CLASS 10 SCIENCE EXTRA QUESTIONS

Class 10 Science Chapter 10 Human Eye and Colourful World Extra Questions (HOTS)

Genuinely harder, HOTS-level practice for Class 10 Science Chapter 10 (The Human Eye and the Colourful World), going beyond the standard exercise with fresh numbers, assertion-reason, and multi-step reasoning. These Class 10 Science Chapter 10 important questions are handy for last-minute exam practice.

Contents

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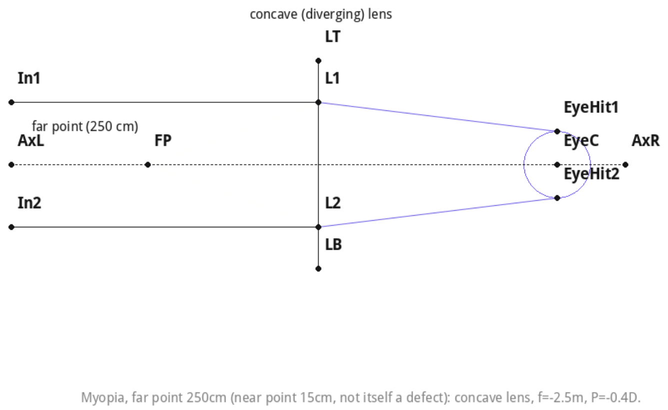
Q1 (Assertion-Reason). Assertion (A): A person with myopia can see nearby objects clearly but not distant objects. Reason (R): In myopia, the image of a distant object forms in front of the retina due to increased curvature of the eye lens or elongation of the eyeball.
(a) Both A and R true, R correctly explains A (b) Both true, R does not explain A (c) A true, R false (d) A false, R true
Answer: (a) — both statements are correct and R is the accepted physiological explanation for A.

Q2 (Conceptual/general). Explain, using the sign convention for lens power, why the corrective lens for myopia always has negative power while the corrective lens for hypermetropia always has positive power.
Solution: A concave (diverging) lens has a negative focal length by the standard sign convention, so P = 1/f is negative — concave lenses are used for myopia (to diverge rays so they appear to originate from the myopic eye's nearer far point). A convex (converging) lens has a positive focal length, so P = 1/f is positive — convex lenses are used for hypermetropia (to converge rays so a nearby object appears to be at the eye's farther near point). Hence the sign of power directly reflects the type of defect being corrected.

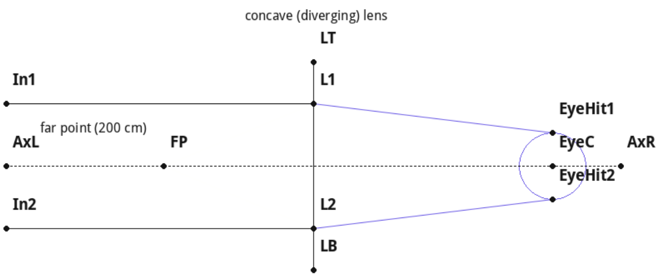
Q3 (Fresh-number word problem). A person can see clearly only objects lying between 15 cm and 250 cm from the eye. (a) What defect does this person suffer from? (b) What type of lens is required, and of what power, to enable clear distant vision?



Myopia, far point 250cm (near point 15cm, not itself a defect): concave lens, f=-2.5m, P=-0.4D.

Solution: A near point of 15 cm is closer than the normal 25 cm (not itself a defect requiring correction), but a far point of 250 cm (2.5 m) instead of infinity indicates **myopia**. A single **concave lens** with f = −2.5 m is needed: P = 1/(−2.5) = **−0.4 D**.

Q4 (Multi-step, fresh numbers). The far point of a myopic eye is 200 cm. (a) Find the power and focal length of the lens needed for distant vision. (b) If the same person also needs +2 D for reading, what kind of lens would an optician prescribe?

