What do you know?

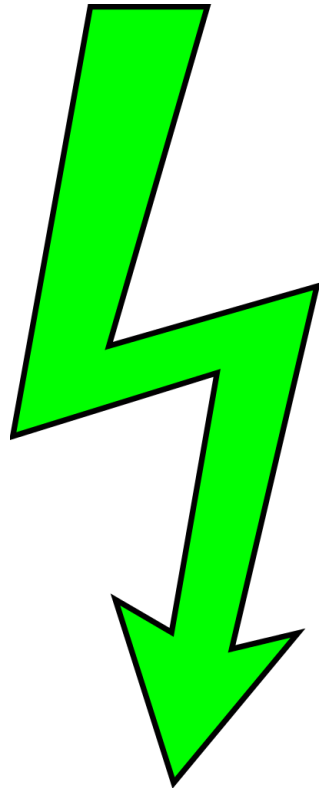
- What is energy?
- What do you need energy for?
- How does your body use/store energy?

What is energy?

- Energy is the ability to do work.

- Without ability to ***obtain & use*** energy, life would NOT exist.

- Molecule used to do work in a cell: **<u>adenosine triphosphate</u> <u>(ATP)</u>.**

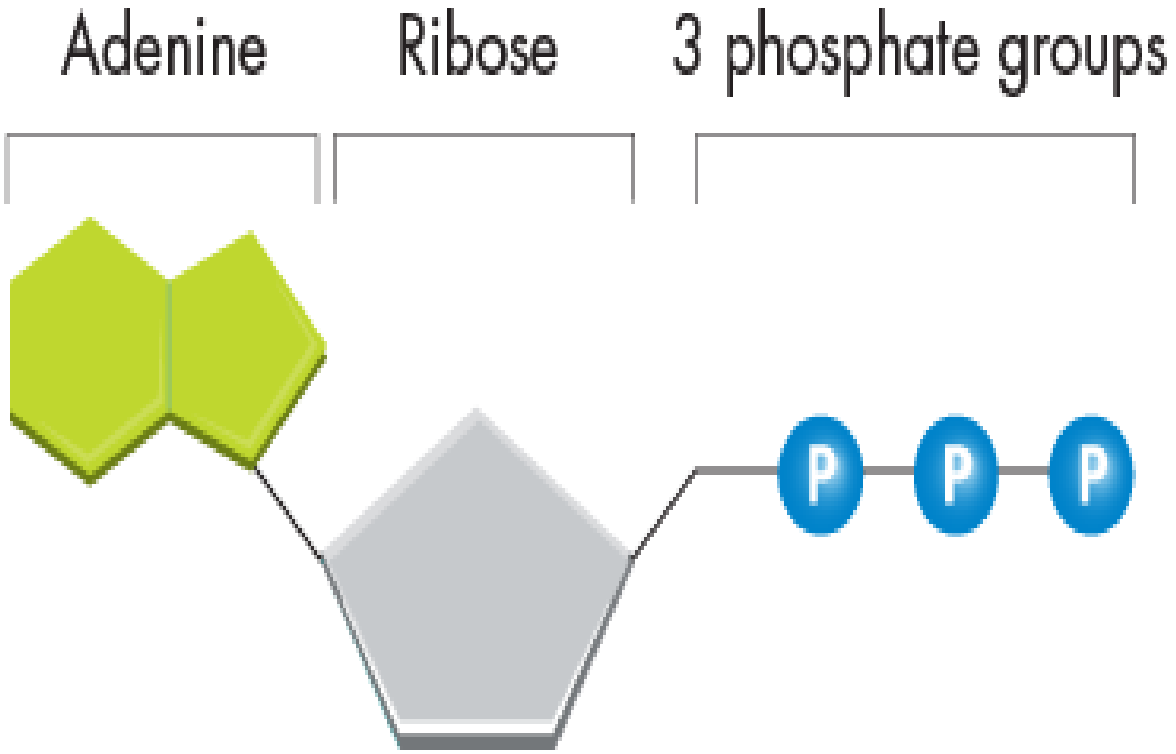


- ATP consists of:

  -adenine (nitrogenous base)

