ICSE CLASS 10 EXAMINATION

PRACTICE QUESTION PAPER

PHYSICS

Chapter 5 : REFRACTION THROUGH A LENS

(Convex and Concave Lenses · Image Formation · Lens Formula and Magnification · Power of a Lens · Magnifying Glass)

Maximum Marks: 40 **Time allowed: One hour**

1. Answers to this Paper must be written on the paper provided separately.

2. You will not be allowed to write during the first 5 minutes. This time is to be spent in reading the question paper.

3. The time given at the head of this Paper is the time allowed for writing the answers.

*4. **Section A** is compulsory. Attempt **all** questions from Section A and **any two** questions from Section B.*

5. The intended marks for questions or parts of questions are given in brackets [ ].

6. Use the Cartesian sign convention for lens problems. In ray diagrams, draw rays with arrows; scale drawing is not required. Figures are for completion on the answer sheet.

SECTION A (20 Marks)

(Attempt all questions from this Section.)

Question 1

Choose the correct answers to the questions from the given options. *(Do not copy the question, write the correct answers only.)* **[8]**

(i) A ray of light directed towards the optical centre of a thin lens:

(a) bends towards the principal axis (b) bends away from the principal axis

(c) passes undeviated (d) is totally reflected

(ii) A convex lens forms a real, inverted image of the same size as the object when the object is placed at:

(a) the focus F_1 (b) $2F_1$

(c) infinity (d) between O and F_1

(iii) The power of a concave lens of focal length 25 cm is:

(a) −4 D (b) +4 D

(c) +0.04 D (d) −0.25 D

(iv) A lens produces a magnification of −0.5. The image is:

(a) virtual, erect and diminished (b) real, inverted and diminished

(c) real, erect and enlarged (d) virtual, inverted and enlarged

(v) Assertion (A): A convex lens can be used as a burning glass.

Reason (R): A convex lens forms a real, highly diminished image of the sun at its focus.

(a) (A) is true and (R) is false.

(b) (A) is false and (R) is true.

(c) Both (A) and (R) are true, and (R) is the correct explanation for (A).

(d) Both (A) and (R) are true, but (R) is not the correct explanation for (A).

(vi) For an object kept 30 cm in front of a convex lens, a real image is formed 30 cm behind the lens. The focal length of the lens is:

(a) 30 cm (b) 60 cm

(c) 10 cm (d) 15 cm

(vii) When a convex lens is placed in water, its focal length:

(a) decreases (b) remains the same

(c) increases (d) becomes zero

(viii) Two thin lenses of powers +3 D and −1 D are placed in contact. The power of the combination is:

(a) +4 D (b) +2 D

(c) −2 D (d) +3 D

Question 2

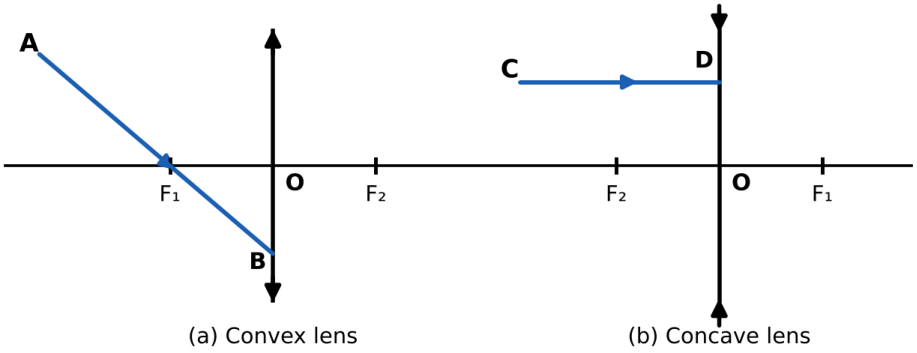
(a) Define (i) the optical centre of a lens and (ii) the focal length of a lens. **[2]**

(b) Fig. 1(a) shows a ray AB incident on a convex lens after passing through its first focus F_1. Fig. 1(b) shows a ray CD incident parallel to the principal axis of a concave lens. **[3]**

(i) Complete the path of the ray AB after refraction through the convex lens. **[1]**

(ii) Complete the path of the ray CD after refraction through the concave lens, using a dotted line for the backward extension. **[1]**

(iii) Name the point from which the refracted ray in Fig. 1(b) appears to diverge. **[1]**



(a) Convex lens (b) Concave lens

Fig. 1

(c) State the sign of the focal length of (i) a convex lens and (ii) a concave lens, according to the Cartesian sign convention. **[1]**

Question 3

(a) An object 6 cm tall is placed 30 cm in front of a convex lens of focal length 12 cm. Using the lens formula, find (i) the position of the image, (ii) the magnification, and (iii) the height and nature (erect or inverted) of the image. **[3]**

(b) Fig. 2 shows an object AB placed on the principal axis of a convex lens beyond $2F_1$. **[3]**

(i) Complete the ray diagram using two rays, to locate the image A′B′. **[2]**

(ii) State the position, nature and size of the image. **[1]**

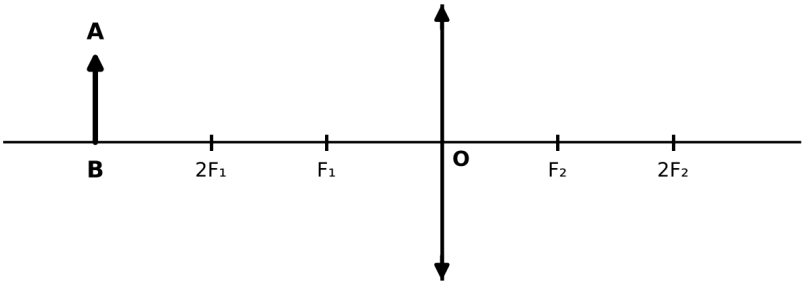


Fig. 2

SECTION B (20 Marks)

(Attempt any two questions from this Section.)

