Science SOL 5.3 Light

What is Light?

- Light is a form of **energy**
- Light travels in **transverse** waves
- It has both **electric** and **magnetic** fields and is referred to as electromagnetic radiation

How Does Light Travel?

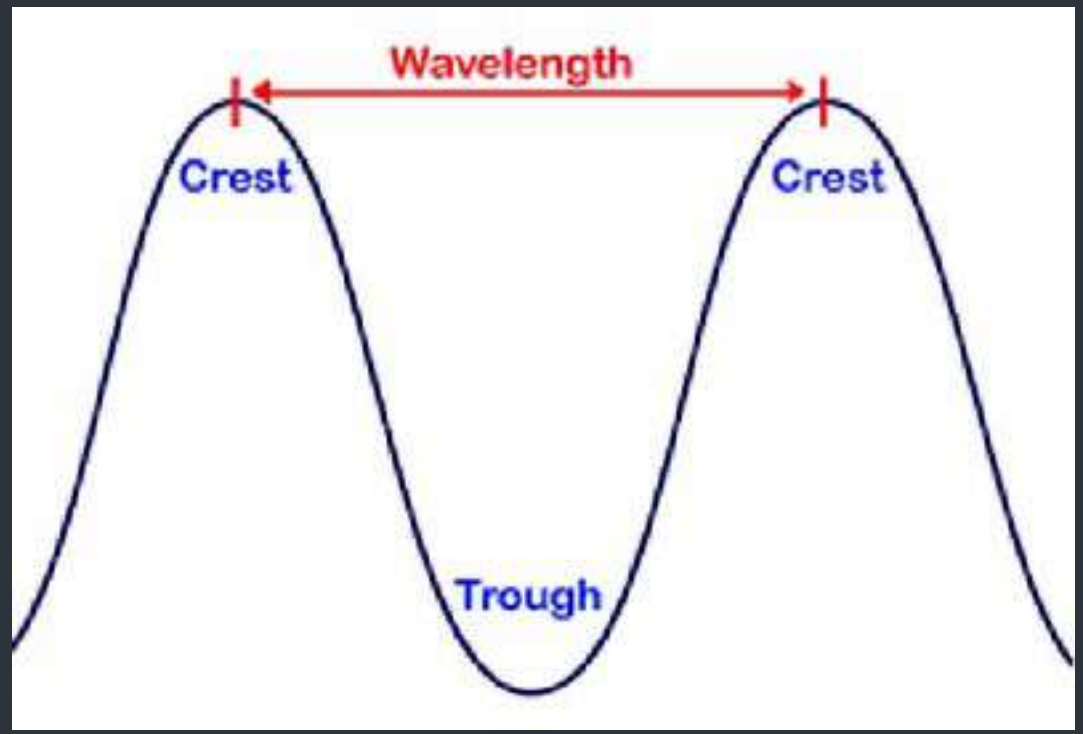
- Light travels in **straight** paths called **rays** and do not need a medium (solid, liquid, or gas) through which to move
- **Ray-** the straight line that represents the path of light
- **Beam-** a group of parallel rays

Parts of a Light Wave

- **Wavelength-** the distance between two consecutive waves, usually measured crest-to-crest or trough-to-trough
- **Crest-** the highest point on a wave
- **Trough-** a valley between two waves or the lowest point of a wave
- **Frequency-** the number of waves passing a given point in one second

