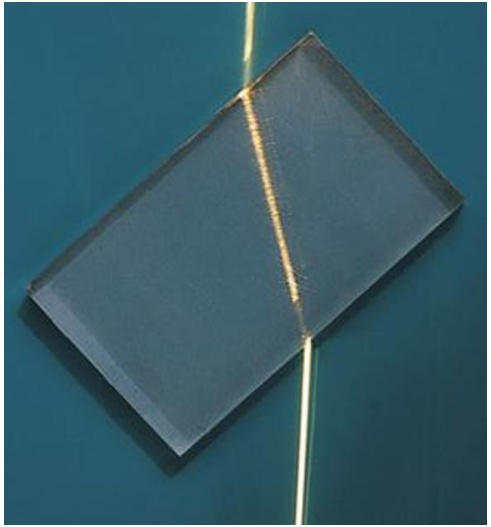
Diffraction and Refraction

(insert good subtitle here)

Refraction

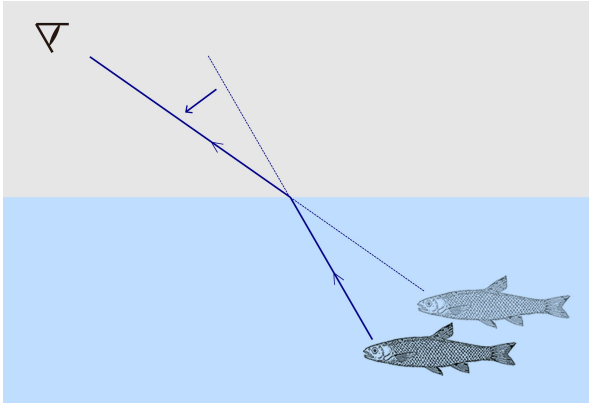
What is Refraction

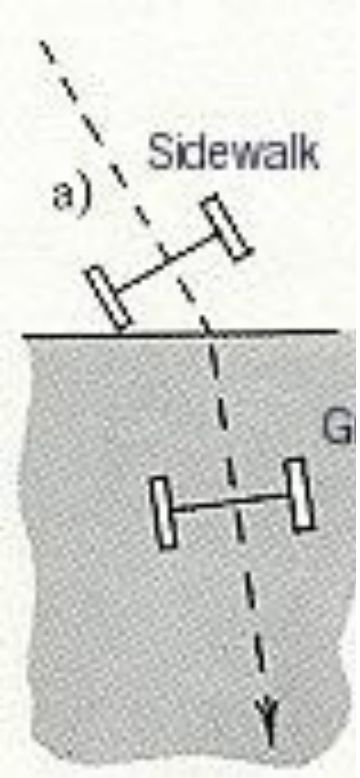


- “Refraction, in physics, the change in direction of a wave passing from one medium to another”
- Why?
- Where is this seen?

Water

- Fish in a Pond
- Light bends when it hits water
- Eyes do not Compensate
- Object is Lower Down and Farther than Image

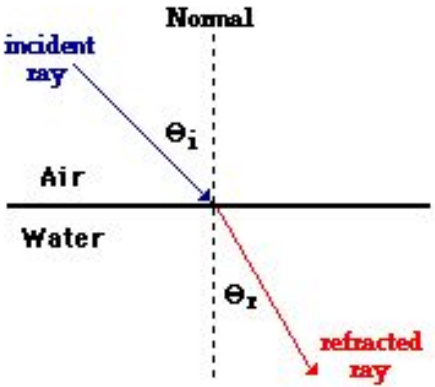




Why?

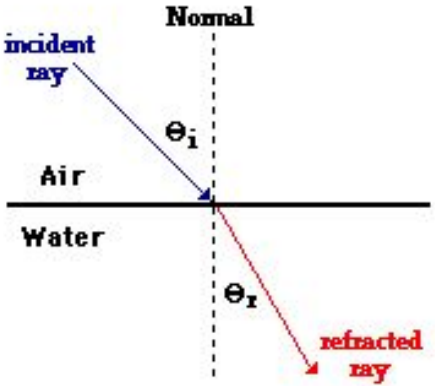
- Lawn Mower on grass
- Lawn Mower is going straight and right wheel hits Grass
- The wheel on grass moves slower than left wheel
- The Lawn Mower turns
- After the second wheel hits the grass the mower goes straight