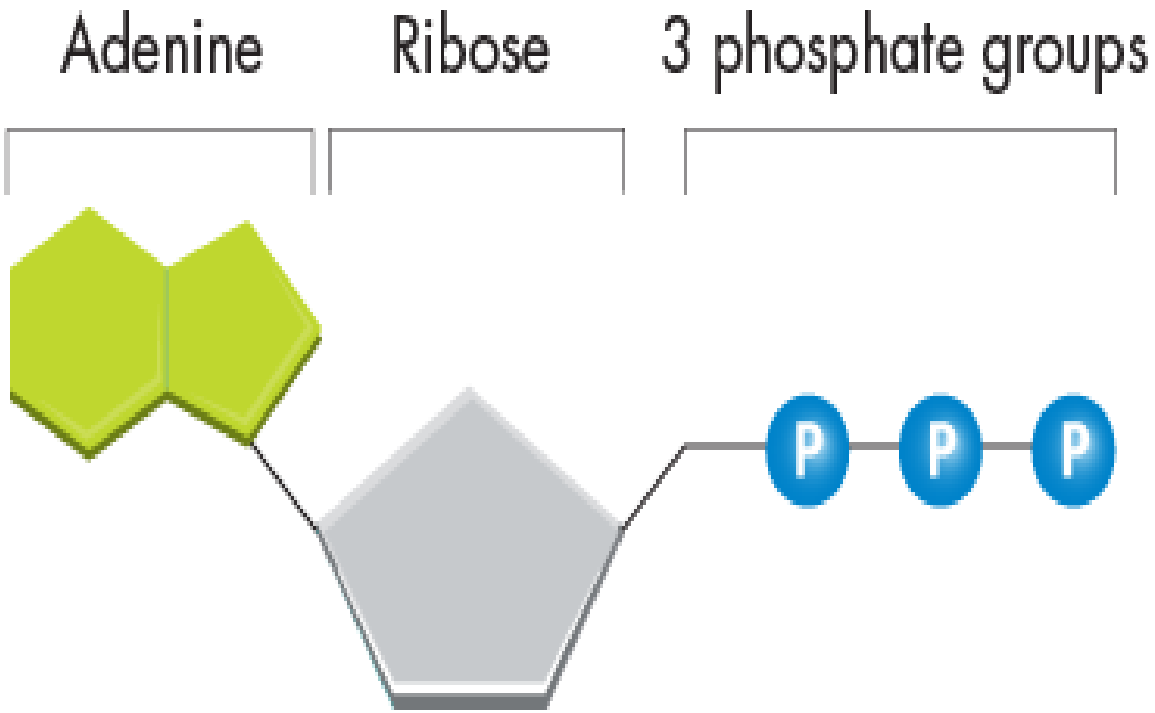
  -a 5-carbon sugar called ribose

  - three phosphate groups



- ATP can easily **release** and **store** energy by **breaking** and **re-forming** the bonds between its phosphate groups.

- This characteristic makes ATP very useful as a basic energy source for cells



Storing Energy

- **<u>Adenosine *di*phosphate (ADP)</u>** -has 2 phosphate groups instead of 3.

  -contains some energy (not as much as ATP)

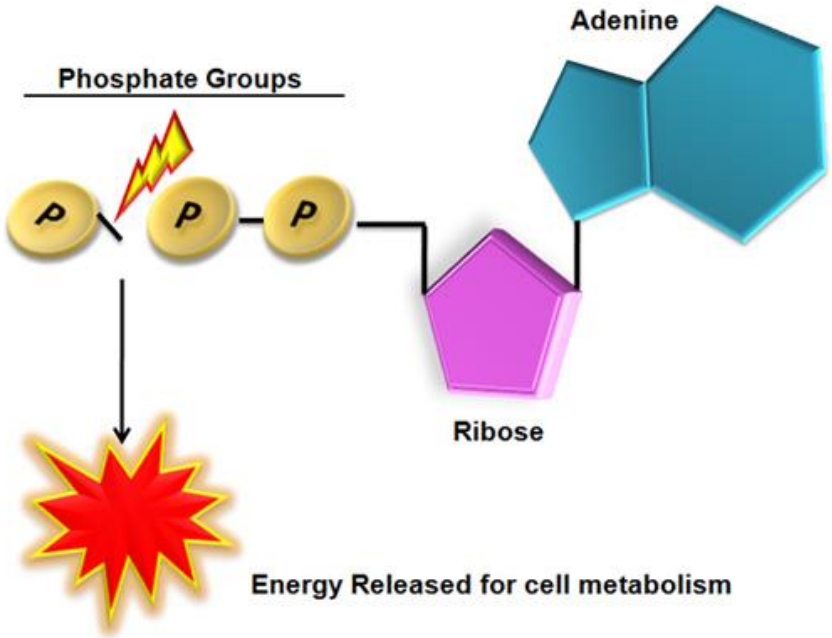
- When a cell has energy available, it stores small amounts by adding a phosphate group to ADP, making ATP.

- ADP is like a rechargeable battery that powers the cell.

Releasing Energy

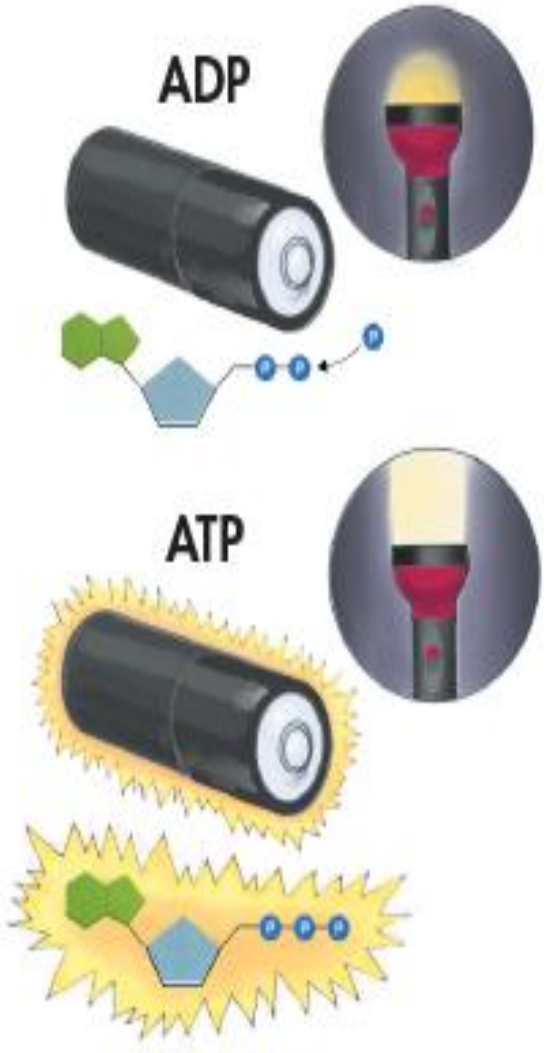
- Cells release the energy stored in ATP by breaking the bonds between the ***2nd & 3rd*** phosphate groups.

- A cell can add (+) or subtract (-) these phosphate groups giving it an easy way of storing & releasing energy as needed.