  ***the greater the frequency, the greater the amount of energy

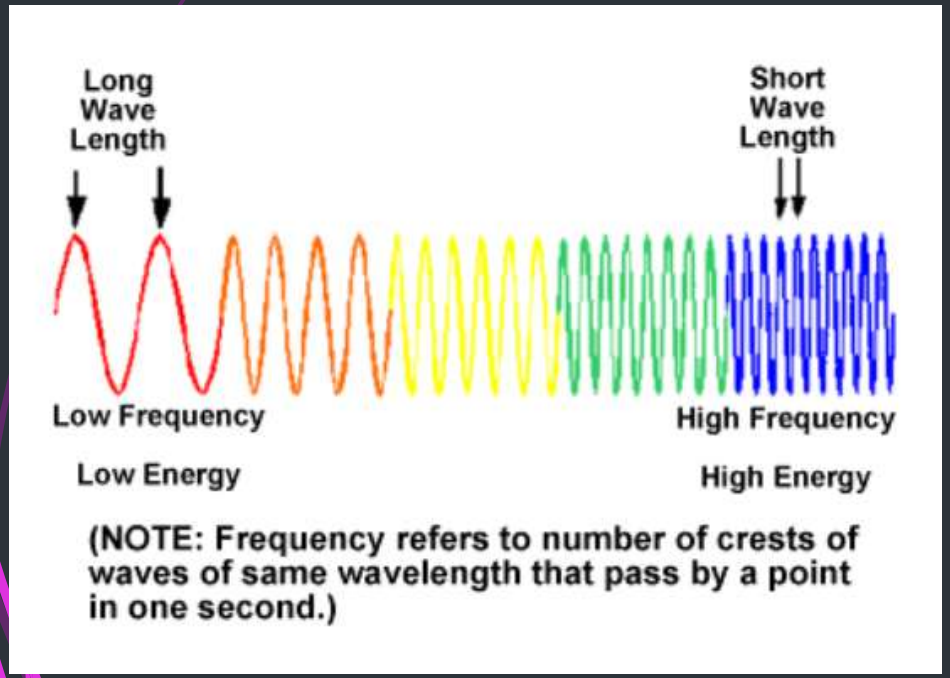
Draw a Light Wave

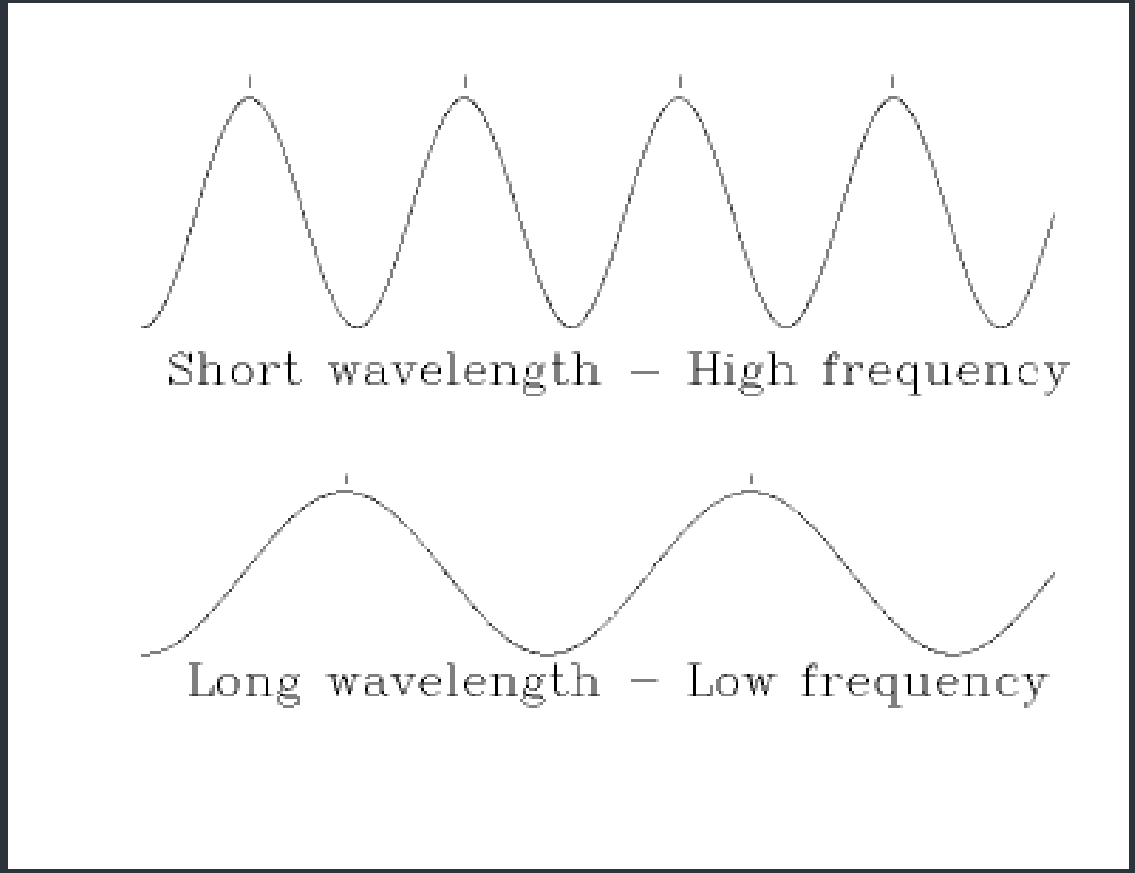


Light is a Form of Energy

- Light waves are waves of **energy**
- The amount of light in a wave is related to its **frequency**
- **High** frequency light has **high** energy
- **Low** frequency light has **low** energy
- The more **wavelengths** in a light wave in a given period of time, the **higher** the energy level

