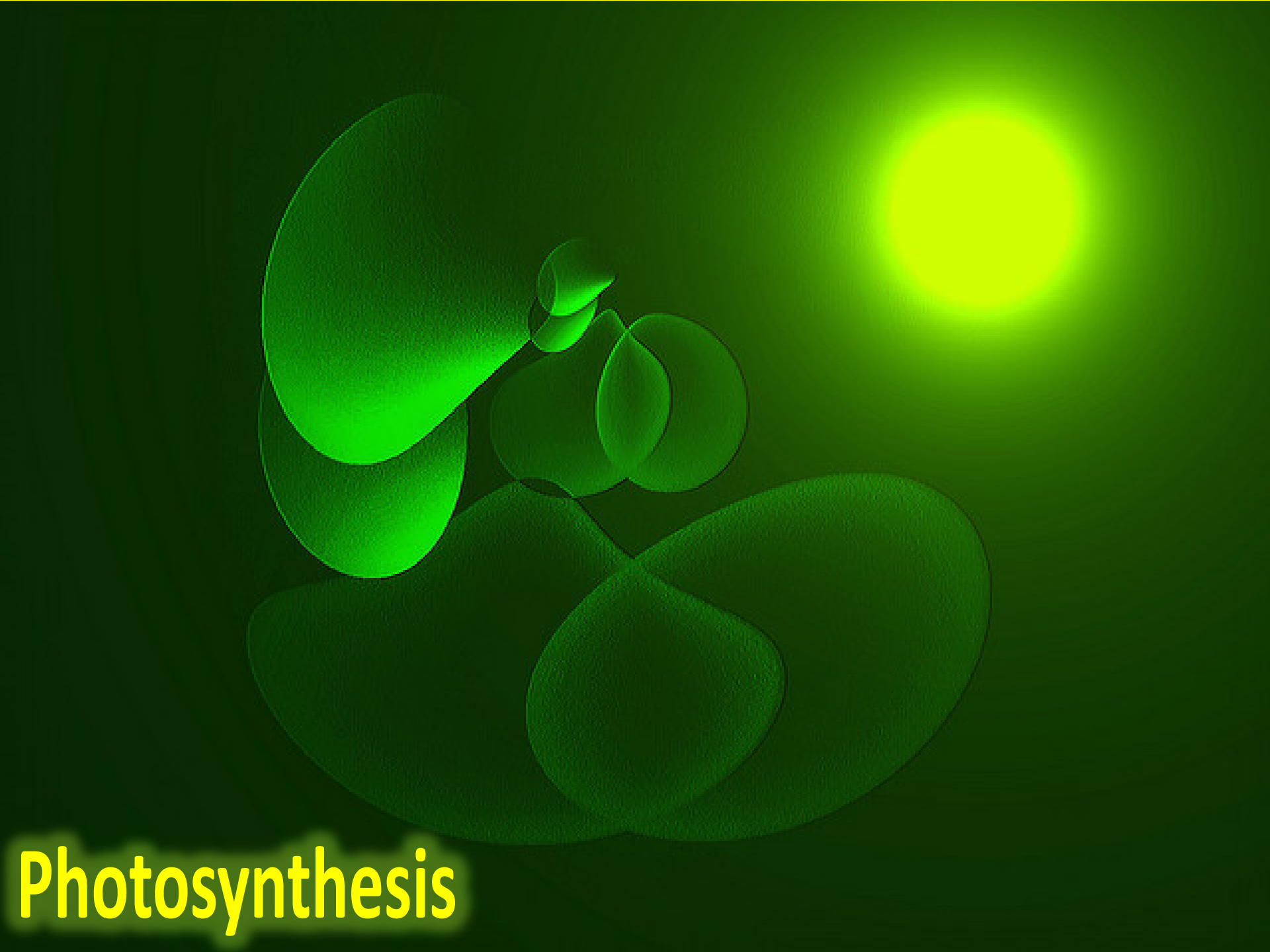

Photosynthesis

Photosynthesis

Definition: **The transfer of sunlight energy into the energy of food (chemical energy) through chlorophyll, thereby making glucose ($C_6H_{12}O_6$) from carbon dioxide (CO_2) and water (H_2O), with the release of free oxygen (O_2). Succinctly, it's…**

