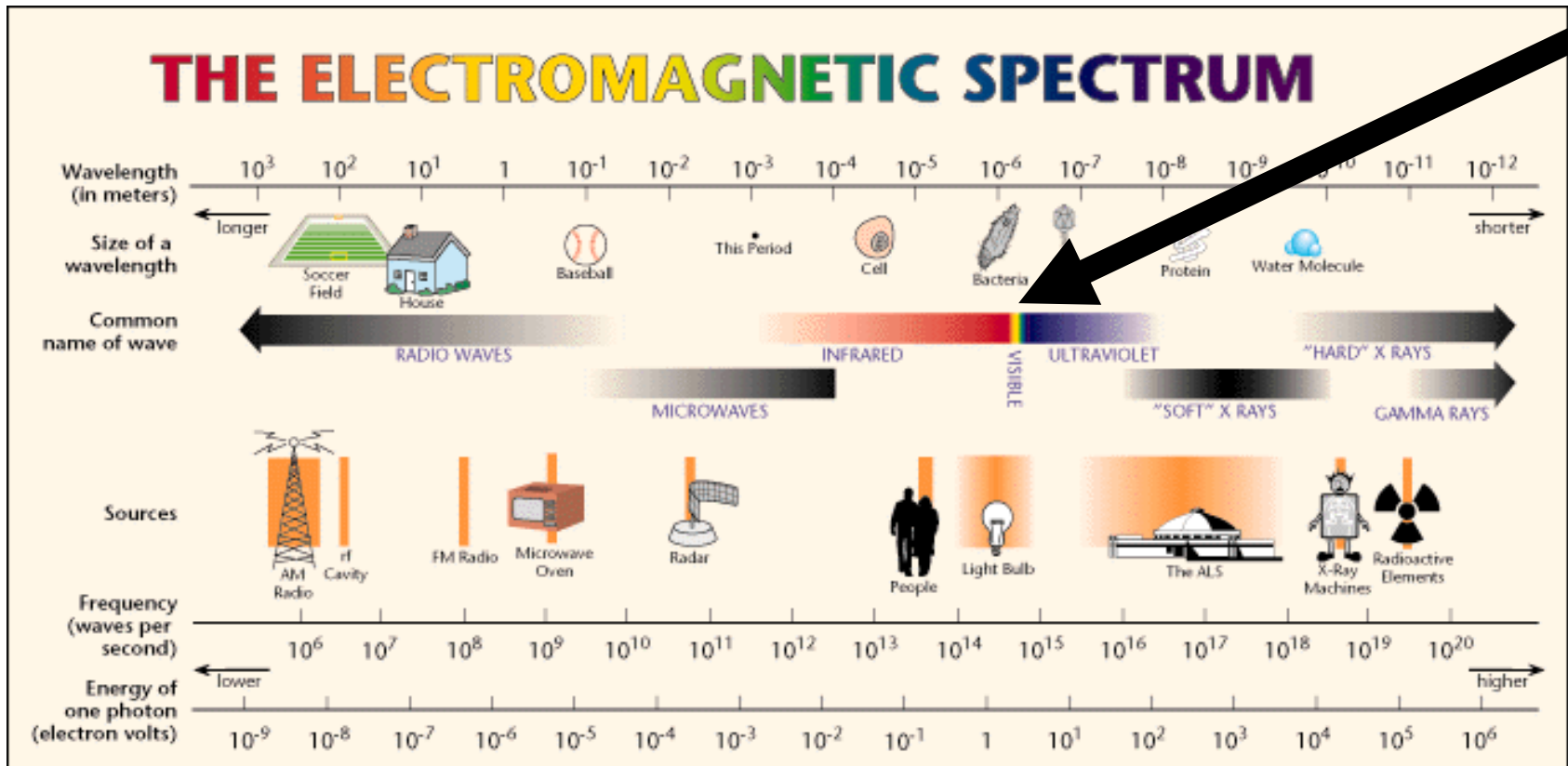


# Electromagnetic Waves: Seeing Objects and Color

Essential Question: How are wavelengths detected by the human eye?