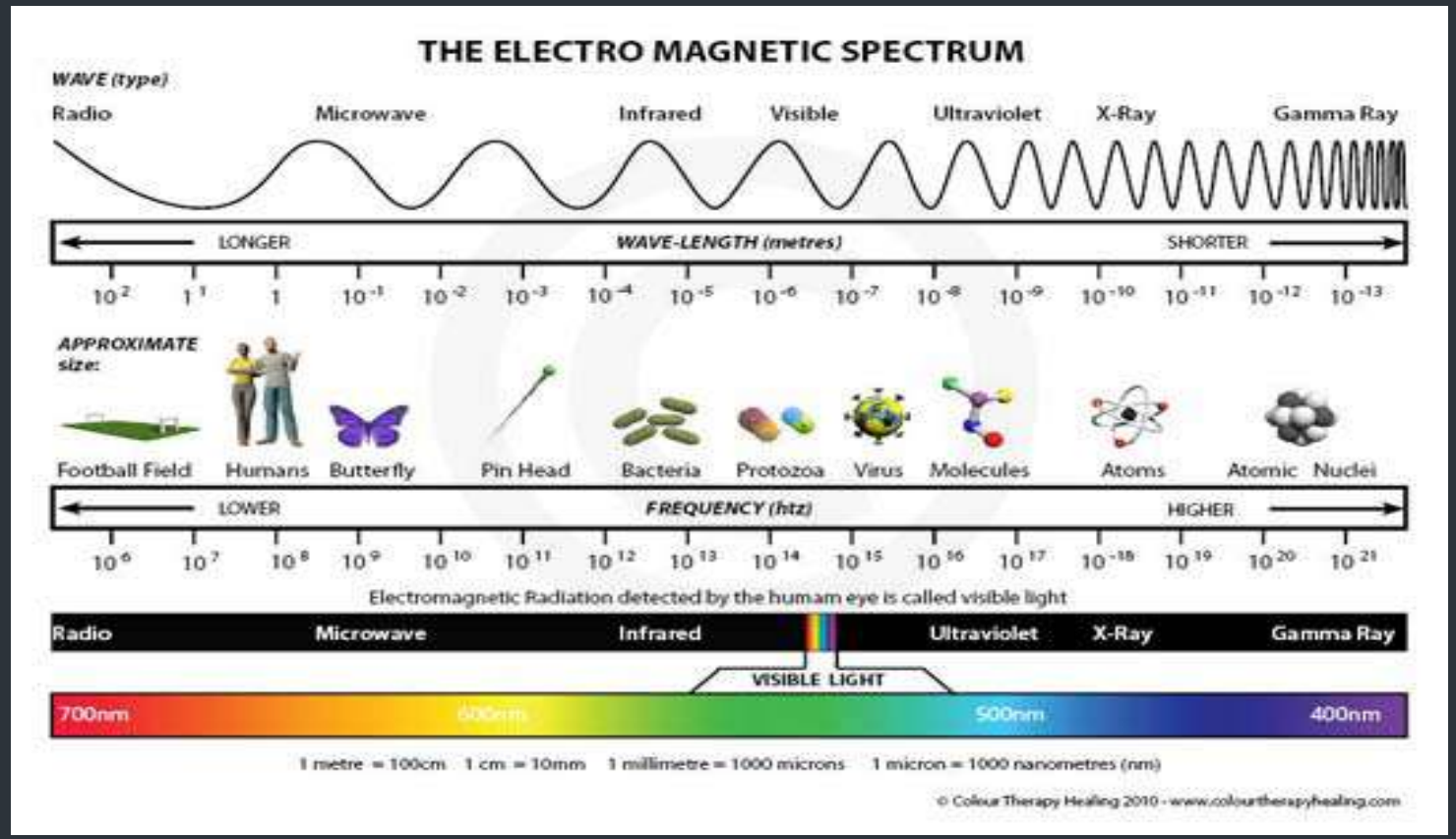
Frequency of a Light Wave





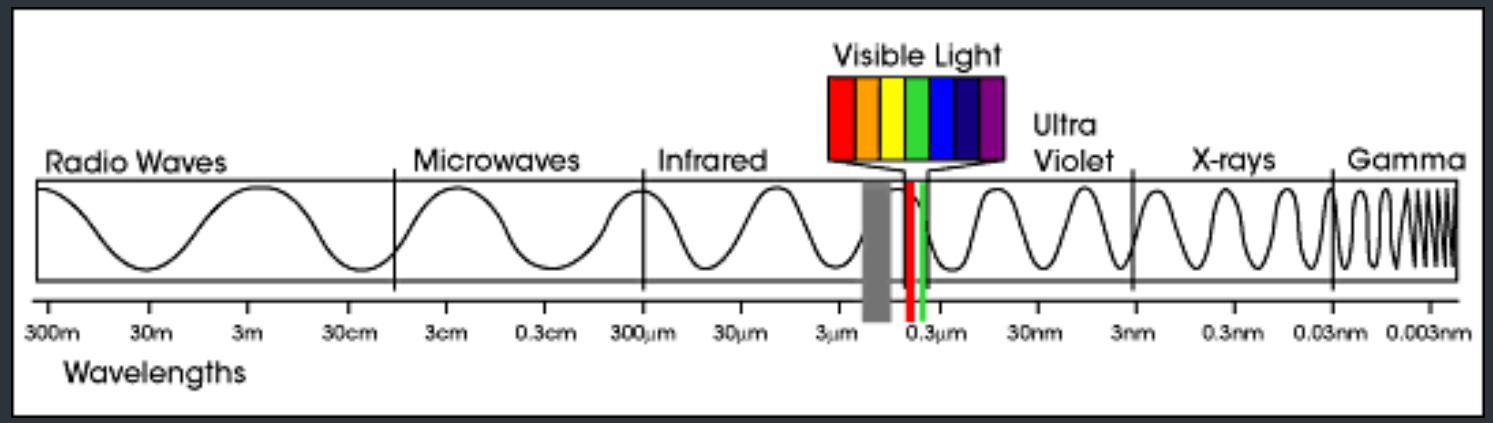
Electromagnetic Spectrum

- The entire range of electromagnetic radiation (light) is called the electromagnetic spectrum



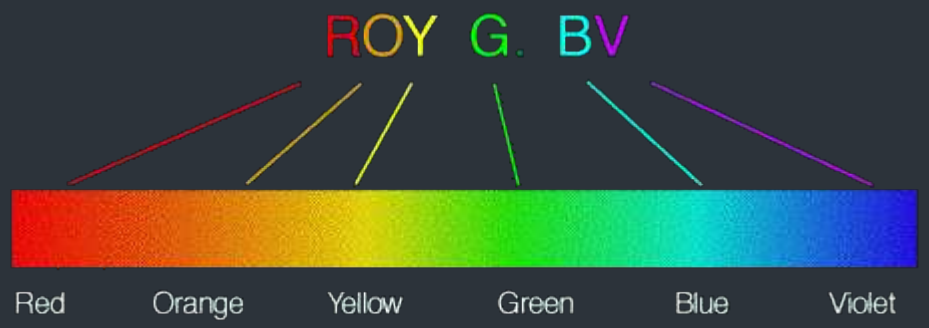
Visible/White Light

- Within the electromagnetic spectrum, the area that we see as light is known as "**visible light**" or "**white light**"
- Of the visible light, **red** would have the **longest** wavelength and **violet** (purple) has the **shortest**



Visible/White Light

- The white light/visible light that we see is really a combination of several different **wavelengths** of light traveling together
- These wavelengths are represented by the colors: **red**, orange, **yellow**, green, **blue**, and violet
- Acronym to remember order of visible light: **ROY G BV**