Storing Energy

*ADP into ATP= stored energy (fully charged battery)



Releasing Energy

*ATP into ADP= released energy (used battery)

Intro to Photosynthesis

Types of Organisms

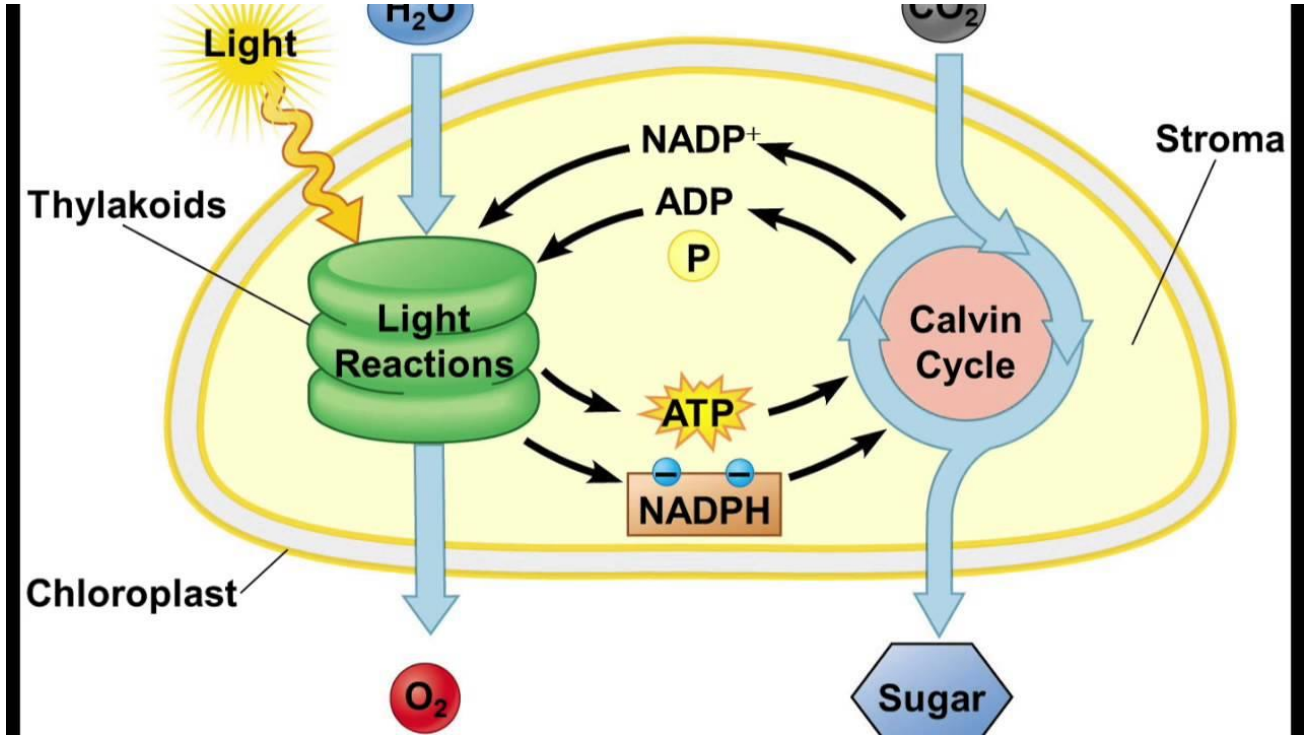
- **Autotrophs**- organisms that make their own food (carry out photosynthesis)

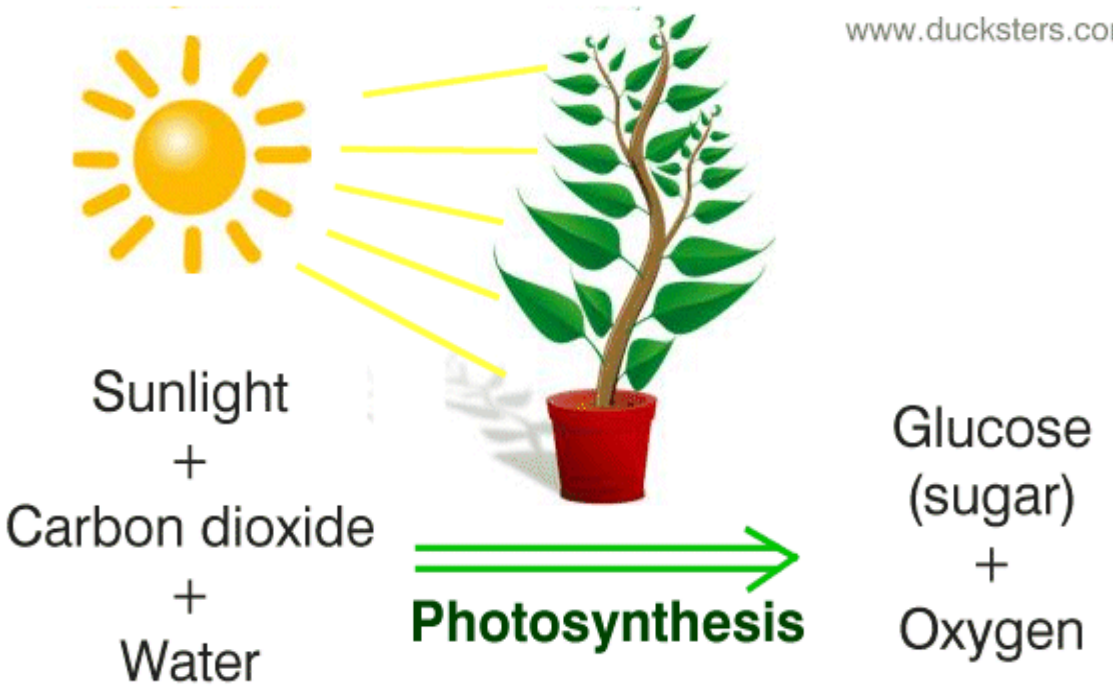
  Ex: plants, algae, some bacteria
- **Heterotrophs**- organisms that obtain food by consuming other living things

