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Physics 2135 End-Material Test

December 18, 2014

EM Test Total
/ 50

Printed Name: _____

Rec. Sec. Letter: _____

Remove only the cover sheet and starting equations from the test before you begin. Write clearly on this page the answer you believe is the best or most nearly correct answer. You may also record the answers on your starting equation sheet for comparison with the answer key, which will be posted after all students have taken the test. When you finish both the 50-point End-Material Test and 200-point Final Exam, turn both in (with all pages, including this page, stapled together). You may keep the starting equation sheet.

Each question is worth 6 points, except question 8 is worth 8 points.

Your answers:

1. _____

2. _____

3. _____

4. _____

5. _____

6. _____

7. _____

8. _____

Eight multiple choice questions, 6 points each, except question 8 is worth 8 points. Choose the **best** or **most nearly correct** answer.

1. The index of refraction of glass is 1.5 and the index of refraction of water is 1.33. Which of the following is true for light from a red laser of wavelength 633 nm in air?

[A] the frequency of the light in glass is greater than the frequency of the light in water
[B] the frequency of the light in glass is less than the frequency of the light in water
[C] the wavelength of the light in glass is greater than the wavelength of the light in water
[D] the wavelength of the light in glass is less than the wavelength of the light in water

2. Light traveling in glass (n_g = 1.5) is incident on a glass/liquid interface. If the critical angle for total internal reflection is 60°, what is the index of refraction of the liquid?

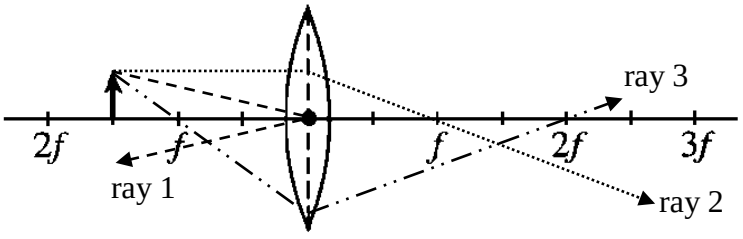
[A] 0.57 [B] 1.15
[C] 1.30 [D] 1.73

3. A real object is viewed in a convex mirror of -30 cm focal length. A virtual image is formed 20 cm from the mirror. What is the object distance?

[A] -60 cm [B] -12 cm
[C] 12 cm [D] 60 cm

4. Which of the rays in the ray diagram to the right is a valid principal ray for illustrating image formation for a converging lens?

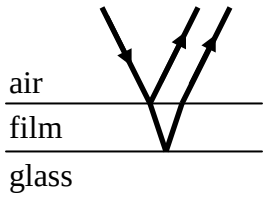
[A] ray 1 - - - - - - - -
[B] ray 2 .....
[C] ray 3 — · · — · · — · ·



5. Coherent monochromatic light of wavelength 500 nm passes through two narrow slits that are separated by 0.1 mm. An interference pattern is observed on a screen 3 m away from the slits. What is the width of the central interference maximum?

[A] 9 mm [B] 15 mm
[C] 18 mm [D] 33 mm

6. Glass of index of refraction n_G is coated with a thin film of index of refraction n_F. Light of wavelength λ in air is perpendicularly incident on the film. The film thickness is exactly $4\lambda/n_F$, where λ/n_F is the wavelength of the light in the film. When viewed from above, the light reflected from the top and bottom of the film cancels. What can you say about the index of refraction of the film?



[A] $n_F > n_G$ [B] $n_F = n_G$

[C] $n_F < n_G$

7. Light of wavelength λ is incident on a diffraction grating. The first-order maximum is observed at an angle θ from the central maximum on a detector screen. If the original grating is replaced by a grating that has a larger spacing between slits, what happens to θ?

[A] θ increases [B] θ decreases

[C] θ remains unchanged

8. A peanut butter sandwich is left on the dashboard of a car in the hot sun. The electromagnetic waves from the sun will

[A] melt it all over the dash.

[B] exert a radiation force on the sandwich and push it onto the seat below.

[C] be mostly reflected by the thin film coating on the window.

[D] not make a difference because the dog sitting in the front seat by the open window has already eaten the sandwich.

No peanut butter sandwiches were harmed in the making of this problem. The Physics 2135 teaching staff reminds you to never leave a dog in a car in the hot sun with the windows rolled up, and never eat a melted peanut butter sandwich.