

Subject:

عنوان الدرس:

Date:

الموافق:

التاريخ:

Chp # 4 Bioenergetics

Bio → life → All living things
energetic → energy changes

Definition :

Bioenergetics is the process in which one form of energy is changed into another form by living things.

one form $\xrightarrow{\text{change}}$ 2nd $\rightarrow$ 3rd form

↳ photosynthesis

↳ respiration

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Sun is ultimate energy for life. (form of solar energy) 98 - 99% wast

1 - 2 % absorb by living things

↳ wasted stratosphere ozone

$O_2 \rightarrow O_3$

allotrophic form.

(harmful) radiation

are gone to stratosphere

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categorize of living things :

- ① photosynthetic
- ② cyanobacteria
- ③ plants
- ④ Algae (marine)

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plants make :

glucose → chemical energy

→ solar energy converted to chemical energy

All process is photosynthesis.

→ glucose is product

large molecule

glucose

utilize
all living
organisms.

breakdown & may
be a process

cellular
respiration

- ① heat energy
- ② ATP

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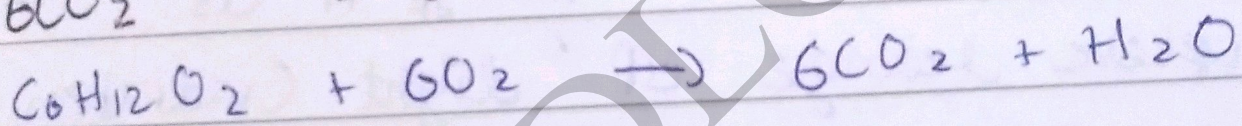
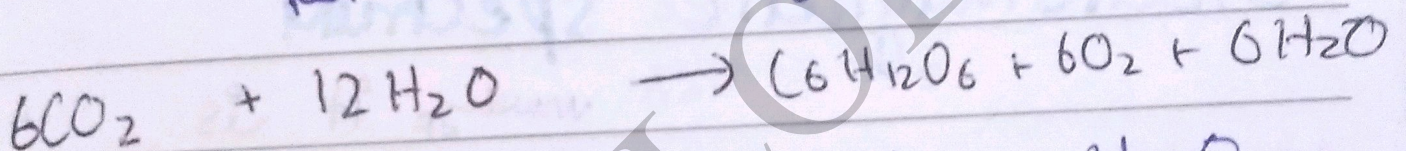
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Ap utilize Krkany energy

By seeing this we can ^{say} ~~conclusion~~
that it change it forms -

formation of glucose



→ Redox reaction



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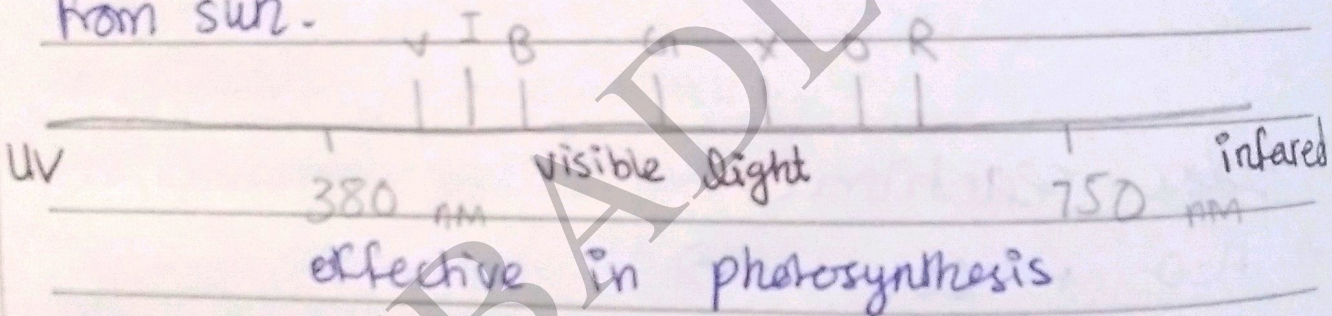
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Electromagnetic spectrum

wavelength of it is

complete range of 'light' (radiation) from sun.



380 below → UV

750 above → infrared

visible light is further divided into 7 colours: VIBGYOR

from UV to infrared this whole range is called electromagnetic spectrum.

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(For knowledge only)

Colour	wavelength	Energy
V	380 - 450	2.75 - 3.75
I	450 - 495	2.48 - 2.5
G	495 - 570	2.50 - 2.75
X	570 - 590	
O	590 - 620	
R	620 - 750	

quantum $\propto \frac{1}{\text{wavelength}}$

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→ Effectiveness of particular wavelength of light depends on its absorption by ~~its~~ the plant body

→ Action spectrum

→ blue and red effective.