# Electromagnetic Waves: Seeing Objects and Colors

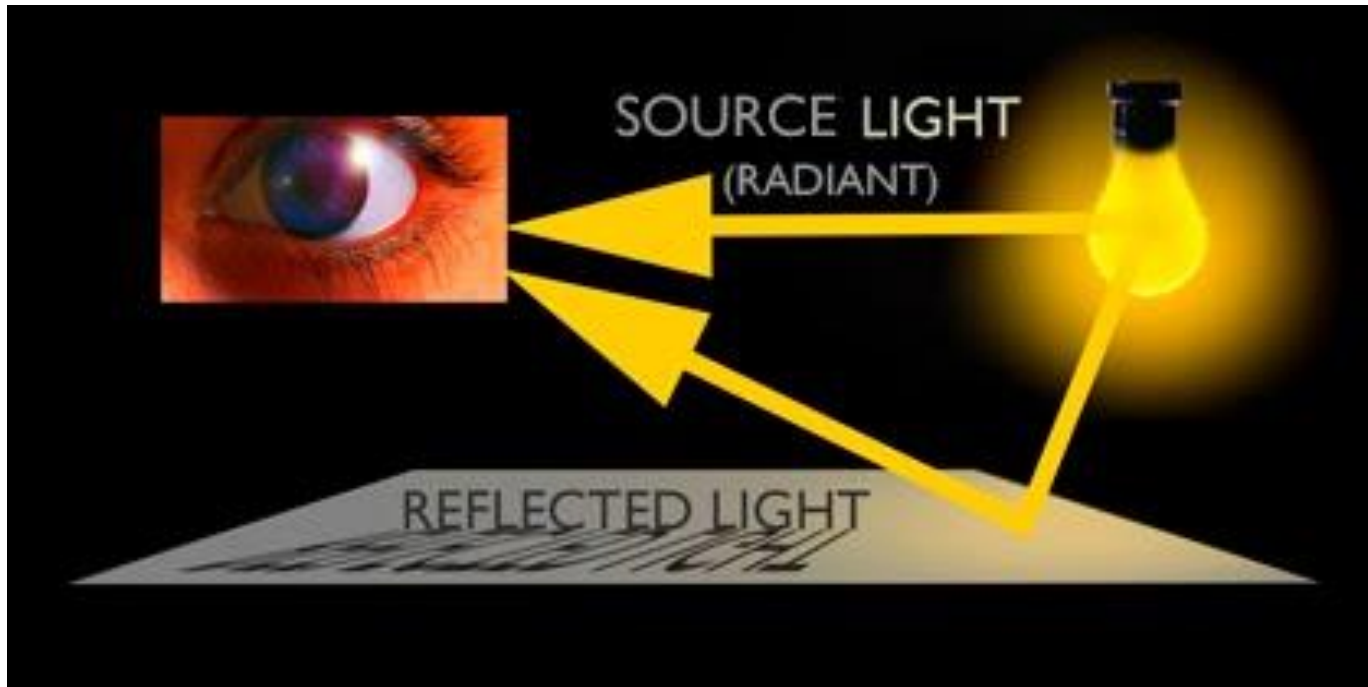
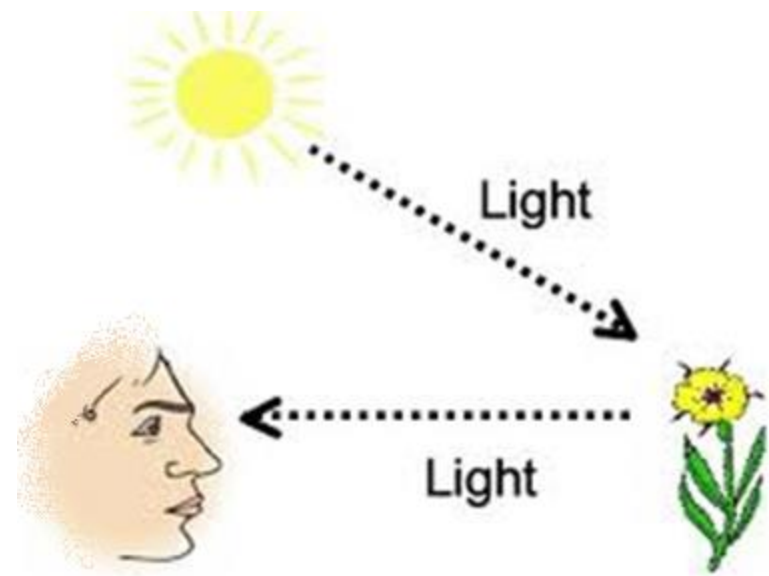
Visible light is a small part of the electromagnetic spectrum that the human eye is capable of seeing



# Electromagnetic Waves: Seeing Objects

- Objects can be seen if they are a source of light
- However, most objects around you do not give off light on their own. They can be seen only if light waves from another source reflect off them and into your eyes
- Light waves move in all directions from a light source

