



Class 9 Academic Program-2020

# BIOLOGY

Lecture : B-08

Chapter 4 : Energy For Life



উদ্ভাস

একাডেমিক এন্ড এডমিশন কোয়ার

[www.udvash.com](http://www.udvash.com)

## What is energy?

Energy



Static

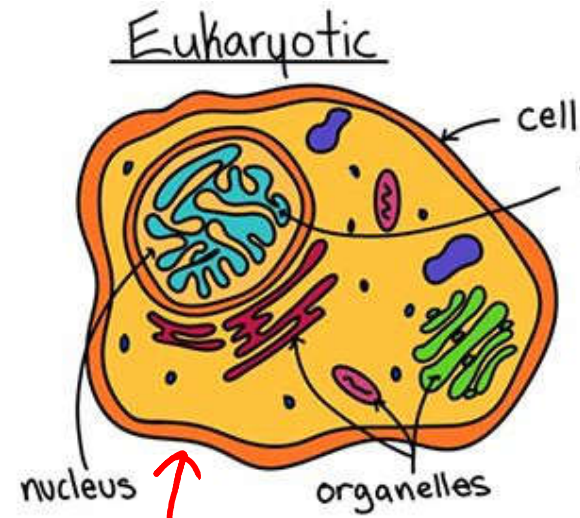


Moving

## Needs of Energy



## Source of Energy to Human body



*Biryani*

## What is ATP?

ATP: Adenosine Tri-Phosphate

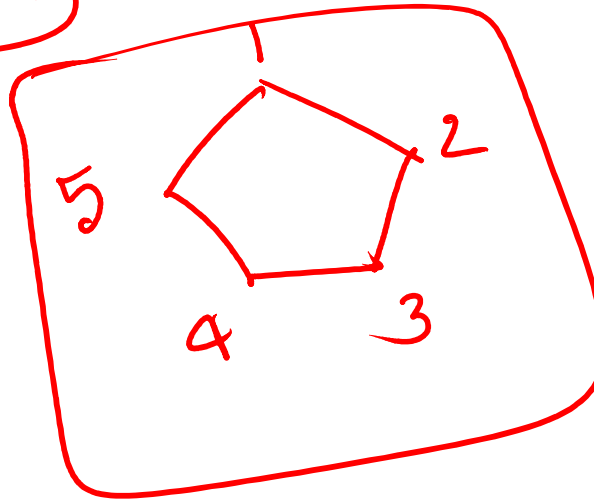
Components:

1. Pentose Sugar

2. Nitrogen Base

3. Phosphate Group

Adenine



① → Mono

② → Di

③ → Tri

④ → Tetra

✓ ⑤ → Penta

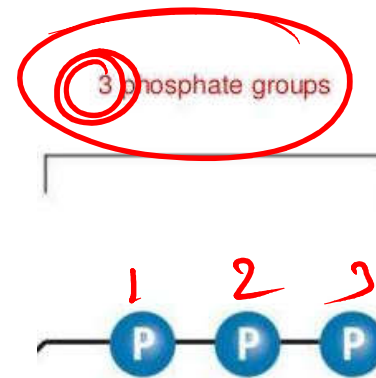
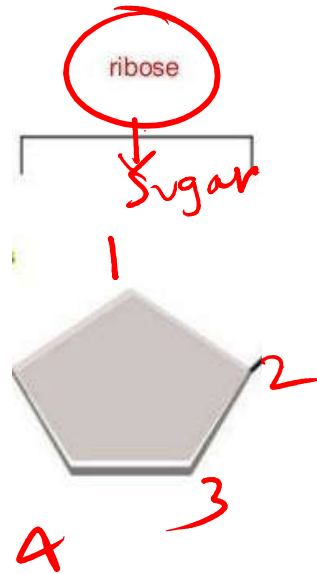
⑥ → Hexa

⑦ → Hepta

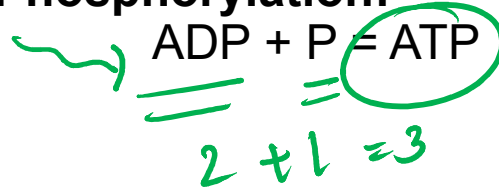
⑧ → Octa

## ATP in structure...

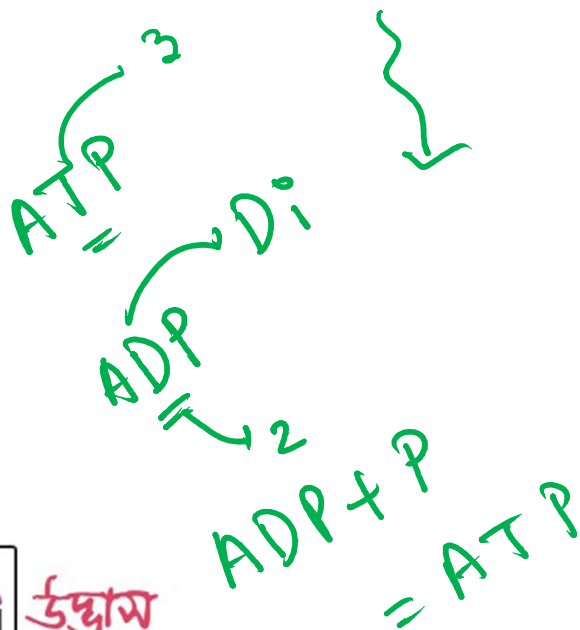
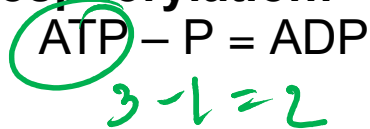
ADP → ri



