Ch 14 Pg 470: 2,10,11,20,23

problems: 8,24

Ch 15 Pg 501: 4,5,11,18,20,24

problem: 17,21,23,81,82,84

Ch 16 Pg 531: 2,6,20,21,26

Ch 17 Pg 568: 1,3,5,11,13,19

problems: 7,10,12,14,18,21,23

Ch 18 Pg 603: 6,9,16,17,22

problems: 10,17,20,23,26,33,37,55,62,66

Ch 19 Pg 631: 23

problems: 24,25

Beat frequency = $\dfrac{Beats}{Second}$ = 4 Hz
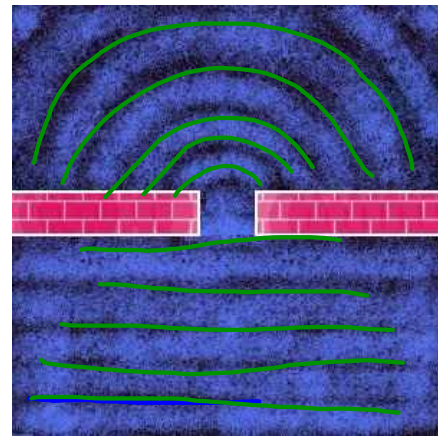
Known f ± Beat f

320 Hz

324 Hz)
316 Hz)

Wave

# Light Behavior

~~12.4~~ Ch 16 & 17

Behavior

- Reflection- a wave bounces off a surface, flips the wave upside down
- Refraction- bending of a wave as it enters a new medium *at an angle*
- Diffraction- bending of a wave as it moves around an obstacle or through a narrow opening

● Interference- when 2 waves collide

⚡● Constructive: Amplitudes (+) together

⚡● Destructive: Amplitudes (-) from one another

⚡● Standing Waves- appears to stay in one place

Antinode

⚡● Node

⚡● Antinode

Node

● Happens only if half a wavelength or a multiple of it fits exactly into the length of the rope
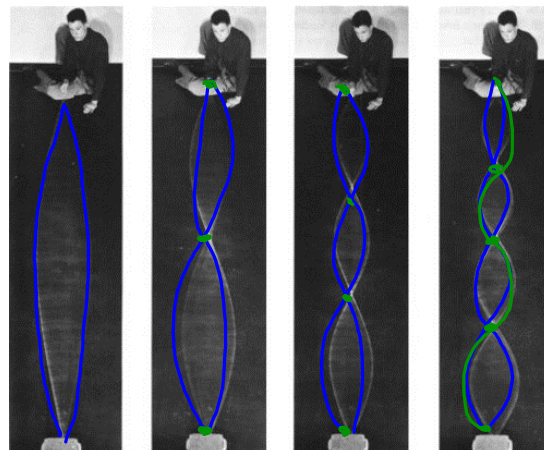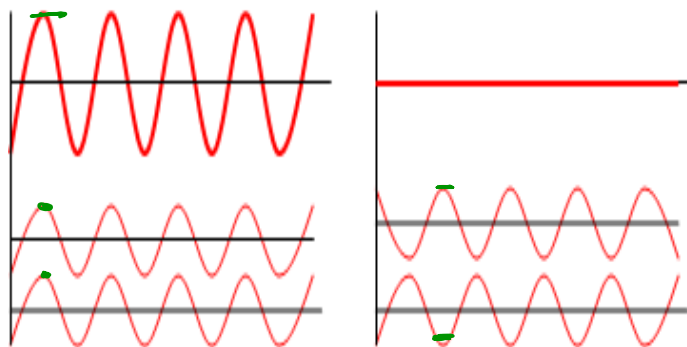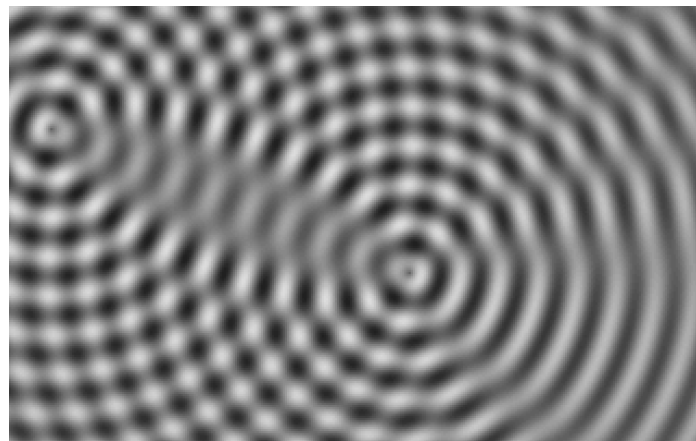
Interactions of Light

