AP BIOLOGY
CELLULAR ENERGETICS
ACTIVITY #4

NAME_____

DATE_____HOUR_____

PHOTOSYNTHESIS

SUMMARY EQUATION

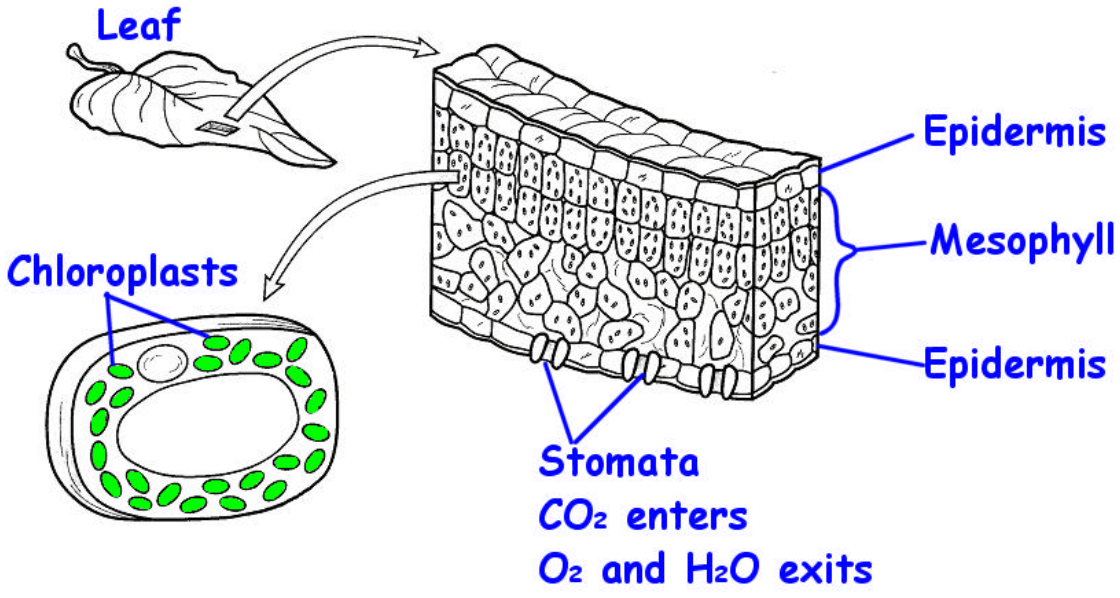
$6CO_2 + 12H_2O + light \rightarrow C_6H_{12}O_6 + 6O_2 + 6H_2O$

$6CO_2 + 6H_2O + light \rightarrow C_6H_{12}O_6 + 6O_2$

$CO_2 + H_2O + light \rightarrow CH_2O + O_2$

(emphasizes production of glucose 1 carbon at a time)

SITE OF PHOTOSYNTHESIS -- PLANTS



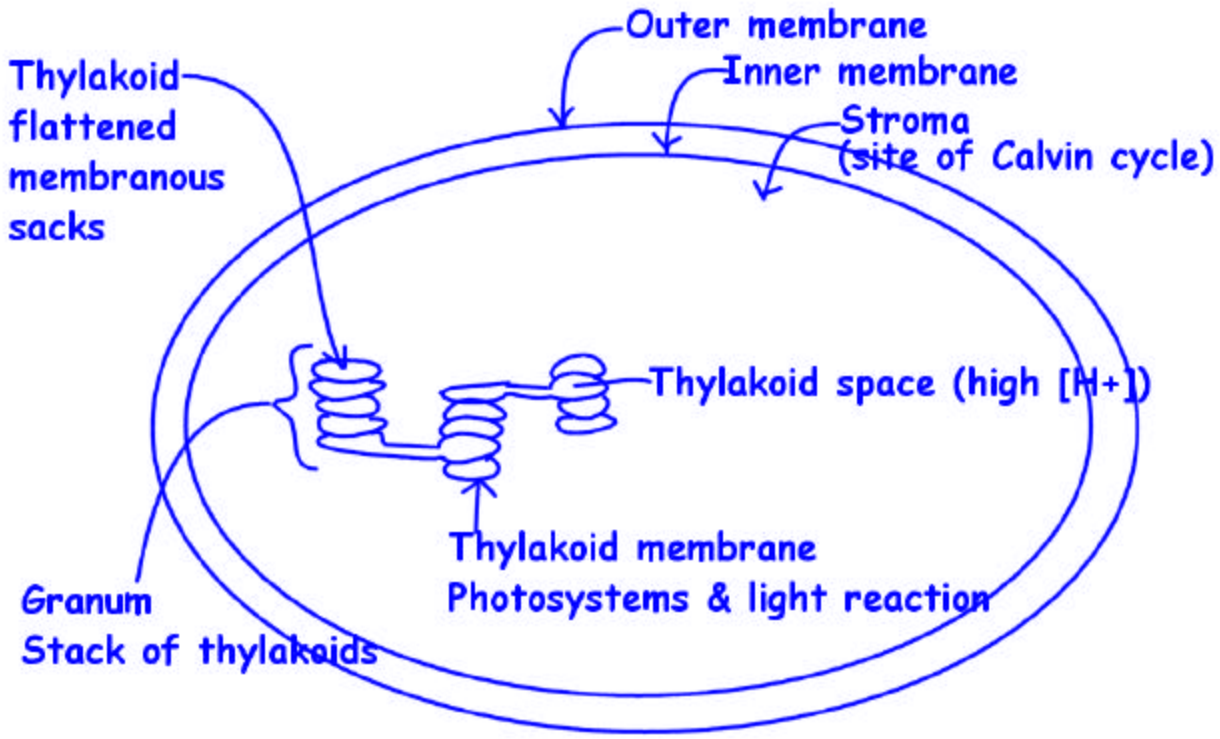
Water:
absorbed by roots
travels up the stem through the xylem
enters veins in leaf