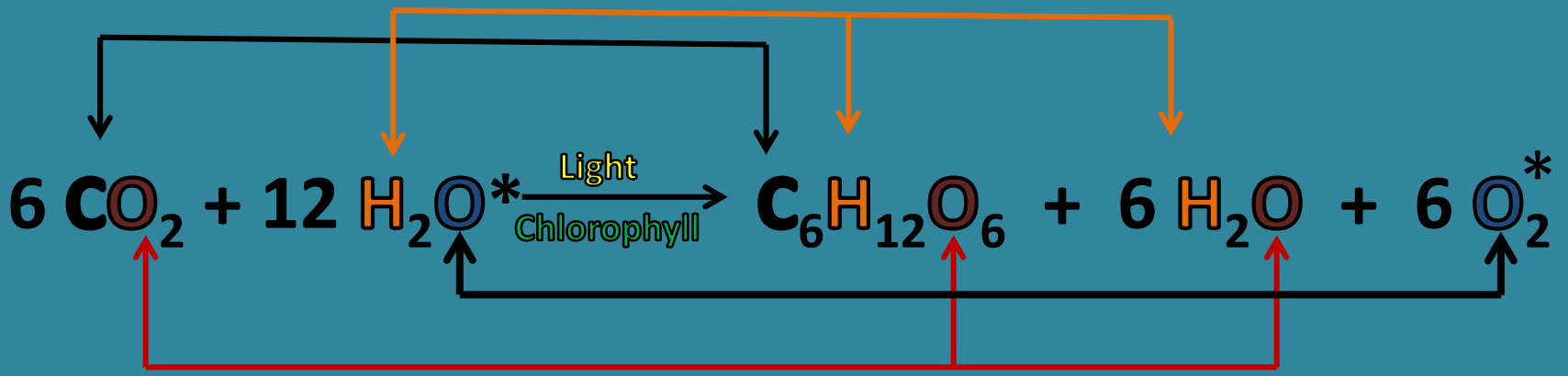
$$CO_2 + H_2O \xrightarrow[\text{Chlorophyll}]{\text{Light}} C_6H_{12}O_6 + O_2$$

Balanced Equation…

$$6\,CO_2 + 12\,H_2O \xrightarrow[\text{Chlorophyll}]{\text{Light}} C_6H_{12}O_6 + 6\,H_2O + 6\,O_2$$

(Carbon Dioxide) (Water) (Glucose = Food) (Water) (Free oxygen)

Which atom is which atom…



* Indicates that the free oxygen comes from the oxygen contained in water.

Photosynthesis is broken down into the…

I. **Light Dependent Reactions:** can only occur in the light.

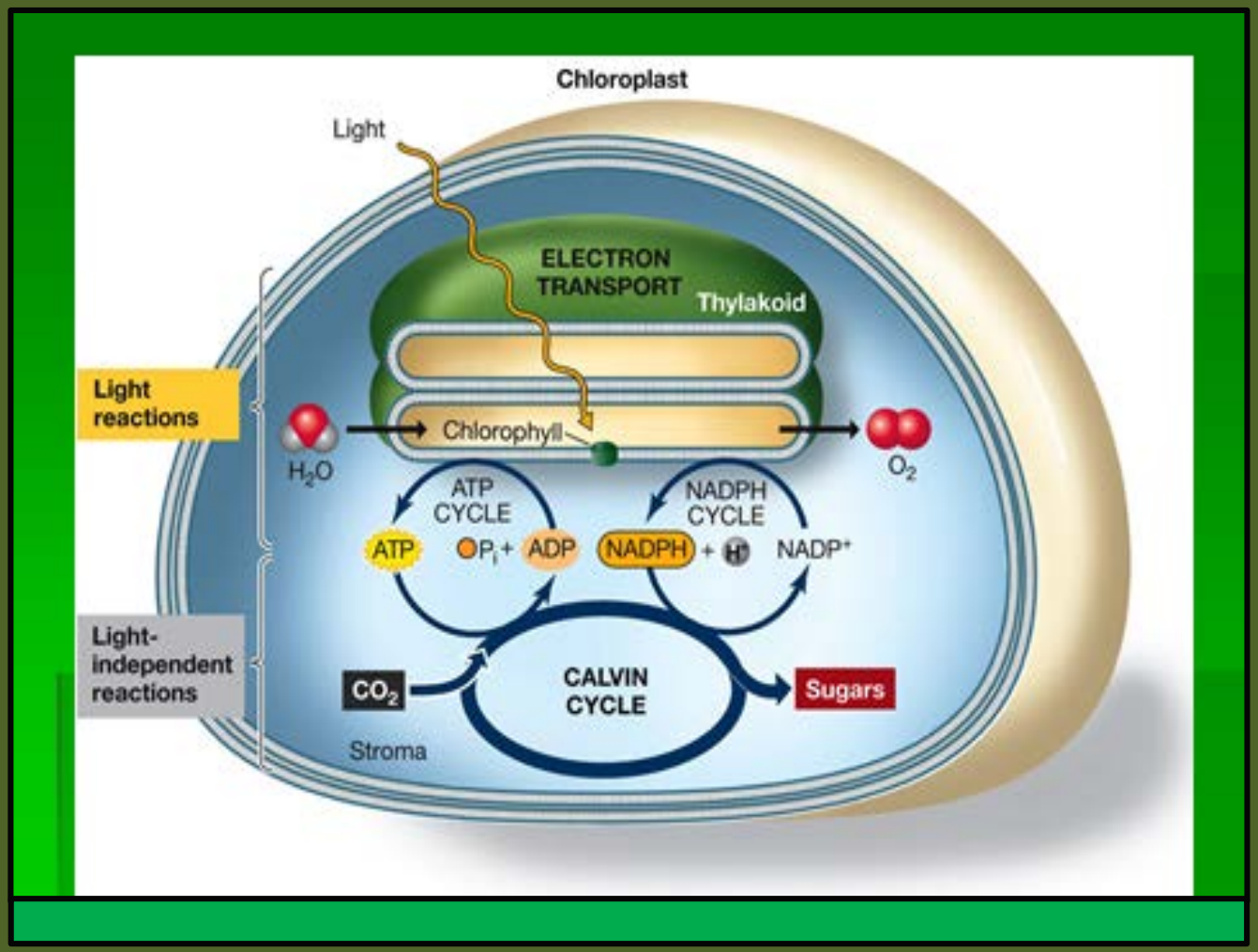
A. Free oxygen is released from the water molecule.