How Light Passes Through Objects

- Light passes through some materials **easily** and does not pass through other materials at all
- The terms **transparent**, translucent, and opaque indicate the amount of light that **passes** through an object

Transparent

- Allows **all/most** light to pass though
- Examples: **clear glass**, clear plastic wrap, **clean water**, air

Translucent

- Allows **some/partial** light to pass through
- Examples: **wax paper**, frosted glass, **thin fabrics**, some plastics, and **thin paper**

Opaque

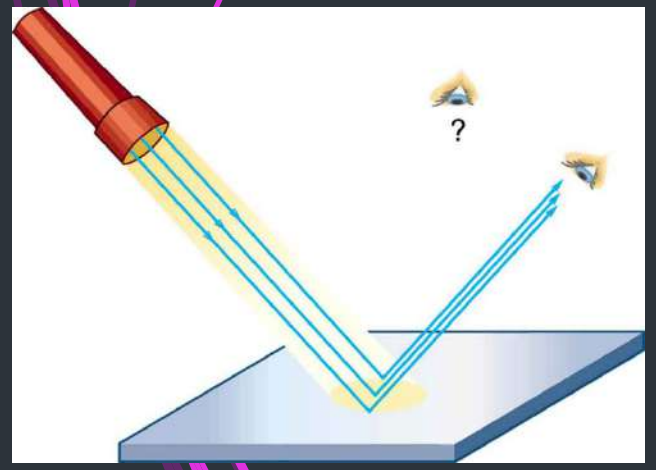
- Does **not allow** light to pass through
- Examples: **metal**, wood, **bricks**, aluminum foil, and **thick paper**

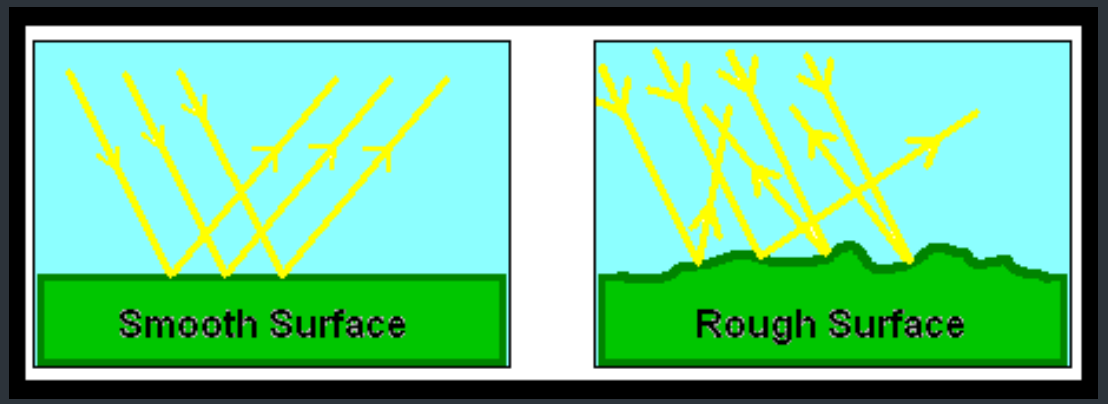
When Light Hits an Object

- Light travels in **straight paths** until it hits an object
- It can bounce off an object or **reflect**
- It can be bent or **refract**
- It can pass through an object or **transmit**
- Or it can be absorbed as **heat**

