

**“Scientists are explorers,
philosophers are tourists.”
-- Richard Feynman**

新年好

Gung Hay Fat Choy!
Xin Nian Kuai Le!
Happy New Year!

1

Suggested Exercises & Problems – Chapter 23

- 22, 43, 53, 71, 80

Reminder

- Written Homework #1 is due by this Friday, January 30, by 5 PM in the appropriate Drop Box

2

Where are we going?

- This week: we finish our discussion of Waves
 - Chapter 23 – Ray Optics
- Next week: Prof. Strong begins a discussion of Electricity & Magnetism
- Monday February 23: Prof. Strong and I will do a review for the test
- Wednesday February 25 – Monday March 23: Prof Strong continues the discussion of Electricity & Magnetism
- Wednesday March 25 – Wednesday April 8: I will coordinate a discussion of the Theory of Relativity

3

Electromagnetism Home Page

- Now active
- From the PHY132 web page:
 - Course Documents / Prof. Strong's Lectures

<http://www.atmos.physics.utoronto.ca/people/strong/phy132/phy132.html>

4

Electromagnetism Assignments

- First EM reading assignment:
Chapter 26 of Knight (2nd edition),
Sections 26.1 to 26.5
- First EM Mastering Physics Pre-Class Quiz:
due at 10 AM Monday, February 2
 - This covers material in Chapter 26
- First EM Mastering Physics Problem Set:
due at **11:59 PM** on Friday, February 6

5

Last Time

- Double Slit experiment for light
 - Finish analysis
 - A small text correction
- “Diffraction” Grating
 - N slits
 - Intensity $\sim N^2$
- Interferometers
 - Michelson Interferometer for sound and for light
 - Holograms
- Began building a *Ray Model* for waves, especially light

6

Today

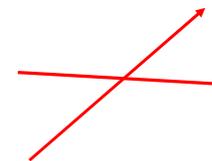
- §23.2 – Reflection
- §23.3 – Refraction
- §23.4 – Image Formation by Refraction
- §23.5 – Color and Dispersion