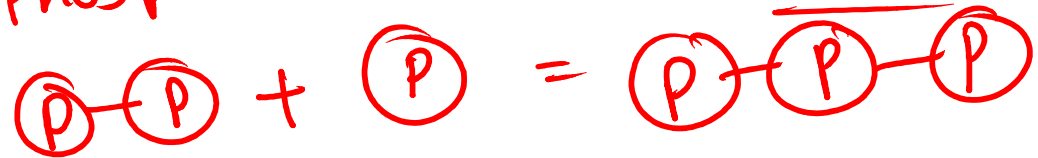
- **Phosphorylation:**



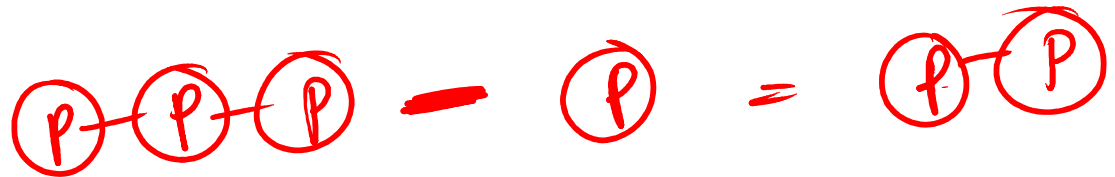
- **Dephosphorylation:**

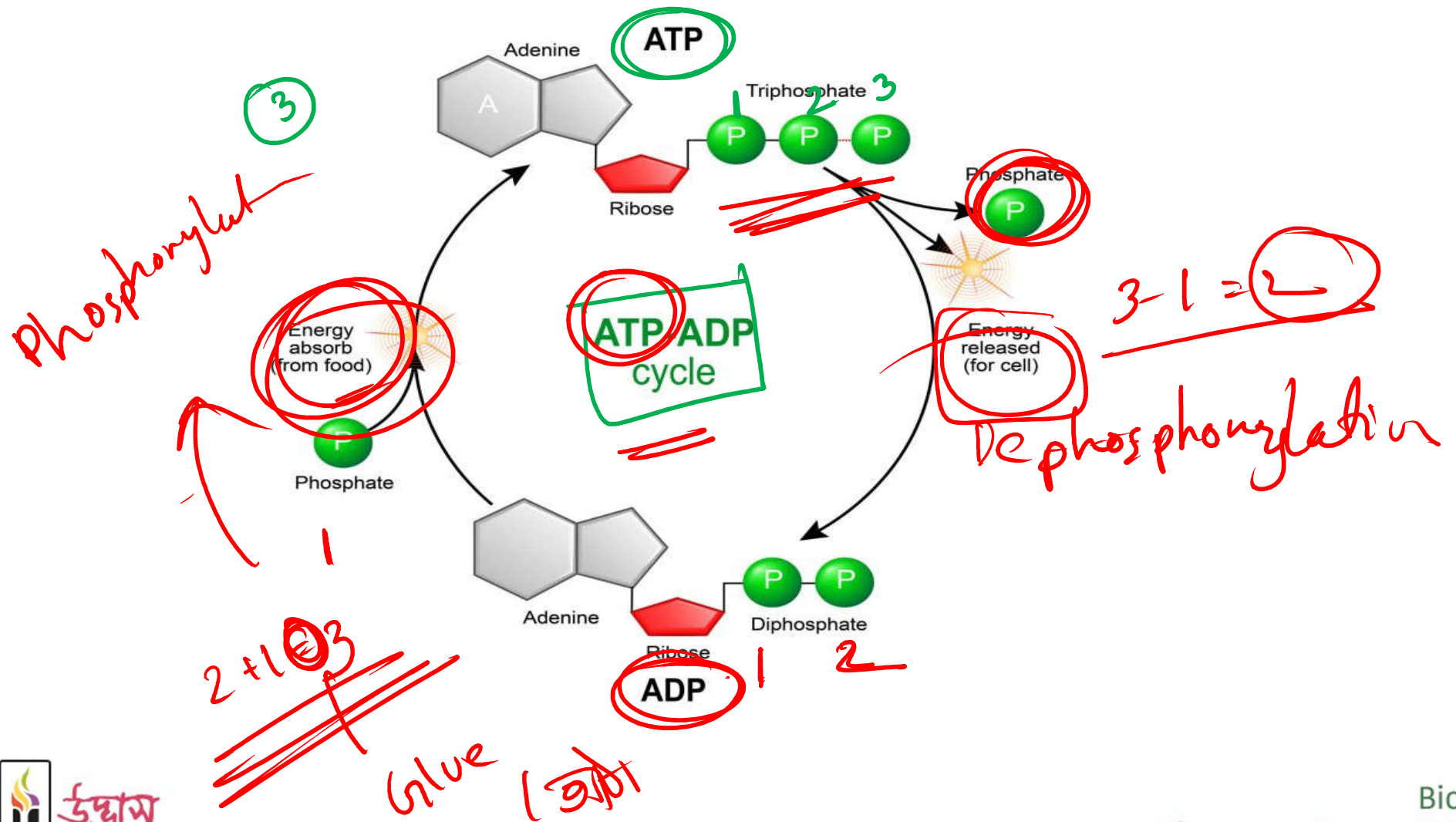


Phosphate addition = Phosphorylation



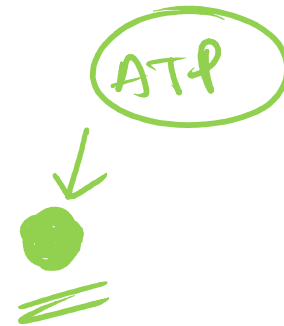
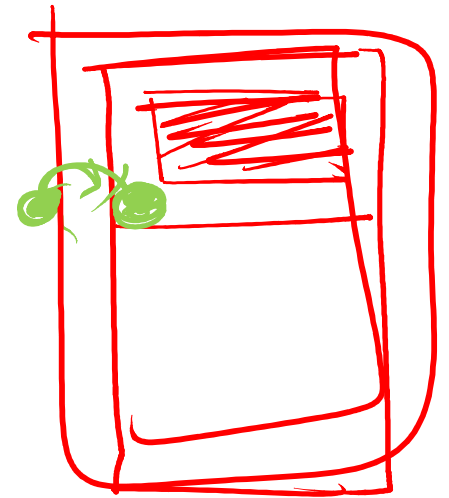
Phosphate destruction = Dephosphorylation



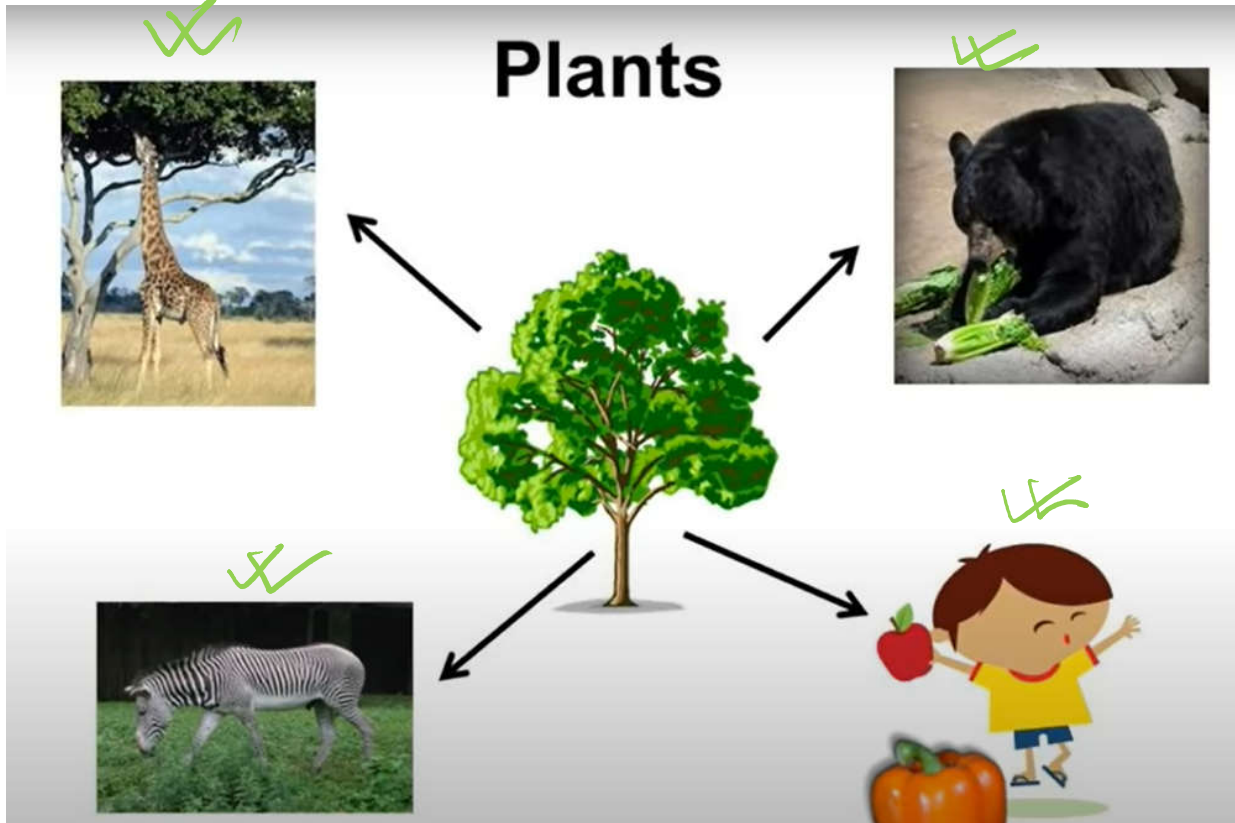


## Energy Coin...

Energy Coin  
Biological Coin  
(2)