Reflection

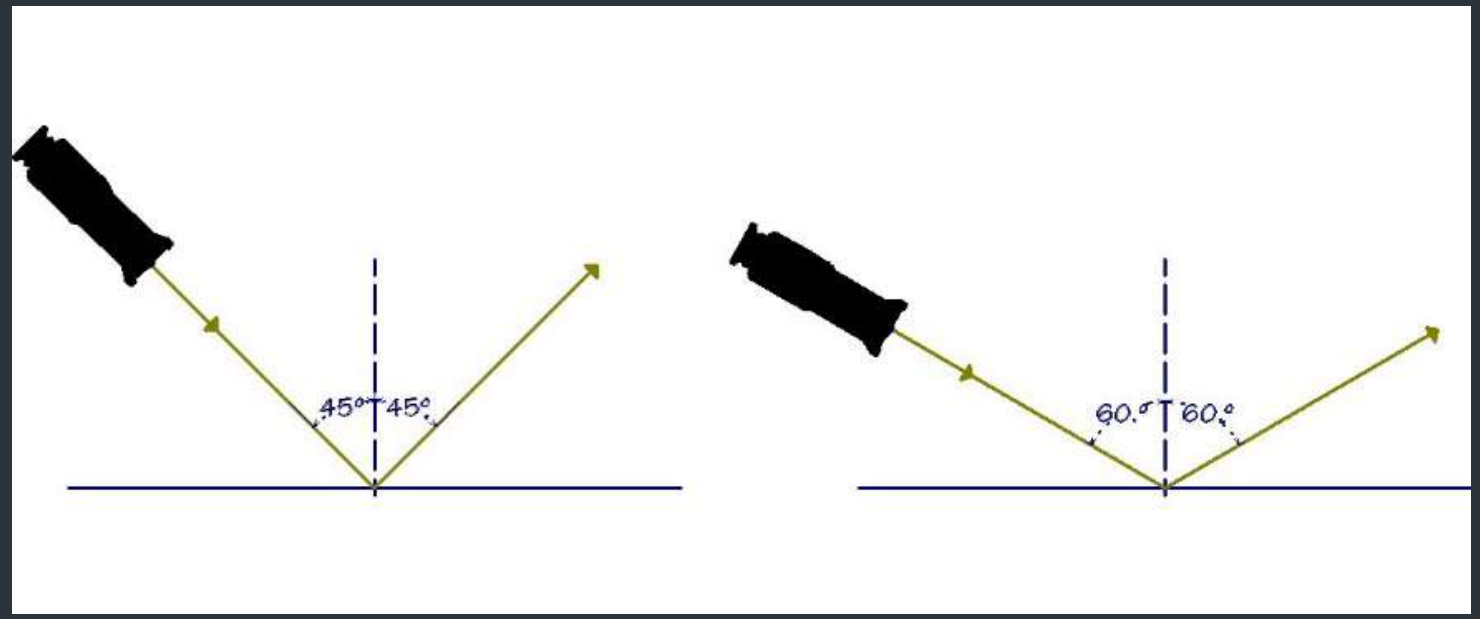
- Light **bouncing off** an object
- **Smooth and hard** objects are better at reflecting light than other objects (ex. mirrors)
- When light bounces off a **rough** surface, it is scattered in many directions





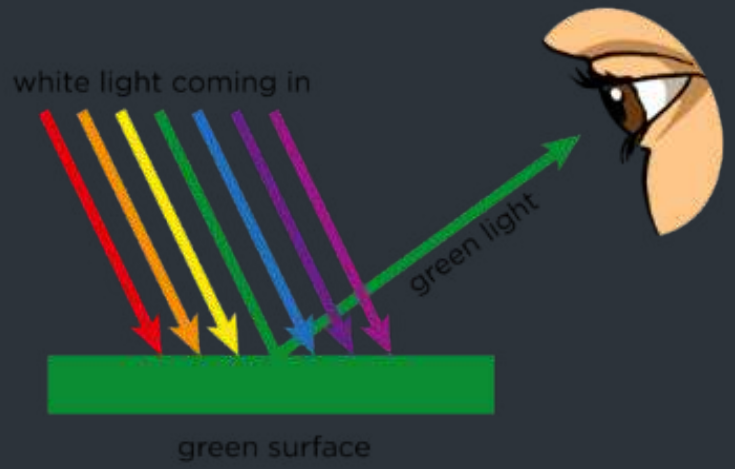
Law of Reflection

- The Law of Reflection states that when light hits a surface, the **angle** at which it is reflected (bounces off) is the **same** as the angle at which it strikes



