BOTANY (GENERAL)
Paper: E 401 (Theory)
(Plant Physiology and Biochemistry)

Write any one assignment of the following

ASSIGNMENT: 1. Definition, types, structure of stomata. Mechanism of opening and closing of stomata. Marks-10

ASSIGNMENT: 2. What is Growth and growth hormones? Discuss about their Practical applications. Marks-10

ASSIGNMENT: 3. Photosynthesis: Discuss Dark phase: calvin cycle (C3), Hatch and Slack cycle (C4) and Crassulacean Acid Metabolism (CAM).

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INTERNAL ASSESSMENT-10 MARKS

Answer any five of the following. Marks -2 each

1. What is root pressure theory?
2. What is the difference between cyclic and non cyclic photophoshorylation ?
3. Photosynthesis and respiration are reverse process. explain.
4. Explain the role of hormone in weed control.
5. Explain the mechanism of Mass flow or munch hypothesis.
6. Write importance of Essential macro elements in plants.
7. Explain the process of Glycolysis.
8. Explain mechanism and mode of enzyme action.
9. What is vernalization and devernalization?

SEND TO : [Write in brief (short) as possible]

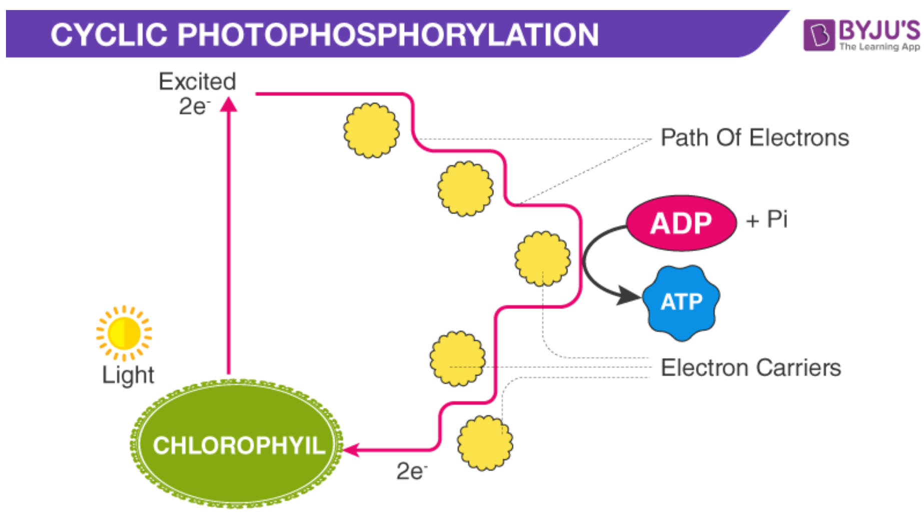
Dr Bipul Saikia, Email : bipul_sai@yahoo.com (within 15 days from date of uploading)

SOME HINTS:

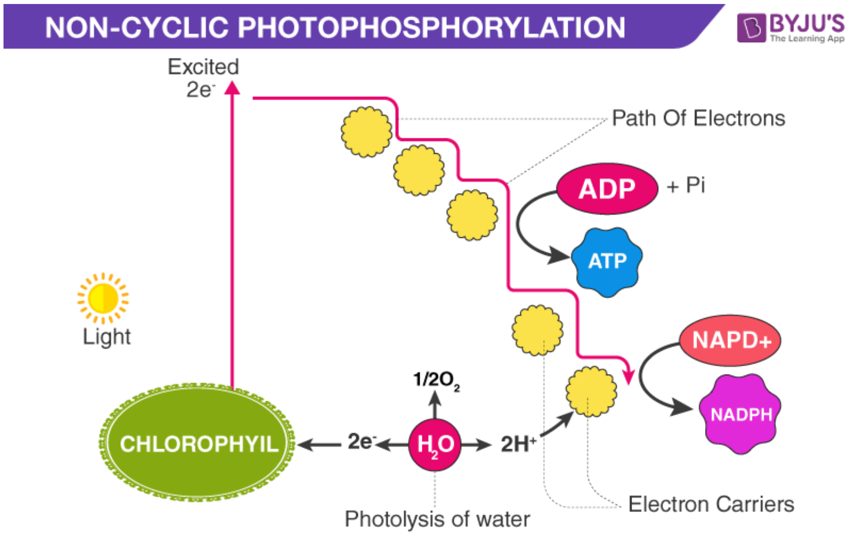
PHOTOPHOSPHORYLATION

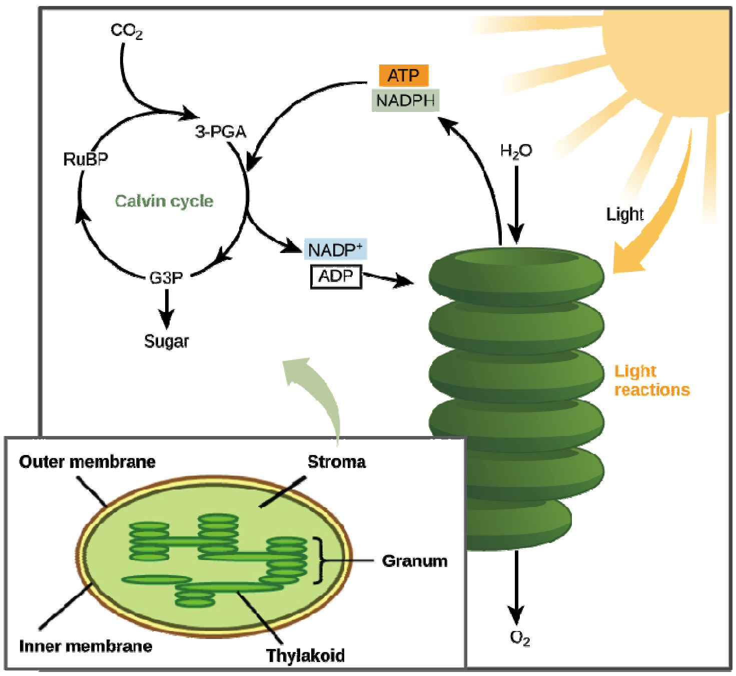
Photophosphorylation is the process of utilizing light energy from photosynthesis to convert ADP to ATP. It is the process of synthesizing energy-rich ATP molecules by transferring the phosphate group into ADP molecule in the presence of light.

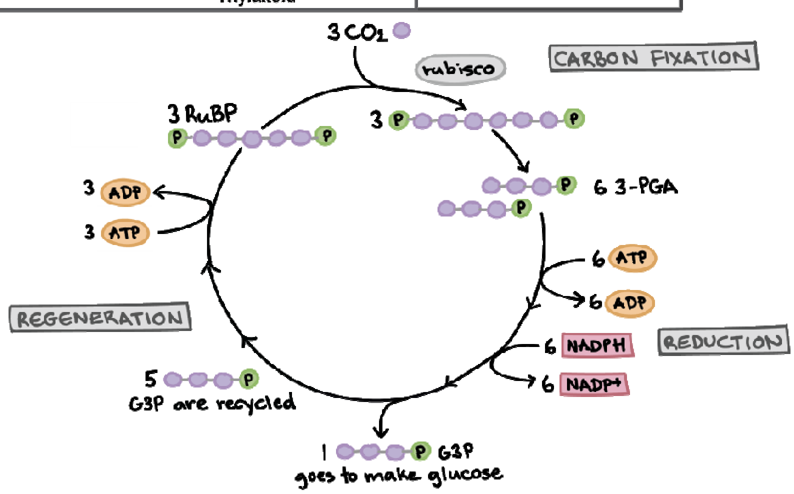
The photophosphorylation process which results in the movement of the electrons in a cyclic manner for synthesizing ATP molecules is called cyclic photophosphorylation.



The photophosphorylation process which results in the movement of the electrons in a non-cyclic manner for synthesizing ATP molecules using the energy from excited electrons provided by photosystem II is called non-cyclic photophosphorylation.


NON-CYCLIC PHOTOPHOSPHORYLATION
BYJU'S
The Learning App
Excited
2e-
Path Of Electrons
ADP
+ Pi
ATP
Light
NAPD+
NADPH
1/2O2
CHLOROPHYIL
2e-
H2O
2H+
Photolysis of water
Electron Carriers


CO2
ATP
NADPH
3-PGA
RuBP
H2O
Calvin cycle
Light
NADP+
ADP
G3P
Sugar
Light
reactions
Outer membrane
Stroma
Granum
Inner membrane
Thylakoid
O2

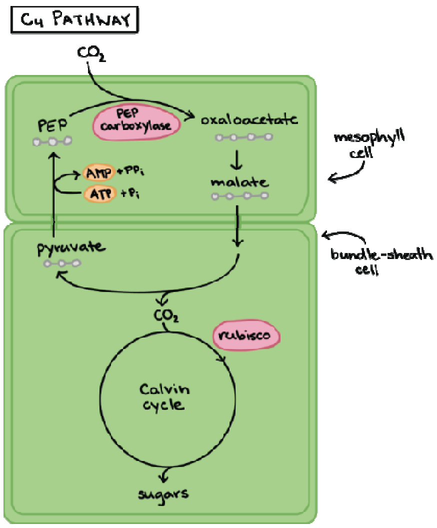

3 CO2
rubisco
CARBON FIXATION
3 RuBP
3
6 3-PGA
3 ADP
3 ATP
6 ATP
6 ADP
REGENERATION
6 NADPH
REDUCTION
6 NADP+
5
G3P are recycled
1 G3P
goes to make glucose

