Smith's Answers

A.P. Physics - B

UNIT 11 TEST REVIEW

Light and Optics: Chapters 22-24

*** In studying for your test, make sure to study this review sheet along with your quizzes and homework assignments.**

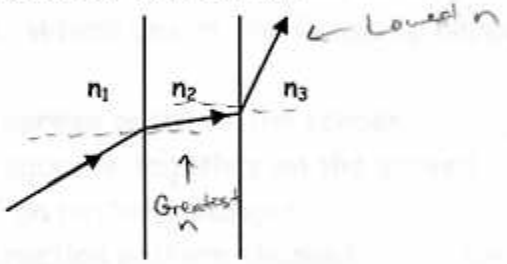
Multiple Choice Review: **On this portion of the test, you will not be allowed to use your calculator or AP formula sheet. (You may, however, use your AP table of information.) Approximate $g=10m/s^2$ for simplicity of calculations. No partial credit will be given.**

$\frac{1}{f} + \frac{1}{S_i} = \frac{1}{q} \rightarrow \frac{1}{S_i} = \frac{1}{q} - \frac{1}{f} = \frac{2}{18} - \frac{3}{18} = -\frac{1}{18}$

$M = \frac{-S_i}{S_o} = \frac{+18}{6}$

1. A physics student places an object 6.0cm from a converging lens of focal length 9.0cm. What is the magnitude of the magnification of the image produced?
   a. 0.6 b. 1.5 c. 2.0 (d.) 3.0 e. 3.6

2. A light ray moves across two interfaces as shown in the figure. Which of the following relations is true for the three indices of refraction?
   a. $n_1 > n_2$, $n_2 > n_3$, $n_1 > n_3$
   b. $n_1 < n_2$, $n_2 > n_3$, $n_1 < n_3$
   c. $n_1 > n_2$, $n_2 > n_3$, $n_1 < n_3$
   (d.) $n_1 < n_2$, $n_2 > n_3$, $n_1 > n_3$
   e. $n_1 < n_2$, $n_2 < n_3$, $n_1 < n_3$



3. A concave mirror with a radius of curvature of 1.0m is used to collect light from a distant star. The distance between the mirror and image is most nearly
   a. 0.25m (b.) 0.50m c. 0.75m d. 1.0m e. 2.0m

$\frac{1}{\infty} + \frac{1}{S_i} = \frac{1}{0.5}$ ← $f = R/2$

4. Which of the following is characteristic of both sound and light waves?
   a. They are longitudinal waves. ← sound
   b. They are transverse waves. ← light
   c. They travel with the same velocity. ← c is really a lot way faster.
   d. They can be easily polarized. ← we didn't learn, but no.
   (e.) They give rise to interference effects.

↑ we did a couple of problems w/sound diffraction.

5. When light passes from air into water, the frequency of the light remains the same. What happens to the speed and wavelength of light as it crosses the boundary in going from air into water?

	Speed	Wavelength
a.	Increases	Remains the same
b.	Remains the same	Decreases
c.	Remains the same	Remains the same
d.	Decreases	Increases
(e.)	Decreases	Decreases

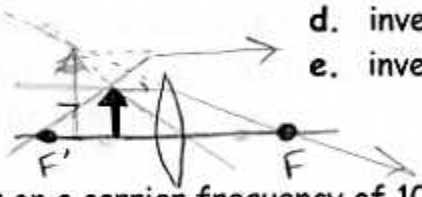
$v = f\lambda$

↑ slower, so ↑ decreases

↗ $n_{water} > n_{air}$, so slower in H_2O.

6. An object is placed in front of a converging thin lens at a distance from the center of the lens equal to half the focal length. Compared to the object, the image is...

(a.) upright and larger.
b. upright and smaller.
c. inverted and larger.
d. inverted and smaller.
e. inverted and the same size.



