

Physics 114 – Practice Test for Midterm 3

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Conceptual Question 1:

- (a) Does light traveling from one medium to another always bend toward the normal?
- (b) As light travels across the interface between two media, does its frequency change?
- (c) Its wavelength?
- (d) Its velocity?

Explain your answers.

Conceptual Question 2:

A thin converging lens is used to form a real image of a nearby object. If the object is moved closer to the lens, a new real image is observed. Does the new image differ from the old one (a) in position relative to the lens, (b) in size? If it does, describe how.

Problem 1:

In SI units, the electric field in an electromagnetic wave is described by the following equation.

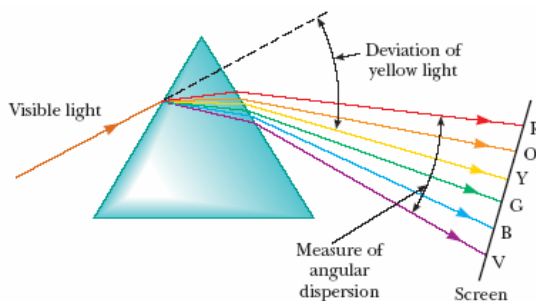
$$E_y = (100 \text{ V/m}) \sin(1.00 \times 10^7 x - \omega t)$$

- (a) Find the amplitude of the corresponding magnetic field oscillations.
- (b) Find the wavelength λ .
- (c) Find the frequency f .
- (d) What is the intensity of the wave?

Problem 2:

The index of refraction for violet light in silica flint glass is 1.66 and that for red light is 1.62.

- (a) What is the angular dispersion of visible light passing through a prism of apex angle 60.0° if the angle of incidence is 50° ?
- (b) Prove that violet light will undergo total internal reflection at the second surface if the angle of incidence is 39° .

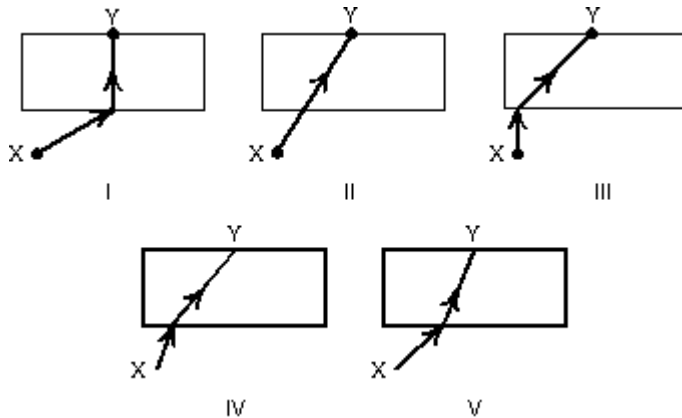


Problem 3:

Design a lens that produces a virtual image which is double the size of an object 10 cm away. The lens should be made of crown glass ($n = 1.515$). Make a sketch of the lens. Your design should indicate the radii of curvature of the two faces of the lens (there is no unique answer to this question).

Multiple Choice Questions:

1. The time averaged energy in a sinusoidal electromagnetic wave is:
 - a) overwhelmingly electrical
 - b) slightly more electrical than magnetic
 - c) equally divided between the electric and magnetic fields
 - d) slightly more magnetic than electrical
 - e) overwhelmingly magnetic
2. When an electromagnetic wave meets a reflecting surface, the direction taken by the reflected wave is determined by:
 - a) the material of the reflecting surface
 - b) the angle of incidence
 - c) the index of the medium
 - d) the intensity of the wave
 - e) the wavelength
3. Which diagram below illustrates the path of a light ray as it travels from a given point X in air to another given point Y in glass?
 - I
 - II
 - III
 - IV
 - V



- a) I
 - b) II
 - c) III
 - d) IV
 - e) V
4. An object is 2 m in front of a plane mirror. Its image is:
 - a) virtual, inverted, and 2 m behind the mirror
 - b) virtual, inverted, and 2 m in front of the mirror
 - c) virtual, erect, and 2 m in front of the mirror
 - d) real, erect, and 2 m behind the mirror
 - e) none of the above
 5. In a two lens microscope, the intermediate image is:
 - a) virtual, erect and magnified
 - b) real, erect and magnified
 - c) real, inverted and magnified
 - d) virtual, inverted and reduced
 - e) virtual, inverted and magnified