- **Reflection-** when light bounces off a surface
  - Regular: parallel lines hit a smooth surface and reflect
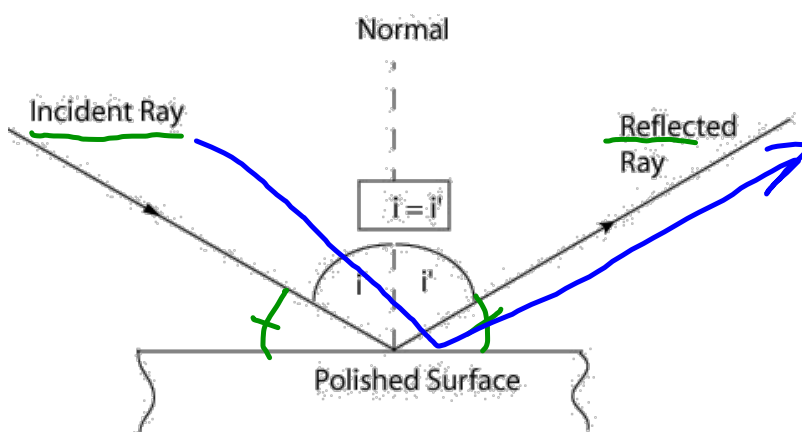 - Diffuse: parallel lines hit a rough surface and reflect

Normal

Incident Ray

Reflected Ray

i = i'

Polished Surface

Figure 1. The angle of the incident ray of light is equal to the angle of the reflected ray of light

(a) Specular Reflection

(b) Diffuse Reflection
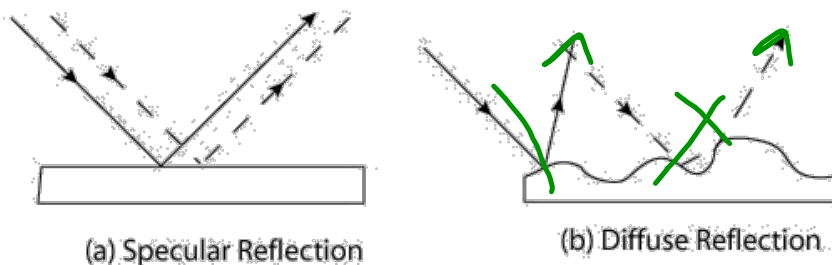
Figure 2. Specular and Diffuse Reflection

● Refraction- light bends as it goes from one medium to another
● Causes a mirage- appears like a reflection off of water

● Polarization- filters unpolarized light through a picket fence filter

● Scattering- redirection of light as it goes through a medium
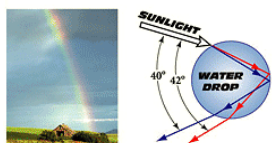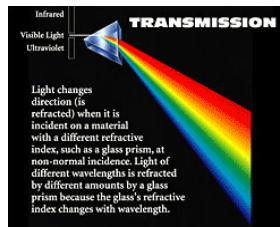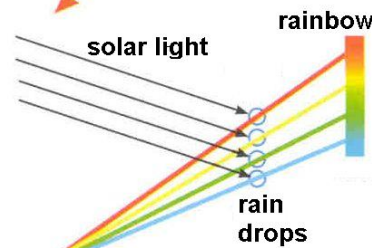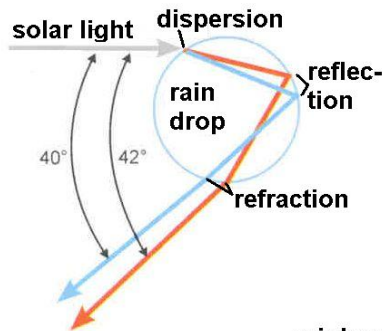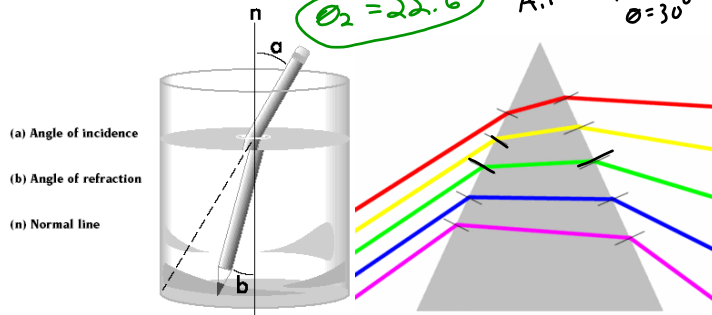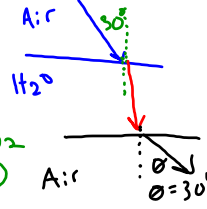

