Name _____ Date _____

CONCEPTUAL Physics PRACTICE PAGE

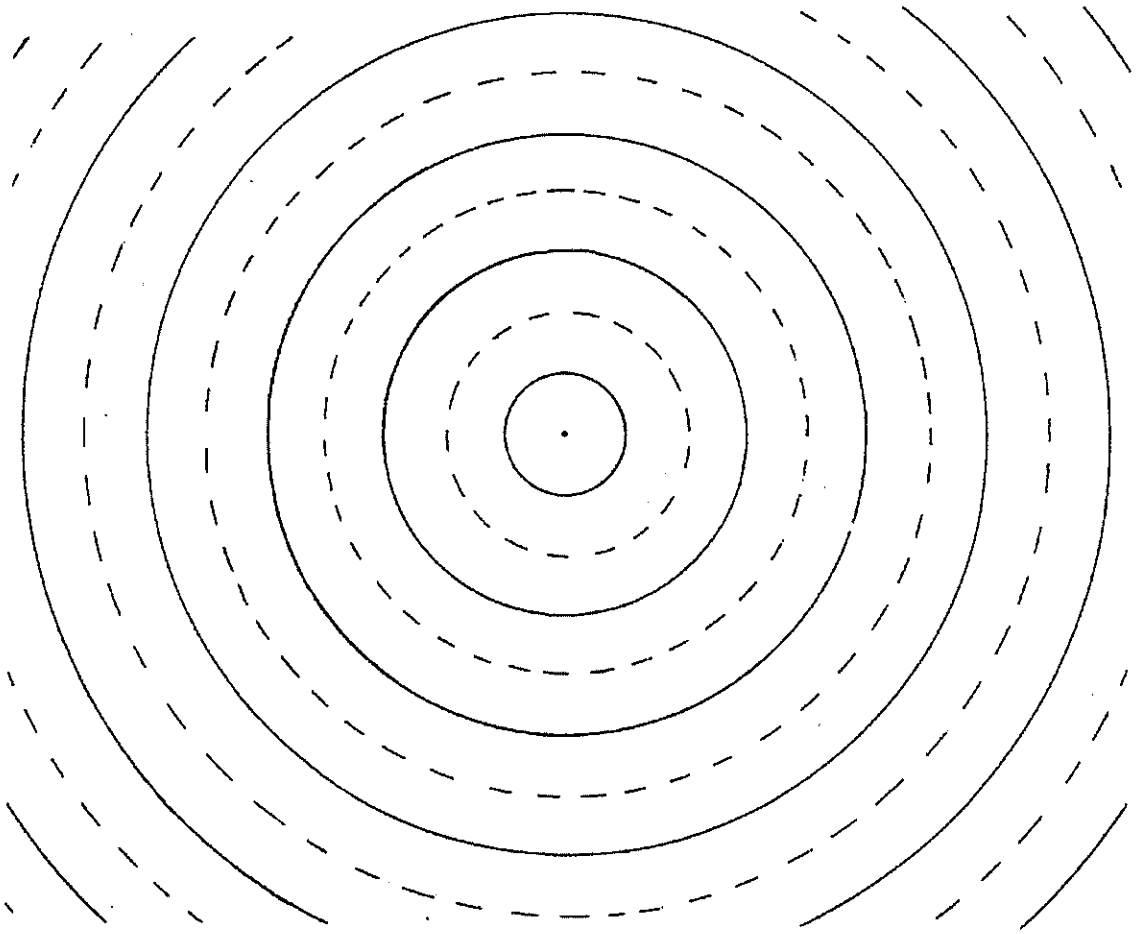
Chapter 29 Light Waves
Diffraction and Interference

1. Shown below are concentric solid and dashed circles, each different in radius by 1 cm. Consider the circular pattern of a top view of water waves, where the solid circles are crests and the dashed circles are troughs.

   a. Draw another set of the same concentric circles with a compass. Choose any part of the paper for your center (except the present central point). Let the circles run off the edge of the paper.

   b. Find where a dashed line crosses a solid line and draw a large dot at the intersection. Do this for ALL places where a solid and dashed line intersect.

   c. With a wide felt marker, connect the dots with the solid lines. These *nodal lines* lie in regions where the waves have cancelled—where the crest of one wave overlaps the trough of another (see Figures 29.14 and 29.15 in your textbook).