Terms, Part 1

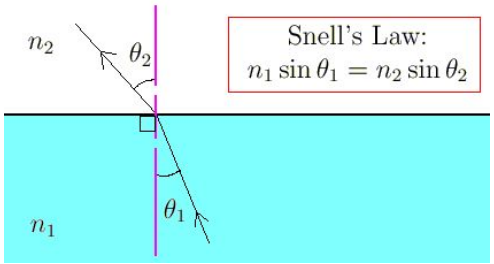


- Medium: What the light is traveling through
- Refractive Index: Ratio of speed of light in different mediums
- Interface: The “border” between the mediums
- Normal: Line Perpendicular to the interface
- Incident Ray: Ray going into the interface
- Refracted Ray: Ray leaving the interface

Terms Part 2 (and a bit of math)



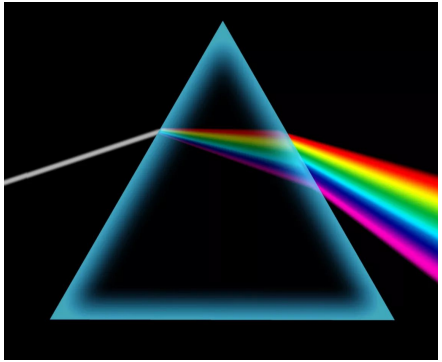
- Incident Angle: The Angle Between the Incident ray to the **Normal, not the Interface**
- Refracted Ray: The Angle Between the Refracted ray to the **Normal, not the Interface**
- Snell's Law, the Math:



In General

- High to low Refractive index: Bends light away from normal
- Low to High refractive index: Bends light towards normal

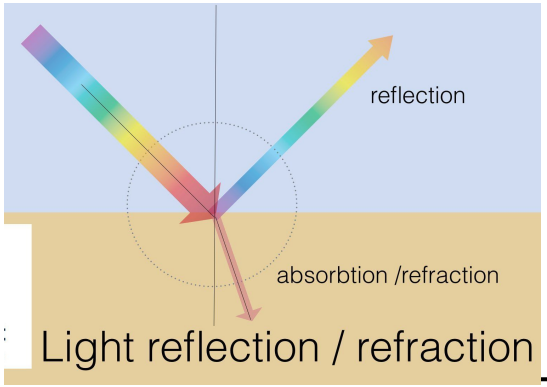
Refraction and Rainbows

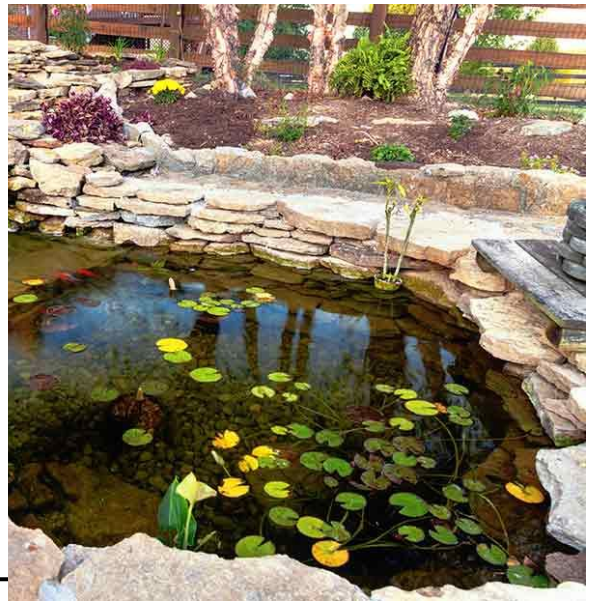


- Refraction Makes Rainbows!!!
- Different Color have Different refractive indexes
- White light = All the colors combined
- Colors separate
- Rainbow!