shark attack　　　　great whites

Index of Refraction

- Speed of light slows down as it changes media
  - Air is the fastest media other than a vacuum
  - Light bends or refracts as it changes speeds $n = \dfrac{c}{v}$
- Index of refraction: ratio of speed in a vacuum to the speed of light in the media
  - The higher the index, the more light is refracted
  - Light bends towards the normal of the higher index of refraction
  - n=c/v
- $n_1 \sin\varnothing_1 = n_2 \sin\varnothing_2$ Snells Law
- $n_1 v_1 = n_2 v_2$

$$n_1 \sin\varnothing_1 = n_2 \sin\varnothing_2$$
$$1\sin 30° = 1.3 \sin\varnothing_2$$
$$\boxed{\varnothing_2 = 22.6°}$$

Air

H_2O

30°

Air

$\varnothing = 30°$

n

a

(a) Angle of incidence

(b) Angle of refraction

(n) Normal line

b

solar light   dispersion

reflec-
tion

rain
drop

refraction

40°   42°

rainbow

solar light

rain
drops

Infrared
Visible Light
Ultraviolet

TRANSMISSION

Light changes
direction (is
refracted) when it is
incident on a material
with a different refractive
index, such as a glass prism, at
non-normal incidence. Light of
different wavelengths is refracted
by different amounts by a glass
prism because the glass's refractive
index changes with wavelength.

SUNLIGHT

40° 42°   WATER
DROP

Part of the incident light undergoes refraction as it enters a
water drop, then reflection at the back surface, then refraction
as it exits the drop. The index of refraction of water is
different for different wavelengths, causing the incident
sunlight to separate into a rainbow of colors. Only shown are
the rays corresponding to the angle at which scattering is a
maximum. See Reference 1, chapter 21 for further details.

air

H_2O
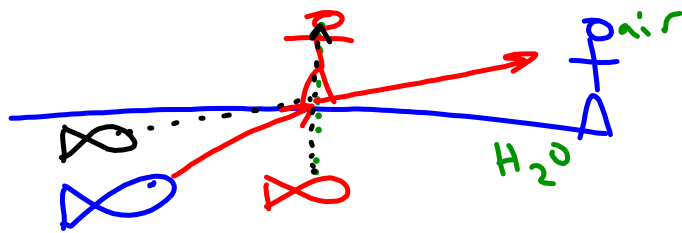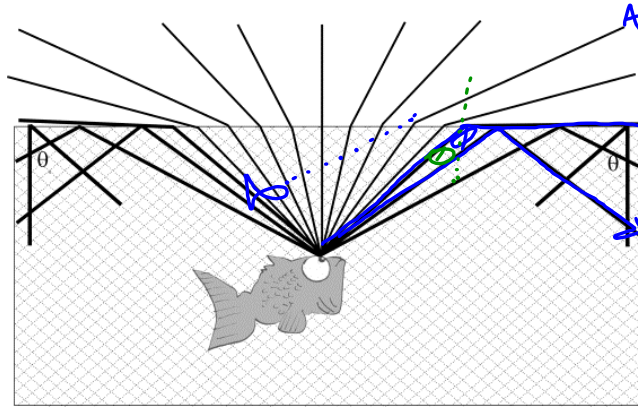
Total Internal Reflection

