Students observe that light interacts differently with objects depending on some properties that we can observe (e.g., transparency) and others we cannot (vibrational frequency).

What you’ll need:
For each pair of students:
• One solid color beach ball, preferably in blue, green, or red— the primary colors of light

Directions:
1. Tell each pair of students that their beach ball represents a photon or particle of light that is traveling in wave motion toward Earth. Each photon is traveling at a single frequency (wavelength). When it enters Earth’s atmosphere, it will do one of three things:
   a. Have one student throw the “photon” to his/her partner. The partner catching the photon represents light absorption.
   b. Have the partner with the “photon” roll it between his/her partner’s legs. This represents light passing through an object, such as a glass window, which is called transmission.
   c. Finally, ask the partner with the “photon” to throw it against the wall. This represents light reflecting off an object, much like the light you observe every time you see your reflection in a mirror.

Ask yourself the following questions:
1. What happens to light after it is absorbed by a substance? (It is converted into heat energy and often raises the temperature of the object.)
2. Once light reflects off of one object, can it reflect off of another, and/or be absorbed or transmitted through another object? (Reflected light can be absorbed, reflected, or through the next object it encounters).
3. What can light pass through and what can’t it pass through?
4. What typically reflects sunlight? Does color play a part in reflection? What about the smoothness or roughness of a surface?

Science background:
Since the time of the Greek philosophers in the 5th century BC, mankind has speculated about the nature of light. Today, physicists have learned through experimentation that light has a dual nature and behaves as a particle at times and as a wave at other times. Light particles are called photons and are different from particles of matter because they have no mass and always move at a constant speed of nearly 299,792 kilometers per second, or 186,281 miles per second through empty space. This makes light the fastest phenomenon known in the universe. Yet light is also a form of radiant energy, or energy that travels in waves, which only slows down when inside substances such as air, water, glass or diamond.

In this activity, our photon was traveling in a single frequency or wavelength. Most often, however, light of many frequencies or even all frequencies travels toward the surface of objects. When this occurs, objects have a tendency to selectively absorb, reflect or transmit certain frequencies from the light. For example, one object might reflect red light while absorbing all other frequencies (colors) of visible light. The manner in which visible light interacts with an object is dependent upon the frequency of the light and the nature of the atoms of the object. The electrons of atoms have a natural frequency at which they tend to vibrate. If a light wave of a given frequency strikes a material with electrons having the same vibrational frequencies, then those electrons will absorb the energy of the light wave. Otherwise, they will reflect or transmit it.