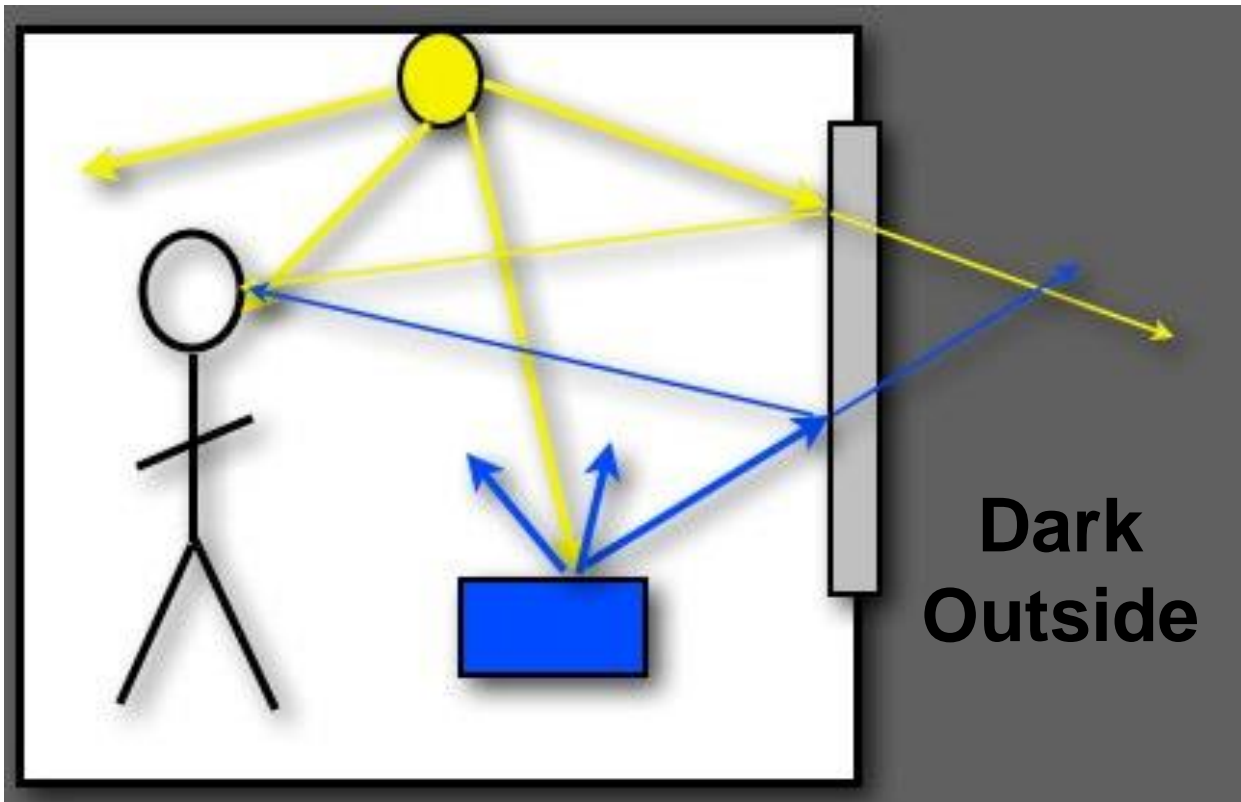
# Examples



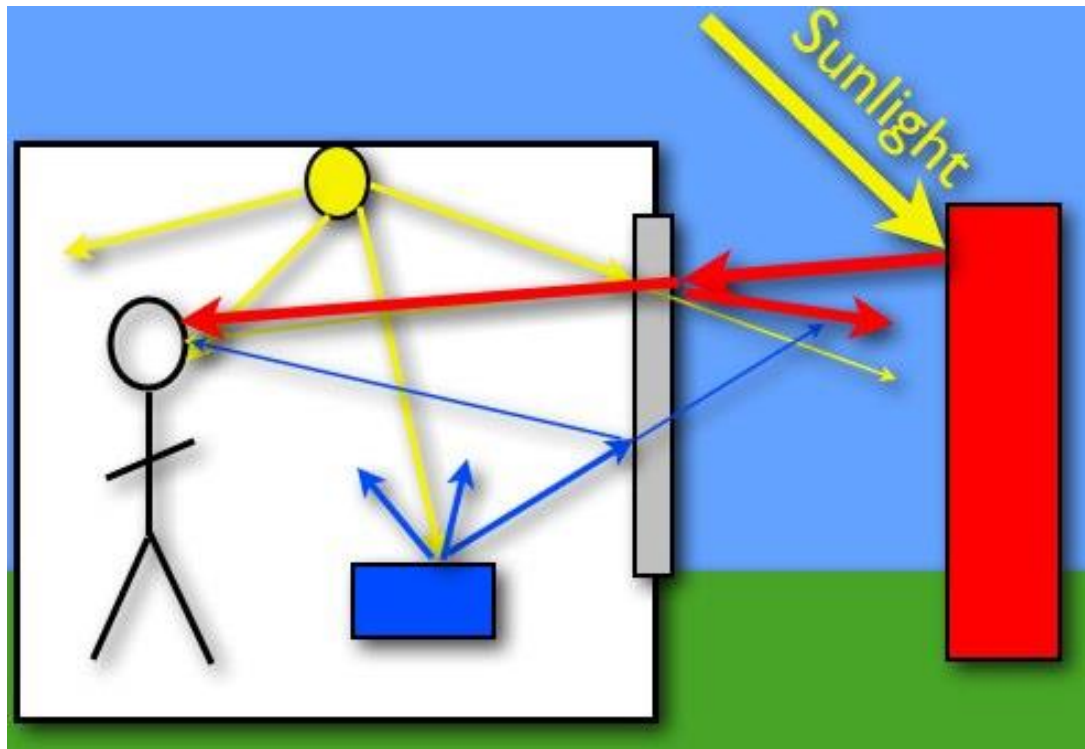


These are two pictures from the same location in a house. The one on the left is taken when the Sun was up outside and the other one when it was dark outside. For both pictures, the same lights were turned on inside.

Lets examine how we see these objects and reflections



- The person can see the blue box because the light from the lamp (light source) reflects off of it (light as blue arrows).
- When light hits the window, some of it goes through the window and some reflects off the window.
- Some of the light reflected from the window goes to the person so that the person can see a reflection of the blue box and the light.
- Some of the light goes through the window. So, if you were outside in the dark, you could see the light and the blue box.



- Notice how the two light sources reflect off objects, which allows these objects to be seen.
- Additionally, light waves reflect in many directions, and only some of these enter your eyes.
- Remember, when waves strike an object, some are absorbed, some are reflected, and some pass through it. It depends on the material of the object.

