠ 2
   (d) ∠ 3 > ∠ 4

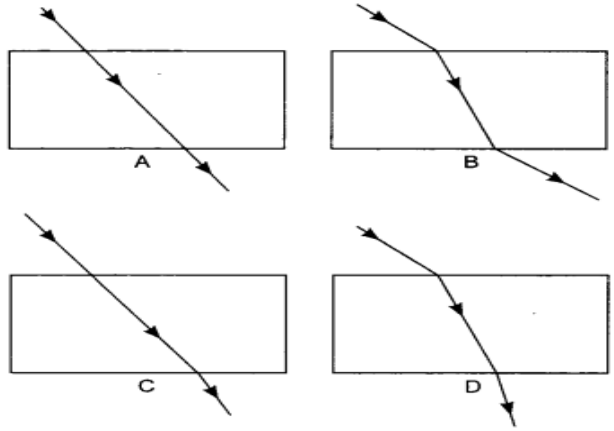
7. A converging lens forms a three times magnified image of an object, which can be take on a screen. If the focal length of the lens is 30 cm, then the distance of the object from the lens is?

   a. -55cm b. -50cm c. -45cm d. -40cm

8. The refractive index of medium A is 1.5 and that of medium B is 1.33. If the speed of light in air is 3 x 108 m/s, what is the speed of light in medium A and B respectively?

   (a) 2 x 10^8 m/s and 1.33 x 10^8 m/s
   (b) 1.33 x 10^8 m/s and 2x 10^8 m/s
   (c) 2.25 x 10^8 m/s and 2 x 10^8 m/s
   (d) 2 x 10^8 m/s and 2.25 x 10^8 m/s

9. 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
10. A divergent lens will produce
   (a) always real image
   (b) always virtual image
   (c) both real and virtual image
   (d) none of these
11. 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

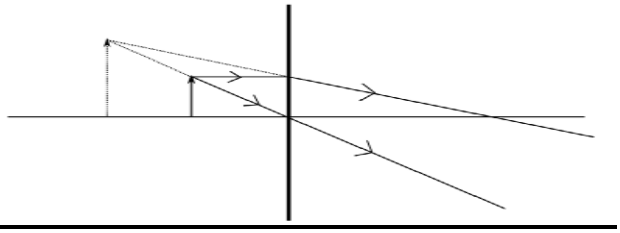
ASSERTION AND REASONING

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.

12. 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.
13. Assertion : Refractive index has no units.
   Reason : The refractive index is a ratio of two similar quantities.

TWO MARKS TYPE QUESTIONS

14.



The above figure shows the formation of an image by a lens shown by a thick line.

Analyse the figure and answer the following questions.

A. What is the type of lens used?

B. What is the nature of the image?

C. If the image is formed at a distance of 30 cm from the lens and the image is twice the size of the object, then where is the object placed?

15. An object is placed at a distance of 60 cm from a concave lens of focal length 30 cm. Use lens formula to find the position of the image formed in this case.
16. Define power of a lens. Find power of a lens whose focal length is 50cm. CBSE 2024
17. 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.
18. What is the velocity of light in a glass slab of refractive index 1.5?

THREE MARKS TYPE QUESTIONS

19. Define power of a lens. The focal length of a lens is - 10 cm. Write the nature of the lens and find its power. If an object is placed at a distance of 20 cm from the optical centre of this lens, according to the New Cartesian Sign Convention, what will be the sign of magnification in this case? CBSE 2023
20. 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?
21. 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

22. (a) (i)The power of a lens 'X' is – 2.5 D. Name the lens and determine its focal length in cm. For which eye defect of vision will an optician prescribe this type of lens as a corrective lens ?

    (ii) "The value of magnification 'm' for a lens is -2." Using new Cartesian Sign

Convention and considering that an object is placed at a distance of 20 cm from the optical centre of this lens, state :

(I) the nature of the image formed;

(II) size of the image compared to the size of the object;

(III) position of the image, and

(IV) sign of the height of the image.

(iii) The numerical values of the focal lengths of two lenses A and B are 10 cm and 20 cm respectively. Which one of the two will show higher degree of convergence/divergence? Give reason to justify your answer.

23. (i) Draw a ray diagram to show the refraction of a ray of light through a rectangular glass slab when it falls obliquely from air into glass.

(ii)State Snell's law of refraction of light.

(iii) Differentiate between the virtual images formed by a convex lens and a concave lens on the basis of object distance, and magnification.

