CLASS 10 SCIENCE · 2026-27

Light: reflection and refraction

Physics

27	35	3
QUESTIONS	MINUTES	EXERCISES

This belongs to _____ **Date** _____

WHAT YOU'LL GET GOOD AT

- Applies the sign convention correctly before substituting
- Uses the mirror and lens formulas to find image position
- Calculates magnification and interprets its sign
- Calculates the power of a lens, with the correct sign
- Names the lens used to correct a given defect of vision

Take your time, and have a go at every one. If you get stuck, look at the orange box — Ollie has already done one for you.

Light: reflection and refraction

Physics · 27 questions · tick each box as you finish

Exercise 1 of 3 · 12 questions State the sign of each quantity. Do not calculate anything.

WRITE THE ANSWER

HERE'S ONE DONE FOR YOU

This exercise has no arithmetic in it on purpose. Nearly every wrong answer in this chapter comes from a sign, not a calculation, and the signs are decided before any formula is written. Writing 'u = -15 cm, f = -10 cm' as the first line of a solution is worth more than any amount of care with the algebra afterwards.

1) The object distance u, in every case

2) The focal length of a concave mirror

3) The focal length of a convex mirror

4) The focal length of a convex lens

5) The focal length of a concave lens

6) The image distance v for a real image formed by a mirror

7) The height of an object placed above the principal axis

8) The height of a real, inverted image

9) The magnification of a virtual, erect image

10) The image distance v for a virtual image in a mirror

11) The power of a converging lens

12) The object distance for a real object

Exercise 2 of 3 · 5 questions Find the image distance and the magnification. Describe the image.

WRITE THE ANSWER

HERE'S ONE DONE FOR YOU

In the first, the magnification is -2, and the negative sign is information rather than decoration - it says the image is inverted, which also means it is real. A positive magnification means erect and virtual. Reading the sign of m before describing the image saves a child from having to remember which cases give which kind of image.

1) An object is placed 15 cm in front of a concave mirror of focal length 10 cm.

2) An object is placed 10 cm in front of a convex mirror of focal length 15 cm.

3) An object is placed 30 cm in front of a concave mirror of focal length 10 cm. Find v and m.

4) An object is placed 20 cm in front of a convex mirror of focal length 15 cm. Find v and m.

5) An object 4 cm tall is placed 12 cm from a concave mirror of focal length 6 cm. Find the image height.

Exercise 3 of 3 · 10 questions Find the image distance, the magnification, and where asked, the power.

WRITE THE ANSWER

HERE'S ONE DONE FOR YOU

Note that the lens formula is 1/v - 1/u = 1/f while the mirror formula is 1/v + 1/u = 1/f. The difference in sign is the single most common source of error once both are in play, and there is no way round it but to write the correct formula down as the first line each time. Power is simply 1/f with f in metres, so 50 cm must become 0.5 m before dividing.

1) An object is placed 30 cm from a convex lens of focal length 20 cm.

2) An object is placed 10 cm from a concave lens of focal length 15 cm.

3) Find the power of a convex lens of focal length 50 cm.

4) Find the power of a concave lens of focal length 25 cm.

5) Which lens corrects myopia, and which corrects hypermetropia?

6) An object is placed 20 cm from a convex lens of focal length 10 cm. Find v and m.

7) An object is placed 15 cm from a concave lens of focal length 10 cm. Find v and m.

8) Find the power of a convex lens of focal length 50 cm.

9) Find the focal length of a lens of power -4 D, and name the type.

10) Which defect of vision is corrected by a convex lens, and why?

All done? How did that feel?

Colour in a star. Three stars means you could teach it to someone else.

☆ ☆ ☆ Tricky · Getting there · Easy now

Answer key

For grown-ups

Light: reflection and refraction · keep this page back until your child has finished.

1. State the sign of each quantity. Do not calculate anything.

1) Negative. The object is always placed on the side from which the light comes, against the direction of incidence.
2) Negative - the focus lies in front of the mirror.
3) Positive - the focus lies behind the mirror.
4) Positive.
5) Negative.
6) Negative, since a real image forms in front of the mirror, on the same side as the object.
7) Positive, because distances above the principal axis are taken as positive.
8) Negative, because it is measured downwards from the principal axis.
9) Positive, because the image is erect and m = h'/h with both heights on the same side.
10) Positive, because the image is behind the mirror, on the opposite side to the incident light.
11) Positive, because a converging (convex) lens has a positive focal length.
12) Negative, because it is measured against the direction of the incident light.

2. Find the image distance and the magnification. Describe the image.

1) u = -15 cm, f = -10 cm. From 1/v + 1/u = 1/f, 1/v = -1/10 + 1/15 = -1/30, so v = -30 cm. m = -v/u = -(-30)/(-15) = -2. The image is real, inverted, twice the size, and 30 cm in front of the mirror.
2) u = -10 cm, f = +15 cm. 1/v = 1/15 + 1/10 = 5/30, so v = +6 cm. m = -v/u = -6/(-10) = +0.6. The image is virtual, erect, diminished, and 6 cm behind the mirror.
3) u = -30, f = -10. 1/v = 1/f - 1/u = -1/10 + 1/30 = -1/15, so v = -15 cm. m = -v/u = -(-15)/(-30) = -0.5. Real, inverted, half the size.
4) u = -20, f = +15. 1/v = 1/f - 1/u = 1/15 + 1/20 = 7/60, so v = 60/7 ≈ 8.6 cm. m = -v/u = +0.43. Virtual, erect and diminished - which is what a convex mirror always gives.
5) u = -12, f = -6. 1/v = -1/6 + 1/12 = -1/12, so v = -12 cm. m = -v/u = -1, so the image is 4 cm tall and inverted - the same size, as expected at the centre of curvature.

3. Find the image distance, the magnification, and where asked, the power.

1) u = -30 cm, f = +20 cm. From 1/v - 1/u = 1/f, 1/v = 1/20 - 1/30 = 1/60, so v = +60 cm. m = v/u = 60/(-30) = -2. Real, inverted and magnified.

2) u = -10 cm, f = -15 cm. 1/v = -1/15 - 1/10 = -1/6, so v = -6 cm. m = v/u = -6/(-10) = +0.6. Virtual, erect and diminished.

3) P = 1/f in metres = 1/0.5 = +2 D.

4) P = 1/(-0.25) = -4 D. The power of a concave lens is always negative.

5) Myopia, or short-sightedness, is corrected by a concave lens, which diverges the light so the image falls further back on the retina. Hypermetropia is corrected by a convex lens.

6) u = -20, f = +10. 1/v = 1/f + 1/u = 1/10 - 1/20 = 1/20, so v = +20 cm. m = v/u = -1. Real, inverted, same size.

7) u = -15, f = -10. 1/v = -1/10 - 1/15 = -1/6, so v = -6 cm. m = v/u = 0.4. Virtual, erect, diminished.

8) P = 1/f in metres = 1/0.5 = +2 D.

9) f = 1/P = -0.25 m = -25 cm. The negative sign means it is a concave (diverging) lens.

10) Hypermetropia, or long sight. The eye focuses near objects behind the retina, and a convex lens converges the light so the image falls on the retina.

WHILE YOUR CHILD WORKS

- Write the signs of u and f as the first line of every solution. Nearly every wrong answer in this chapter is a sign.
- The mirror formula has a plus and the lens formula a minus. Write the right one down before substituting.
- For power, convert the focal length to metres first. 50 cm is 0.5 m, giving +2 D rather than +0.02.