# Distributed Summarizing

With a partner, discuss the following:

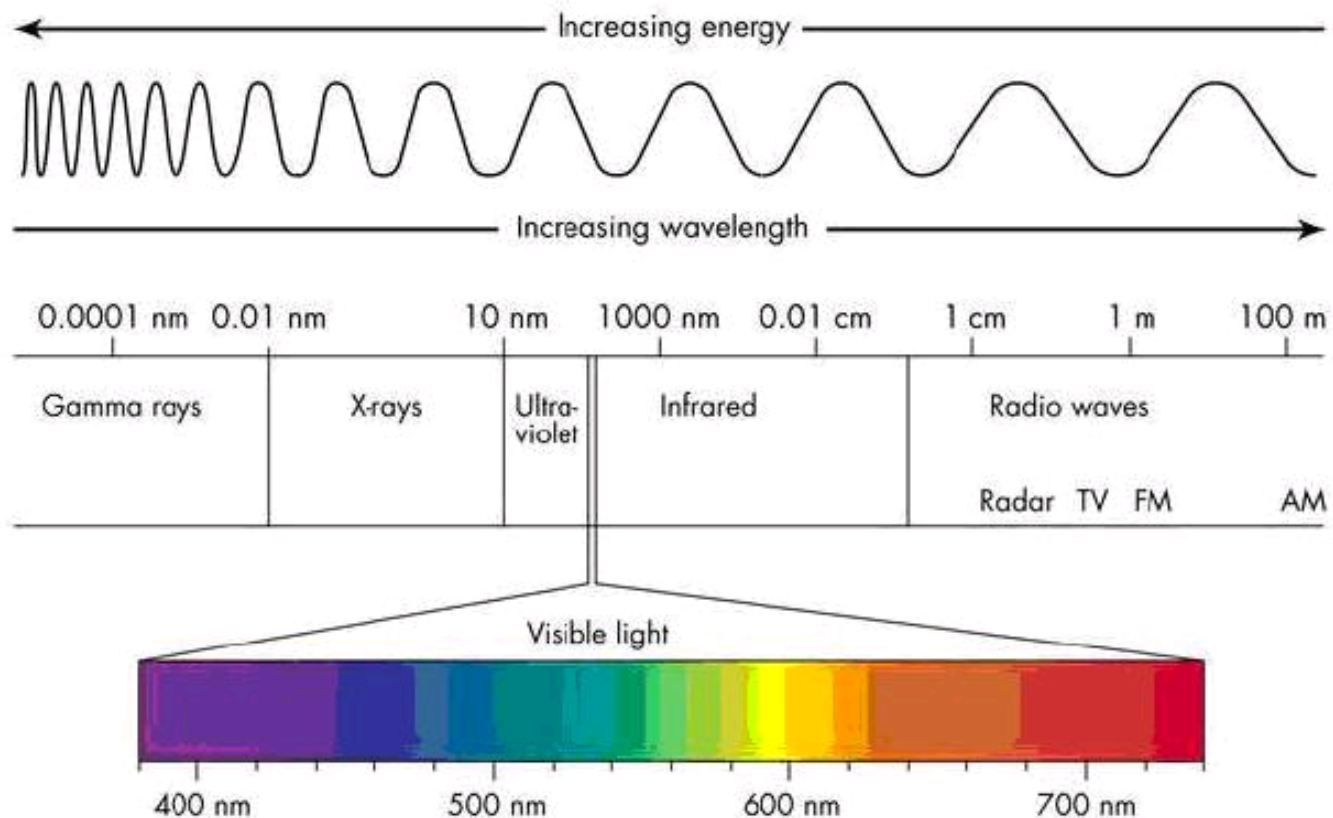
Take turns selecting objects in the room and outside. Identify the light source and explain how you are able to see the object.

Individually, on your notes sheet, add a light source and objects to the drawing provided. Include arrows to illustrate how the object(s) are seen by the person.