24. (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 (ν) and the focal length (f) of a

(a) Spherical lens

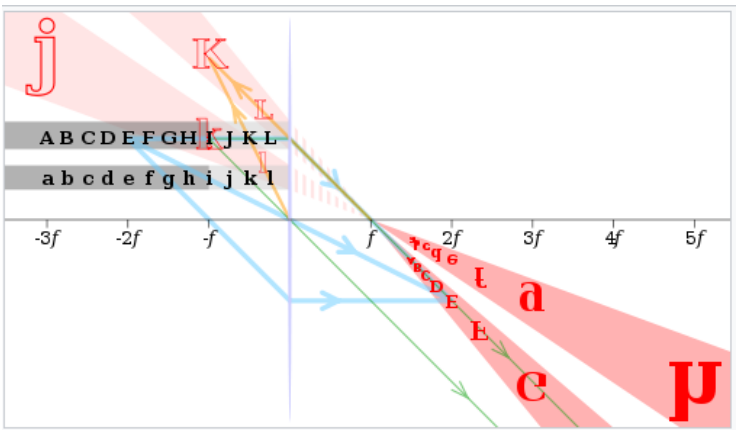
(b) Spherical mirror

(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.

25. 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.

CASE STUDY QUESTIONS/PASSAGE BASED QUESTIONS

26. *Study the following and answer the four questions from (i) to (iv).*



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.

i. 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

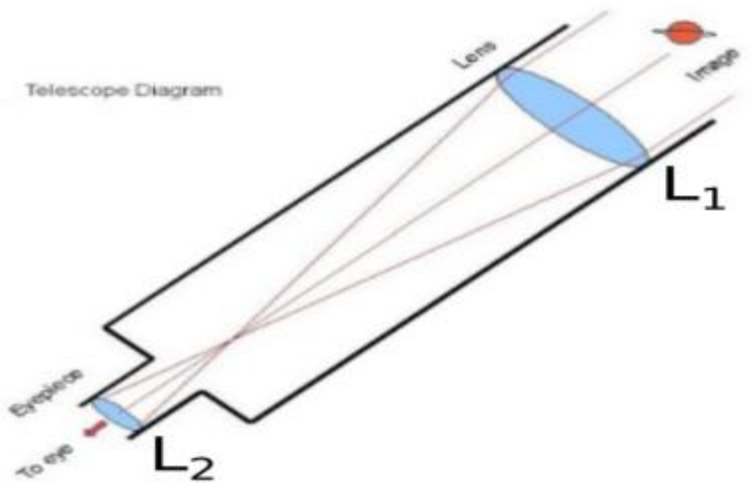
ii. When the object is placed between f and 2f of a convex lens, the image formed is
   a) at f b) at 2f
   c) beyond 2f d) between O and f

iii. 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

iv. 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

27. Read the following and answer any four questions from 19 (i) to 19 (v)

Suman wanted to see the stars of the night sky. She knows that she needs a telescope to see those distant stars. She finds out that the telescopes, which are made of lenses, are called refracting telescopes and the ones which are made of mirrors are called reflecting telescopes.



So she decided to make a refracting telescope. She bought two lenses, L1 and L2. out of which L1 was bigger and L2 was smaller. The larger lens gathers and bends the light, while the smaller lens magnifies the image. Big, thick lenses are more powerful. So to see far away, she needed a big powerful lens. Unfortunately, she realized that a big lens is very heavy. Heavy lenses are hard to make and difficult to hold in the right place. Also 1x 4 8 since the light is passing through the lens, the surface of the lens has to be extremely smooth. Any flaws in the lens will change the image. It would be like looking through a dirty window

i. Based on the diagram shown, what kind of lenses would Suman need to make the telescope?

a) Concave lenses b) Convex lenses c) Bifocal lenses d) Flat lenses

ii. If the powers of the lenses L1 and L2 are in the ratio of 4:1, what would be the ratio of the focal length of L1 and L2?

a) 4:1 b) 1:4 c) 2:1 d) 1:1

iii. What is the formula for magnification obtained with a lens?

a) Ratio of height of image to height of object
b) Double the focal length.
c) Inverse of the radius of curvature.
d) Inverse of the object distance.

iv. Suman did some preliminary experiment with the lenses and found out that the magnification of the eyepiece (L2) is 3. If in her experiment with L2 she found an image at 24 cm from the lens, at what distance did she put the object?

a) 72 cm b) 12 cm c) 8 cm d) 6 cm

v. Suman bought not-so-thick lenses for the telescope and polished them. What advantages, if any, would she have with her choice of lenses?

a) She will not have any advantage as even thicker lenses would give clearer images.
b) Thicker lenses would have made the telescope easier to handle.

c) Not-so-thick lenses would not make the telescope very heavy and also allow considerable amount of light to pass.

d) Not-so-thick lenses will give her more magnification.

28. 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.

29.