  Ex: humans, insects, cheetah, mushroom, etc

Photosynthesis

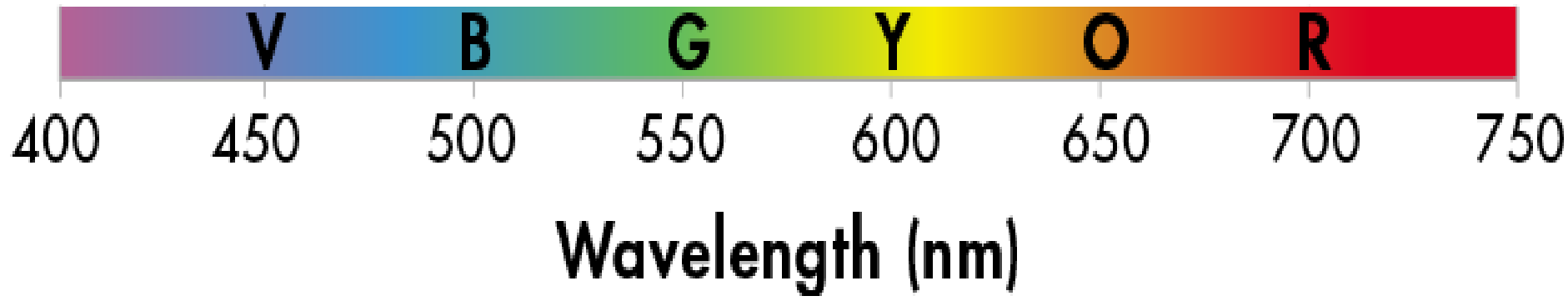
- During **<u>photosynthesis</u>**-
  organisms convert energy from sunlight into chemical energy stored in the bonds of carbohydrates.





- Energy from the sun travels to Earth in the form of light

- Sunlight is a mixture of different wavelengths & make up a color spectrum. (ROYGBIV)

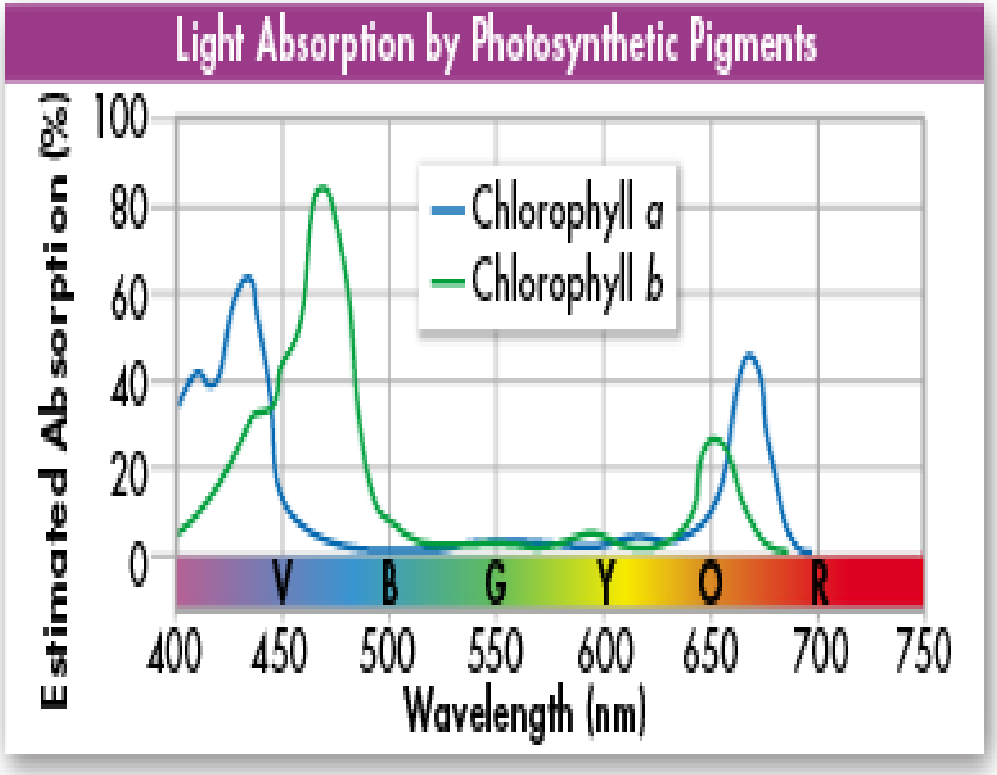


- Plants gather the sun's energy with light-absorbing molecules- **pigments.**

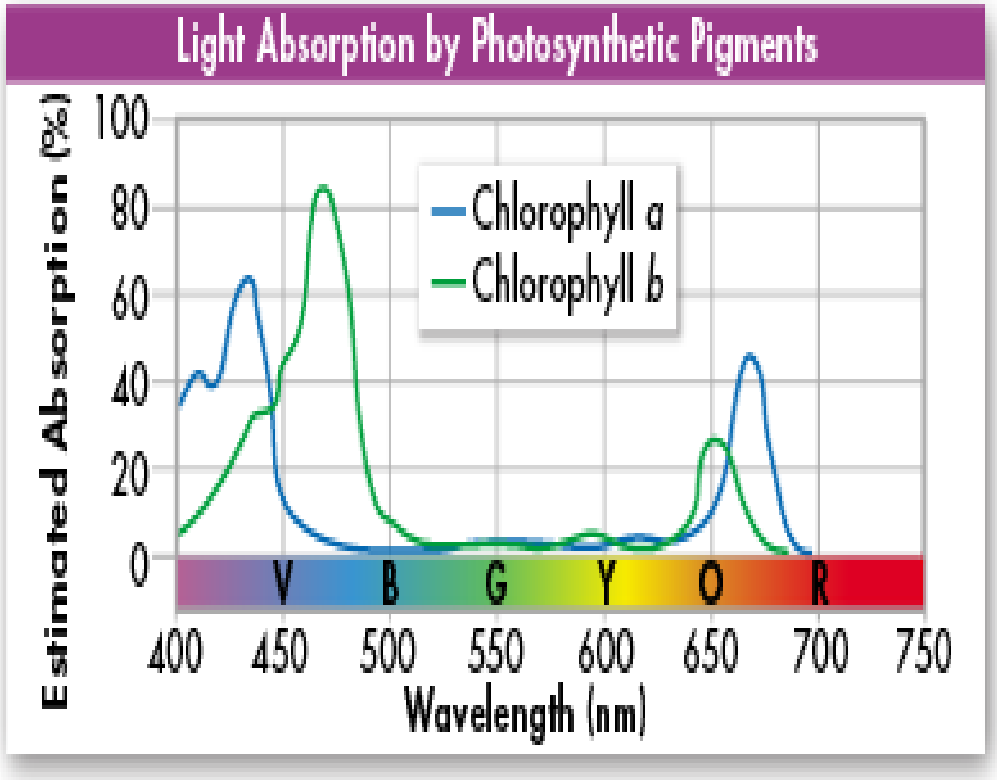
  - plants' main pigment is **chlorophyll**
    - 2 types in plants: - chlorophyll *a*
      - chlorophyll *b*