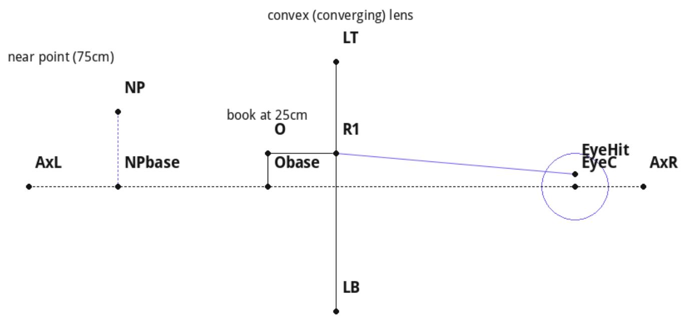


Myopia, far point 200cm: -0.5D for distance; +2D also needed for near work -> bifocal lens prescribed.

Myopia, far point 200cm: -0.5D for distance; +2D also needed for near work -> bifocal lens prescribed.

Solution: (a) f = −2 m, P = 1/(−2) = **−0.5 D**. (b) Since the same person needs −0.5 D for distance and +2 D for near vision, a single **bifocal lens** (upper portion −0.5 D, lower portion +2 D) would typically be prescribed rather than two separate pairs of glasses.

Q5 (Reverse-engineering, fresh numbers). A hypermetropic eye can see objects clearly only beyond 75 cm. What power of lens is required to enable the person to read a book held at 25 cm?



Hypermetropia, near point 75cm: convex lens needed to read at 25cm -> P ≈ +2.67 D.

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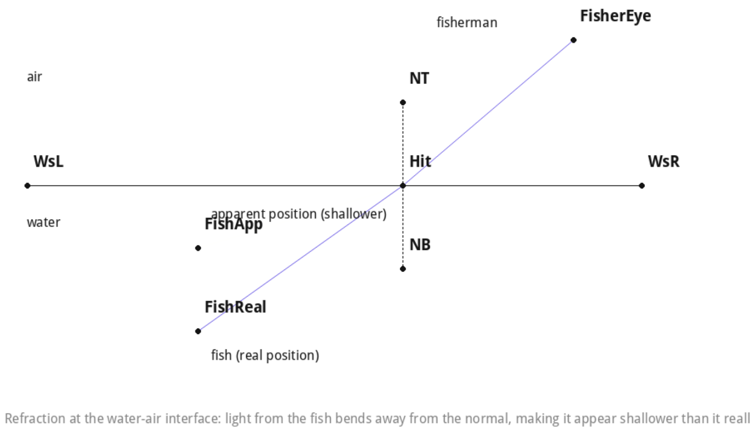
Solution: u = −0.25 m, v = −0.75 m (virtual image at the near point). 1/f = 1/v – 1/u = 1/(−0.75) – 1/(−0.25) = −1.33 + 4 = 2.67 ⇒ f = 0.375 m. P = 1/f = **+2.67 D** (approx.)

Q6 (Extension/synthesis). A fisherman standing on a riverbank sees a fish underwater appearing nearer to the surface than it actually is, while the fish sees the fisherman appearing taller than his actual height. Explain both observations using the concept of refraction, and relate this general idea to why atmospheric refraction makes stars appear at a slightly different position than their true position.



Refraction at the water-air interface: light from the fish bends away from the normal, making it appear shallower than it really is.

Solution: Both effects are due to **refraction at a plane interface** (water–air): light bends away from the normal on entering a rarer medium. Light from the fish bends away from the normal as it exits water into air, making the fish appear closer to the surface (shallower) than it really is to the fisherman. Conversely, light from the fisherman bends towards the normal on entering the denser water, making him appear taller/farther than he is to the fish. In the same way, starlight bends as it passes from the near-vacuum of space into progressively denser atmospheric layers, so the star's apparent position is slightly different (usually slightly higher) than its true geometric position — the same underlying principle (refraction across changing-density media) explains both the everyday water observation and the astronomical one.

Class 10 Science Chapter 10 – Solutions and Notes

For complete step-by-step answers and a quick summary, check the Class 10 Science Chapter 10 Solutions and Class 10 Science Chapter 10 Revision Notes.