Physics 102 (F16)

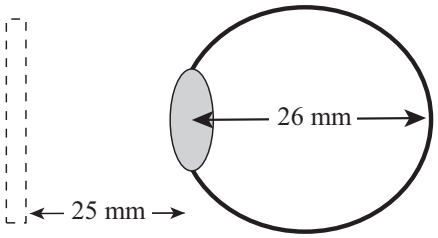
Q11A

Name: _____ **Section:** _____ **Score:** _____/20

1. For a myopic student the distance between the middle of her own lens and her retina is 26 mm as illustrated below.

(1) She was prescribed a pair of glasses of focal length −100 mm. When she wears the glasses 25 mm in front of her own lenses, her insufficiently corrected near point is 125 mm (from her own lenses). Where is her uncorrected near point? [5]

Principle of eye correction =
place virtual image
where you can see it clearly

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f = -100 mm
She must hold the book 125 - 25 = 100 mm
from the lenses to place its virtual image at her uncorrected near point.
1/(-100) = 1/100 + 1/x -> x = -50 mm.  That is, the virtual image is 5 cm in front of
the glasses. That is, the virtual image is 5 cm left of the glasses -> 7.5 cm from
the eyes.
This is her uncorrected near point.
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(2) Prescribe a pair of glasses for her to read books (held 25 cm away from her eyes). That is, determine the focal length of the needed lenses. [5]

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We wish to place the virtual image of the book held 250-25 = 225 mm from the
glasses at 50 mm left of the glasses.
1/f = 1/225 + 1/(-50) = 1/(-64.3).
Thus f = - 6.4 cm is required.
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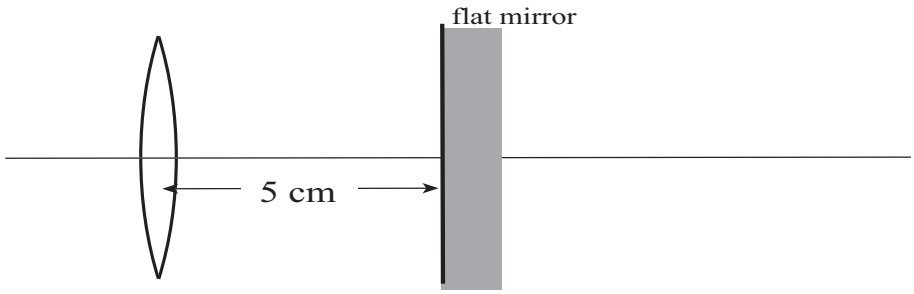
2. A convex lens of focal length $|f_1| = 5$ cm is placed 5 cm in front of a flat mirror.



(1) An object of height 2 cm is placed 14 cm to the left to the convex lens. Where is the final image by the lens and the mirror? You must tell whether the image is real or virtual. [Hint: a flat mirror has $f = \infty$.][5]

1/f = 1/do + 1/di
Proceed step by step, one by one

the first lens: f = +5cm, do = +14 cm
Therefore, 1/d_i = 1/f - 1/do = 1/5 - 1/14 = 9/70. di = 70/9 = 7.8 cm, real image.

This is 25/9 = 2.8 cm behind the mirror, so it becomes a virtual object for the mirror, so its image is a real image and 2.8 cm in front of the mirror.

This should be obvious without using the formula, but if you insist on using the lens/mirror formula
f= +infty, do= -2.8 cm -> 0 = -1/2.8 + 1/di, so di = +2.8 cm, Real image.

(2) What is the size of the image? Is it upright or inverted?[5]

m = -di/do
compute this for each element and multiply all.

For the lens: m = - (70/9)/14 = -5/9,
For the mirror: obviously 1, but an honest calculation gives m = - (2.8)/(-2.8) = +1.

Thus, the overall magnification is -5/9. 2 x 5/9 = 10/9 = 1.1 cm inverted.