-OR- $\frac{1}{f/2} + \frac{1}{s_i} = \frac{1}{f}$

$s_i = -f \rightarrow M = \frac{-s_i}{s_o} = \frac{f}{f/2} = 2$

7. A radio station broadcasts on a carrier frequency of 100MHz. The wavelength of this radio wave is most nearly...

a. 0.003m b. 1.0m (c.) 3.0m d. 3.3m e. 3×10^6m

$c = f\lambda$

$3E8 = 100E6\,\lambda$

$\lambda = \frac{3E8}{1E8} = 3$

8. When monochromatic light is passed through a slit of a particular width, a diffraction pattern is formed on a screen. Which one of the following happens when the width of the slit is decreased?

(a.) The bands of the diffraction pattern spread apart on the screen.
b. The bands of the diffraction pattern squeeze together on the screen.
c. The color of the bands in the diffraction pattern changes.
d. The intensity of the bands in the diffraction pattern changes.
e. There is no change in the diffraction pattern.

$d\sin\theta = m\lambda$

↑ ↑ Inversely related.

If $d \downarrow, \theta \uparrow$

↙ +f (diverging = −f)

9. An object is placed on the axis of a converging thin lens of focal length 2cm, at a distance of 8cm from the lens. The distance between the image and the lens is most nearly...

$1/8 + 1/s_i = \frac{1}{2} \rightarrow \frac{1}{s_i} = \frac{1}{2} - \frac{1}{8} = 3/8 \rightarrow s_i = 8/3$

a. 0.4cm b. 0.8cm c. 1.6cm d. 2.0cm (e.) 2.7cm

10. Monochromatic light of wavelength 500nm falls upon two slits spaced 5μm apart. How far from the central maximum does the first bright fringe appear on a screen that is 4m from the slit-plate? (Hint: For very small angles, tanθ and sinθ are basically equal.)

a. 4mm b. 4cm c. 8cm (d.) 40cm e. 80cm

$d\sin\theta = m\lambda$

$5E^{-6}\sin\theta = (1)(500E^{-9})$

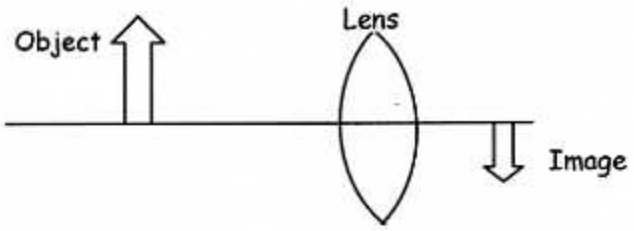
$\sin\theta = \frac{5E^{-7}}{5E^{-6}} = \frac{5}{50} = 0.1$

$\tan\theta = \frac{x}{L}$ ($\sin\theta$)

$0.1 = \frac{x}{4}$

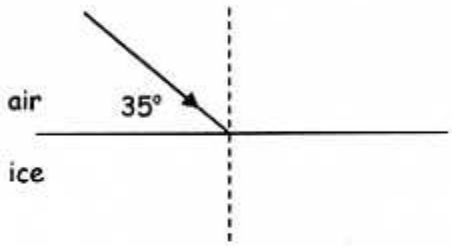
11. For the diagram, the image formed by the converging lens is a real image and the image distance is positive.

a. converging, real, positive
b. converging, real, negative
c. converging, virtual, positive
d. diverging, virtual, negative
e. diverging, virtual, negative



Problem Review: On this portion of the test, you may use your calculator, AP formula sheet, and AP table of information. Partial credit will be given on these problems.

12. A ray of monochromatic 500nm-wavelength light traveling through air is incident upon ice (n=1.309) as shown.



a. What is the speed of the light in the ice?

b. What is the wavelength of the light in the cube of ice?

c. What is the angle between the reflected and refracted rays as they leave the boundary?

d. If the light had been approaching from inside the ice, what would be the maximum angle from the normal at which it could have approached, in order to pass into the air, rather than be totally internally reflected?

13. A 10cm-tall object is placed 12cm in front of a convex mirror that has a radius of curvature of 35cm. First sketch a ray diagram to predict the approximate image position and height. Then calculate the image position and height, and state whether the image is real or virtual, and upright or inverted.