The above images are that of a specialized slide projector. Slides are small transparencies mounted in sturdy frames ideally suited to magnification and projection, since they have a very high resolution and a high image quality. There is a tray where the slides are to be put into a particular orientation so that the viewers can see the enlarged

erect images of the transparent slides. This means that the slides will have to be inserted upside down in the projector tray. To show her students the images of insects that she investigated in the lab, Mrs. Iyer brought a slide projector. Her slide projector produced a 500 times enlarged and inverted image of a slide on a screen 10 m away.

(a) Based on the text and data given in the above paragraph, what kind of lens must the slide projector have?

(b) If v is the symbol used for image distance and u for object distance then with one reason state what will be the sign for v u in the given case?

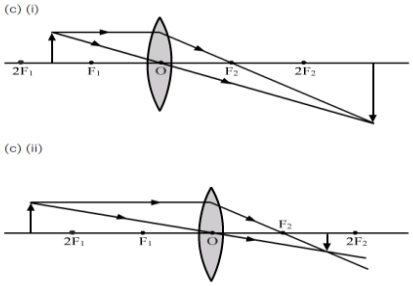
(c) A slide projector has a convex lens with a focal length of 20 cm. The slide is placed upside down 21 cm from the lens. How far away should the screen be placed from the slide projector's lens so that the slide is in focus?

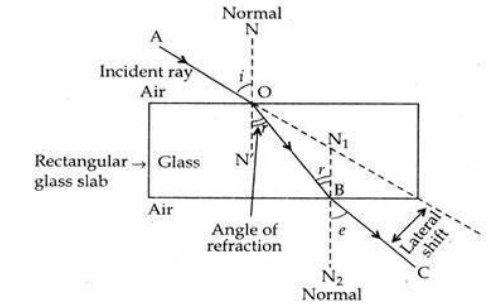
OR

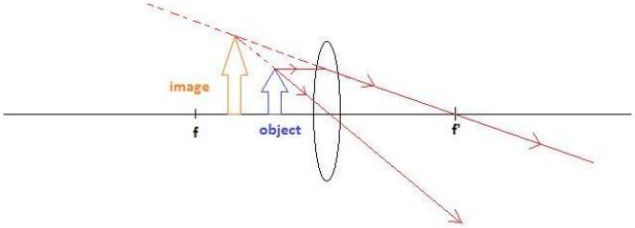
(c)When a slide is placed 15 cm behind the lens in the projector, an image is formed 3 m in front of the lens. If the focal length of the lens is 14 cm, draw a ray diagram to show image formation. (not to scale)

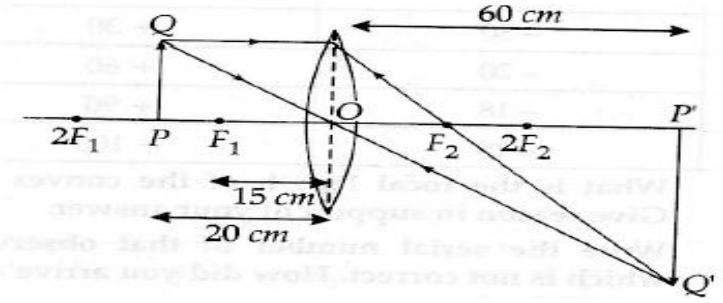
ANSWER KEY	
1	(c) The brightness of the image will reduce.
2	(a) Red
3	(b) Concave lens
4	C
5	(b) A-B
6	**(c) ∠ 3 = ∠ 2**
7	d. -40cm
8	(d) 2 x 10^8 m/s and 2.25 x 10^8 m/s
9	c. At infinity
10	(b) always virtual image
11	(b) B
12	(c)Assertion (A) is true but reason (R) is false.
13	(a) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A).
14.	A. The lens is a convex lens. B. The image is virtual. C. Magnification for lens = $\frac{v}{u} = \frac{h_i}{h_o} = 2.$ $\frac{-30cm}{u} = 2$ Hence u = -15 cm
15	$\frac{1}{f} = \frac{1}{v} - \frac{1}{u}$ $\frac{1}{-30} = \frac{1}{v} - \frac{1}{-60}$ v=−20cm

