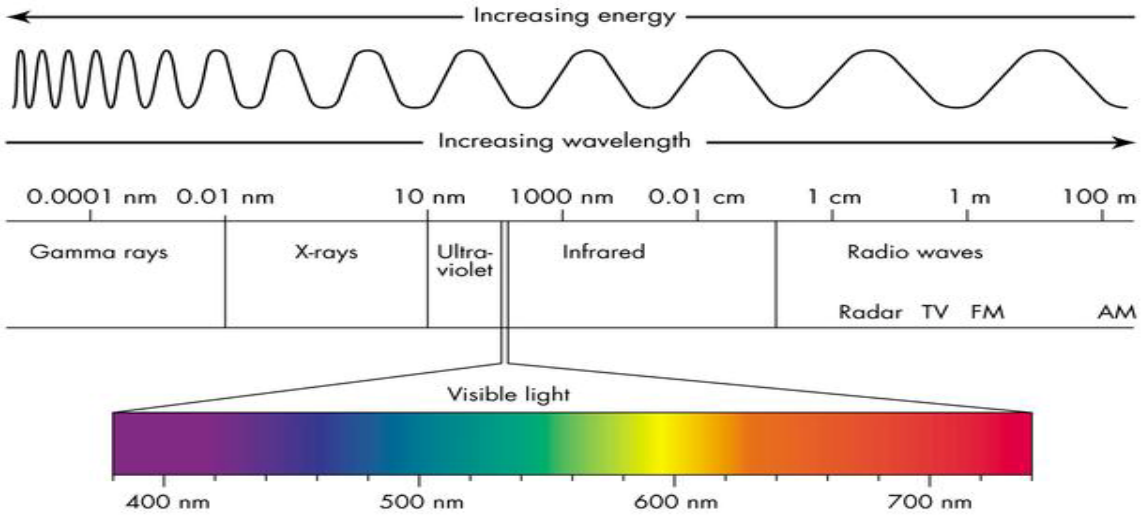
TEACHER BACKGROUND INFORMATION

LIGHT

Light is a type of energy created when heat, electrical, or another type of energy is transferred into matter. The matter, which then has an over-abundance of energy, will then release some of its energy as light. Light travels through a medium or through a vacuum as a wave of **electromagnetic radiation**.

The main quantitative measurement of electromagnetic radiation is its wavelength. Wavelengths can vary from the size of an atom to 1000's of meters long. Our eyes can only detect a very small section of all the different wavelengths that light can exist in. We call these wavelengths, or colors, of light **visible light** or the **visible spectrum**. Familiar types of light that we cannot see include X-rays, infrared rays, and ultraviolet waves.

Figure 1- Electromagnetic Spectrum



Three different things can happen to light when it interacts with matter. Light can be **reflected, refracted,** or **absorbed** by matter. It is important that when you think about what is happening when light interacts with matter, you ask yourself "where did the light's energy go?" The answer is usually a combination of reflection, refraction, and absorption.

Matter that allows light to travel through it, such as glass or water, is said to **refract** light. When light is refracted through matter, it generally changes its direction some amount, depending on the shape of the surface of the matter, and on what kind of matter it is (water, glass, jello). Matter that can refract light is said to be transparent.

Reflection occurs when light bounces off of things. How well a surface reflects depends both on how flat it is, and how well the material can reflect light. Flat surfaces cause most of the light to be reflected off in the same direction. A mirror gives an almost perfect reflection of light because it is very flat, and because the silver material makes up its backing allows almost all of the light that hits it to bounce off. If an object is made of something that reflects light well but is not flat (such as a crumpled piece of aluminum foil that has been flattened out again) then the light scatters in many different directions.

Light that hits a surface but is not reflected is **absorbed**. Absorption causes light to transform into another type of energy. If light is absorbed by matter, then the matter will usually transform the light's energy into heat, causing the temperature of the matter to rise. There are some instances (such as a solar cell) where light can be transformed into electricity.

Keep in mind that when light interacts with matter all three possibilities (reflection, refraction and absorption) are happening. We will say a mirror reflects light because that is what happens to MOST of the light that hits the mirror. Some of the light is also absorbed, and in many cases, materials will reflect, refract, and absorb light. For instance, light passes through a glass window so you may say that light refracts through it. But the window will also absorb light because you can feel it get hot when there is lots of sunlight. You can also see your reflection in windows so light is also being reflected. Because most of the light passes through it we call it transparent, but this does not mean that absorption and reflection are not happening as well.

We see light in different **colors**. The property of light that determines its color is its **wavelength**. The shortest wavelength of light we can see looks violet to us, and the longest wavelength we can see looks red. The wavelengths of light that we can see are called **visible light**. The entire series of light that human eyes can see is called the **visible spectrum**.

When there is no light shining in our eyes from the visible spectrum, we see black. When every color of the visible spectrum is shining in our eyes at the same time, we see white.

There are many more wavelengths of light that we cannot see (refer to figure 1). X-rays, infrared, microwaves, and radio waves are all examples of light that have wavelengths above and below our visible limit. Light with short wavelengths (ultraviolet waves, microwaves) has more energy than light with long wavelengths (infrared, radio).