

## Calvin Cycle Notes

Plants...

...need to produce all organic molecules necessary for growth

- carbohydrates, lipids, proteins, nucleic acids

...need to store chemical energy (ATP) produced from light reactions

- in a more stable form
- that can be moved around plant
- saved for a rainy day

Light Reactions

Convert solar energy to chemical energy

- ATP
- NADPH

What can we do now?

Want to make  $C_6H_{12}O_6$  ?

- synthesis
- How? From what?

What raw materials are available?

$CO_2$  has very little chemical energy

- fully oxidized

$C_6H_{12}O_6$  contains a lot of chemical energy

- highly reduced

Synthesis = endergonic process

- put in a lot of energy

Reduction of  $CO_2 \rightarrow C_6H_{12}O_6$  proceeds in many small uphill steps

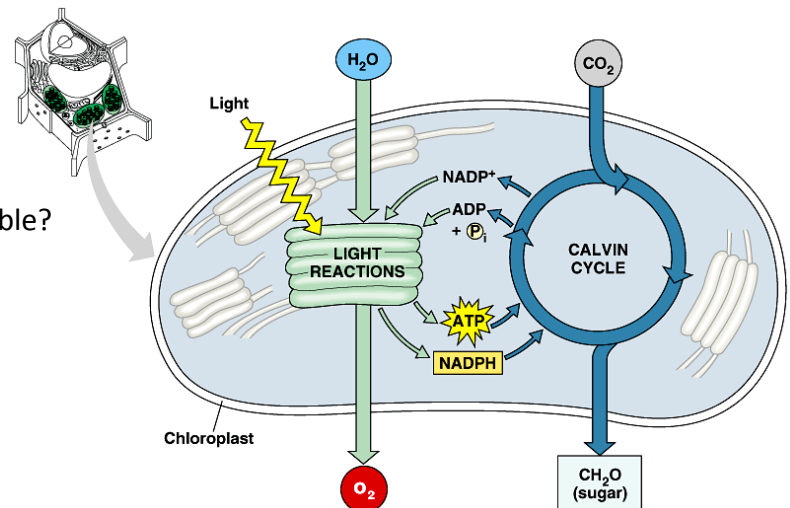
- each catalyzed by a specific enzyme
- using energy stored in ATP & NADPH

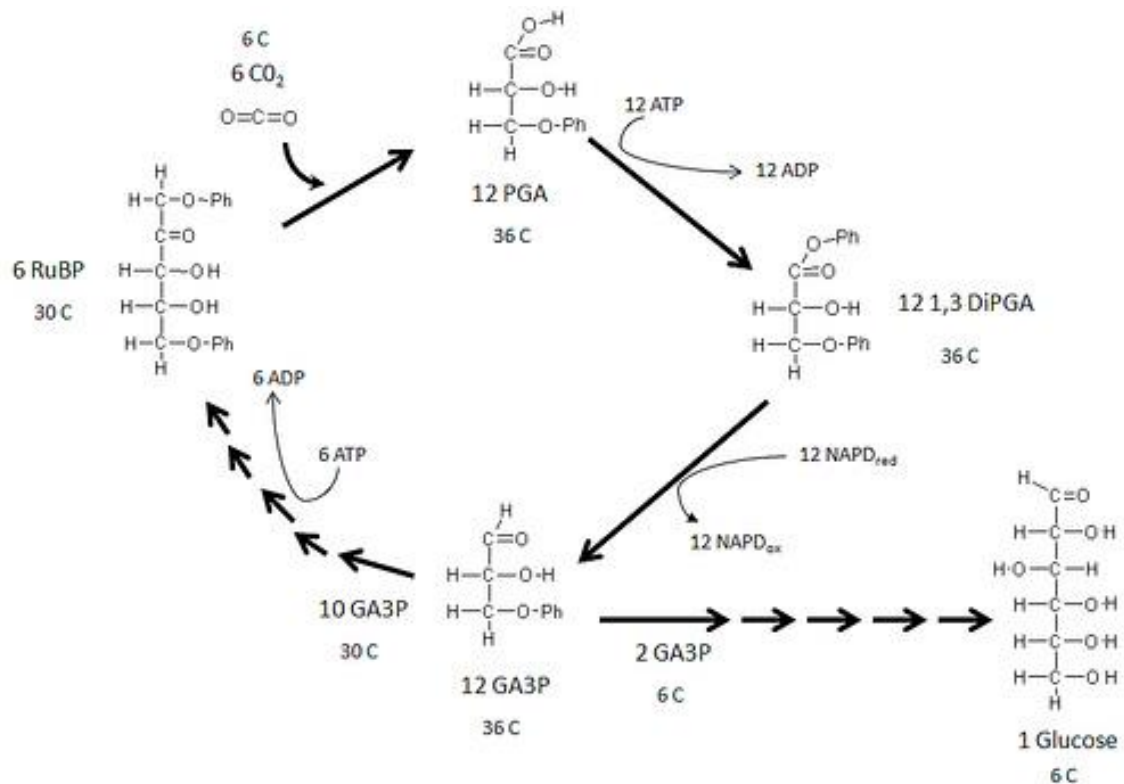
Calvin cycle

- chloroplast stroma

Need products of light reactions to drive synthesis reactions

- ATP
- NADPH





### Glyceraldehyde-3-P

- end product of Calvin cycle
- energy rich 3 carbon sugar
- "C3 photosynthesis"

- 3 turns of Calvin cycle = 1 G3P
- 3 CO<sub>2</sub> → 1 G3P (3C)
- 6 turns of Calvin cycle = 1 C<sub>6</sub>H<sub>12</sub>O<sub>6</sub> (6C)
- 6 CO<sub>2</sub> → 1 C<sub>6</sub>H<sub>12</sub>O<sub>6</sub> (6C)
- 18 ATP + 12 NADPH → 1 C<sub>6</sub>H<sub>12</sub>O<sub>6</sub>
- any ATP left over from light reactions will be used elsewhere by the cell

### G3P is an important intermediate

G3P → → glucose → → carbohydrates  
 → → lipids → → phospholipids, fats, waxes  
 → → amino acids → → proteins  
 → → nucleic acids → → DNA, RNA

### RuBisCo = ribulose biphosphate carboxylase

Enzyme which fixes carbon from air

- the most important enzyme in the world!
  - it makes life out of air!
- definitely the most abundant enzyme

### Summary:

- Light reactions
  - produced ATP
  - produced NADPH
  - consumed H<sub>2</sub>O
  - produced O<sub>2</sub> as byproduct
- Calvin cycle
  - consumed CO<sub>2</sub>
  - produced G3P (sugar)
  - regenerated ADP
  - regenerated NADP