Refraction and Reflection

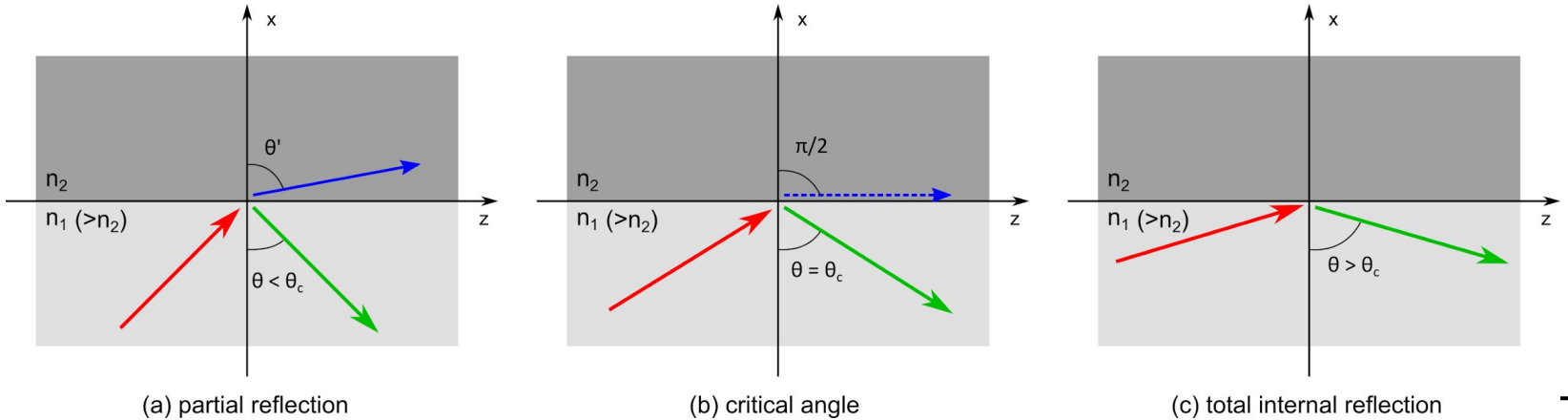
- When light hits a interface, it boths Reflects and Refracts
- Water: Reflection and Refraction
- Advanced: Brewster's Angle
- Colors?





TIR: Total Internal Reflection

- What if everything is a reflection?
- How does it work?
- What are some uses?



Review

What is Refraction?

What are some substances that refract waves?

If an incident angle is 60 degrees, how many degrees is it away from the normal?

When a wave hits water, does it refract or reflect?

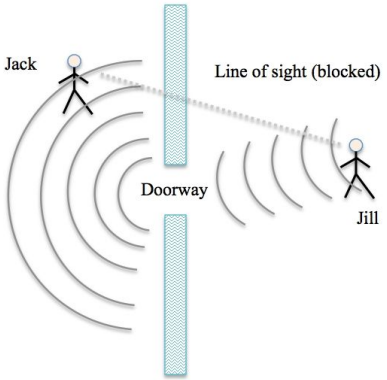
What is total internal reflection useful for?

Diffraction

Diffraction

Waves “bend” around objects

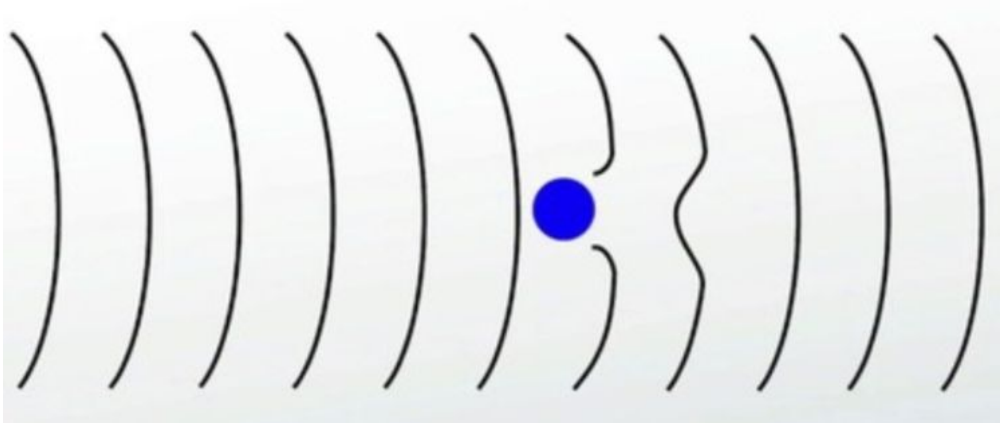
Why can we hear sound around a doorway?



Non-slit diffraction

Waves can easily bend around objects.