SITE OF PHOTOSYNTHESIS – PROKARYOTES

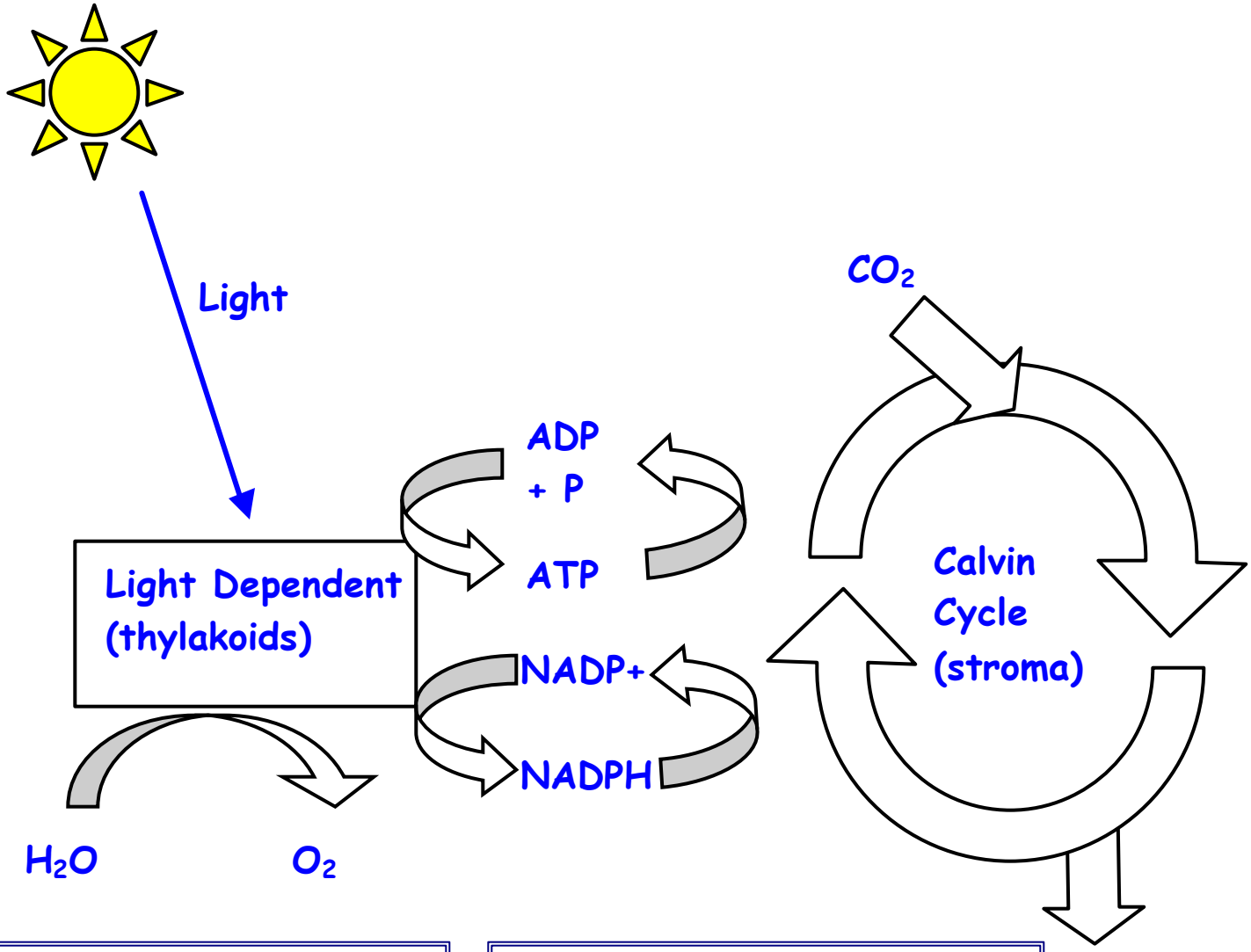
Lack chloroplasts

Chlorophyll built into plasma membrane

STRUCTURE OF CHLOROPLASTS



OVERVIEW OF PHOTOSYNTHESIS