- Physical nature
- Electromagnetic spectrum
- effectiveness of diff waves
- Action spectrum

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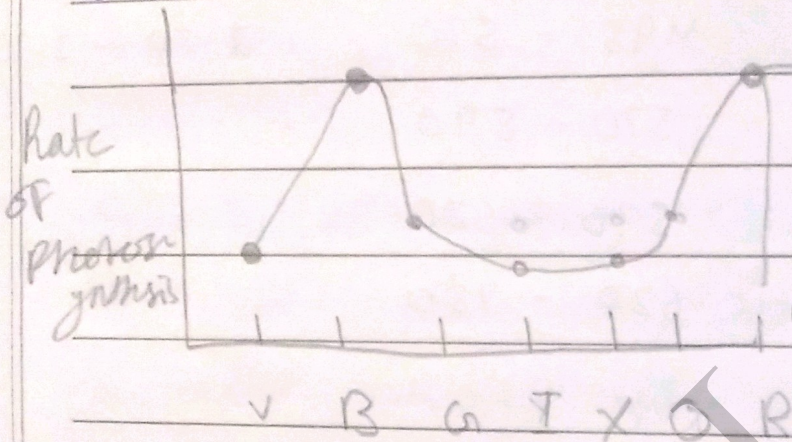
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Action spectrum

After examining the different wavelengths of colours



ek plant ko observe kr kya sari lights mein check kr key.

Def :

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A graph that shows the effectiveness of different wavelength of light for the process of photosynthesis is called Action spectrum.

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Role of carbon dioxide

Concentration of CO_2 & Rate of photosynthesis

CO_2 increase $\rightarrow$ rate of photo increases

conc. CO_2 decrease $\rightarrow$ r.o photosynthesis decrease

$\rightarrow$ conc of CO_2 increases above 1% then rate of photosynthesis will slow down

- Jitni plants ko CO_2 chahye ussay ziada agr CO_2 dein then it slows down
- so or bcz the stomata closes
- water will also be lost present inside. thats why stomata closes so that water can't be lost
- Marine ~~animals~~ plants

attain CO_2 from water - CO_2 is dissolved in water

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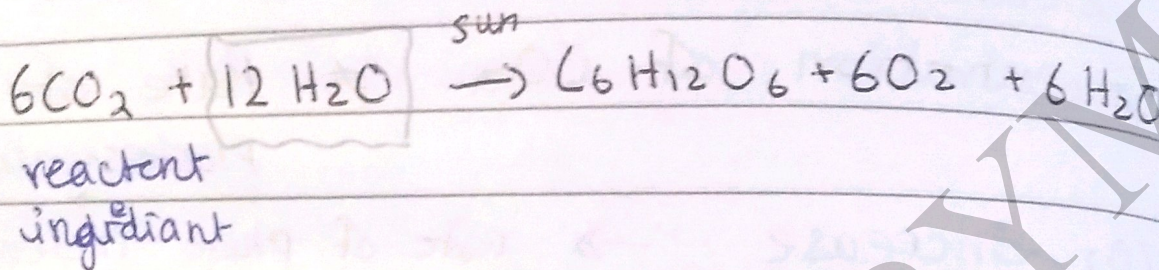
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Role of water



- water has a low reaction energy
- it will also be seen as a product
- water as reducing agent

hydrogen donor

- source of oxygen

- Neils hypothesis

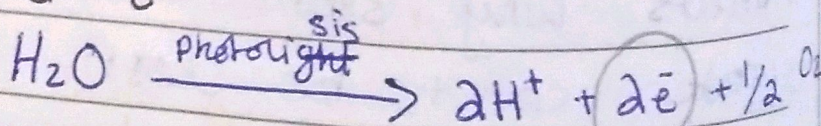
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Photosynthesis $\begin{cases} \rightarrow \text{light dependent} \\ \rightarrow \text{light independent} \end{cases}$ (light reach) (dark)

Light dependent :



Photolysis → breakdown of water in presence of light (sun)