7

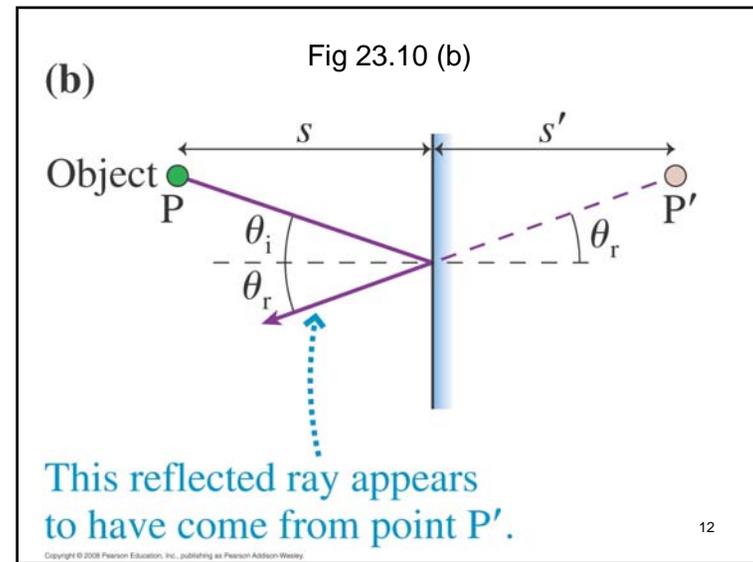
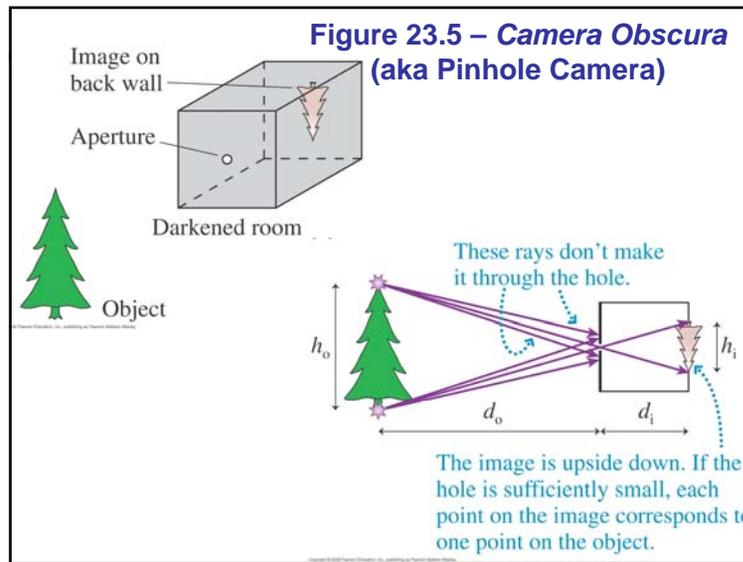
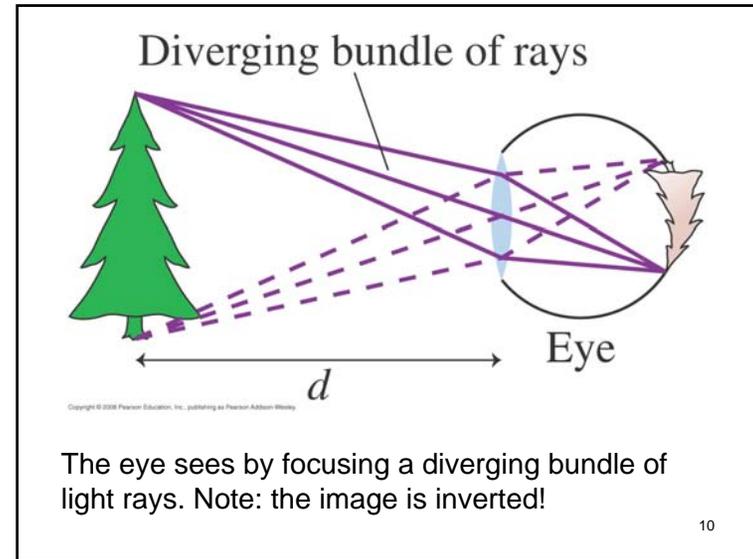
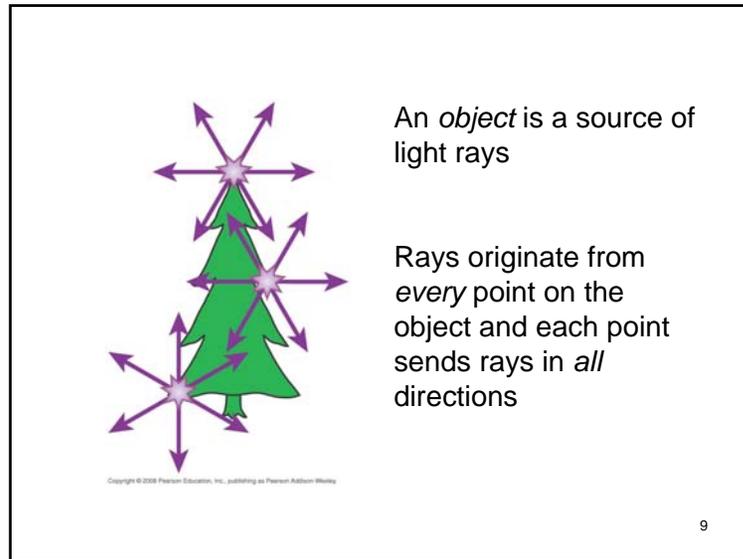
In the Ray Model, rays can cross each other without interacting with each other in any way

What property of the Wave Model corresponds to this property of the Ray Model?

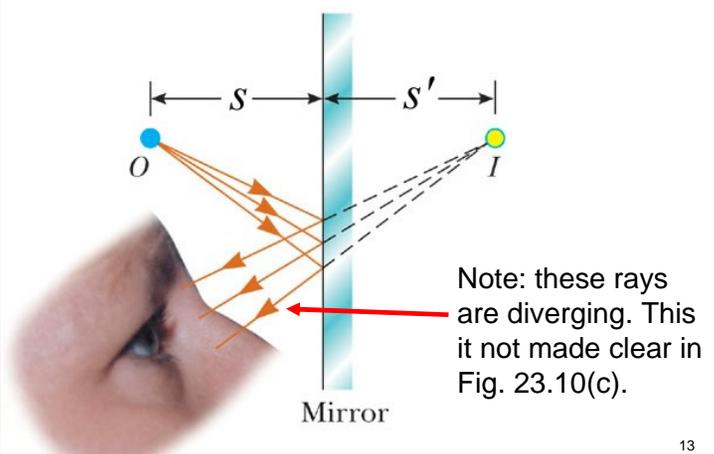
- A. Waves reflected from a fixed end are inverted
- B. The phase difference between the waves determines where constructive interference will occur
- C. Superposition
- D. Beats
- E. There is no corresponding property in the Wave Model



8



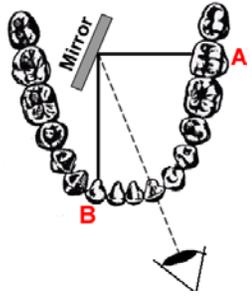
How an image is formed



Mirror

Note: these rays are diverging. This is not made clear in Fig. 23.10(c).