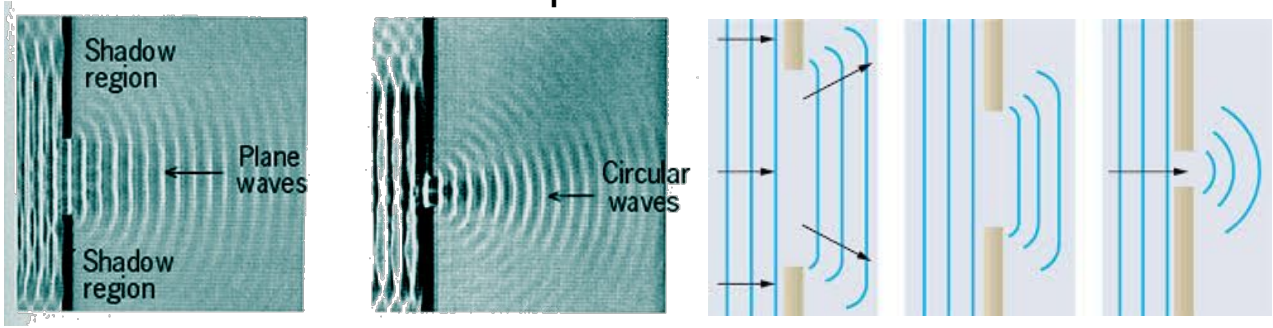
Why can we hear sound around a post?



Large vs small slits

The smaller the slit, the more obvious the diffraction

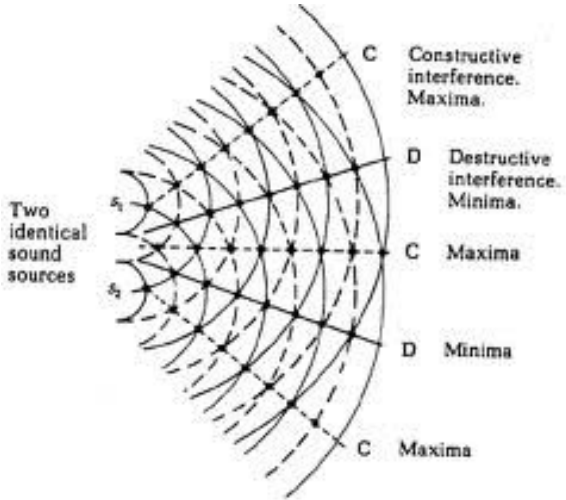
Diffraction occurs because there's a barrier; the closer the two sides of the barrier are to each other, the closer the diffraction effects of the top and bottom are



Interference?

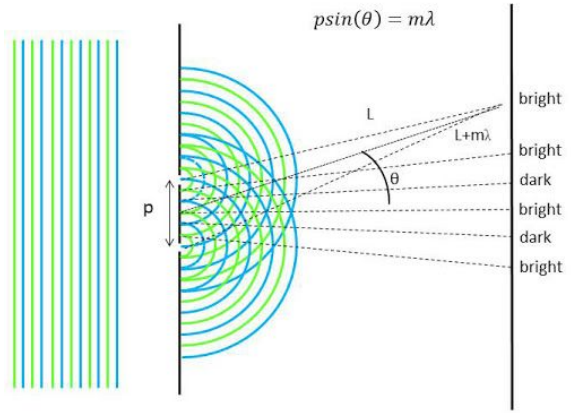
Last week we saw this image with two point sources. . .

How can we create point sources?