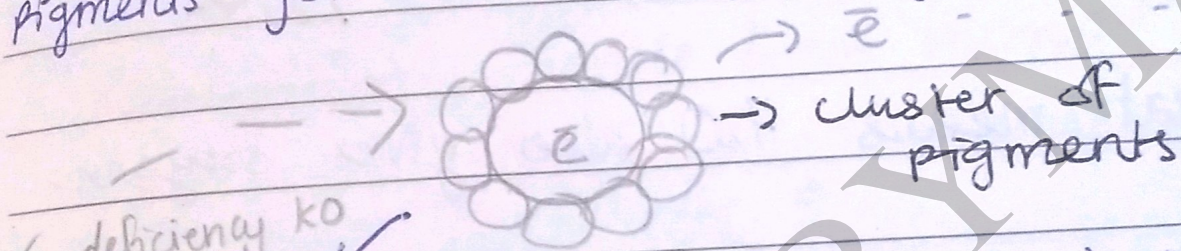
$\frac{1}{2}\text{O}_2 \rightarrow$ cuz O_2 doesn't exist in atomic form

only diatomic form is present

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Light is absorbed by pigments →

Pigments join to form photosystem



Jaisay he light ko absorb krtay hain
photosystem will be oxidized -

e^- will excite (activate) → (chlorophyll)

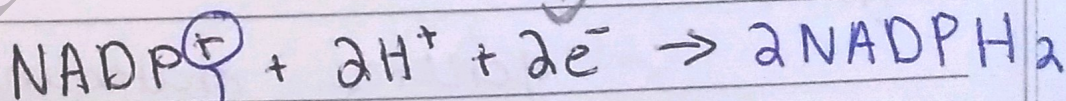
→ H_2O react with pigment
excite (activate) w/ light

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→ coenzyme in plant



electron

Ki Kammi hai

used in 2nd phase

used in dark
reaction.

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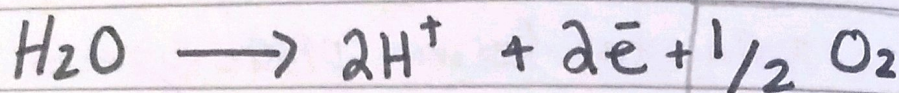
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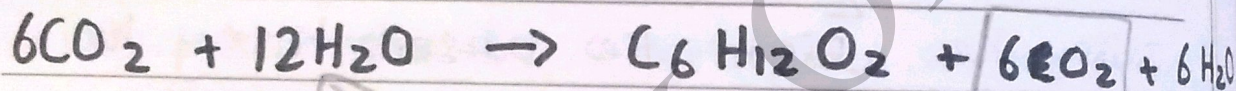
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→ as source of oxygen -



that means H_2O also gives oxygen.



Neil's hypothesis :

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the oxygen is obtained from water not carbon-dioxide.

• in 1930 by van neil

Hypothesis :

general statement that can be true or false

→ water as reducing agent
→ water as source of oxygen

20 sept

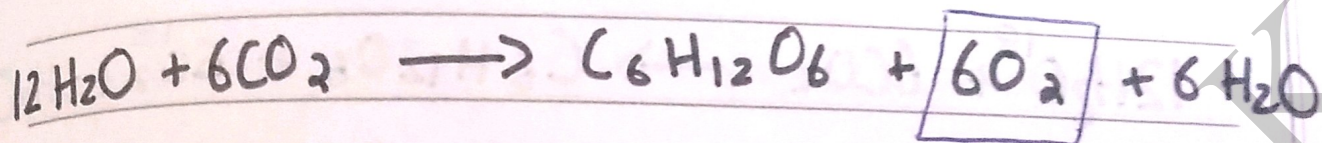
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Hypothesis : oxygen created during photosynthesis comes from H_2O not from CO_2

Base of Neils hypothesis :

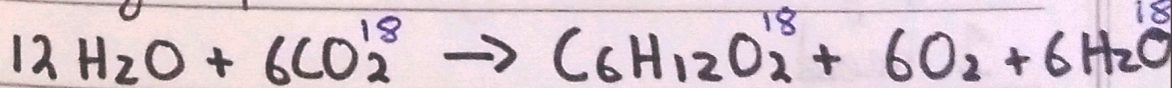
neil's hypothesis was based on photosynthesis in bacteria
 $\text{CO}_2 + \text{H}_2\text{S} \longrightarrow (\text{CH}_2\text{O})_n + \text{S} + \text{H}_2\text{O}$
bacteria perform photosynthesis :

does not produce oxygen ^{Anoxygenic}

→ 1940 ←

Testing :

group # 1 (Plants)



O^{18} → isotope of oxygen

→ they did to test where does O goes in product

→ was correct after testing

→ water as oxygen.

→ other scientist concluded after

him that said it was correct.

