

LIGHT & COLOR



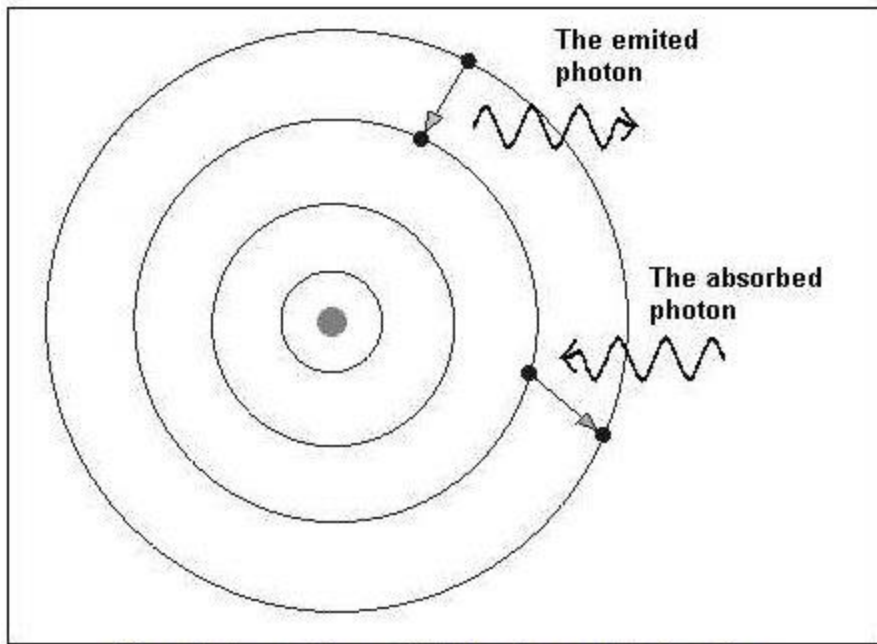
GRAPHIC ORGANIZERS
& POWER POINT

What makes up light?

- ATOMS - the nucleus is surrounded by orbiting electrons.
- Like the planets in the solar system, electrons stay in the same orbit, unless...



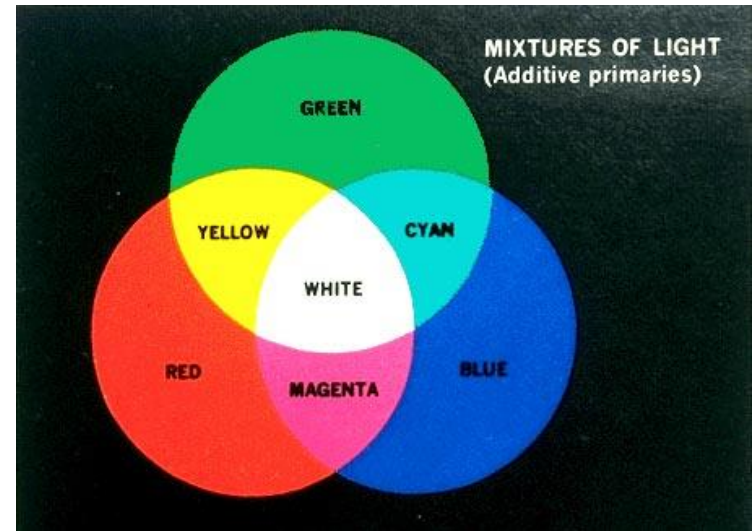
Making light



The electron emits or absorbs the energy changing the orbits.

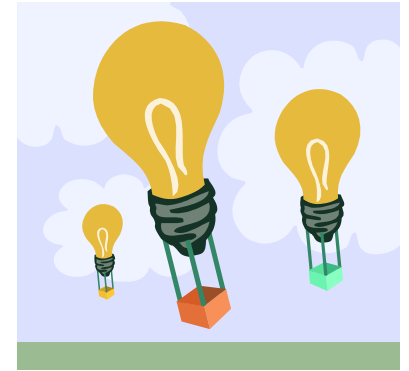
- Energy is added to an atom (heat)
- Then electrons jump to bigger orbits.
- When the atom cools, electrons jump back to original orbits.
- As they jump back, they emit light, a form of energy

Why is light colored?



- Each electron that jumps back emits one photon of light; the bigger the jump, the higher the energy.
- The amount of energy (frequency of the wave) determines color thus a blue photon has more energy than a red
- Shine all the colors together, you get white light!