Chapter 29 Light Waves

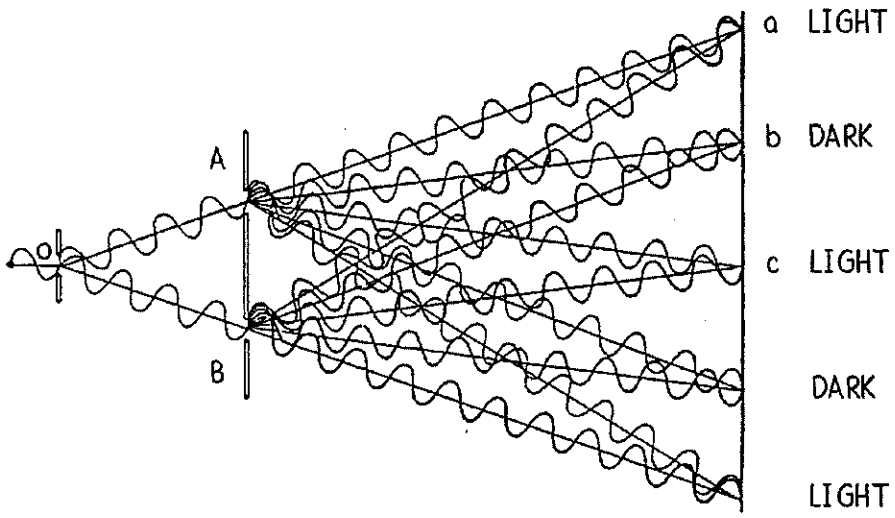
***Diffraction and Interference**—continued*

2. Look at the construction of overlapping circles on your classmates' papers. Some will have more nodal lines than others, due to different starting points. How does the number of nodal lines in a pattern relate to the distance between centers of circles (or sources of waves)?

_____

_____

3. Figure 29.18 from your textbook is repeated below. Carefully count the number of wavelengths (same as the number of wave crests) along the following paths between the slits and the screen.



a. Number of wavelengths between slit A and point a is _____.

b. Number of wavelengths between slit B and point a is _____.

c. Number of wavelengths between slit A and point b is _____.

d. Number of wavelengths between slit B and point b is _____.

e. Number of wavelengths between slit A and point c is _____.

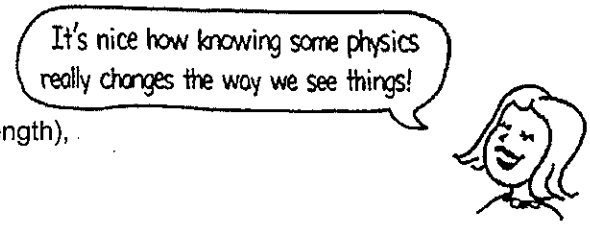
f. Number of wave crests between slit B and point c is _____.

4. When the number of wavelengths along each path is the same or differs by one or more whole wavelengths, interference is

[constructive] [destructive]

and when the number of wavelengths differ by a half wavelength (or odd multiples of a half wavelength), interference is

[constructive] [destructive].



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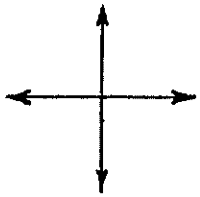
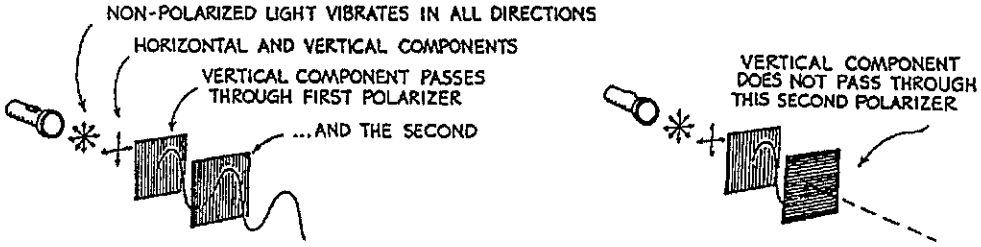
Chapter 29 Light Waves

Polarization

The amplitude of a light wave has magnitude and direction, and can be represented by a vector. Polarized light that vibrates in a single direction is represented by a single vector. The single vector to the left represents vertically polarized light. The pair of perpendicular vectors to the right represents non-polarized light. The vibrations of non-polarized light are equal in all directions, with as many vertical components as horizontal components.