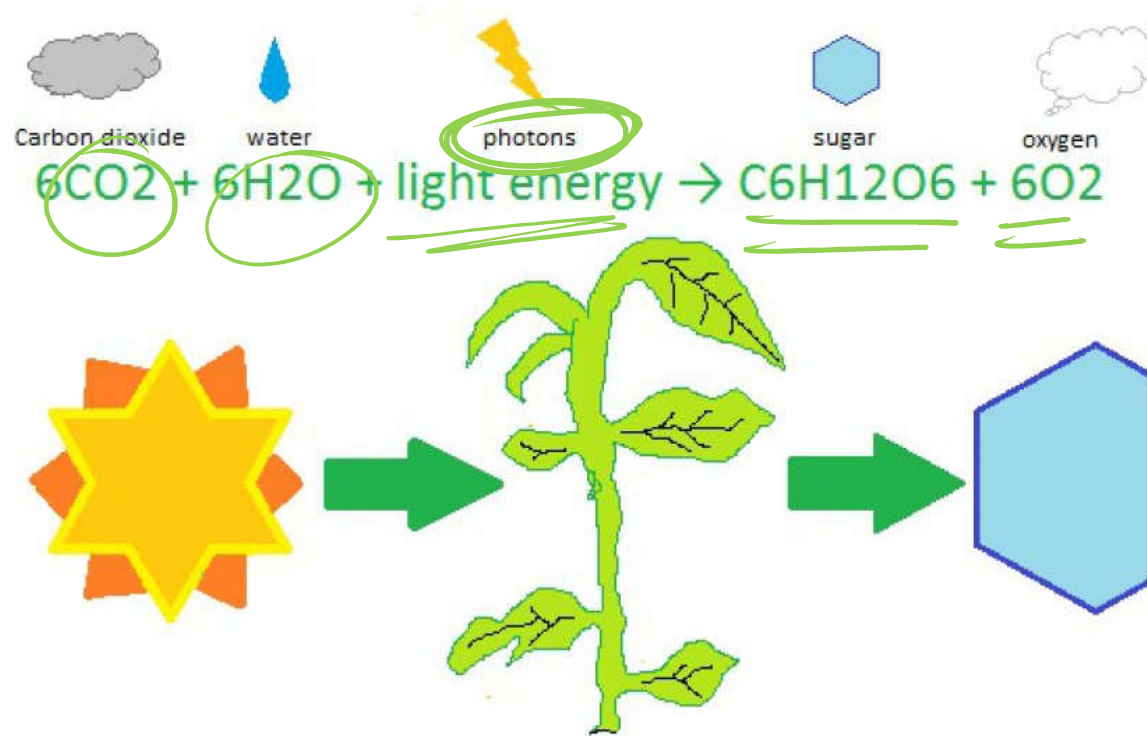
Light → Photosynthesis → produce



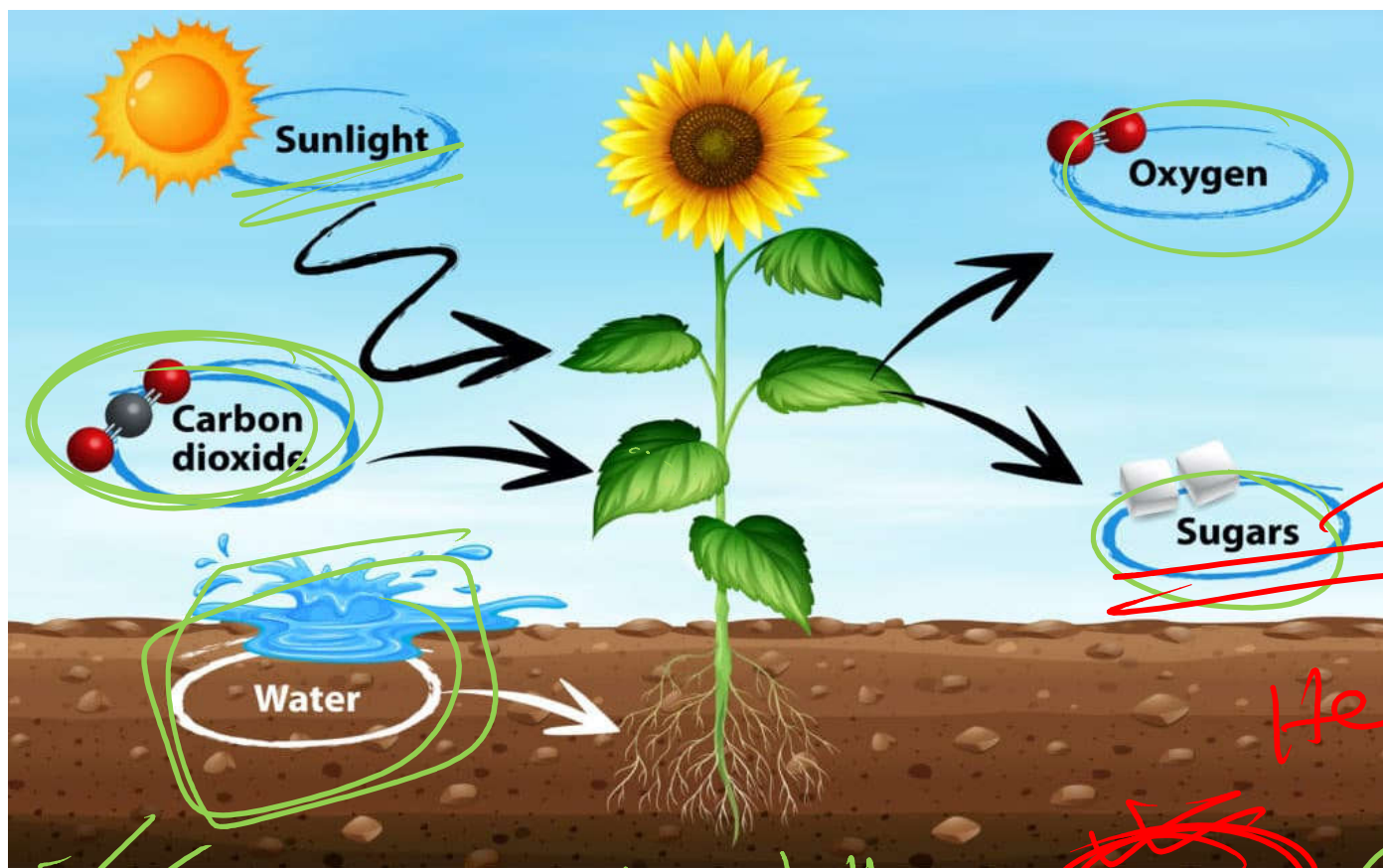
Food  
⇓

Carbohydrate

# Photosynthesis

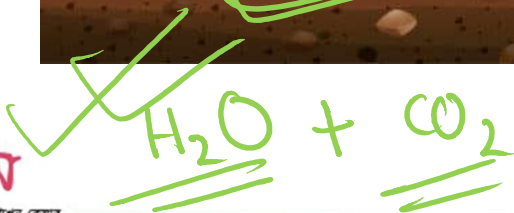


## Process of Photosynthesis

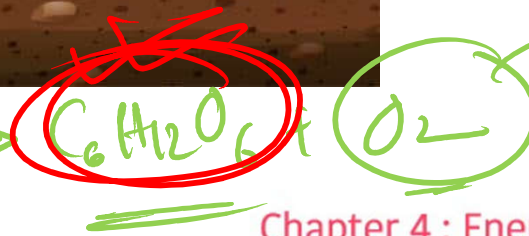