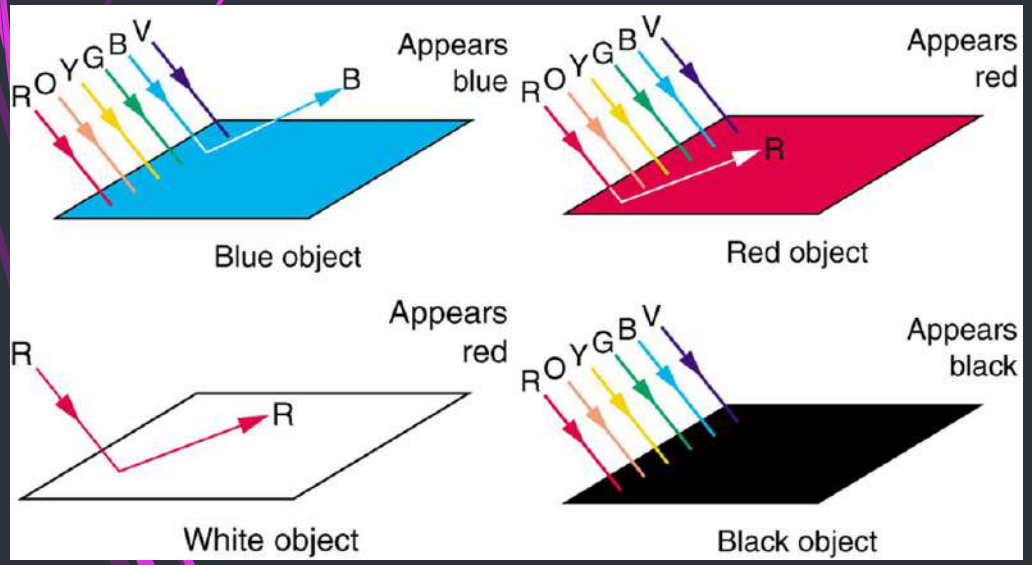
Reflecting Colors

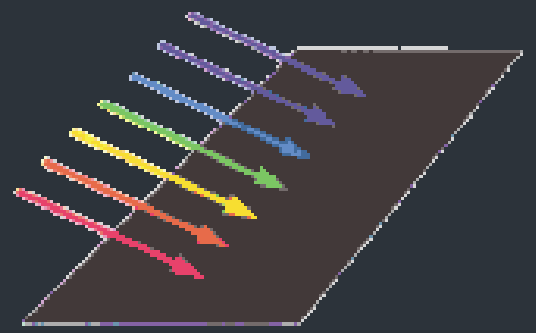
- The **color** of an object is the color of the light it reflects
- Grass looks green because it is **reflecting** green light and **absorbing** all the other colors

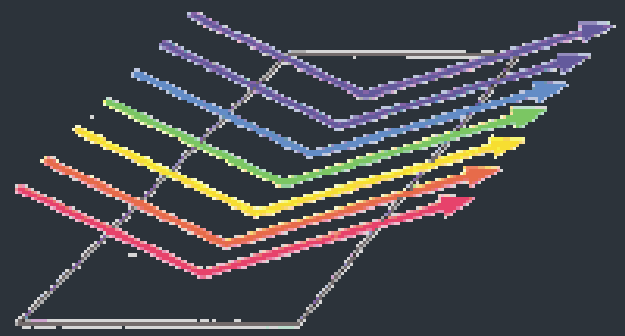


Black and White

- Black and white are **not colors** on the spectrum
- Black is when a material **absorbs** all of the visible light and no light is reflected back
- White is a **reflection** of all visible light together







Refraction

- Light travels in straight lines, but when it passes at an angle from one transparent medium to another, it can be **refracted** or **bent**.
- The speed of light **slows** as it passes from one transparent object to another.
- The speed of the light wave changes, but its frequency **does not**.