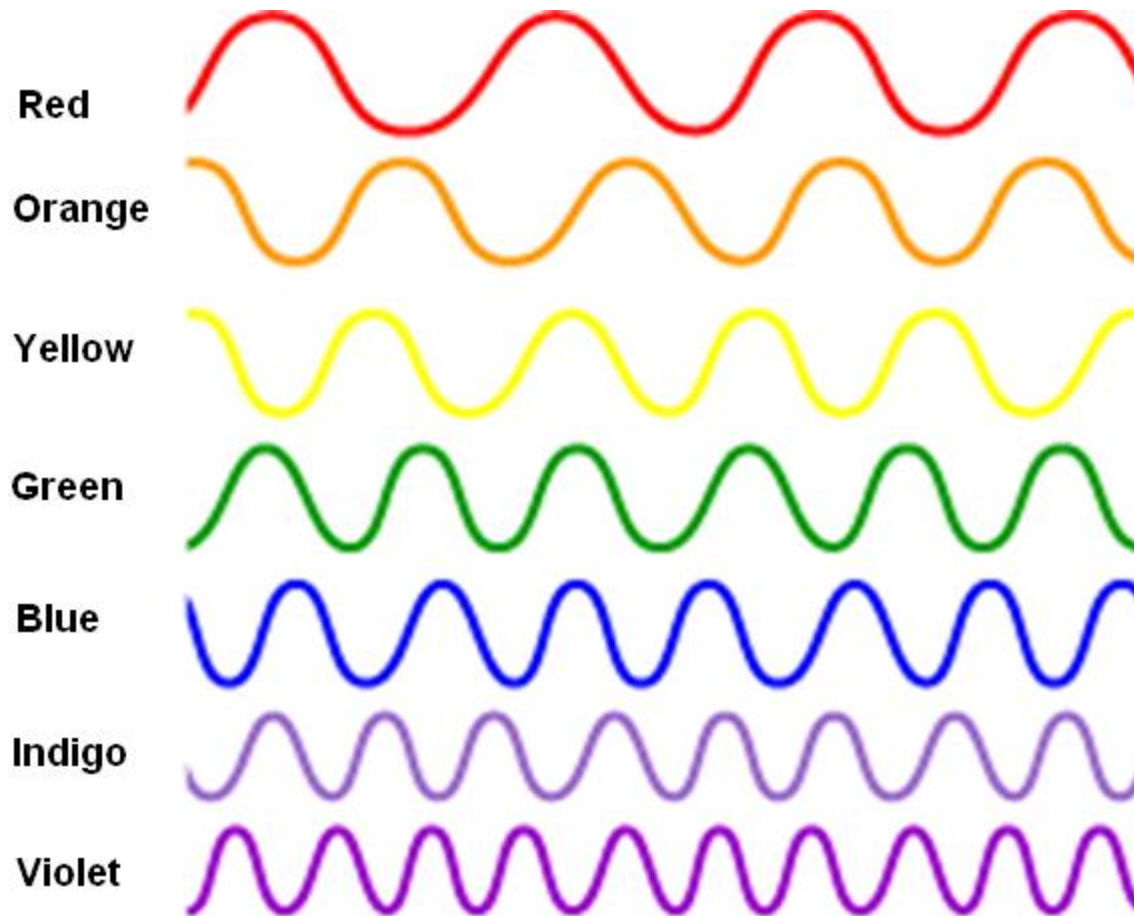


# Electromagnetic Waves: Seeing Color

Remember that visible light is a small part of the electromagnetic spectrum that the human eye is capable of seeing



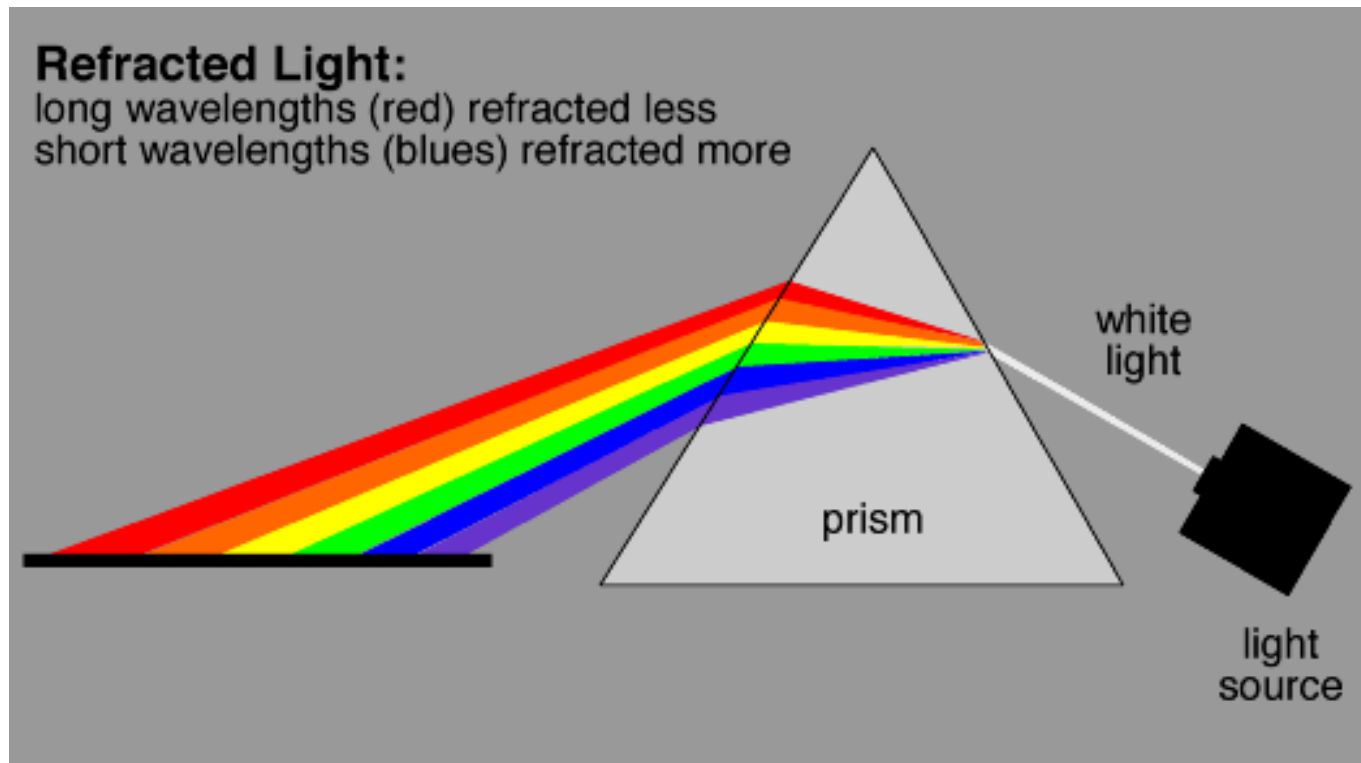
The colors of visible light are created by electromagnetic energy of various wavelengths (frequencies). See below