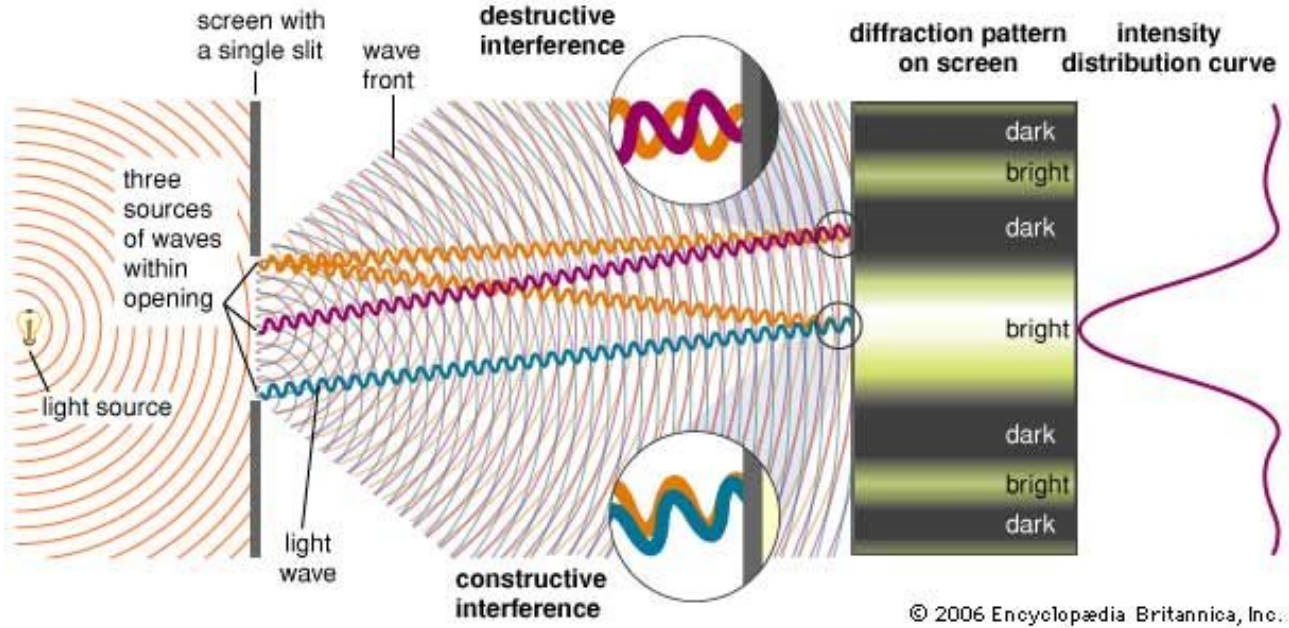


Diffraction interference!

We can see “dark” and “light” spots on the wall if we send a light wave into 2 slits. Why?

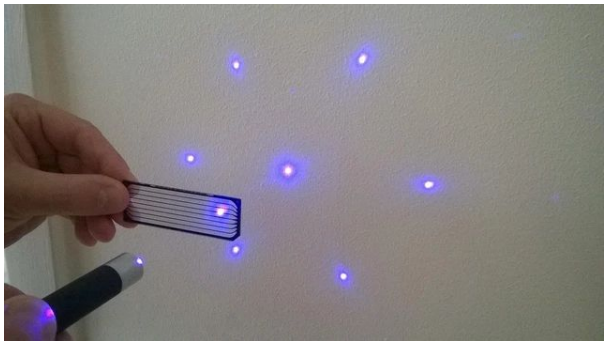


Single slit diffraction???



More diffraction examples

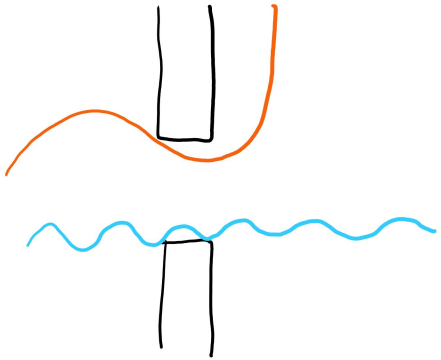
It’s a single slit, so why do we see dark/light spots?

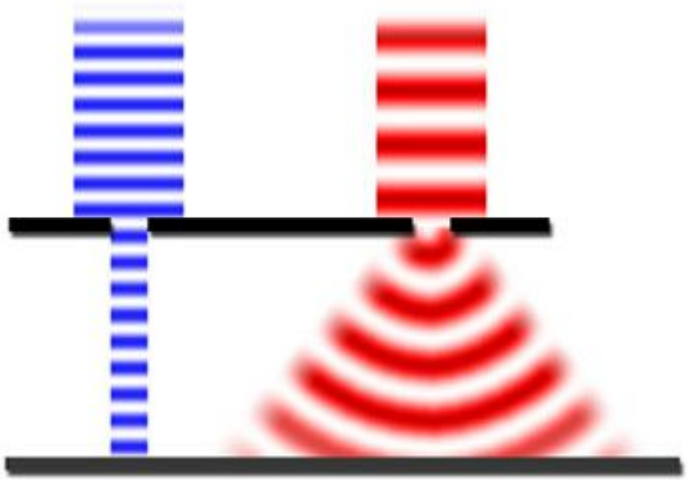


Wavelength

Longer wavelengths diffract more!