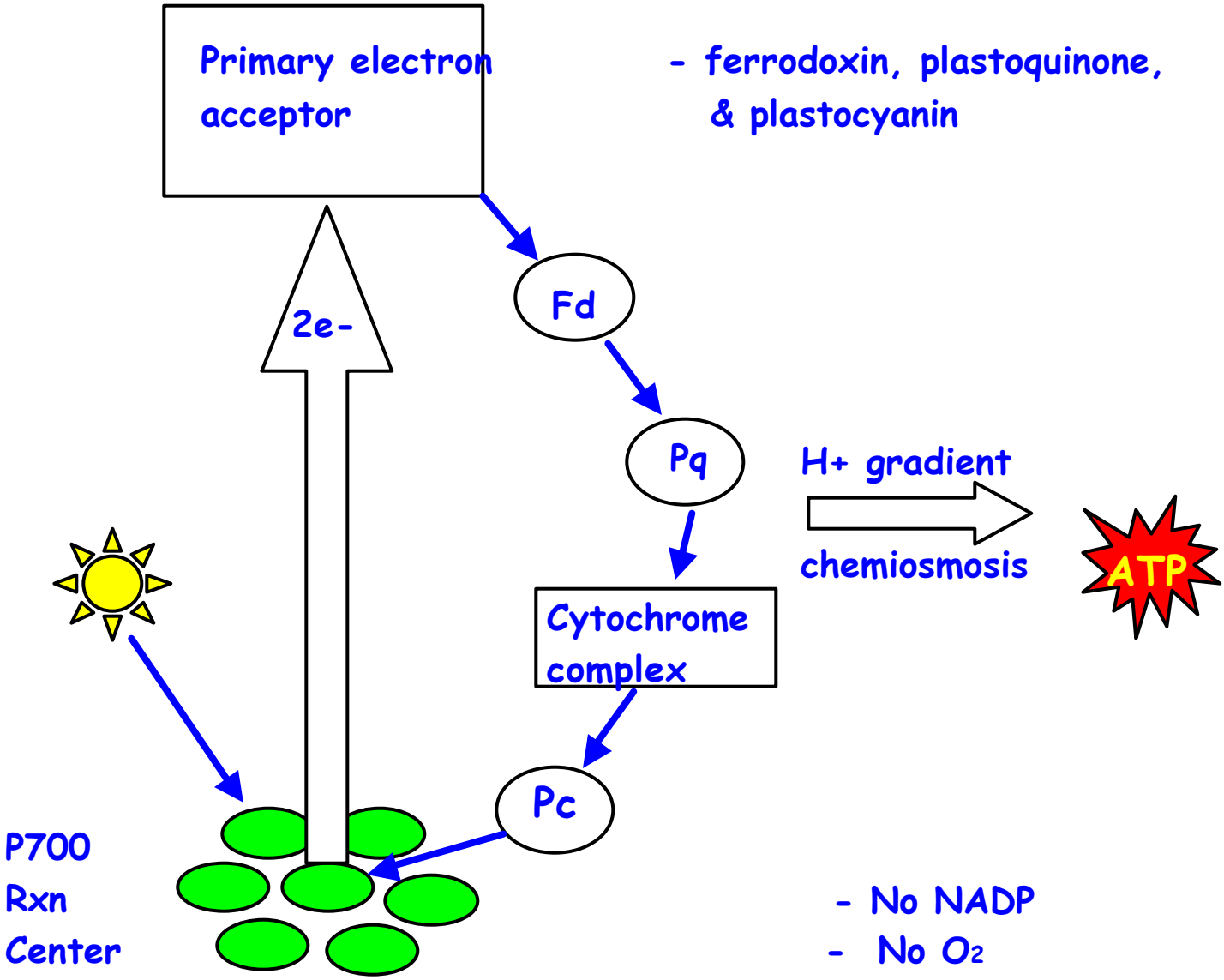
Light Dependent

- Take e- from H_2O
- Use light energy to boost e- to higher energy level
- Use some energy to make ATP
- Add high energy e- to NADP+