উদ্ভাস

একাডেমিক এন্ড এডমিশন কোয়ার্টার



Chlorophyll  
Sunlight



Hexose

6C

Biology

Chapter 4 : Energy For Life

## Organ of Photosynthesis

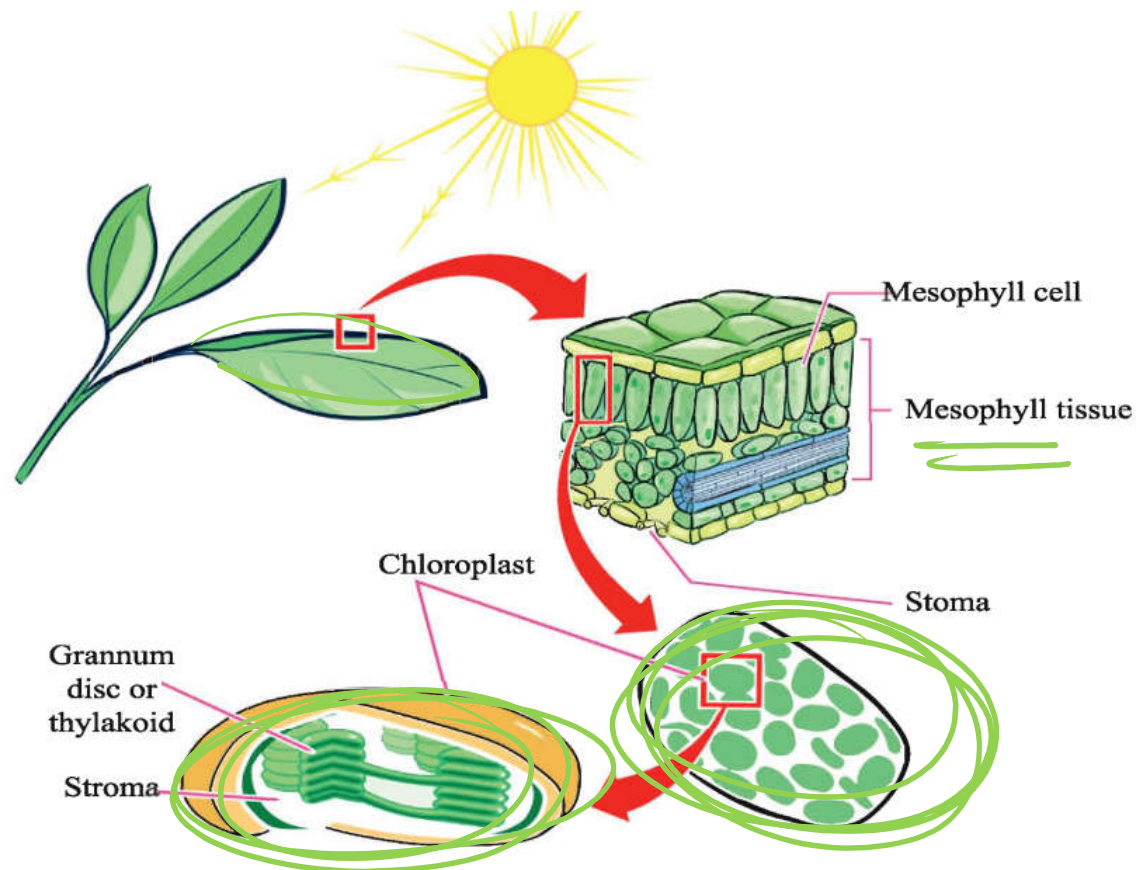
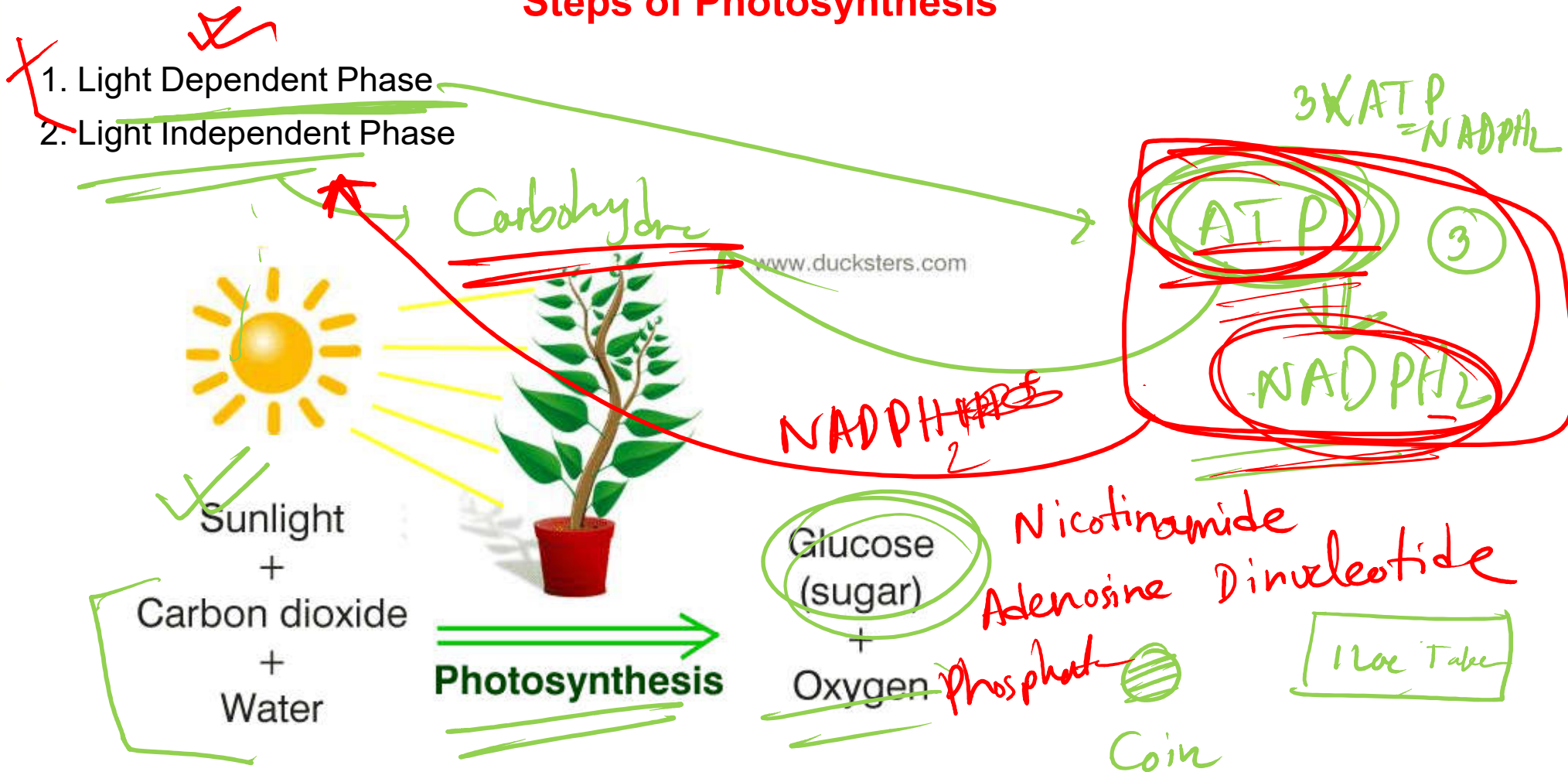
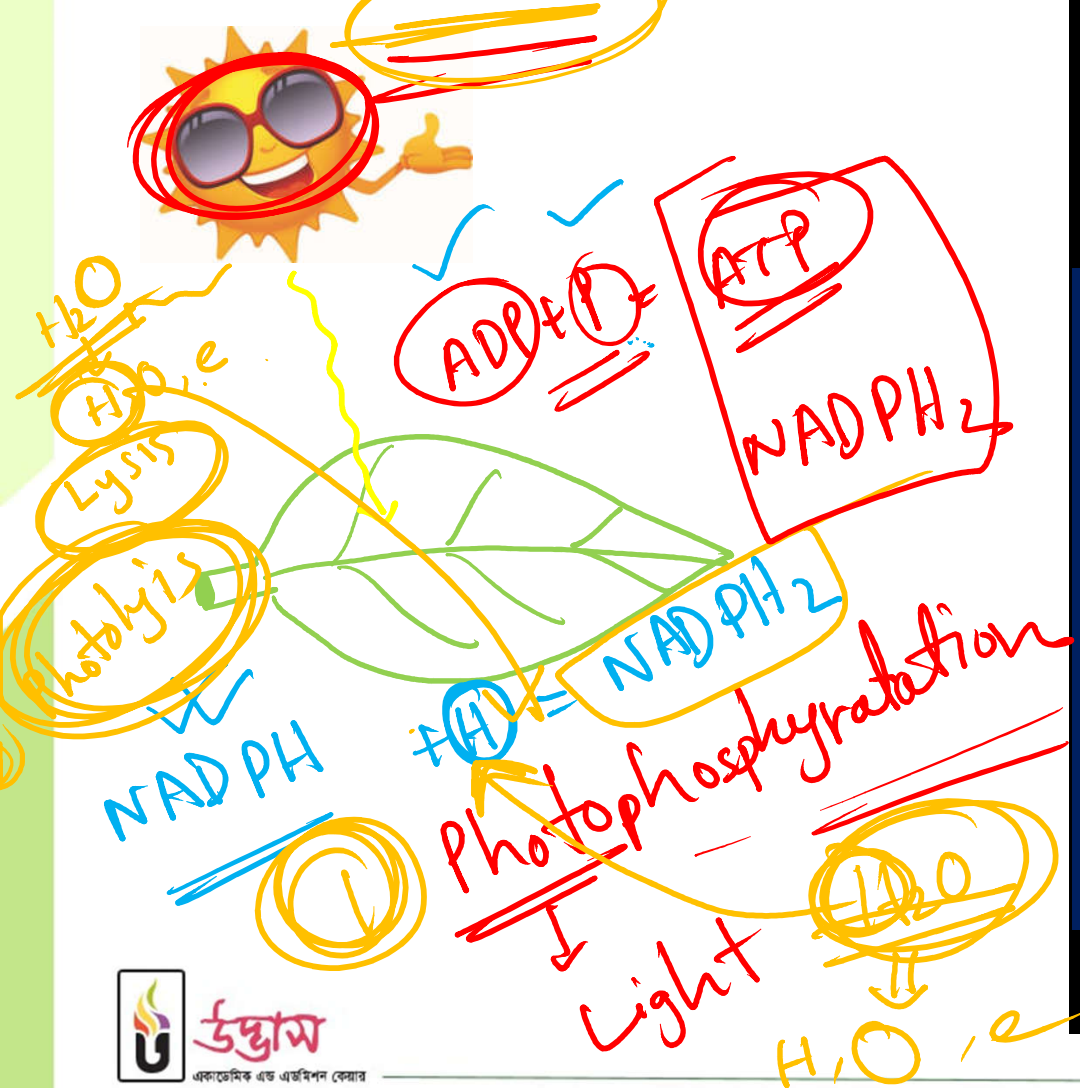