Summary of Calvin cycle reactants and products

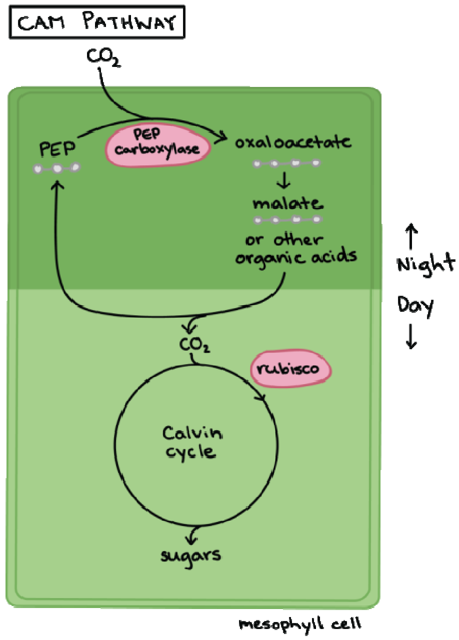
Three turns of the Calvin cycle are needed to make one G3P molecule that can exit the cycle and go towards making glucose. Let's summarize the quantities of key molecules that enter and exit the Calvin cycle as one net G3P is made. In three turns of the Calvin cycle:

- **Carbon.** 3 Co2 combine with 3 RuBP acceptors, making 6 molecules of glyceraldehyde-3-phosphate (G3P).
- 1 G3P molecule exits the cycle and goes towards making glucose.
- 5 G3P molecules are recycled, regenerating 3 RuBP acceptor molecules.
- **9** ATP are converted to 9 ADP (6 during the fixation step, 3 during the regeneration step).
- **6** NADPH are converted to 6 NADP +start superscript, plus, end superscript (during the reduction step).
- A G3P molecule contains three fixed carbon atoms, so it takes two G3Ps to build a six-carbon glucose molecule. It would take six turns of the cycle, or 6 CO2 , 18 ATP, and 12NADPH, to produce one molecule of glucose.

C4 CYCLE:



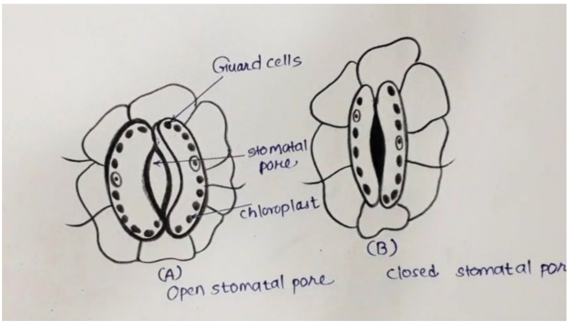
CAM:



Comparison of C_3, C_4, and CAM plants

C3 plants	C4 plants	CAM plants
Most plants	Tropical grasses like corn, sugarcane	Succulents, pineapple, agave
Fix carbon in Calvin cycle - attach CO_2 to RuBP	Fix carbon in cytoplasm - attach CO_2 to PEP	Fix carbon at night only, fix it to organic molecules
Enzyme - Rubisco	Enzyme – PEP-ase	Enzyme – PEP-ase
Most energy efficient method	1/2 way between these two	Best water conservation
Loses water through photorespiration	Loses less water ←→	Loses least water

THE OPENING AND CLOSING OF STOMATA:



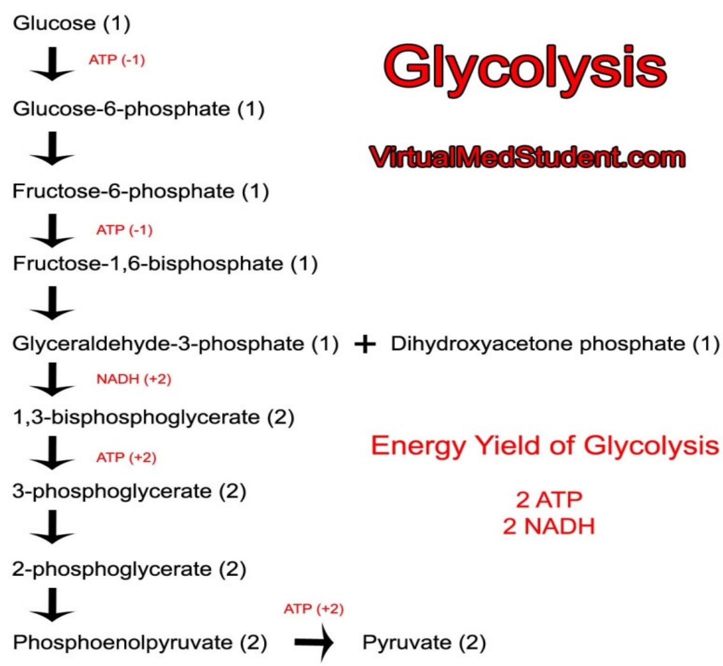
The opening and closing depends upon the turgor pressure in the guard cells. The swelling of guard cells due to absorption of water causes opening of stomatal pores while shrinking of guard cells closes the pores. Opening and closing of stomata occurs due to turgor changes in guard cells. When guard cells are turgid, stomatal pore is open while in flaccid conditions, the stomatal aperture closes. There are other theories which explains the opening and the closing of the stomatal pore.

Concentration of CO_2 hypothesis by Bonner and Galston:
Bonner and Galston have proposed the following mechanism of opening and closing of stomata. This depends upon the concentration of the carbon dioxide (CO_2) found in the stomatal chamber and not upon the presence or absence of light.
Normally .03% of carbon dioxide is found in the atmosphere, and when the density of the CO_2 in the sub-stomatal chamber also remains .03%, then the guard cells become flaccid and the stomata closed. As the density of CO_2 retards gradually, the stoma begins to open and it opens gradually lengthwise until the density of CO_2 becomes .01%. Now the stomata are perfectly open and they are not open further beyond this density.

Active Potassium (K+) Theory:

Role of potassium K+ in stomatal opening is now universally accepted. This was observed for the first time by Fujino (1967) that opening of stomata occurs due to the influx of K^+ ions into the guard cells.
The sources of K^+ ions are nearby subsidiary and epidermal cells, thereby increasing the concentration from 50 mM to 300 mM in guard cells. The increase in K^+ ions concentration increases the osmotic concentration of guard cells thus leading to stomatal opening. The uptake of potassium K^+ controls the gradient in the water potential.

GLYCOSIS



Overview

Glycolysis breaks down glucose molecules. In the process the energy rich molecules ATP and NADH are formed. It is regulated at several enzymatic steps, most importantly at the enzyme phosphofructokinase-1. Pyruvate can be further metabolized to acetyl-CoA.

MASS FLOW:

Mass flow is the movement of dissolved nutrients into a **plant** as the **plant** absorbs water for transpiration. The process is responsible for most transport of nitrate, sulfate, calcium and magnesium. Diffusion is the movement of nutrients to the root surface in response to a concentration gradient.

MUNCH'S MASS FLOW OR PRESSURE FLOW HYPOTHESIS:

The movement of organic food materials or the solutes in soluble from one place to another in higher plants is called as translocation of organic solutes.

Mechanism of Translocation through Phloem:

Various theories have been put forward to explain the mechanism of phloem conduction but they are not fully satisfactory. Among them Munch's (1930) hypothesis is most convincing.

Munch's Mass Flow or Pressure Flow Hypothesis:

According to this hypothesis put forward by Munch (1930) and elaborated by Craft (1938) and others, the translocation of organic solutes takes place en mass through phloem along a gradient of turgor pressure from the region of higher conc. of soluble solutes i.e., supply end to the region of lower conc. i.e., consumption end. The principle involved in this hypothesis can be explained by a simple physical system

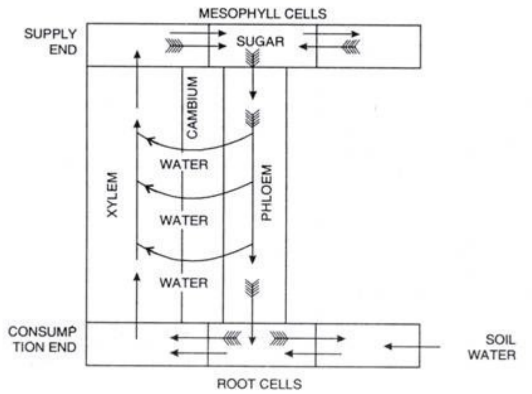


Fig. 15.4. Diagram to illustrate the mechanism of solute translocation according to the Munch's hypothesis.

VERNALIZATION AND DEVERNALIZATION

Vernalization is the artificial exposure of plants to low temperatures to stimulate flowering or enhance seed production. Reversal of the effect of **vernalization** is called **devernalization**. Subjecting the plants to the higher temperature after a cold treatment brings about **devernalization**.