Light Independent

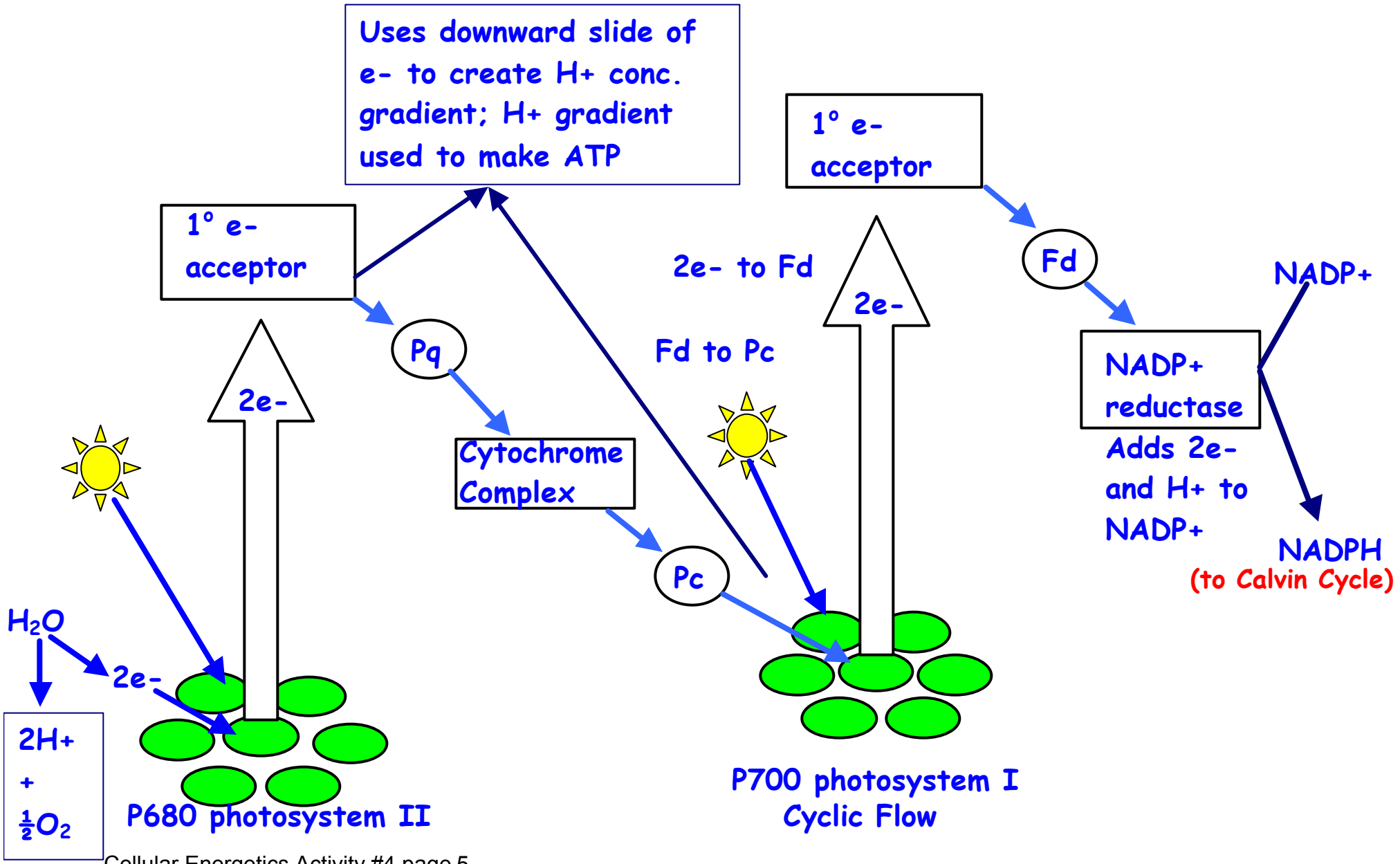
- AKA Calvin Cycle
- Uses ATP produced in light rxn
- Takes high energy e- from NADPH and adds them to CO_2
- Produces sugar 1 carbon at a time