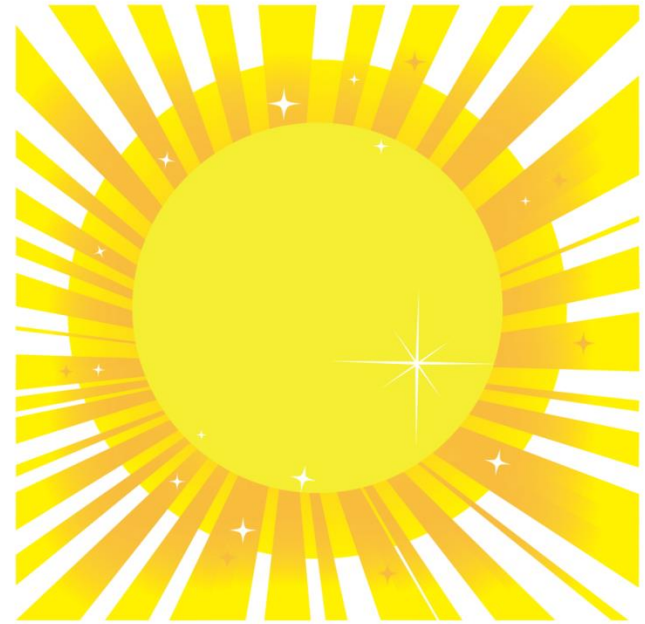
Light as a wave



- Light can act like a wave
- A wave has a wavelength, a speed and a frequency.
- All light travels same speed (in vacuum)
- The energy goes up as frequency goes up
- Color depends on frequency *
- Wavelength gets shorter as frequency goes up

Speed of light

- Light travels at 300,000,000 meters/second
- It takes 8 minutes for a light wave (or a photon) to travel from the sun to the earth.

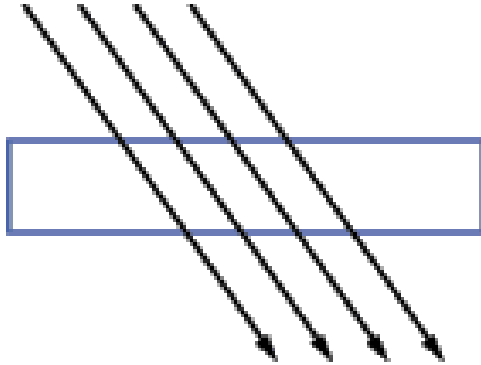


Speed of light

- We see the moon because it reflects the sun's light
- It takes 1 second for light reflected off the moon to reach the earth.



Light and matter

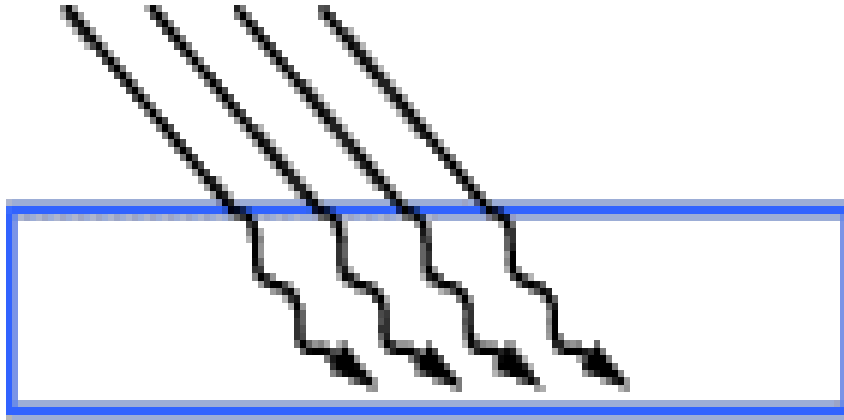


The waves can **pass through** the object

When light hits something it may be:

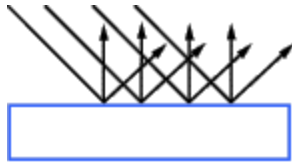
- Transmitted (if the thing is transparent)