Figure: 4.02 Photosynthesis

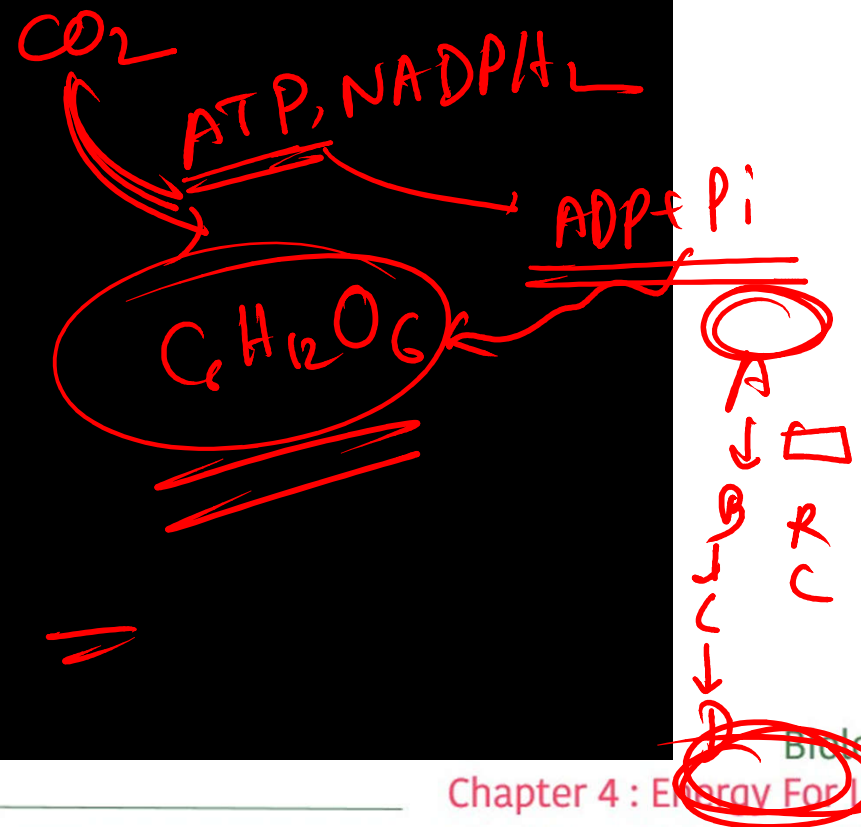
# Steps of Photosynthesis



## Light Dependent Phase



## Light Independent Phase



## Light Dependent Phase

**(1) Light dependent phase:** Light energy is essential in the light dependent phase of photosynthesis. In this phase, solar energy is transformed into chemical energy. Through this process ATP (Adenosine triphosphate) and  $\text{NADPH} + \text{H}^+$  (reduced nicotinamide adenine dinucleotide phosphate) are produced. This converted energy is stored in ATP. Chlorophyll plays a very important role in the

Forma -09, Biology Class-9-10

production of ATP and  $\text{NADPH} + \text{H}^+$ . Chlorophyll molecules absorb photons from light, and with the help of the energy obtained from the photon absorbed, ATP is formed through the addition of an inorganic phosphate with ADP. The process of the formation of ATP is called photophosphorylation.