  - Both chlorophylls absorb light in the blue- violet & red regions of the spectrum

- Green plants do NOT absorb in the **green** region
  - have chlorophyll b which ***reflects*** green light, which is why plants look green.

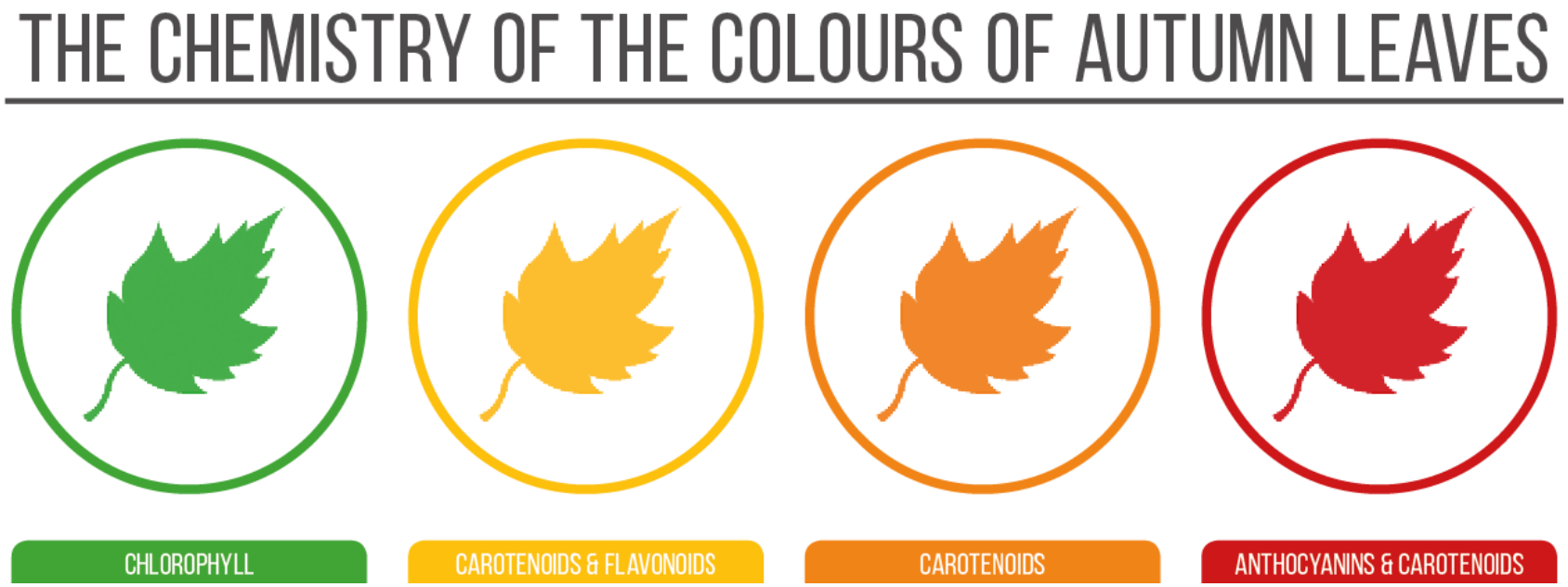


- Red plants do NOT absorb in the **red** region
  - have chlorophyll a which ***reflects*** red light, which is why plants look red.



Why to leaves change in the fall?

- Leaves turn red from green during the fall because chlorophyll b breaks down, leaving other pigments to show their colors