B. Energy is transferred from the light into an excited chlorophyll molecule, and then into ATP and $NADPH_2$.

II. **Light Independent Reactions:** can occur in the light or dark.

The energy of ATP and $NADPH_2$ (from the light dependent reactions) is transferred into the energy of glucose during the Calvin Cycle.

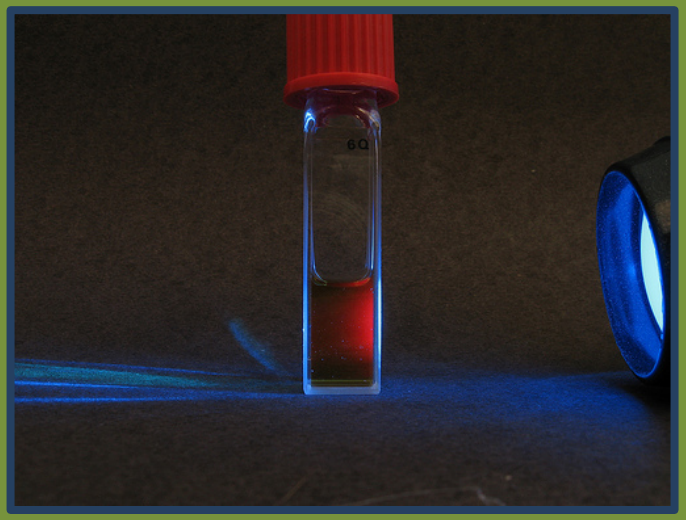
Location of Photosynthesis



Exercise 1: Light Activation of Chlorophyll

Chlorophyll in Sunlight

Chlorophyll in Blue Light



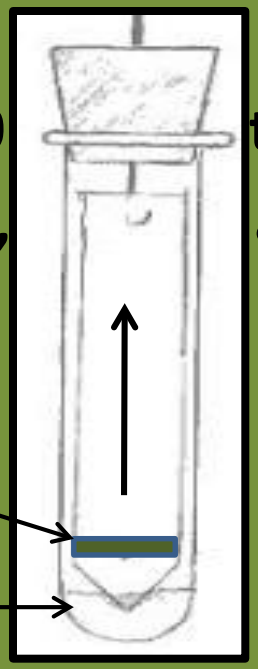
Chlorophyll in Blue Light

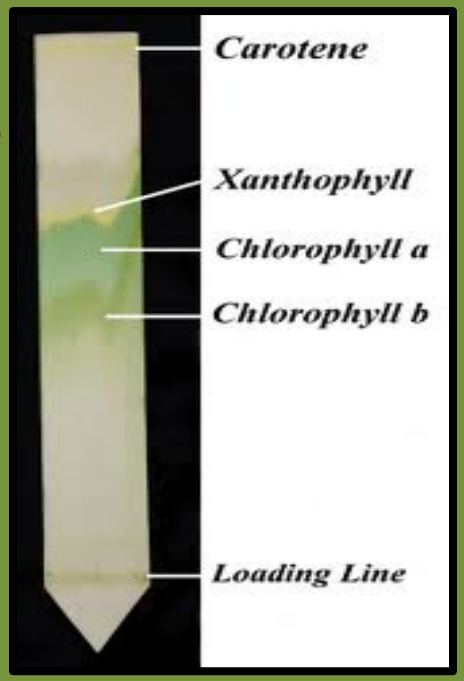
After the demonstration, answer questions 1-4 on page 132.

Exercise 2: Leaf Pigments (Page 133)

- **Extraction of leaf pigments using "paper chromotography."**

  Note - when you roll the quarter over the spinach leaf which is lying on the chromotography paper, let it dry out in between rolls. Water, left on the paper, will not only make it tear more easily, but will interfere with the pigments uptake into the solvent. You will probably have to roll the quarter 15-20 times to make the extract dense green, and the line of extract as thin as possible.