1. In the sketch below, non-polarized light from a flashlight strikes a pair of Polaroid filters.

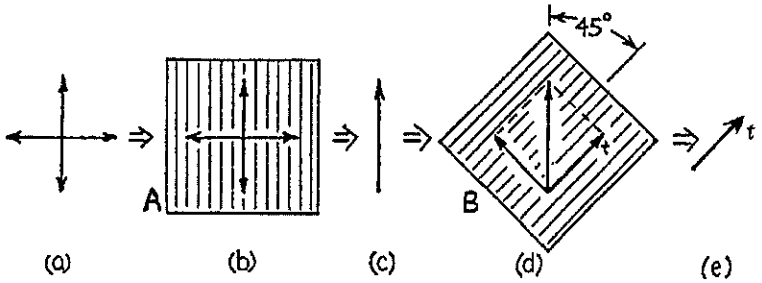


a. Light is transmitted by a pair of Polaroids when their axes are [aligned] [crossed at right angles] and light is blocked when their axes are [aligned] [crossed at right angles].

b. Transmitted light is polarized in a direction [the same as] [different than] the polarization axis of the filter.

2. Consider the transmission of light through a pair of Polaroids with polarization axes at 45° to each other. Although in practice the Polaroids are one atop the other, we show them spread out side by side below. From left to right:

(*a*) Non-polarized light is represented by its horizontal and vertical components.
(*b*) These components strike filter A.
(*c*) The vertical component is transmitted, and
(*d*) falls upon filter B. This vertical component is not aligned with the polarization axis of filter B, but it has a component that is aligned—component *t*,
(*e*) which is transmitted.



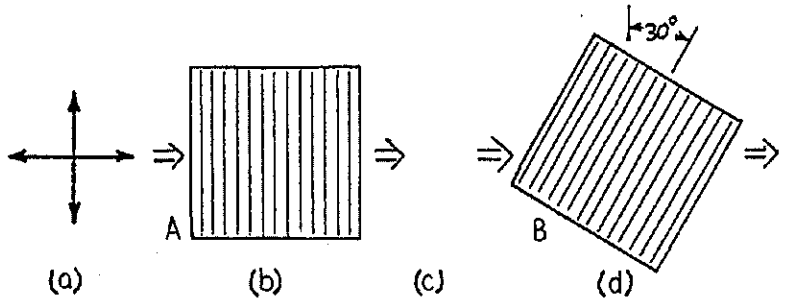
a. The amount of light that gets through filter B compared to the amount that gets through filter A is [more] [less] [the same].

b. The component perpendicular to *t* that falls on filter B is [also transmitted] [absorbed].

Chapter 29 Light Waves

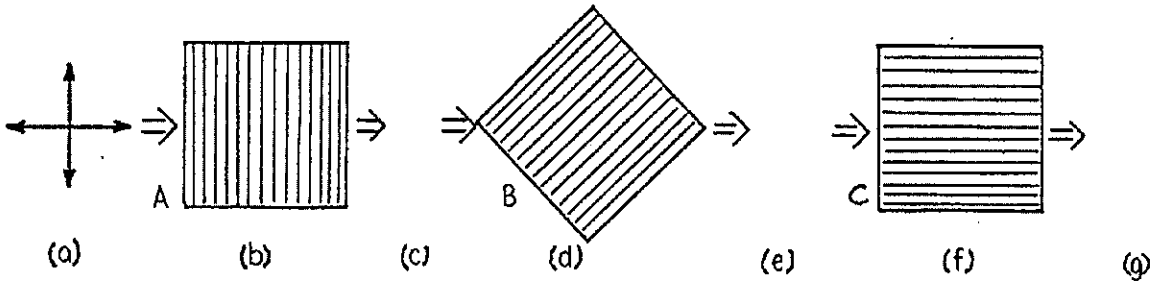
***Polarization**—continued*

3. Below are a pair of Polaroids with polarization axes at 30° to each other. Carefully draw vectors and appropriate components (as in Question 2) to show the vector that emerges at *e*.



a. The amount of light that gets through the Polaroids at 30° compared to the amount that gets through the 45° Polaroids is [less] [more] [the same].

4. Figure 29.35 in your textbook shows the smile of Ludmila Hewitt emerging through three Polaroids. Use vector diagrams to complete steps *(b)* through *(g)* below to show how light gets through the three-Polaroid system.



5. A novel use of polarization is shown below. How do the polarized side windows in these next-to-each-other houses provide privacy for the occupants? (Who can see what?)