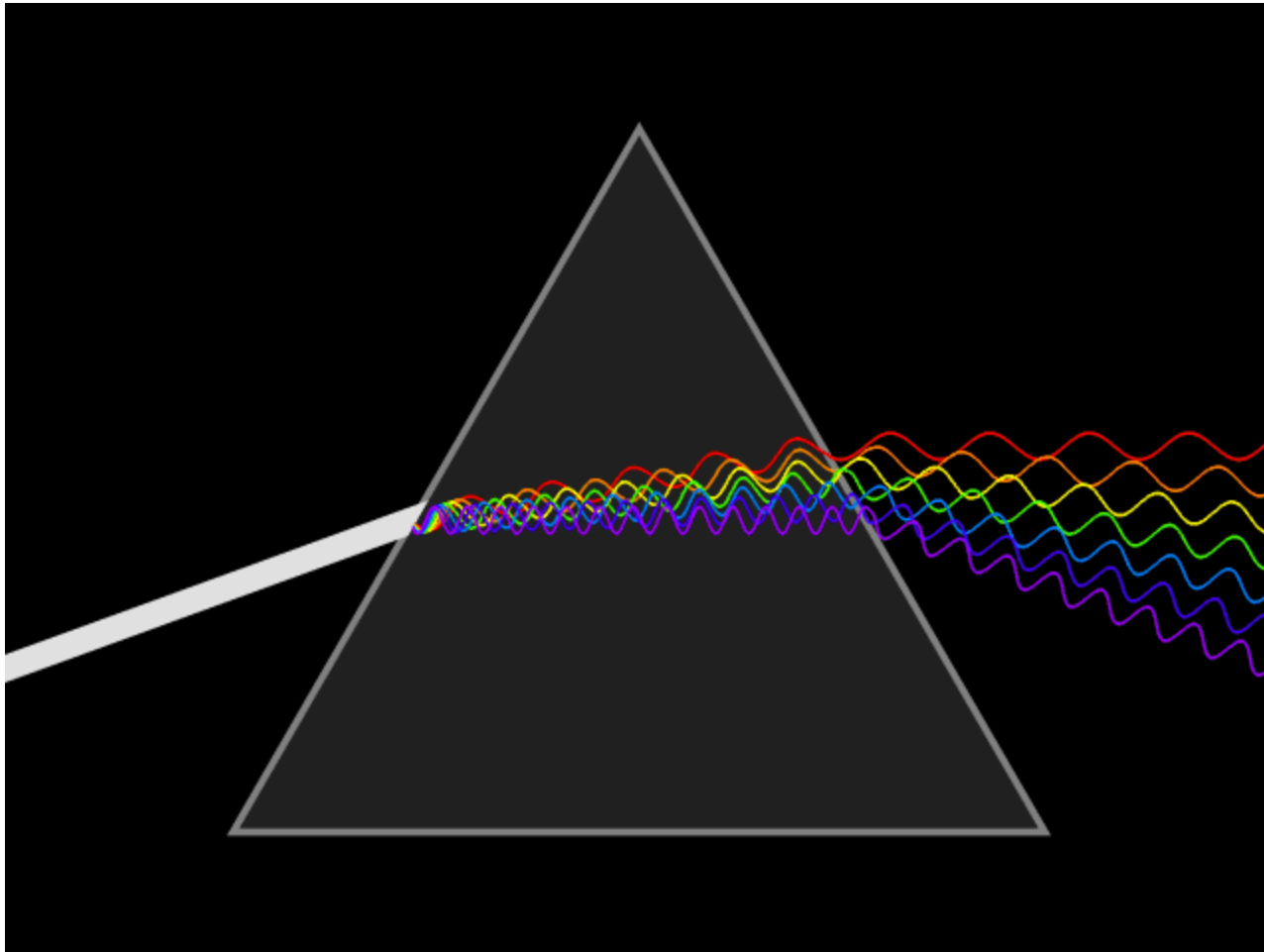


White light is made up of all the wavelengths of visible light.

When white light is refracted, it can be separated into its component colors.

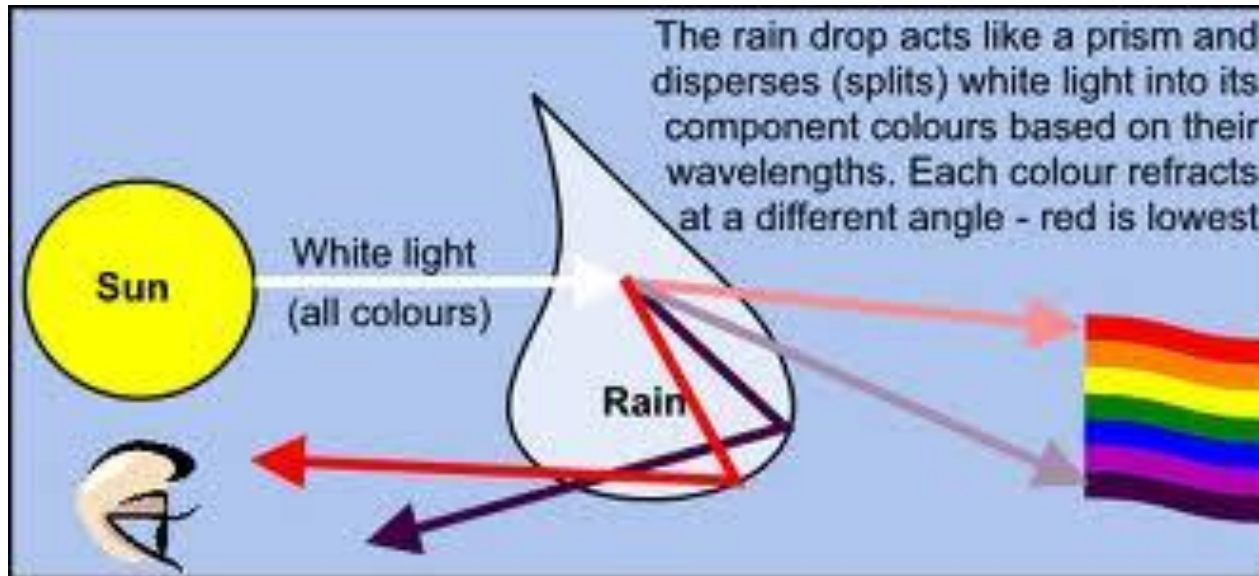
As light passes through a prism, refraction causes light to bend and separate into many colors.