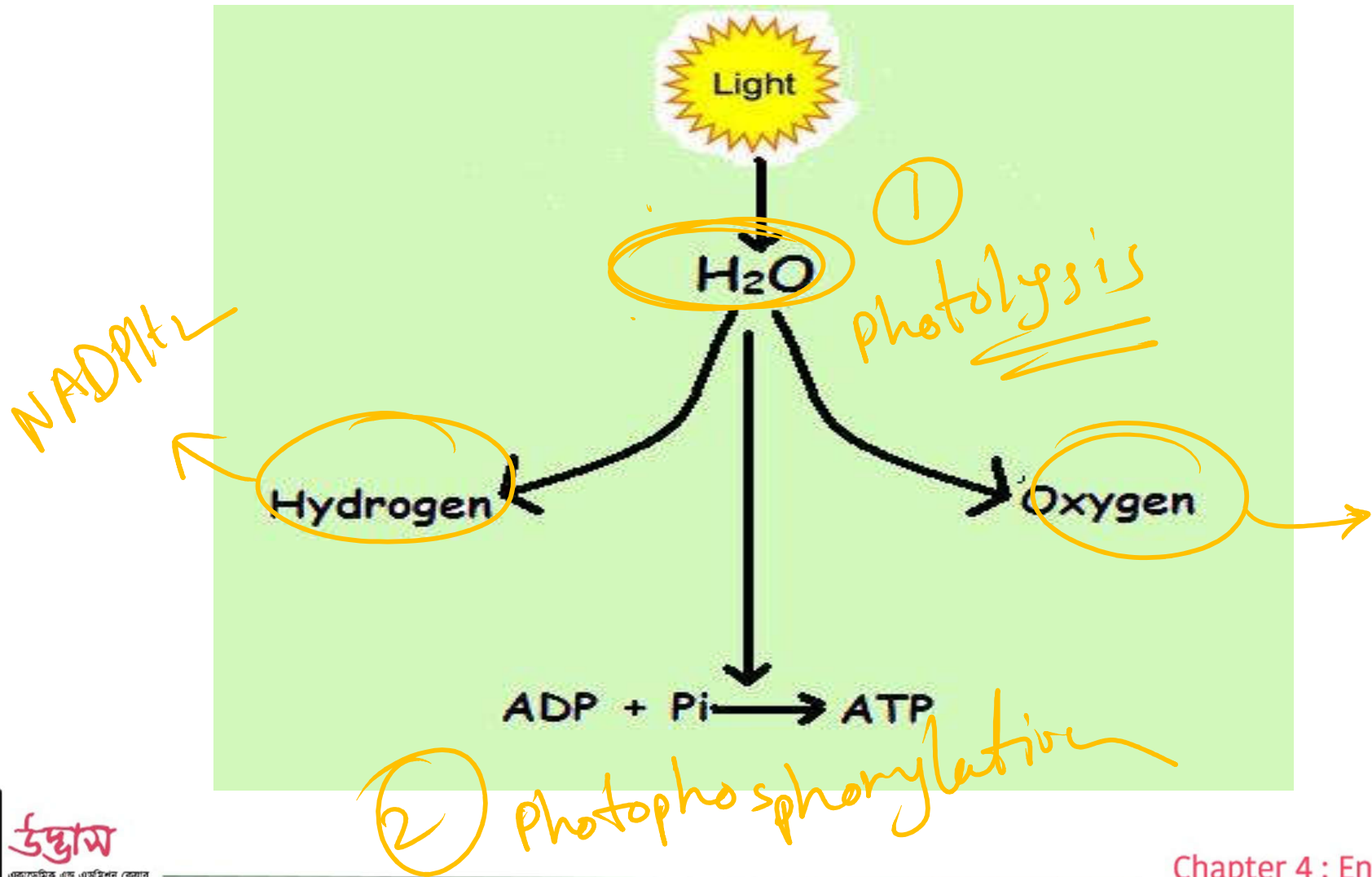
ADP + P → ATP



Oxygen, hydrogen and electrons are released through the hydrolysis of water with the help of sunlight and chlorophyll. The process is called the photolysis of water.

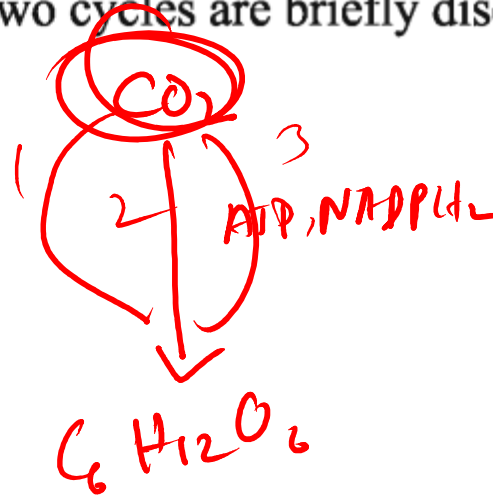
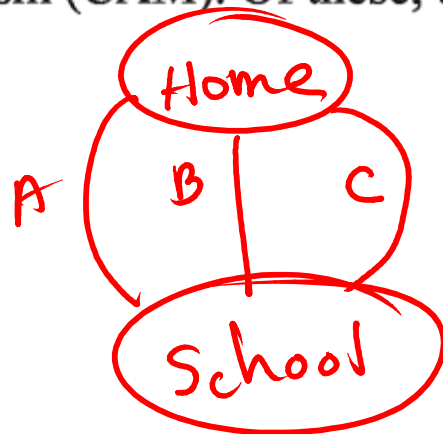
ATP is produced through the process of photophosphorylation. The electrons reduce NADP, and produce  $\text{NADPH} + \text{H}^+$ . This process of producing ATP and  $\text{NADPH} + \text{H}^+$  is called assimilatory power.

## Photolysis of Water



## Light independent phase

(2) **Light independent phase or dark phase:** No light is directly required in the light independent phase, although the process can be carried out in presence of light. Atmospheric  $\text{CO}_2$  enters the cells through the stomata of the leaves. In this phase, carbohydrates are produced by the reduction of  $\text{CO}_2$  with the help of ATP and  $\text{NADPH} + \text{H}^+$  that was produced in the light phase. In green plants, the pathways of  $\text{CO}_2$  reduction have been identified, and they are briefly discussed here: (a) Calvin cycle (b) Hatch & Slack pathway and (c) Crassulacean acid metabolism (CAM). Of these, the first two cycles are briefly discussed below.