The waves can be
absorbed by the object

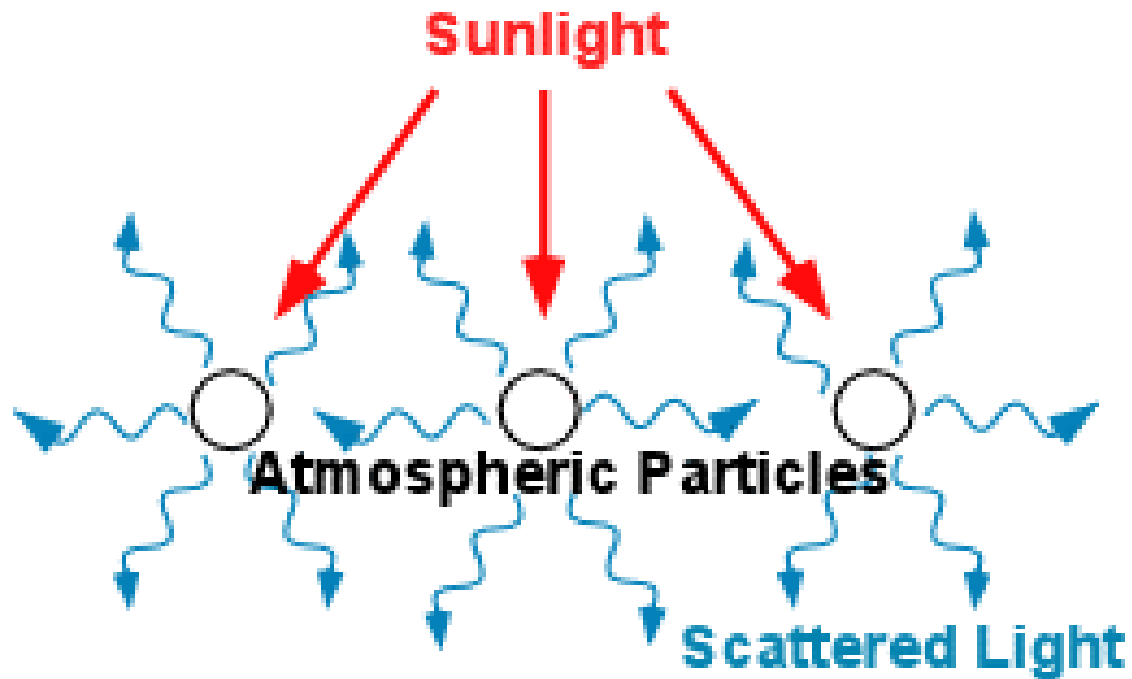


Absorbed (off a black cat or shirt)



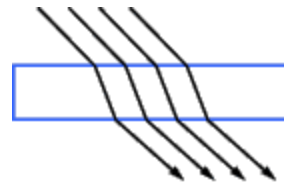


The waves can be **scattered** off the object.





The waves can be **refracted** through the object. Look at the straw. It appears bent. It is really the light waves being bent.





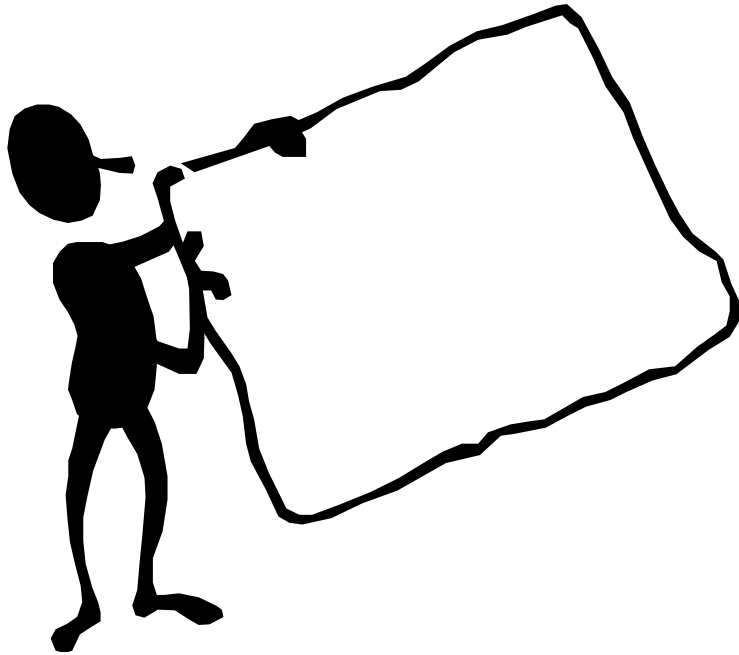
The light waves can be **reflected** off the object.

Reflected or scattered
(off mirror or raindrops)



The light waves can be **reflected** off the object.

Light and matter



- Often it's some combination. Take a simple piece of paper: you can see some light through, white reflects, black print absorbs.

Reflection and color



- Why does a blue wall look blue in the sunshine but different when it's in the shade?
- In the shade, no light reflects off it. Under light, it reflects only blue light; it absorbs all the other colors.

Absorption and color



Why is a black car hotter than a white car in the summer?

(Remember light is energy. Heat is another form of energy.)

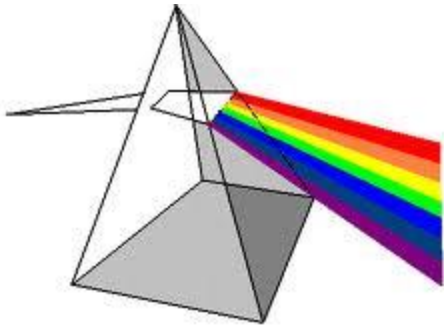
Absorption and color



A white car reflects all wavelengths of light.

A black car absorbs all wavelengths of light, absorbing the energy and turning it to heat.

Light transmission



Transparent materials transmit light, like windows. Different frequencies have different speeds in transparent materials – that causes a prism to separate the colors.

Using Light to Study the Stars

Astronomers collect energy from the stars with a telescope

Visible light

Infrared light

Radio waves, etc.

Each atom has a special pattern of light frequencies like a fingerprint

The fingerprint of frequencies will be shifted if the star is moving away or toward us (like the sound of a freight train)



Using Light to Study the Stars



The temperature of the Star can be determined from the color of the star. This is the William Herschel **Telescope**