<http://tower-freshmanphysics.wikispaces.com/Chapter+29+-+Reflection,+Refraction>

A rainbow is produced when a raindrop acts like a prism causing white light to refract (bend) and separate into many colors



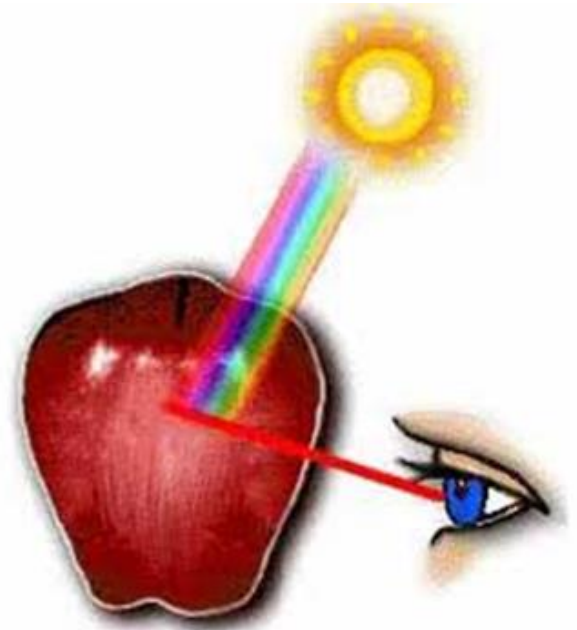
# Electromagnetic Waves: Seeing Color

- Humans see different wavelengths of light as different colors.
  - Humans see long wavelengths as red 
  - Humans see short wavelengths as violet 
- Some colors, like pink and brown, are seen when certain combinations of wavelengths are present.

# Electromagnetic Waves: Seeing Color

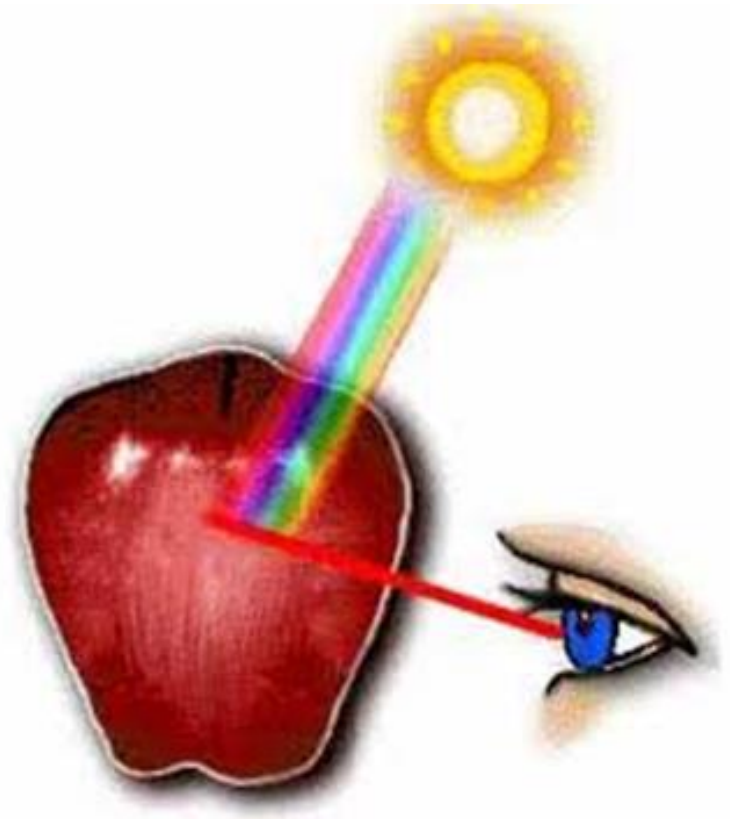
If we see an object because light is reflected off the object by a light source and white light is made up of all the wavelengths of visible light, why do objects have different colors?

The color of an object is determined by the wavelengths (color) of light it reflects. So, if an object reflects one wavelength (color), it absorbs all the other wavelengths (colors) of visible light.