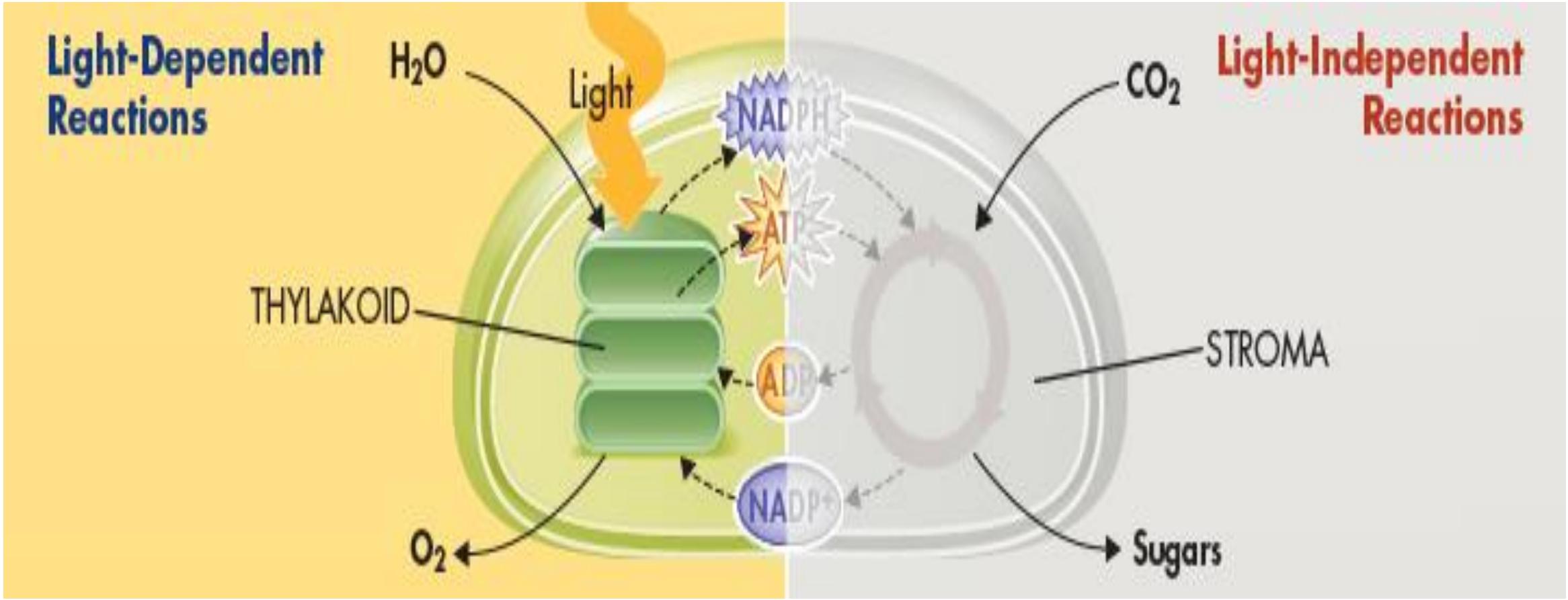


- Photosynthesis uses the energy of sunlight to convert water & carbon dioxide into high-energy sugars & oxygen.

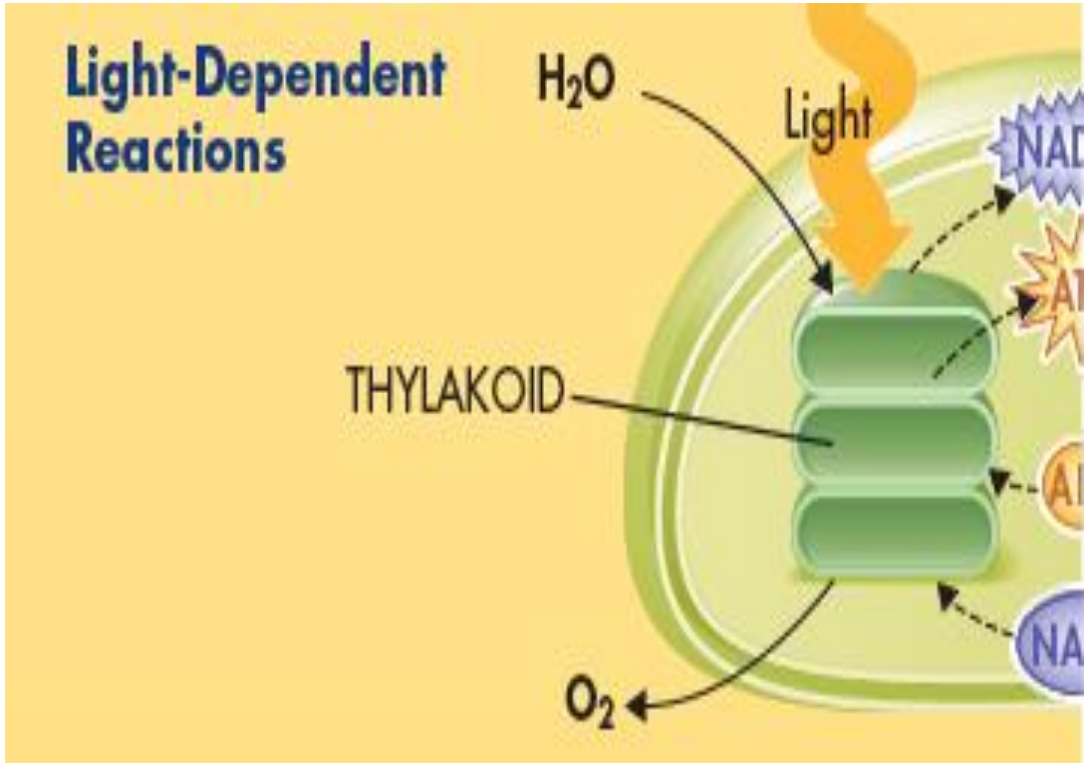
$$6\ CO_2 + 6\ H_2O \xrightarrow{\text{Light}} C_6H_{12}O_6 + 6\ O_2$$

$$\text{Carbon dioxide} + \text{Water} \xrightarrow{\text{Light}} \text{Sugars} + \text{Oxygen}$$

- Photosynthesis involves 2 reactions sets:
    1- **light-dependent reactions**
    2**- light-independent reactions** (Calvin cycle)

