Angles are always measured from the normal direction

Physics 102 (F16) Q10B

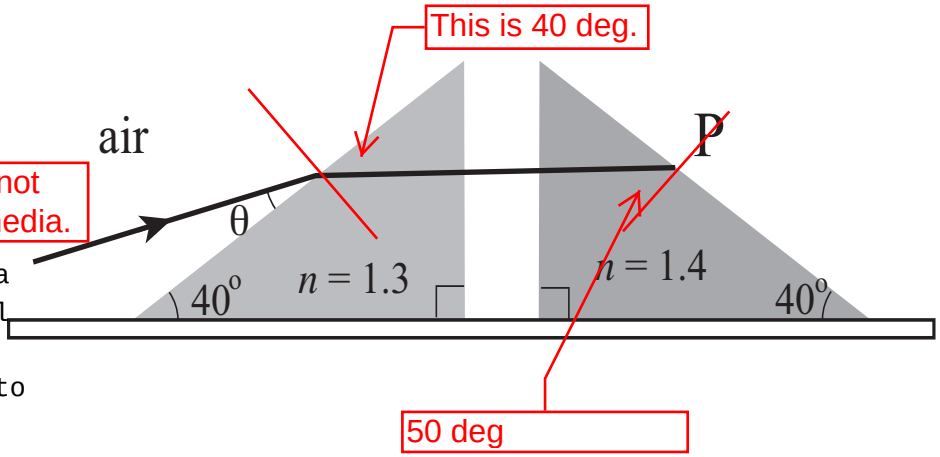
Name: _____ **Section:** _____ **Score:** _____/20

1. Two orthogonal triangular prisms with identical shapes are placed back to back as illustrated. The index of refraction of the left prism is $n = 1.1$ and that of the right prism is $n = 1.2$. Light is incident from Left as shown.

(1) The wavelength of the light in the left prism is 520 nm. What is it in the right prism? [4]

c = f lambda
c = c0/n

The frequency does not change in different media.



Therefore, lambda in a medium is proportional to 1/n. That is,
n x lambda is common to all the media. Hence,
1.3 x 520 = 1.4 x X.
X = 520 x 1.3/1.4 = 483 nm. You must know that the wavelength in the right prism is shorter than that in the left prism.

(2) In the left prism, the ray is parallel to the floor on which the prisms are placed as shown in the figure above.
(i) Find the angle θ [4].

Snell's law: n1 sin theta1 = n2 sin theta2

Snell tell us
1.3 sin 50 = sin (90 - theta) = cos theta.
Therefore, cos theta = 0.99586 -> theta = 5.22 deg.

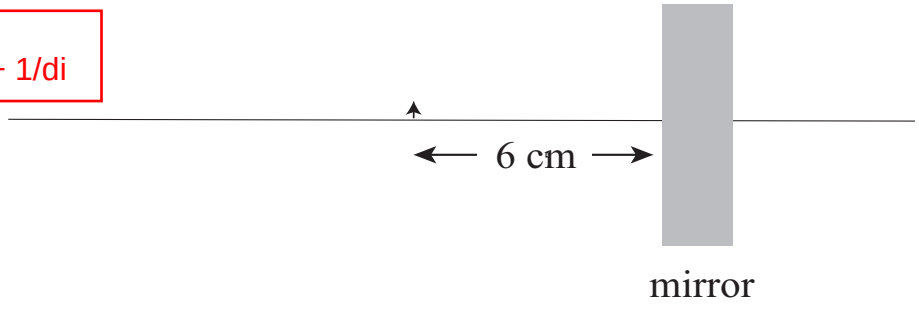
(ii) Can the light go out from P into air? [2]

Let us apply Snells law at P:
1.4 sin 50 = 1.07 > 1, so there is no real angle satisfying Snell's law -> perfect internal reflection

If
(n1/n2)sin theta1 > 1 -> internal reflection

2. 6 cm in front of a mirror is a real object of height 3 mm whose image is formed 9 cm away from the mirror.

m = -di/do
1/f = 1/do + 1/di



(1) What is the (absolute) size of the image? [5]

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|m| = 9/6 = 1.5 -> 1.5 x 3 = 4.5 mm
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(2) The image is actually upright. What is the focal length of the mirror? Is it converging or diverging? [5]

m > 0 upright
m < 0 inverted

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Therefore, di = -9 cm.
1/f = 1/6 - 1/9 = (3-2)/18 = 1/18 > 0 -> 18 cm

That is, converging mirror (that is, a concave mirror)
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