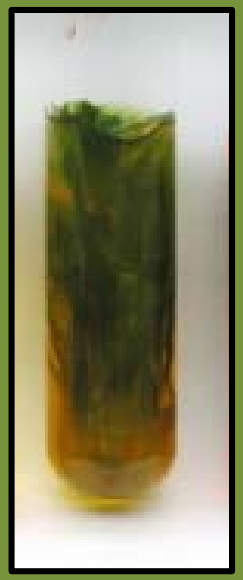


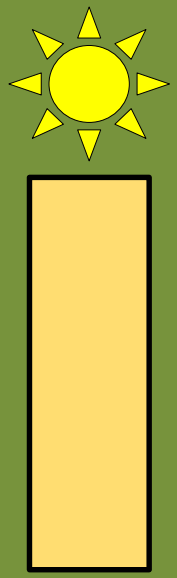
Exercise 3: CO_2 Uptake by Plants (Page 134)

Phenol Solution without CO_2

Exhale into it through a straw

Phenol Solution with CO_2

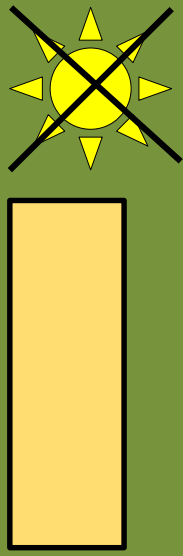




Sprig of *Elodea* with Light

The two set-ups

Now, what happens?



Sprig of *Elodea* in the Dark

Answer questions 1-4 on page 135.

Exercise 4: O_2 Production by Plants

(Page 135)

You will assign one person from your group –the one with the best math skills- to perform this experiment, and they will share the calculations for page 137.

Exercise 5: Oxygen demand for a Human (Page 136)

"How much oxygen does a human need to survive one-hour of this biology lab?"

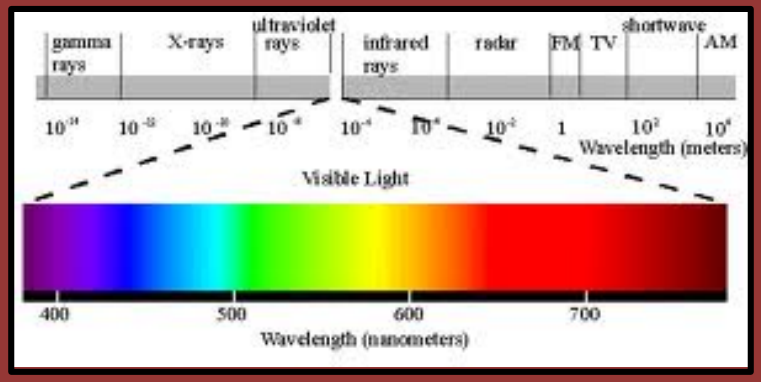
Make this calculation for the oxygen requirement (in ml) for an average person, and answer the question on page 136.

Exercise 6

“How Big of a Plant Does it Take to Keep you Alive for One-hour in this Biology Lab?”