Question 4

(a) A concave lens of focal length 15 cm forms an image of an object placed 30 cm in front of it. Calculate (i) the image distance, (ii) the magnification, and (iii) state the nature of the image. **[3]**

(b) (i) Define the power of a lens and state its S.I. unit. (ii) A convex lens of focal length 25 cm is placed in contact with a concave lens of focal length 50 cm. Find the power of each lens and the power and focal length of the combination. **[3]**

(c) Fig. 3 shows an object AB placed between the optical centre O and the focus F_1 of a convex lens. **[4]**

(i) Complete the ray diagram to locate the image A′B′. **[2]**

(ii) State the nature, position and size of the image formed. **[1]**

(iii) Name a simple optical instrument that works on this principle and state where the eye should be placed. **[1]**

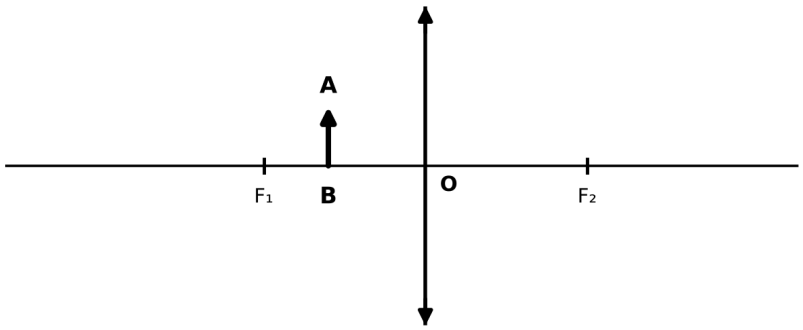


Fig. 3

Question 5

(a) State three differences between the image formed by a convex lens and the image formed by a concave lens. **[3]**

(b) Fig. 4 shows an object AB in front of a concave lens, with its foci F_1 and F_2. **[3]**

(i) Complete the ray diagram, using two rays, to locate the image A′B′. **[2]**

(ii) State three characteristics of the image. **[1]**

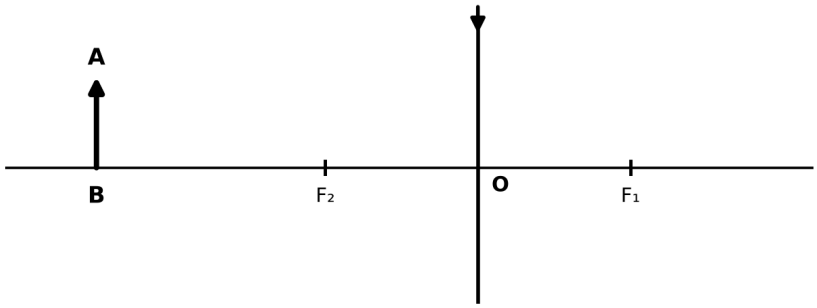


Fig. 4

(c) Fig. 5 shows an object AB, 4 cm tall, placed 15 cm in front of a convex lens of focal length 10 cm. **[4]**

(i) Complete the ray diagram to locate the image. **[2]**

(ii) Calculate the image distance using the lens formula. **[1]**

(iii) Find the magnification and the height of the image. **[1]**

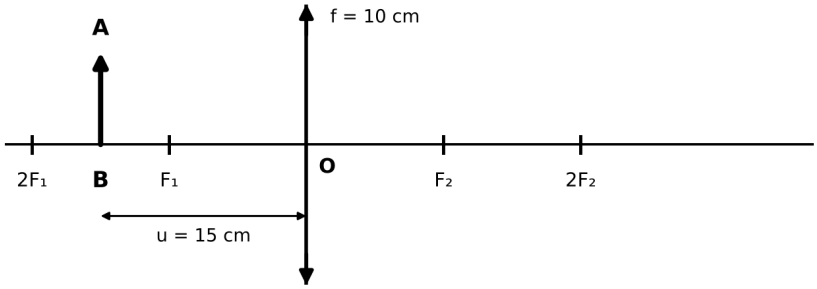


Fig. 5

Question 6

(a) Where must an object be placed in front of a convex lens so that its image is (i) formed at infinity, (ii) real, inverted and of the same size as the object, and (iii) real, inverted and magnified? **[3]**

(b) Describe how you would find the approximate focal length of a convex lens using a distant object. State the principle and what you would measure. **[3]**

(c) Fig. 6 shows the set-up for finding the focal length of a convex lens L using a plane mirror M. A pin O is placed on the principal axis at the position where its image is formed on the pin itself. **[4]**

(i) Draw two rays from O to show how the image is formed at O itself. **[2]**

(ii) State the size of the image and two more of its characteristics. **[1]**

(iii) To which point will the rays return if the mirror is moved farther from the lens? Give a reason. **[1]**

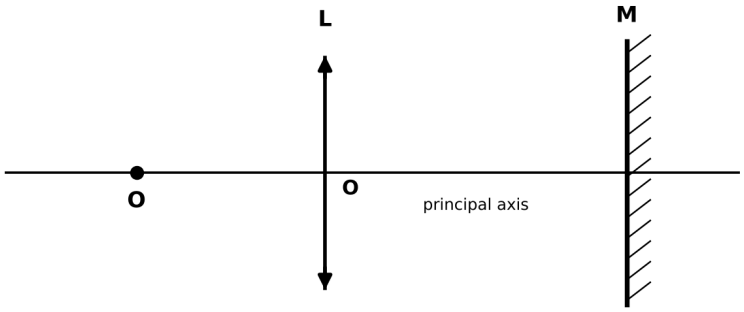


Fig. 6

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