13



A dentist uses a mirror to look at the back of a second molar (A). Next, he wishes to look at the back of a lateral incisor (B), which is 90° away. By what angle should he rotate the mirror?

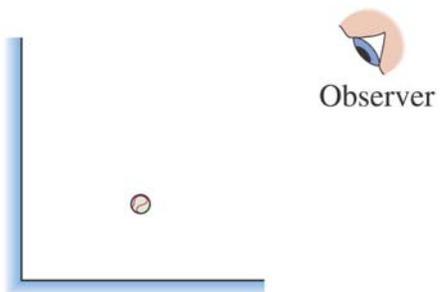
A. 90°
 B. 45°
 C. 180°

14

Two plane mirrors form a right angle

The ball is closer to the bottom mirror than the mirror on the left. How many images can you see in the mirrors?

A. 0
 B. 1
 C. 2
 D. 3
 E. 4



Observer

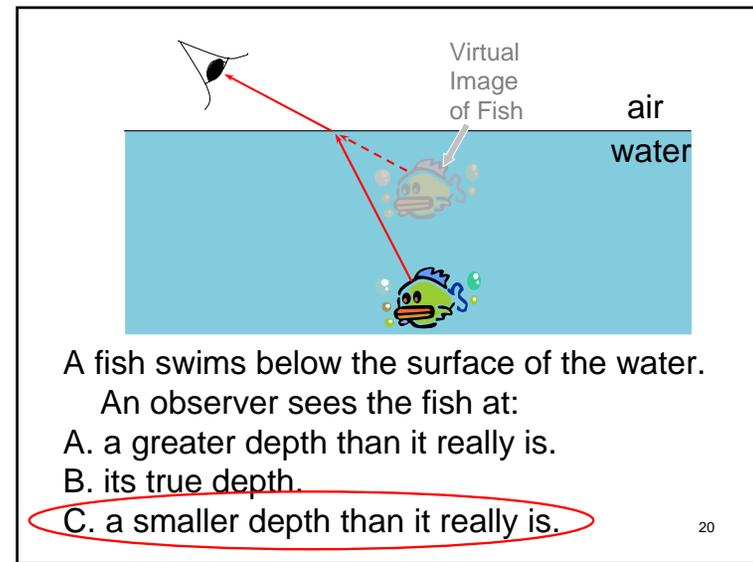
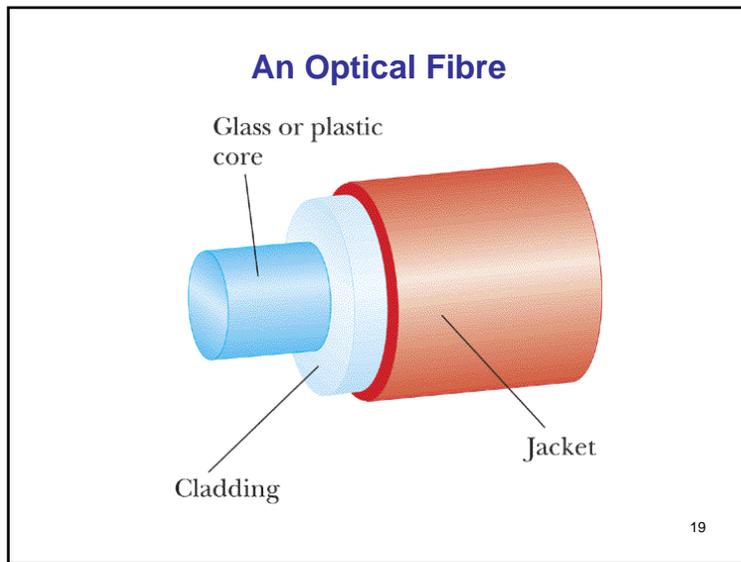
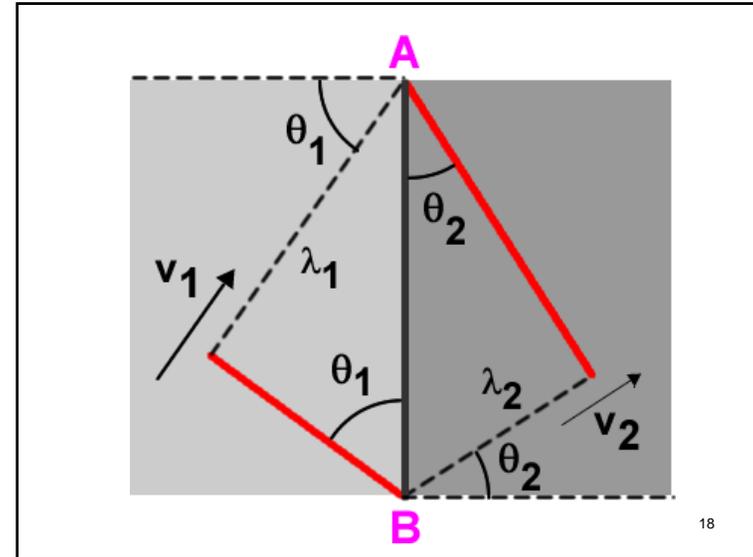
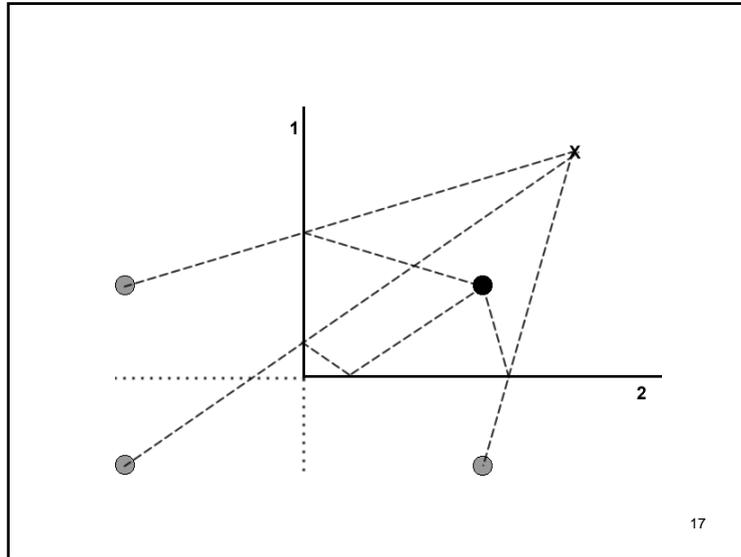
15