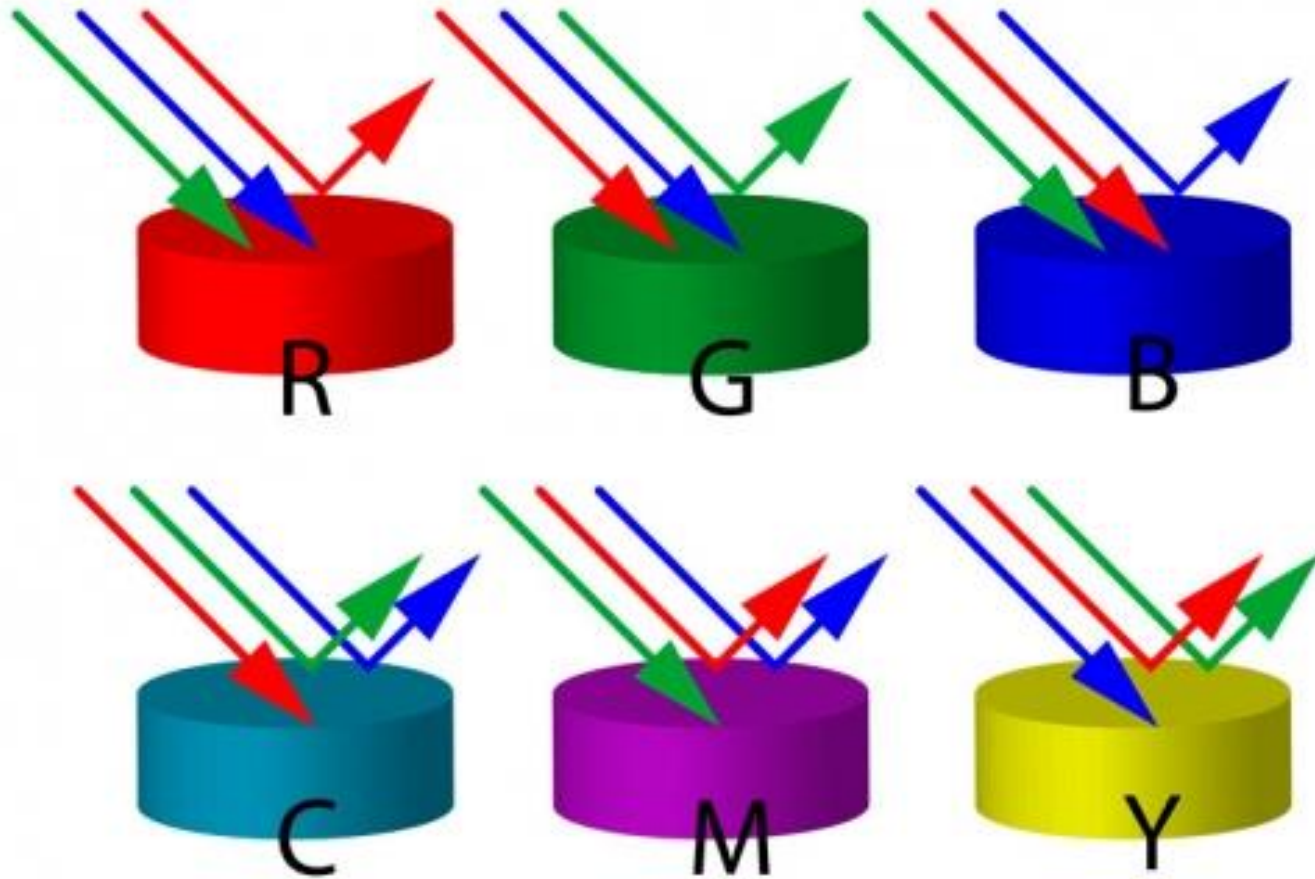
In this example, the sun is the light source. The sun's light appears white because it is made up of all the wavelengths of visible light.

However, humans see the apple as red because all of the other wavelengths (or colors) are absorbed by the apple. The wavelength that we see as red is reflected off the apple.





# Absorption and Reflection



# Seeing Color

- An object that reflects all the light waves that strike it looks white

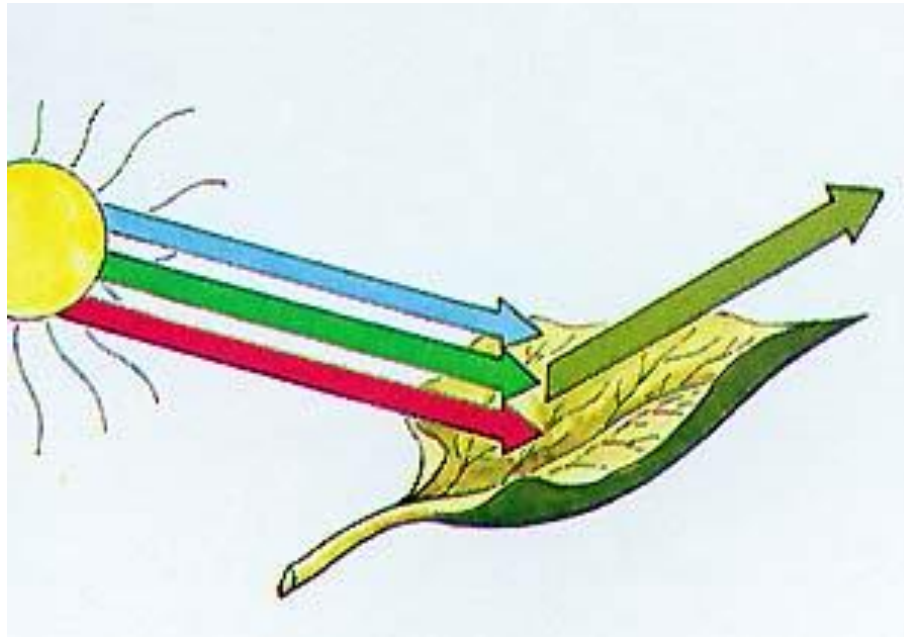


- An object that reflects none of the light waves that strike it (which means it absorbs all light waves) looks black



# Distributed Summarizing

On your notes sheet, explain how you are able to see the leaf and explain how you see the color of the leaf. Be sure to use the words: light source, electromagnetic waves, wavelengths, reflection, absorption, and color



# Distributed Summarizing

With a partner, discuss the following questions:

It is summertime and you are going to the pool with friends. You see a plain white towel and a new black towel with a cool print on it. Which one would you select? Why?