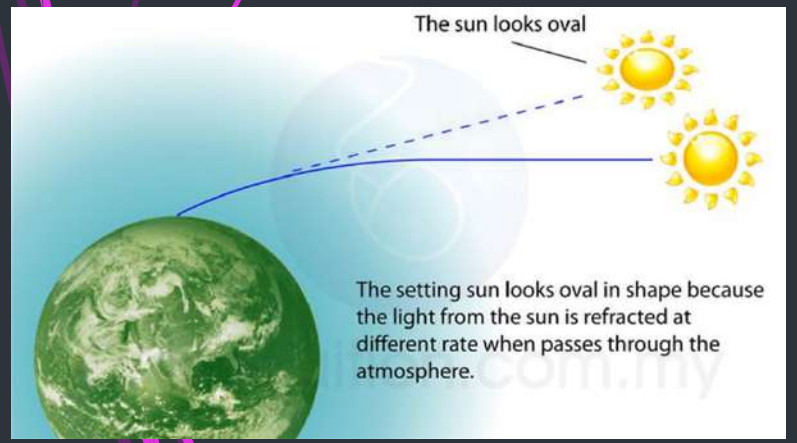
Refraction

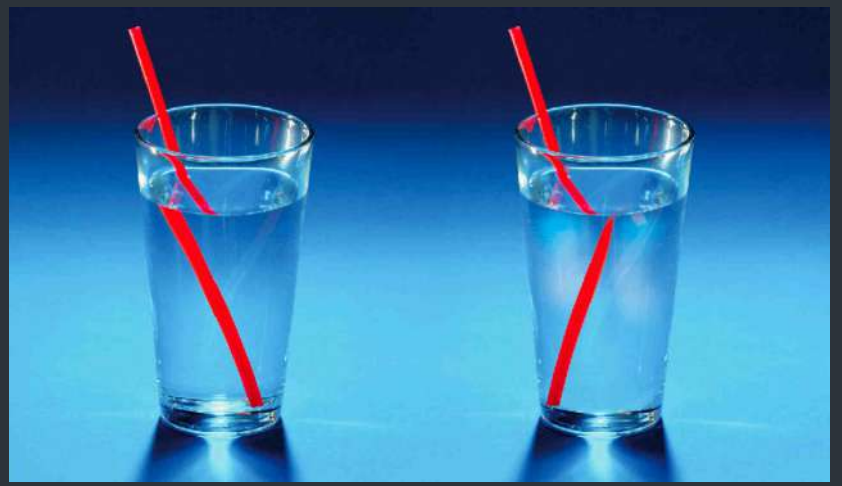
- The amount of bending of the light wave depends on:

1. The **density** of the material it is entering
2. The **wavelength** of the light wave
3. The **angle** at which the original light wave enters the new medium

Examples of Refraction

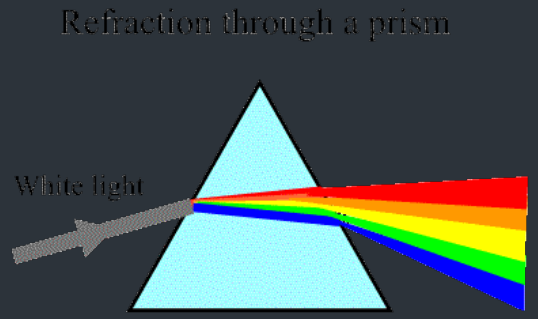
- A setting sun looks **flat** instead of round
- A straw appears to **bend** when it is placed in a glass of water
- Objects appear **larger** in water than they actually are

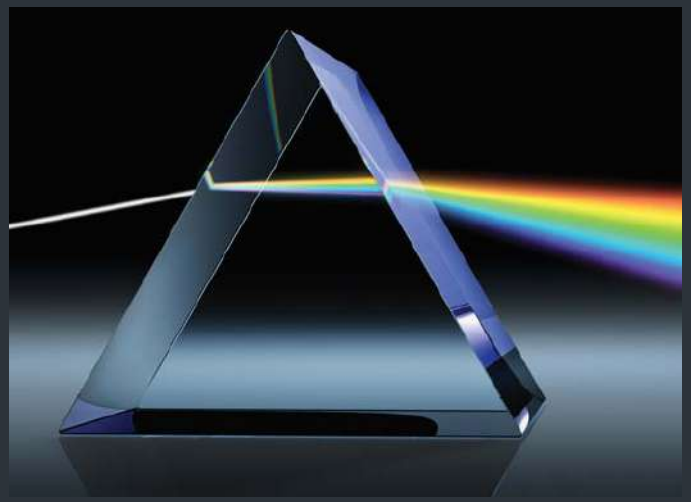




Prisms

- A prism can be used to **refract** white/visible light
- When the different wavelengths of light in white light pass through a prism, they are **bent** at different **angles** (refracted)
- The colors of light we see are red, orange, yellow, green, blue, and violet





Rainbows

- A rainbow is an example of both **refraction** and **reflection**
- Sunlight is first **refracted** when it enters the surface of a spherical raindrop
- It is then **reflected** off the back of the raindrop, and once again **refracted** as it leaves the raindrop