

Properties of Visible Light---Guided Reading Notes from Stemslopedia

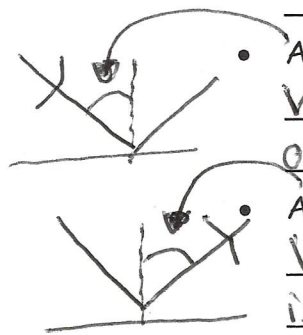
Name: Mrs. Todaro - KEY

Date: _____ Hour: _____

Key Terms: as you read through the Stemslopedia define each of the terms listed below:

- Visible Light:
the range of wavelengths of electro-
magnetic radiation that our eyes can detect
- Spectrum:
the band of colors produced when light
is separated into its component wavelength
- Transmit:
to pass through a medium
- Refract:
to bend or change direction of a
wave
- Reflect:
to bounce back
- Photons:
particles of energy that travel along
the electromagnetic spectrum
- Frequency:
number of waves that pass a given
point in a given period of time
- Prism:
a special lens that is used to separate
white light into different colors

- Electromagnetic Spectrum:
all the wavelengths of electromagnetic radiation
a continuum of all kinds
- Electromagnetic Wave:
Waves of visible and invisible light that do
not need a medium to travel through but can interact
with solids liquids & gasses
- Reflection:
Occurs when incoming photons bounce
off the media they encounter
- Scattering:
occurs when incoming photons reflect
in all directions off the media they encounter
- Refraction:
occurs when incoming photons bend as
they encounter the media
- Dispersion:
occurs when refracting white light can
be separated into different wavelengths
- Absorption:
occurs when light energy transfer to another
medium
- Diffraction:
occurs when light energy spreads or bends
around the edge of an obstacle
- Transmission:
occurs when light wave passes through
a medium



- Angle of Incidence:
When a ray is reflected from a surface, the angle
of incidence is the angle between the ray and a line
perpendicular to the surface
- Angle of Reflection:
When a ray is reflected from a surface, the angle of reflection
is the angle made between the reflected ray and a line
perpendicular to the surface
- Transparent:
an object/surface that allows all light
to pass through

- Translucent: an object / surface that allows some light to pass through - objects appear fuzzy
- Opaque: a surface that does not allow light to pass through

Guided Reading/ Note Taking As you read through the Stemsopedia—fill in the blanks -these statements are key ideas that are important from the reading

- A rainbow is a perfect example of how visible spectrum light is composed of a spectrum of colors
- Light is made of electromagnetic waves that do not need a medium in which to travel

Electromagnetic Waves

- Light is a combination of electric and magnetic energy that travel as particles called photons.
- Each photon have different wavelength along the electromagnetic spectrum
- In order of decreasing wavelength :

- smallest wavelength
highest frequency
↓
largest wavelength
lowest frequency
- Radio waves
 - Micro waves
 - Infrared
 - Visible
 - Ultraviolet
 - X-ray
 - Gamma Rays

Electromagnetic Spectrum

Raging Martians invaded ROYGBIV using x-ray guns

Inverse
relationship

- In a vacuum, all wavelengths travel at the same speed 300,000 m/s (186,000 miles/second)
- Electromagnetic waves with longer wavelengths have (smaller) lower frequencies, in other words fewer waves pass a given point each second.
- Electromagnetic waves with shorter wavelengths have higher frequencies, which means more waves pass a given point

Visible Light and Color

- Visible light is the only part of the electromagnetic spectrum that human eyes can detect
- Visible light is made up of photons of different wavelengths ranging from about 400 to 700 nanometers (nm) - which is a billionth of a meter
- Visible light from longest wavelength to shortest wavelength

- Red longest wavelength
- Orange
- Yellow
- Green
- Blue
- Indigo
- Violet shortest wavelength

ROY G BIV

- Visible light can be separated into different colors using a special lens called a prism
- As visible light passes from air into the glass, the change in medium causes a change in the direction and speed

- Refraction causing the separation of white light into its various color wavelength is called dispersion

Wave Behavior

- When electromagnetic waves encounter surface of different media, they behave differently in the form of:

Picture at the bottom of page 2

- Scatter --- reflect in all directions
- reflect --- bounce-off
- refract --- bend around
- disperse --- separate (refract)
- absorb --- transfer into a diff. medium
- diffract --- spreading of bending around the edge

Reflection

- The most commonly observed wave behavior is reflection
- Example: looking into a mirror
- Reflection of light waves occurs whenever a light waves strikes a surface and then bounces back
- The angle of incidence equals the angle of reflection
 - Draw a picture/model below

- shiny surfaces reflect back virtual images
- dull surfaces scatter light
- white reflects all light
- Black absorbs all light
- Any color (red) only reflects that color

what happens when white light goes into a medium

- Scattering is different from reflection in that scattering light goes back out in all directions
- Reflection depends on texture and color of the surface

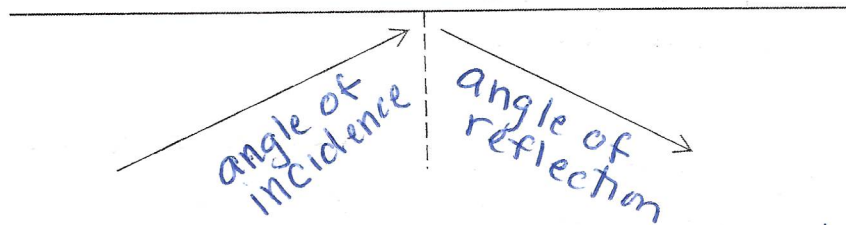
- Shiny surface reflects back virtual image
- Dull surfaces scatter light
- White light reflects all light
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- Red light only reflects red

Absorption

- Not all light is reflected or scattered
 - Black absorbs all light
 - Colored surfaces absorbs all wavelengths except for the color reflected
- Absorption occurs when all or some of the light energy from the light waves is transferred from one medium to another
- Certain pigments reflect or transmit the wavelength they cannot absorb, making them appear in the corresponding color

Law of Reflection

- Model of Law of reflection—draw and label (angle of incidence & angle of reflection)



- The law of reflection states that the angle of incidence is equal to the angle of reflection
- Reflection of waves occurs when the energy strikes a boundary and returns the energy back to the source.
 - Example: seeing a hot-air balloon reflections on a still lake.---the light strikes travels through the air to the lake allowing the image to be seen on the lake's surface

What Do You Think?

- Not all materials transmits light clearly
- transparent objects allow all light to pass
 - translucent objects only some light
 - opaque surfaces do not allow light to pass through them---it is either absorbed by the surface of reflected from it
- Example materials that light waves can travel through are:
- Transparent: clear glass (sheet protector)
 - Translucent: frosted glass (wax paper)
 - Opaque: wood (black paper - foil)

Explore 3
Sheet protector
Wax paper
black paper
foil

Refraction:

- A wave can also be transmitted through a boundary, meaning that it passes through the boundary from one medium to another.
- Most waves move at different speeds through different media
- Waves change speed as they transmit from one medium to another.
- Refraction causes light from the sun to spread out into different colors as it passes from air into new media, such as water or glass.
- Refraction through concave or convex lenses allows correction of poor vision or magnification of objects
- Refraction bends light
- Convex lenses make objects appear closer (car side view mirror)
 - Concave lenses spreads light out
- Refracting telescopes use lenses to gather light from distant sources and focus that light through an eyepiece so that distant object can be seen

Diffraction

- Diffraction is when the light wave pass through a narrow slit in a barrier—the waves spread out radially
- Every day examples of Diffraction
 - Light passes through tiny grooves on the surface of a CD and the light is separated into a rainbow of colors
 - Used when producing special holographic images such as security measure on identification cards or credit cards. Or in supermarket checkouts scanners that use holographic optical elements HOE that can read a universal product code (UPC) from any angle

Now that you finished reading and have completed the guided notes—take the time to complete the Try Now (last page of the Stemslopedia) along with the Linking Literacy Worksheets.

This handout is meant to be a study guide for an upcoming test/quiz