- At the Critical Angle light will no longer escape
- Total Internal Reflection- when the light can't escape and just reflects back inside
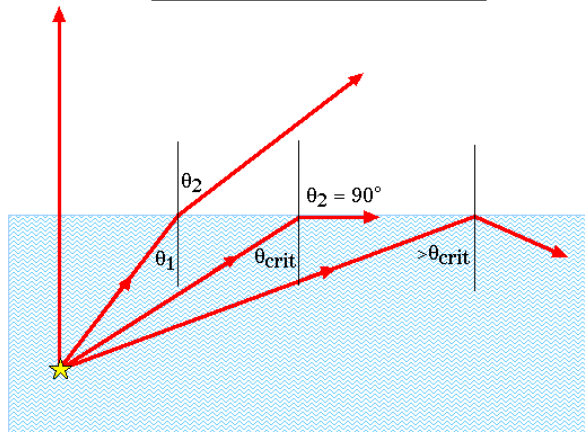 - Fiber optics and diamonds
- $\sin\varnothing_c = n_2/n_1$

$$\sin\theta_c = \frac{n_2}{n_1} \quad \frac{small}{Big}$$

$$\varnothing = 24.4^\circ \qquad \sin\theta_c = \frac{1}{2.42} \begin{array}{l} air \\ diamond \end{array}$$

A

TOTAL INTERNAL REFLECTION

θ_2
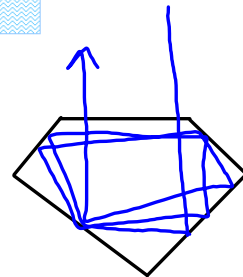
$\theta_2 = 90°$

θ_1 θ_{crit} $>\theta_{crit}$

Critical angles
- Glass to air: $\theta_{crit} = 41.1°$
- Diamond to air: $\theta_{crit} = 24.4°$
- Water to air: $\theta_{crit} = 48.6°$
- Glass to water: $\theta_{crit} = 61.0°$

Carat Weight

Color Grade

Clarity Grade

Cut Grade

Laser
Inscription
Registry
Number

Color

- Need to separate white light into colors through dispersion
- To see a color it must reflect it to your eye
- All colors form from a combination of 3 primary colors Red, Green, Blue

Additive and subtractive color combinations
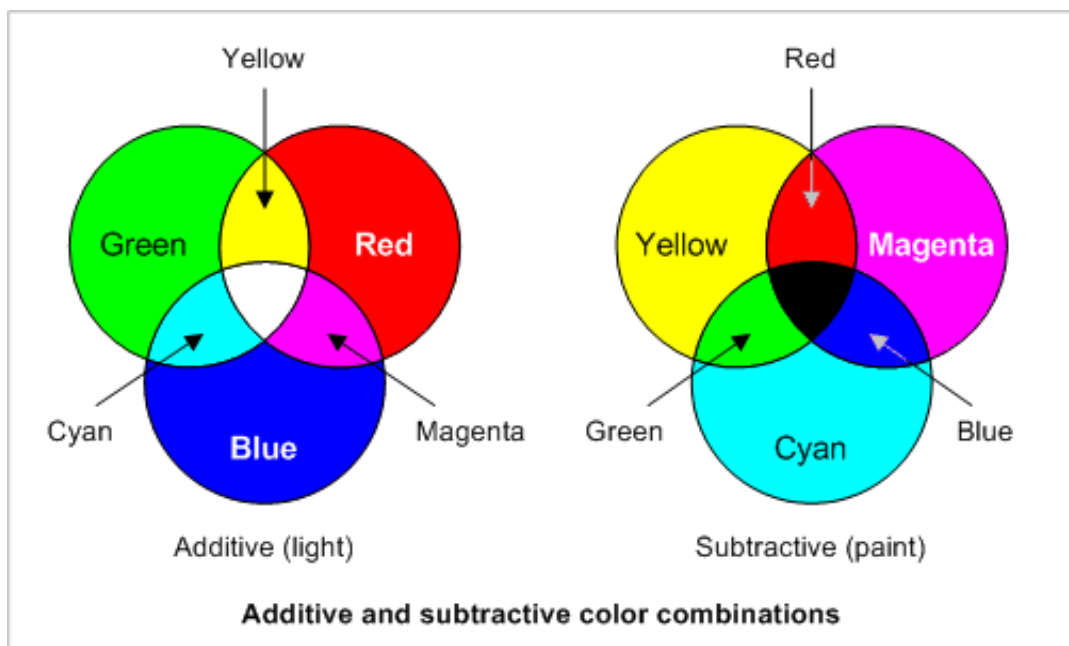
Color Wheel