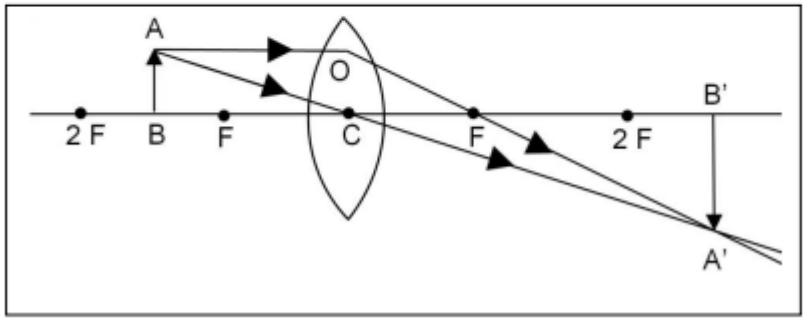
<table>
<tr><td>16</td><td>The degree of convergence and divergence provided by a lens is called the power of the lens. / The power of a lens is given by the reciprocal of its focal length.
Concave lens
P=100/f= 100/50=2D</td></tr>
<tr><td>17</td><td>Ans: A convex lens forms an image of magnification -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</td></tr>
<tr><td>18</td><td>we know that refractive index $n = \frac{speed\ of\ light\ in\ vacuum}{speed\ of\ light\ in\ medium}$
where $c = 3 \times 10^8 m/s$
$1.5 = \frac{c}{v}$
$v = \frac{3 \times 10^8}{1.5}$
$v = 2 \times 10^8 m/s$</td></tr>
<tr><td>19</td><td>The degree of convergence and divergence provided by a lens is called the power of the lens. / The power of a lens is given by the reciprocal of its focal length.
Concave lens
P=100/f= 100/-10=-10D
Magnification- positive</td></tr>
<tr><td>20</td><td>Ans:- The first lens of focal length f =+50 cm, is a convex lens.
The second lens of focal length f=−50 cm is a concave lens.
<table><tr><td>Power of the convex lens,
$P_1 = \frac{1}{f_1}$
$= \frac{1}{+0.5\ \text{m}}$
$= +2\ \text{D}$</td><td>Power of the concave lens,
$P_2 = \frac{1}{f_2}$
$= \frac{1}{-0.5\ \text{m}}$
$= -2\ \text{D}$</td></tr></table>The concave lens always gives a virtual and diminished image irrespective of the object's position.</td></tr>
</table>

21	**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. 
22	Determine the focal length, The power P of a lens is related to its focal length f (in meters) by the equation: $\therefore P = \frac{1}{f}$ $\therefore f = \frac{1}{2.5}$ = −0.4 m = −40 cm (or 40 cm in magnitude) The negative sign of the power indicates that the lens is a diverging (concave) lens. A concave lens is typically prescribed to correct myopia (nearsightedness). In myopia, the eye focuses images in front of the retina. A concave lens diverges the incoming light rays, moving the focal point back onto the retina for clear vision. Using the new Cartesian sign convention, we take distances measured from the optical centre in the direction of the incident light (from left to right) as positive. Thus, the object placed on the left of the lens is at: u = +20 cm For a thin lens under this convention, the linear magnification is given by $m = \frac{v}{u}$ so the image distance is v = m.u = (−2) (20 cm) = −40 cm **1. The nature of the image formed:**

	The negative value of v (i.e. v = −40 cm) indicates that the image is formed on the side opposite to the incident light direction. In this convention, that means the image is real. The magnification m = −2 is negative, which tells us that the image is inverted relative to the object. **2. Size of the image compared to the size of the object:** The magnitude of the magnification is |m| = 2. Therefore, the image is twice as large as the object. **3. Position of the Image:** The image is located 40 cm from the optical centre, on the opposite side to the object (to the right of the lens). **4. Sign of the Height of the Image:** Since m = $\frac{h_i}{h_o}$ = −2, if we take the object's height h_o as positive (by convention), then the image height h_i must be negative. A negative image height indicates that the image is inverted relative to the object.
23	 ii. The ratio of the sine of the angle of incidence (i) to the sine of the angle of refraction (r) is equal to the refractive index of the medium, which is a constant. $\frac{\sin i}{\sin r} = \mu$ iii. The image formed by concave lens is always diminished (magnification value less than one) and virtual wherever the object is placed, whereas the image formed by convex lens be virtual and magnified (magnification value more than one)when the object is placed between focus and optical centre.
24	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 
25	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.
26	i. a) virtual and magnified ii. c) beyond 2f iii. c) 10 cm iv. a) A convex lens has 4 dioptre power having a focal length 0.25 m
27	(i) b) Convex

	(ii)	P=1/f $P_1=1/f_1$ and $P_2=1/f_2$ $P_1/P_2=4/1$, hence $(1/f_1)/(1/f_2) = 4/1$ Hence $f_1/f_2=1/4$ b) ¼
	(iii)	a) Ratio of height of image to height of object
	(iv)	m=v/u 3=24/u Hence u = 8cm c) 8 cm
	(v)	c) Not-so-thick lenses would not make the telescope very heavy and they will also allow considerable amount of light to pass through them.
28		(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. 

29	(a) Convex Lens (1mark) (b) Negative as the image is real and inverted. (1mark) (c) 1/f= 1/v- 1/u 1/20 = 1/v- 1/-20 1/v = 1/20 - 1/21 = (21 - 20)/420 = 1/420 v= 420 cm (2 marks) **OR** (c)  (2 marks)

Prepared by: *Ms. Vipina Gangadharan*	*Checked by:* *HoD Science*