## Figure At a Glance

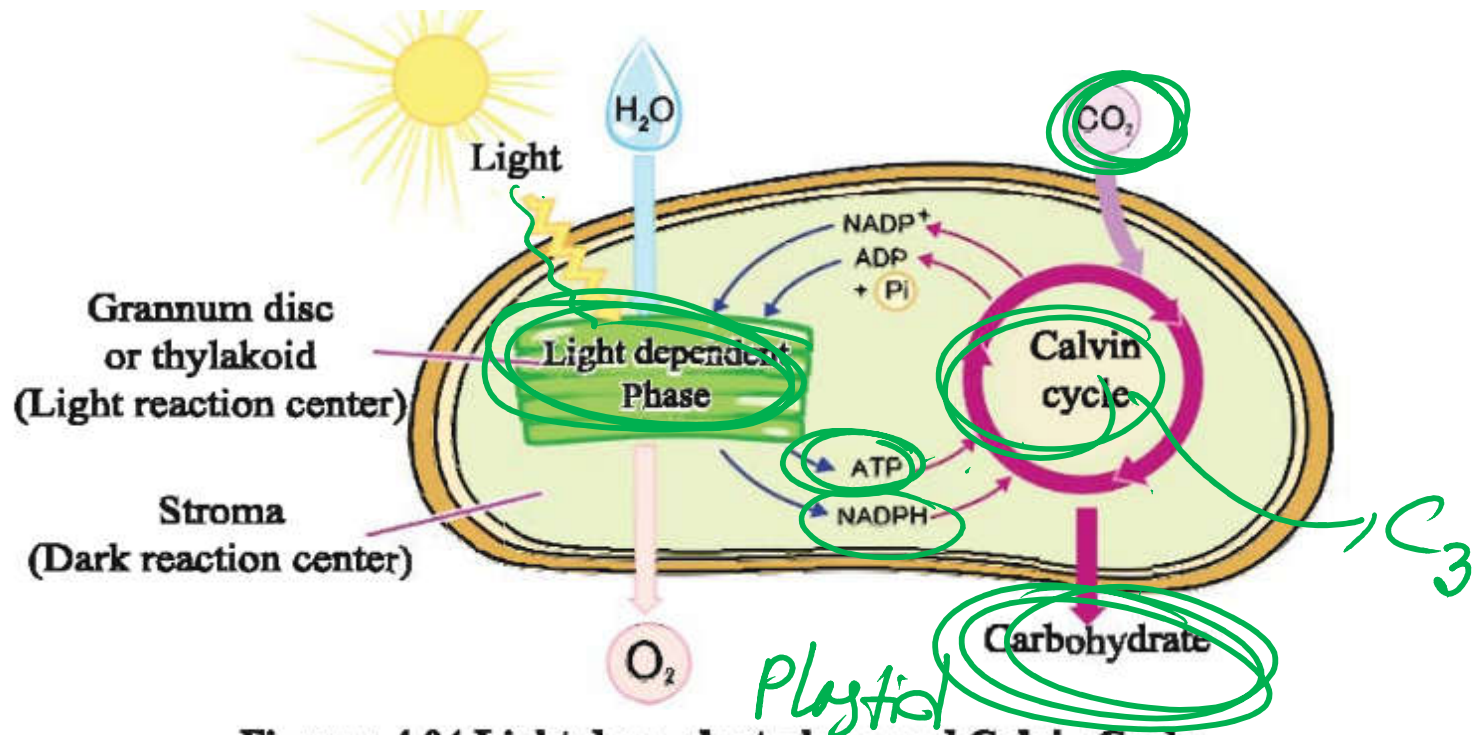
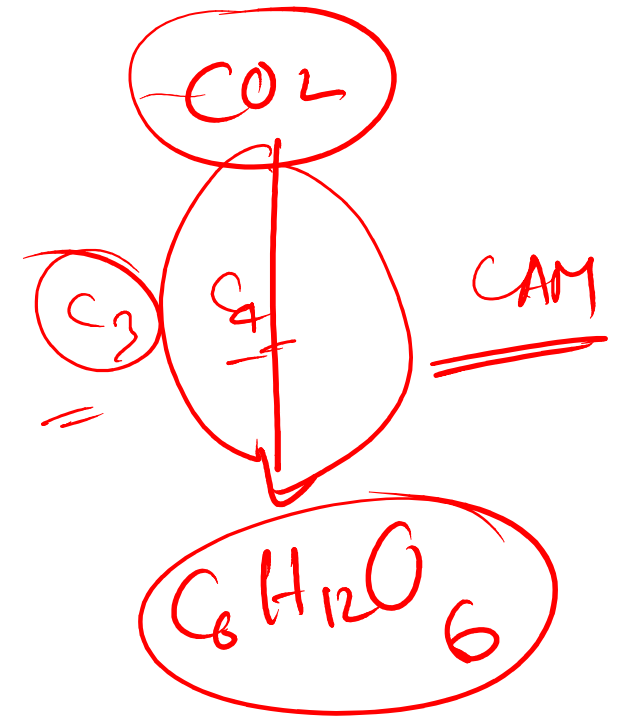
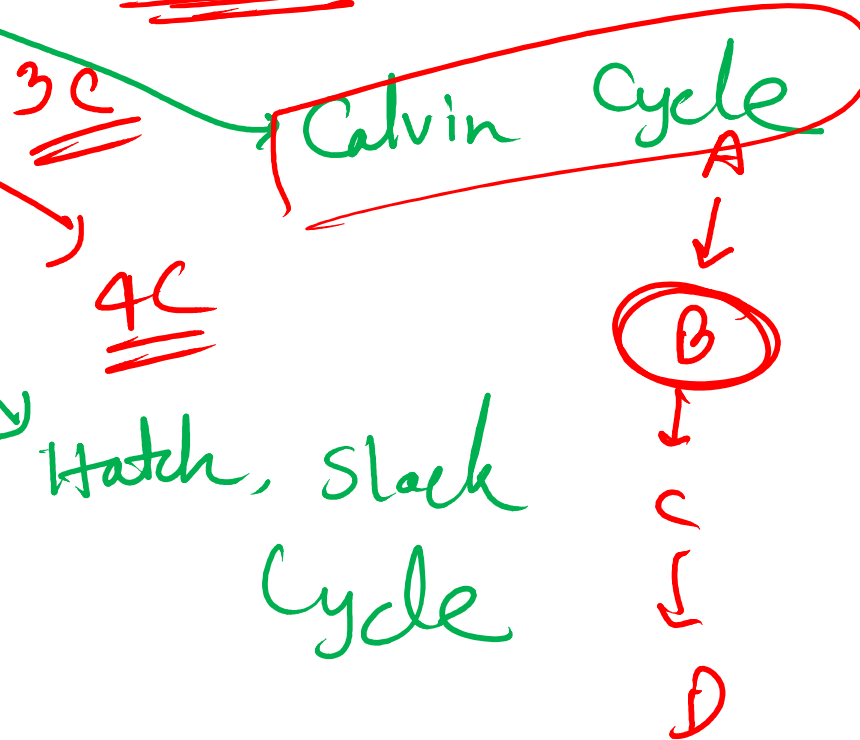
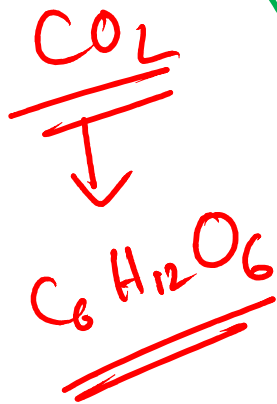