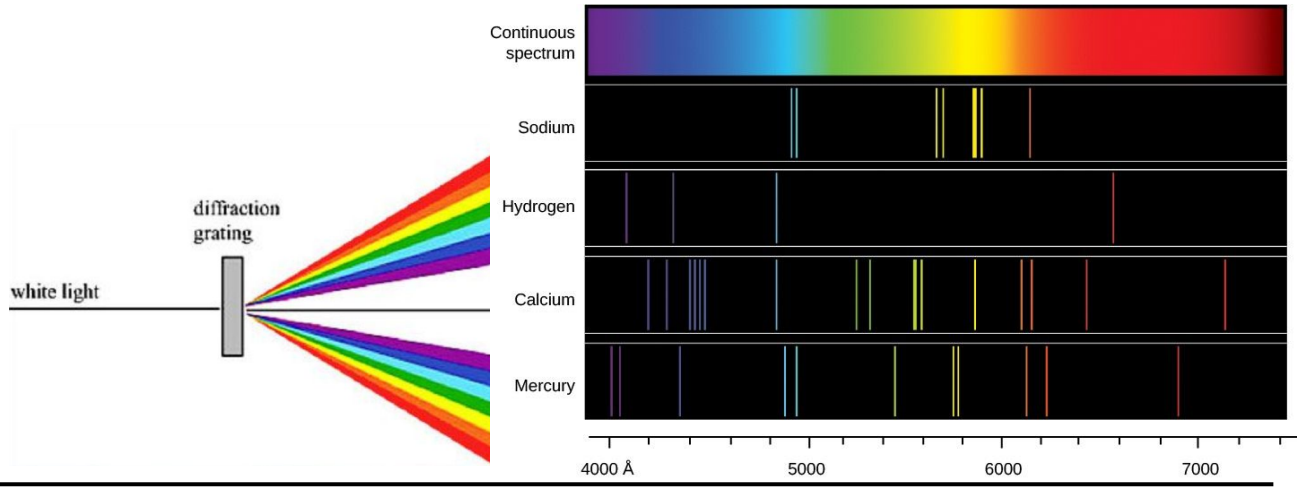
More likely to bend





Spectral lines?

Separate colors so we can see which colors exist!



Review

What is diffraction?

Where do we see this?

What role does the length of the slit play?

What role does wavelength play?

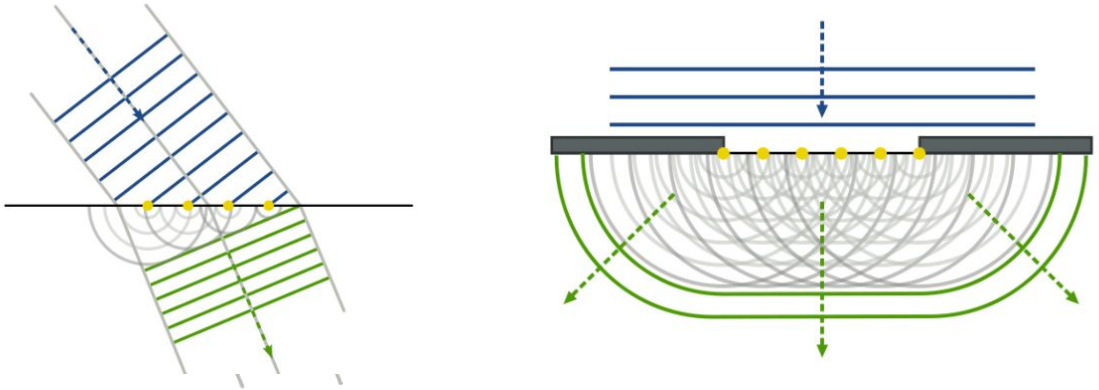
How does this help us see interference?

Pog principle!?

Huygen's principle

What shape is the wave when we throw a pebble in water?