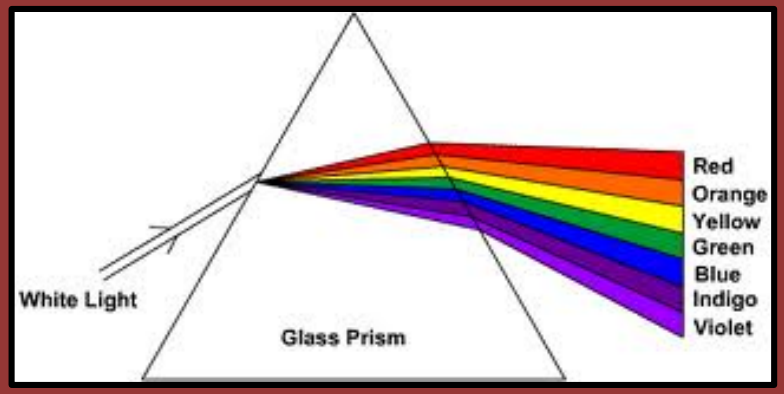
Answer questions 1-5 on page 136.

Light (Electromagnetic Radiation)

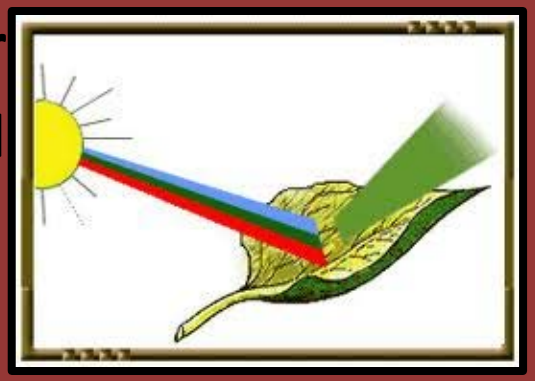


Three (3) things can happen to light when it encounters an object

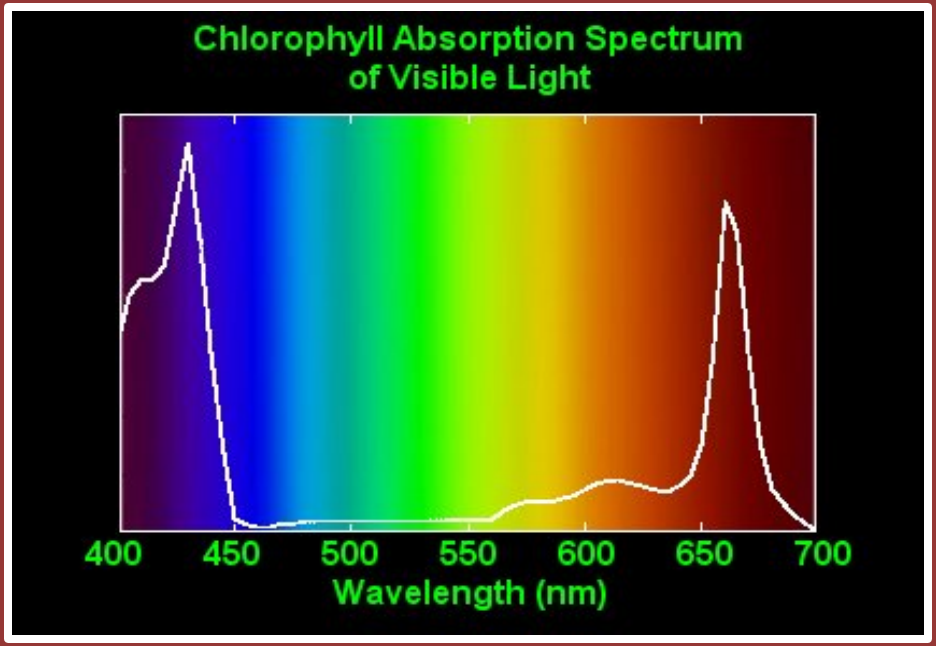
1. **Transmission/refraction: It passes through the object. This causes the bending of light. It is also how we know the colors of the visible/white light spectrum.**



2. **Reflection**: where light bounces off an object at a right angle. When we see an object, other than the light directly, everything is a reflected image. The color that something is, is the color it reflects, or the color of the pigment.



3. **Absorption:** When the chlorophyll molecule does this it increases in energy, and is the mechanism by which light ultimately, is transferred into our food.



*Note – chlorophyll absorbs best the colors of **blue**/violet and **red**