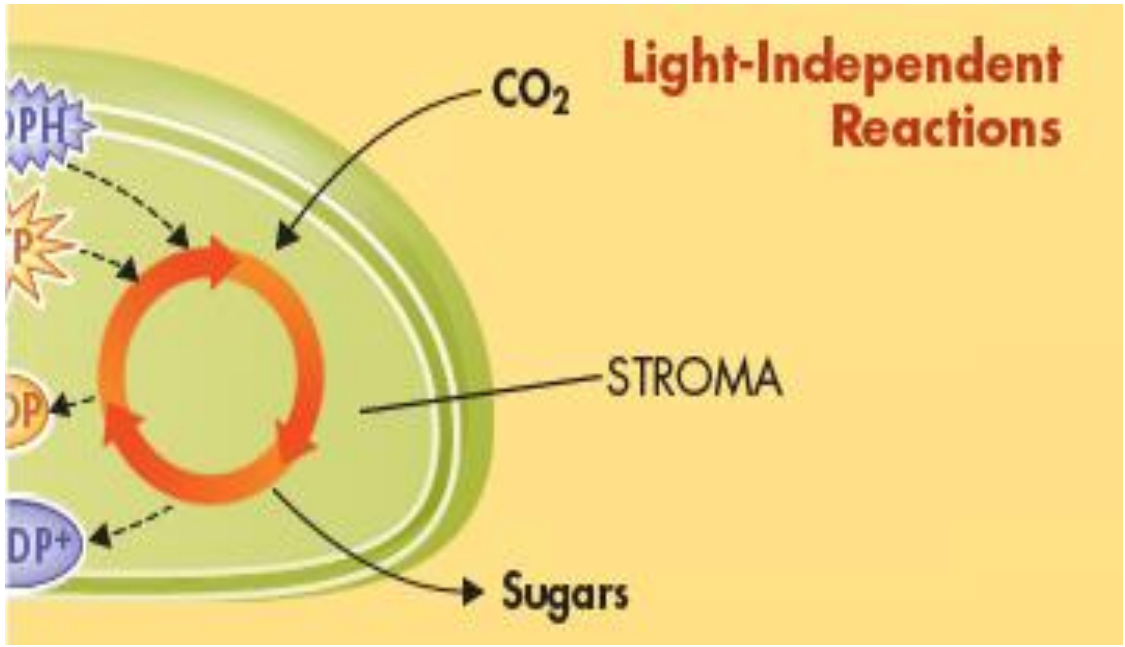


Light-Dependent Reactions:



- Water & light energy = in
- Oxygen, ATP, & NADPH = out

Light-Independent Reactions (Calvin cycle):



- CO_2, ATP & NADPH = in
- high energy sugars/carbohydrates = out

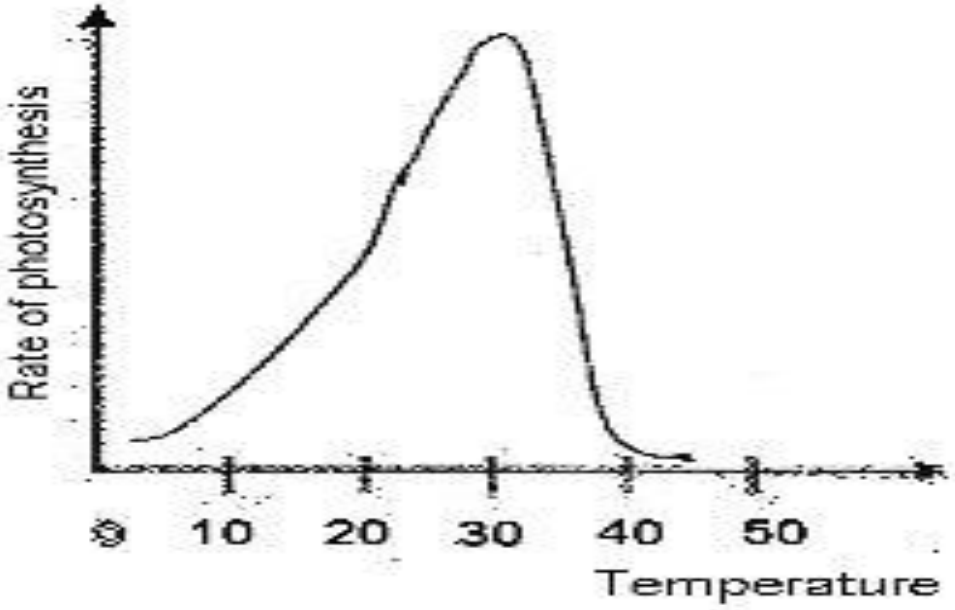
Factors Affecting Photosynthesis

- The main factors that affect photosynthesis are:
  - Temperature
  - Light intensity
  - Availability of water
  - Availability of Carbon Dioxide

Temperature:

- photosynthesis reactions are due to enzymes that function between ***0°C & 35°C***

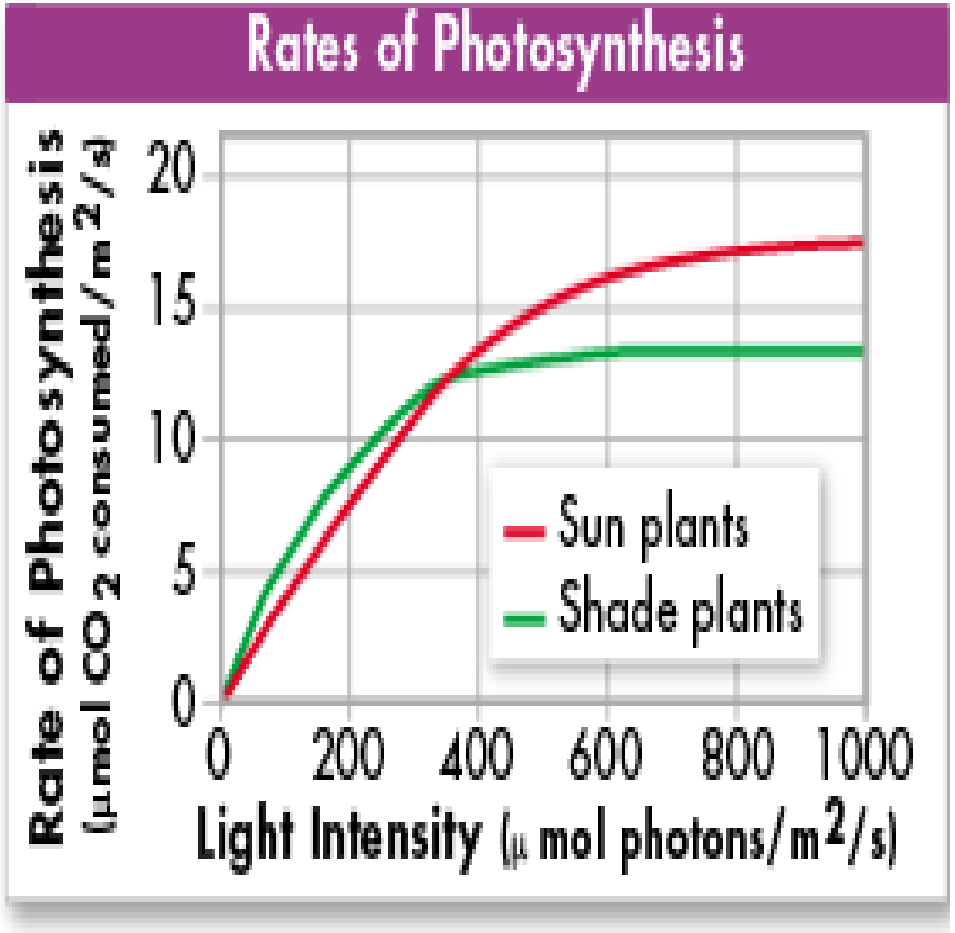
- Temps above or below that range may slow down the rate of photosynthesis or stop it entirely.