Figure : 4.04 Light dependent phase and Calvin Cycle

## Reduction of Carbon

There are 3 cycles or process:

1. C3 cycle
2. C4 cycle
3. CAM process



## C3 & C4 Comparison

C3 cycle <i>Less</i>	C4 cycle <i>High</i>
1. Calvin, Bassham, Benson invented it.	1. C.R Slack, M.D. Hatch invented it.
2. First stable substance is 3 carbon Phosphoglyceric Acid. <i>C<sub>3</sub>H<sub>7</sub>O<sub>7</sub>P</i>	2. First stable substance is 4 carbon Oxaloacetic Acid. <i>C<sub>4</sub>H<sub>4</sub>O<sub>5</sub></i>
3. Photosynthesis rate is low.	3. Photosynthesis rate is high.
4. Maximum plants undergoes this pathway. <i>Mango</i>	4. Maize, sugarcane, motha grass, amaranthus.
5. In a C3 plant, only C3 cycle occurs.	5. In a C4 plant, both C3 and C4 cycle occurs.

*3 < 4  
less more/high*

## C3 Plant

Mango



## C4 Plants



Amaranthus



Metha

## Effect of light in Photosynthesis

### 4.2.3 Role of Light in Photosynthesis

The importance of light in photosynthesis is immense. For the production of carbohydrates from  $H_2O$  and  $CO_2$ , the source of required energy is light. Sunlight



৭

VIBGYOR ✓✓

68

Biology

also takes part in the development of chlorophyll. With sunlight and when stomata are open,  $CO_2$  can enter the leaves, and take part in the production of food. But only a small proportion of the light falling on the leaf, falling on leaf, is used in photosynthesis. Red, blue, orange and purple portions of the visible spectrum function better than that of green and yellow in the process of photosynthesis. The rate of photosynthesis increases with the increase of light upto a definite limit. If the amount of light increases too much, enzymes disintegrate and cause the production of chlorophyll to reduce. Consequently the rate of photosynthesis also decreases. Photosynthesis, generally, is carried out well with light of wavelength between 400nm-480nm and 680nm.



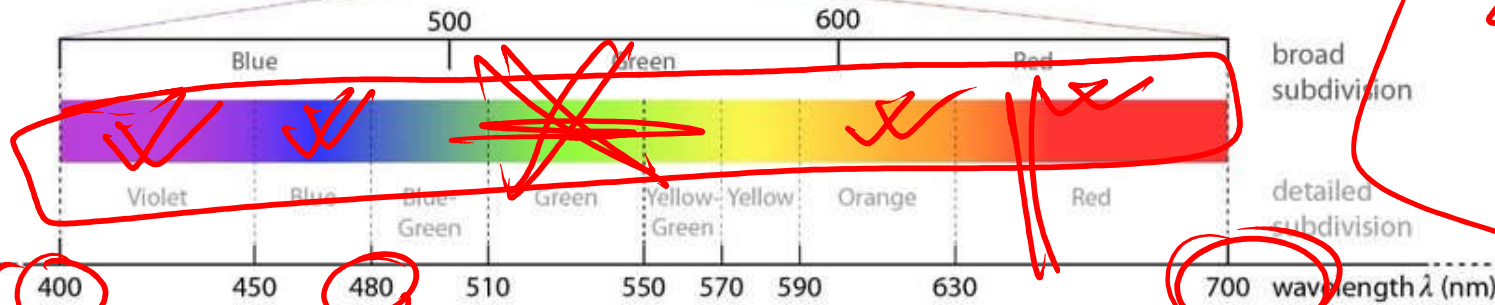
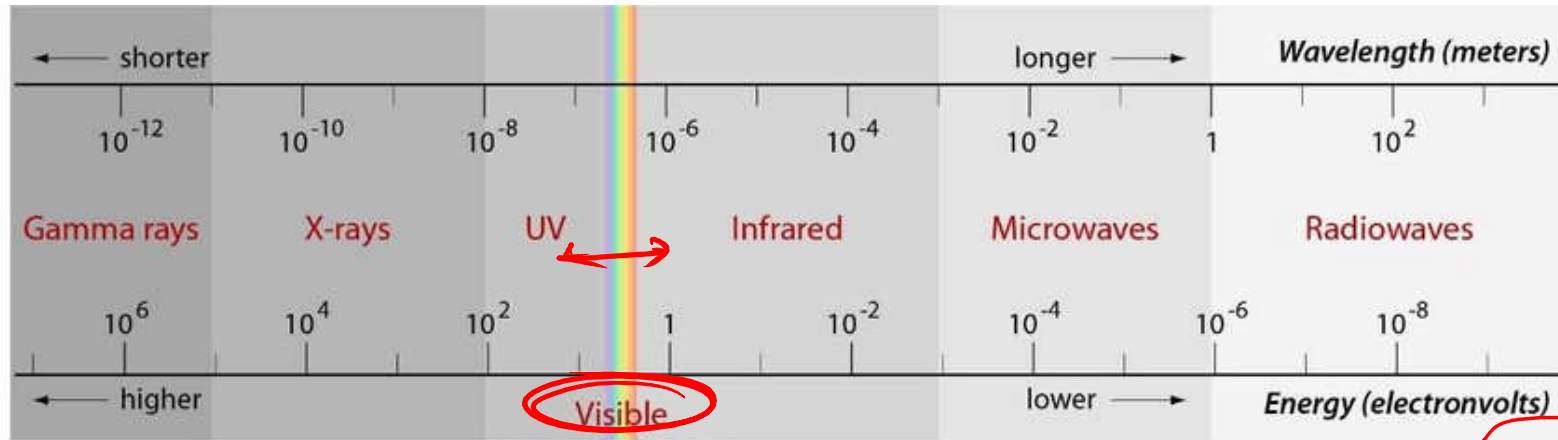
উদ্ভাস

একাডেমিক এন্ড এডমিশন কোয়ার্টার

Biology

Chapter 4 : Energy For Life

# Concept of Light Spectrum



400-480 nm  
680 nm

① ② ③ ④ ⑤ ⑥ ⑦ ⑧ ⑨ ⑩ ⑪ ⑫ ⑬ ⑭ ⑮ ⑯ ⑰ ⑱ ⑲ ⑳ ㉑ ㉒ ㉓ ㉔ ㉕ ㉖ ㉗ ㉘ ㉙ ㉚ ㉛ ㉜ ㉝ ㉞ ㉟ ㊱ ㊲ ㊳ ㊴ ㊵ ㊶ ㊷ ㊸ ㊹ ㊺ ㊻ ㊼ ㊽ ㊾ ㊿

Spectrum

লেগে থাকো সৎ ভাবে,  
স্বপ্ন জয় তোমারই হবে।



উদ্ভাস

একাডেমিক এন্ড এডমিশন কেন্দ্র

[www.udvash.com](http://www.udvash.com)