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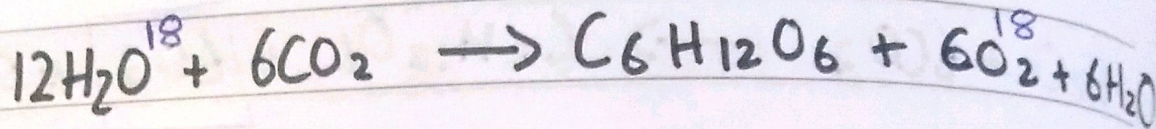
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→ Photosynthetic pigments :

Pigment - Any substance that absorb light

- ① Algae - chlorophyll a, b, c, d, e, peridinin, carotene, xanthophyll.
- ② Bacteria - chlorophyll - a, bacteriochlorophyll
- ③ Higher plants - chlorophyll a, b, carotenoids

Chlorophyll :

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discussing higher plants.
chlorophyll a - bluish green absorb light

1 head

2 tails

long and short tail

long is on 4th pyrrole

short in between 3rd and 4th ring.

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→ Composition ○

→ porphyrin ring (4th pyrrole ring)

→ ~~tail~~ tail → phytyl + propanoic acid

long
→ short

→ methyl ester

→ head → polar and hydrophilic

tail → non-polar and hydrophobic

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function ○

head - light absorbing part

tail - Anchoring point

pigments are present in thylakoid
of chlorophyll -

head is on surface to absorb light

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chlorophyll a

→ contains CH_3 (methyl)
at 2nd pyrrol ring

→ $\text{C}_{55} \text{H}_{72} \text{O}_5 \text{N}_4 \text{Mg}_5$

→ bluish green

→ necessary pigment
directly involved in
light absorption

chlorophyll b

→ CHO (aldehyde)
at 2nd pyrrol ring

→ $\text{C}_{55} \text{H}_{70} \text{O}_6 \text{N}_4 \text{Mg}_5$

→ yellowish green

→ necessary pigment
not absorb
light

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→ every pigment has its own wavelength to absorb

→ Koi pigment jo wavelength absorb karega that will be disappeared

→ reflected light is visible

→ Photon → energy saved

Active centre →

reaction centre → where reactions are done

Q1

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Q- Why chlorophyll is known as access-pigment?

only chlorophyll a can convert into chemical energy

Q- Which is the only [↑] pigment in plant that can convert into chemical energy.

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Absorption spectrum

→ it is graph

→ particular pigment

→ determine by spectrometer

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Q. Difference between Action and absorption spectrum.

→ absorption rate in differ

→ chlorophyll a and b are mostly absor

→ 400 - 470 (Chlo a, b) more absor

→ 330 - 360 (orange red) ↓

Why the absorption spectrum of chlorophyll a and b differ.

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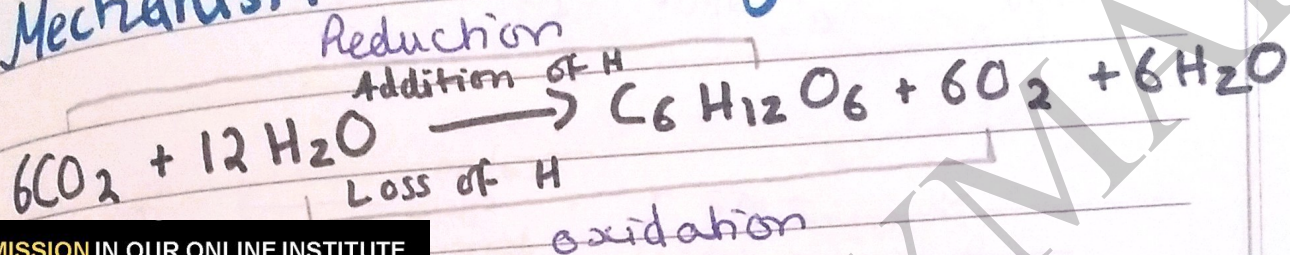
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Mechanism of Photosynthesis



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→ Photosynthesis is a redox reaction

→ photosynthesis is a biochemical process.

energy conversion

Energy poor molecules $\xrightarrow{\text{convert}}$ energy rich molecules

CO_2 water $\text{C}_6\text{H}_{12}\text{O}_6$

light dependent phase

light independent

• light reaction

• Dark reaction

• doesn't requires light

• requires light

• makes product

• product to utilize

• light is absorbed

• production of

in this process

• CO_2 into G3P by

• conversion of light energy into chemical energy

utilizing the ATP produced in light reaction -

• This reactions take place in granum region.

• This reaction takes place in stroma region.