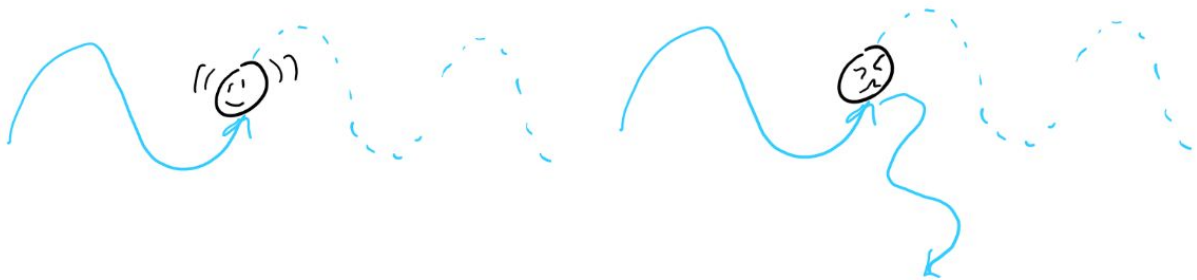
All waves act as point sources; explains refraction/diffraction!



Scattering

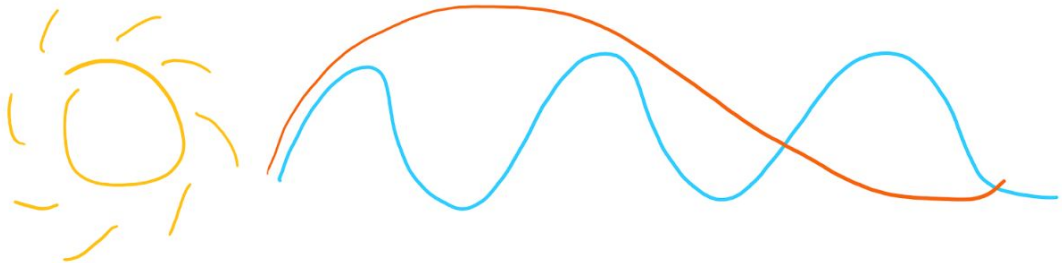
Scattering

Particles absorb and reemit waves



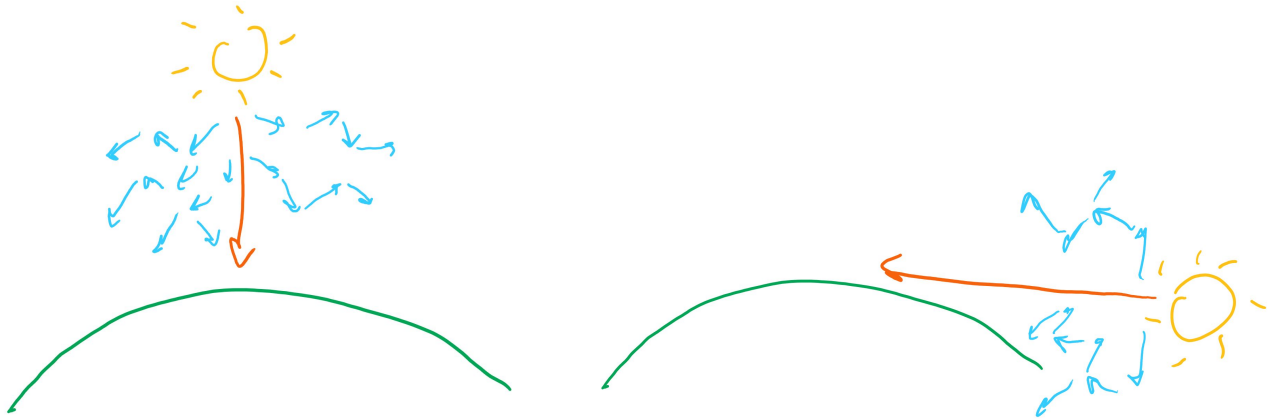
Different colors

You’re more likely to be hit by a wave with a shorter wavelength. Why?



Day, dusk, and dawn

Orange-ish light comes only when we look in the direction of the sun; blue light is scattered everywhere. What does this mean?



Review

What role do atoms have in scattering light?

What wavelengths are scattered more?

Why is the sky blue?

Why is a sunset and sunrise red-ish orange-ish?