LIGHT REACTIONS – CYCLIC ELECTRON FLOW

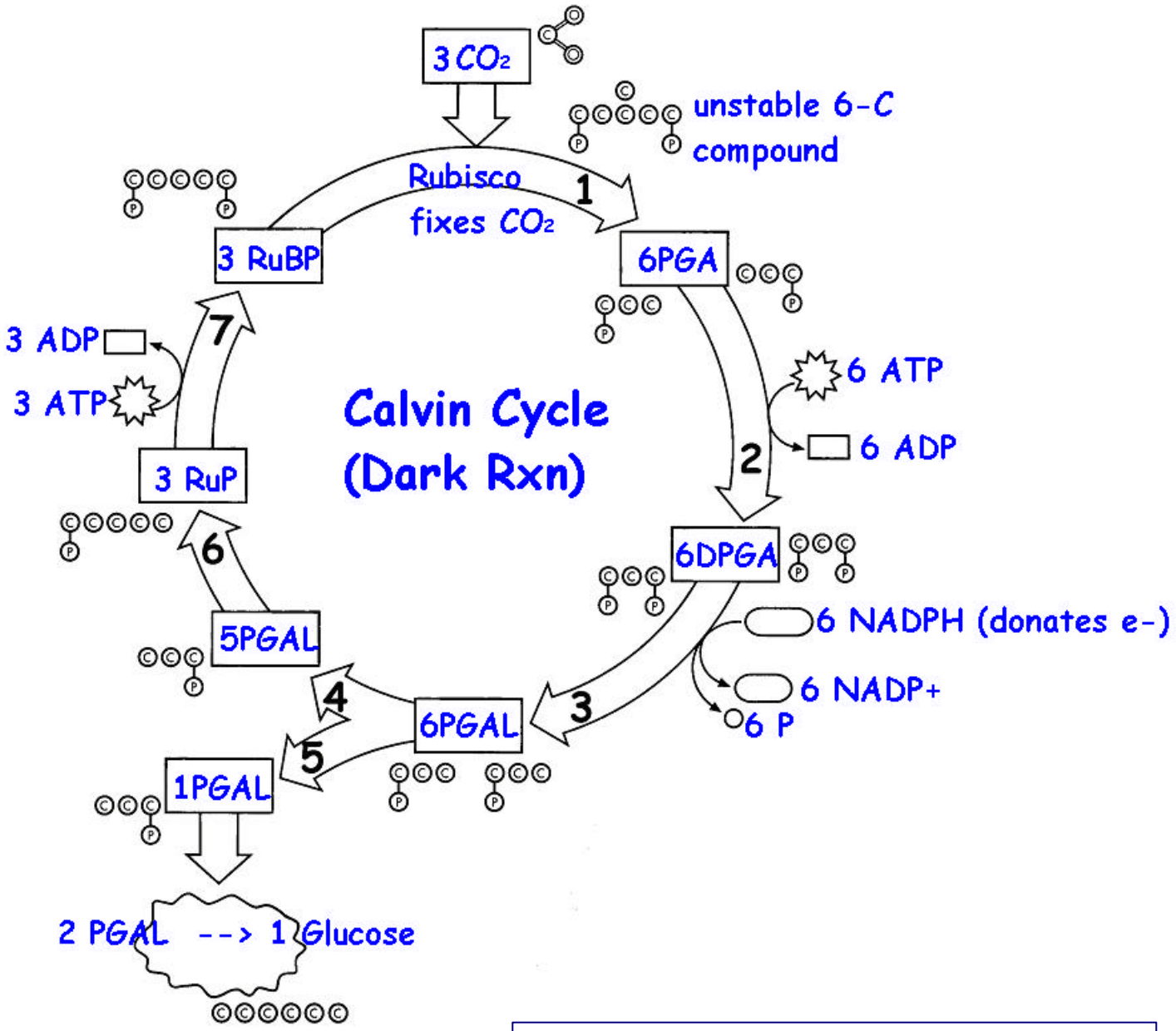


Photosystem I
Few 100 pigment molecules (chlorophyll a, b, & carotenoids)
Reaction center
  Chlorophyll a molecule
  Bound to specific proteins
  Closer to 1° electron acceptor
Antenna pigments absorb photons and pass to rxn center