Light:

- High light intensity ***increases*** rate of PS.

- After light intensity reaches a certain level, plants reach the maximum rate of PS.

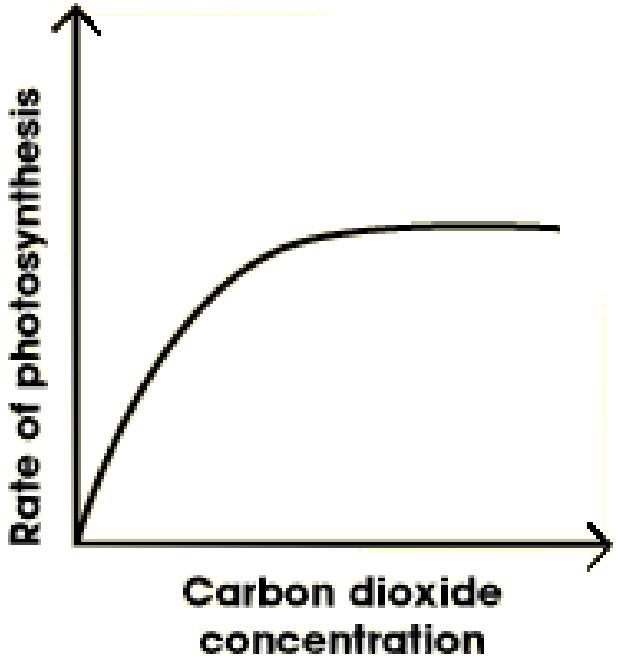


Water:

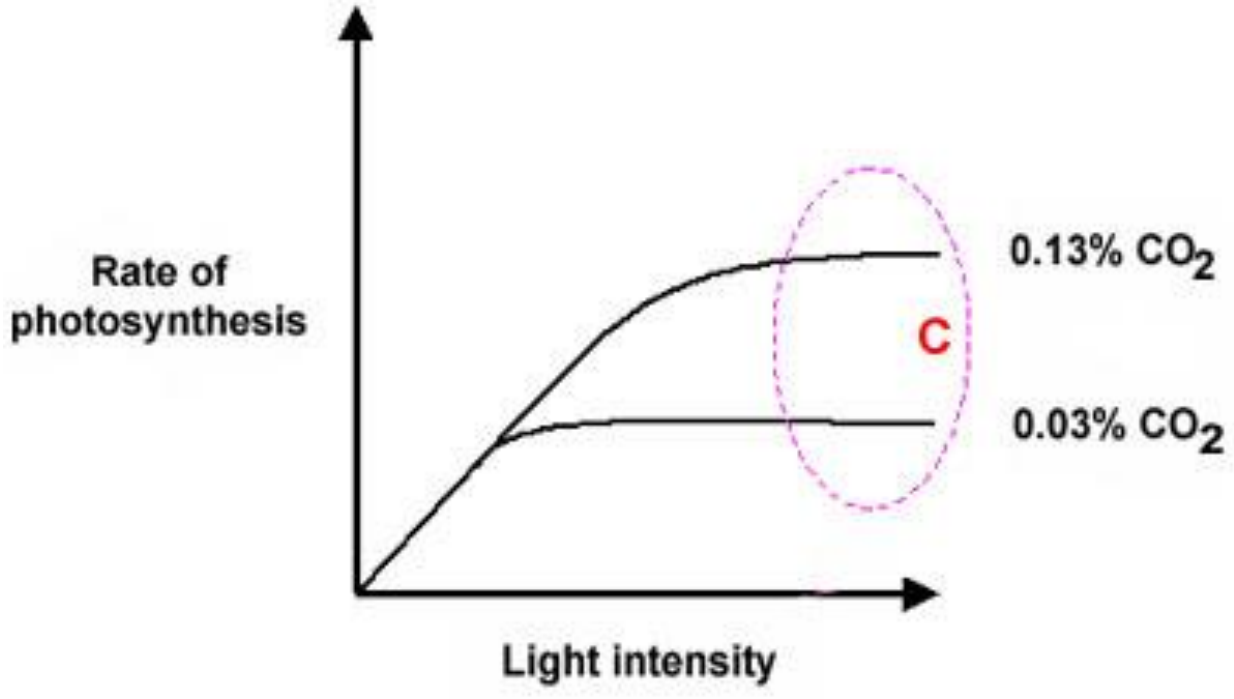
- Water shortage can *slow* or *stop* PS.
  - Water loss can also damage plant tissues.
  - Plants living in dry conditions have waxy coatings on leaves to reduce water loss.
- Too much water can drown plants

Carbon Dioxide:

- More CO_2 = Higher rate of photosynthesis
- No CO_2 = No photosynthesis



Put two together:



Explain this chart in terms of both light intensity and CO_2 availability

Which scenario would result in the most plant growth?