- All colors together are white
- Absence of color is black
- Secondary colors are a combo of 2 primary- yellow, magenta, cyan

Additive and subtractive color combinations
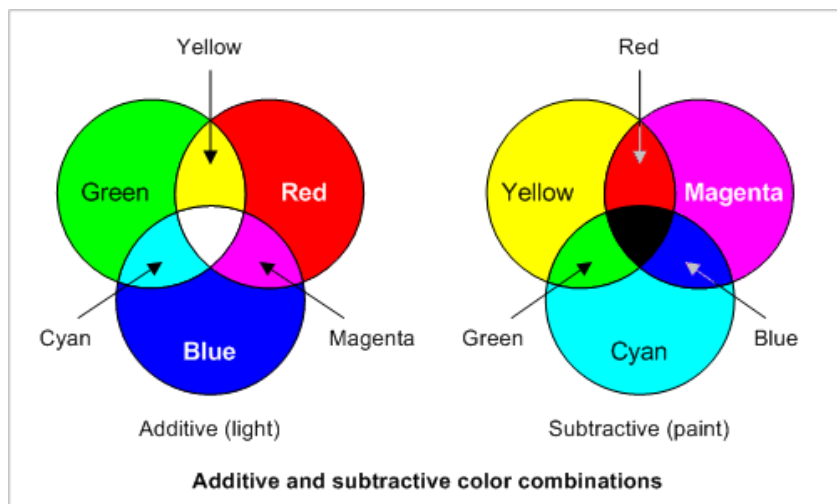
Mixing Pigments

- Pigment make up paint, ink, photos, dyes
- Cyan, yellow, magenta are main colors of pigment
- Combined with black these can make almost any colors
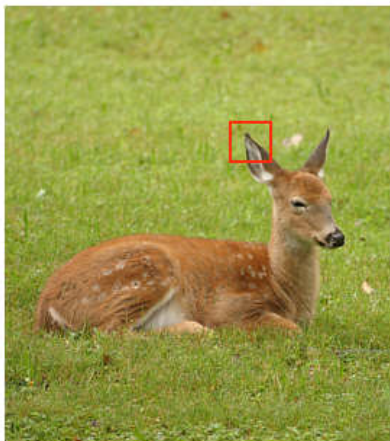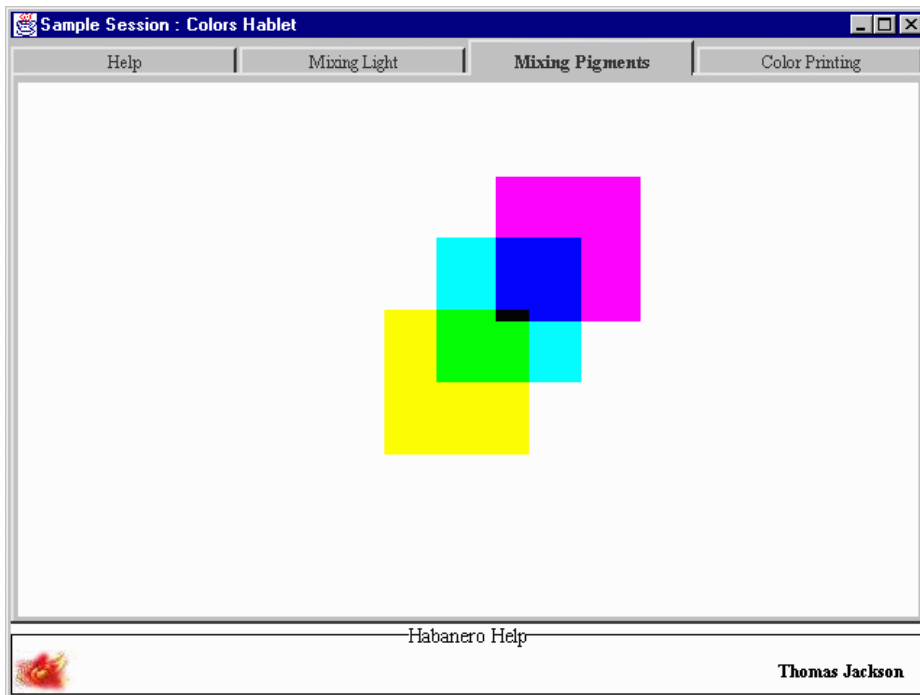
Attachments

great whites

shark attack