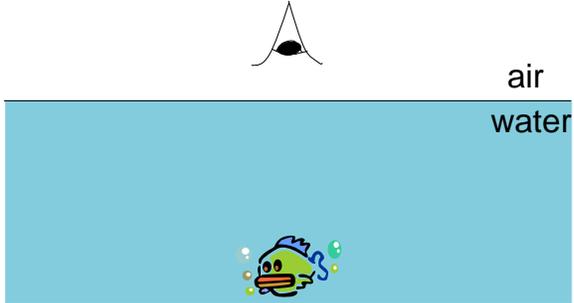
Corner Mirrors



16

http://www.prekfurniture.com/images/_products/prekfurniture/Small%20Mirror.jpg





A fish swims *directly* below the surface of the water. An observer sees the fish at:

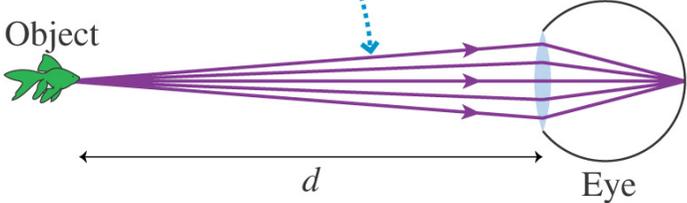
- A. a greater depth than it really is.
- B. its true depth.
- C. a smaller depth than it really is.

21

Depth perception

A fish out of water

The eye sees the object at distance d .



Object

Eye

d

Apparent Depth

A fish in the aquarium

The eye sees the image at distance d' .

Object

Image

Actual rays

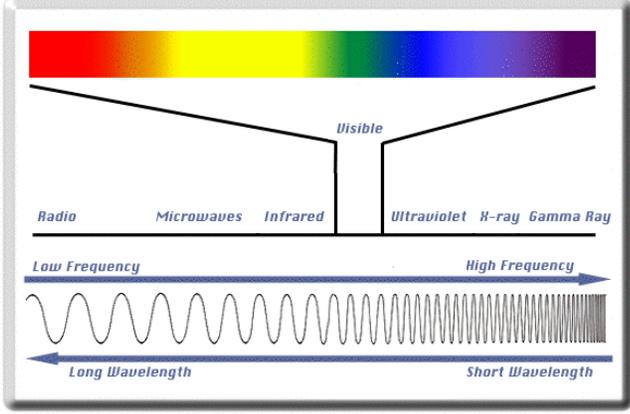
Refraction

d'

Diverging rays appear to come from this point. This is a virtual image.

23

Spectrum of Electromagnetic Waves



Radio

Microwaves

Infrared

Visible

Ultraviolet

X-ray

Gamma Ray

Low Frequency

High Frequency

Long Wavelength

Short Wavelength

<http://www.lcse.umn.edu/specs/labs/images/spectrum.gif>

24