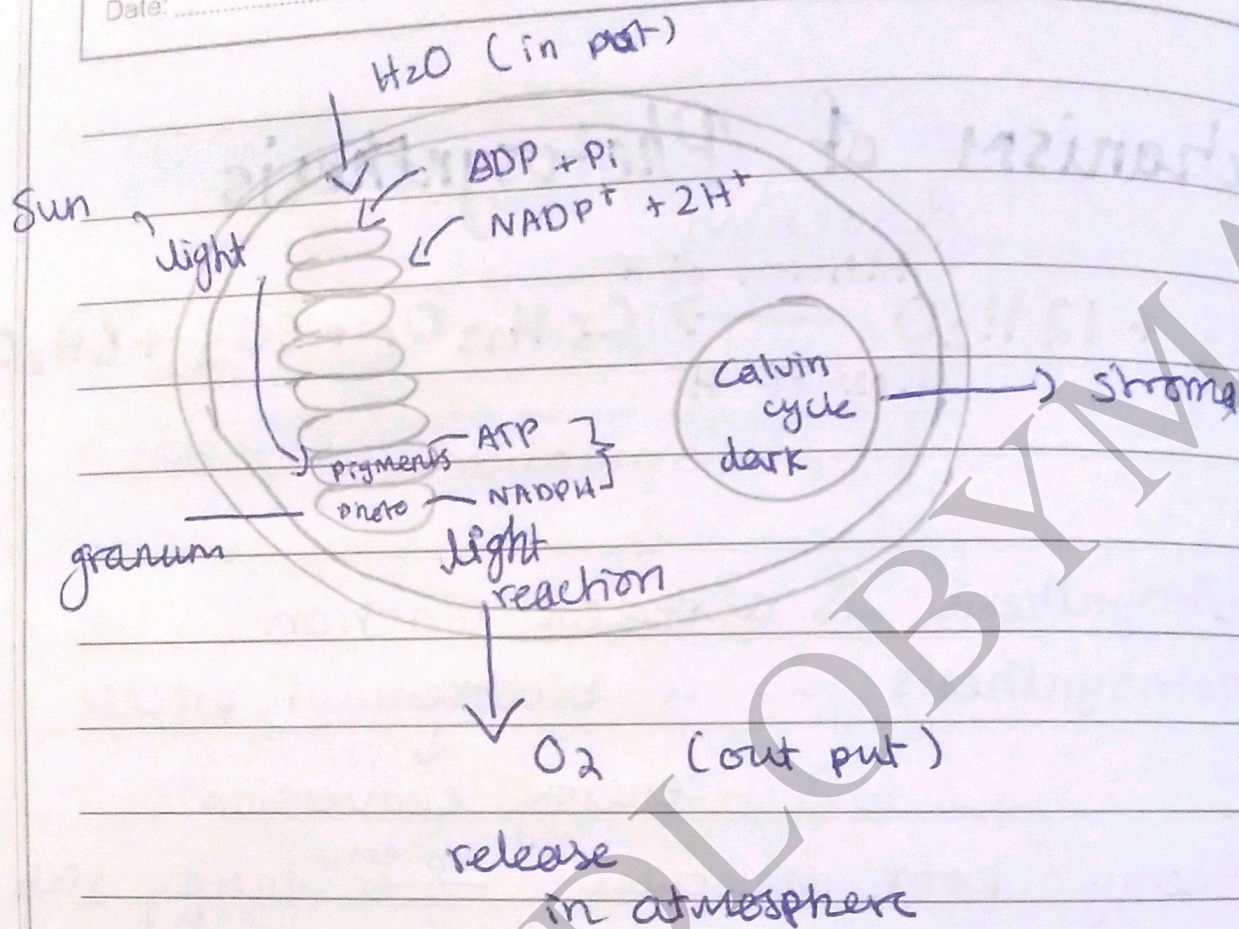
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→ mesophyll cells mein chlorophyll mein
Atp - Assembling

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Q- Why Atp is called Assembling power?

Energy provide krta hai
 CO_2 -

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~~Dark Reaction~~

Light energy is converted to chemical energy ATP $NADPH$.

$ADP \rightarrow$ addition of

Q- What are input and output?

Q- What is product of this cycle.

C_3P [cellular respiration
cellulose
starch

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Mechanism of light dependent phase (light reaction)

→ Event that must occur

→ Absorption of light by photosynthesis and excitation of its electron.

→ Flow of electron of PS and through electron transport chain

occasionally [① cyclic electron flow
② non cyclic electron flow

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→ phosphorylation of ADP to make ATP
(chemiosis.)

① cyclic phosphorylation

② non-cyclic phosphorylation

Non - Cyclic

PS - II

P - 100

P680 Ki nanometer

absorb light this
much wavelength.

Ps - II

P680

chlorophyll
type

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→ they have different works -

→ Ps - II initiate so the Ps - I intro

→ ① Ps - II the ② Ps - I

↓
electron
excite

→ go to Ps - I → they
↓
activate

be separated by NADP⁺