LIGHT REACTIONS – NONCYCLIC ELECTRON FLOW



CALVIN CYCLE Light Independent RXN Location = Stroma



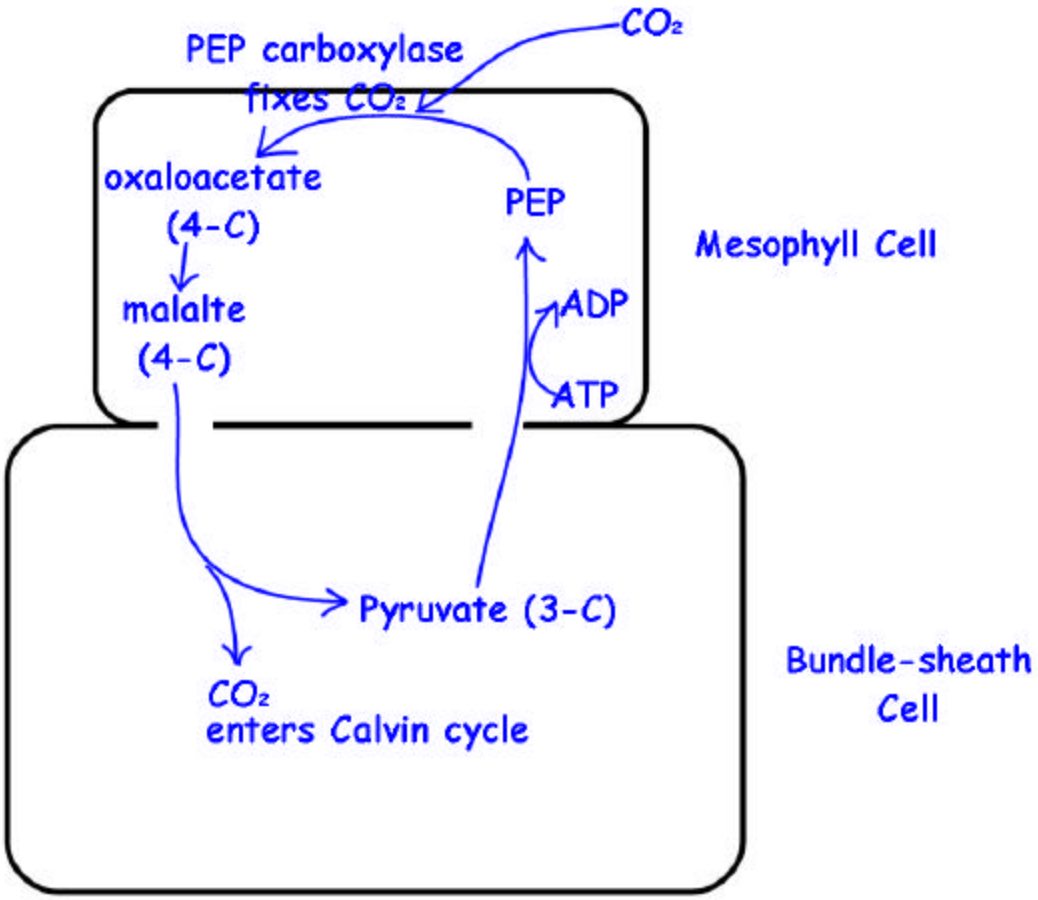
RuBP = ribulose biphosphate
Rubisco = RuBP carboxylase
PGA = phosphoglycerate
DPGA = diphosphoglycerate
PGAL = phosphoglyceraldehyde=G3P
G3P = glyceraldehyde3phosphate
RuP = ribulose phosphate

PROBLEM – PHOTORESPIRATION

If $[O_2] > [CO_2]$ in leaves — C_3 plants
Rubisco fixes O_2 instead of CO_2 — Rice, wheat
5-C compound produced — & Soybeans
5-C → 1 PGA enters Calvin Cycle
1 glycolate (2-C) exits chloroplasts and enters peroxisomes
Decreases productivity
Fostered by hot, dry, bright days

C_4 PLANTS

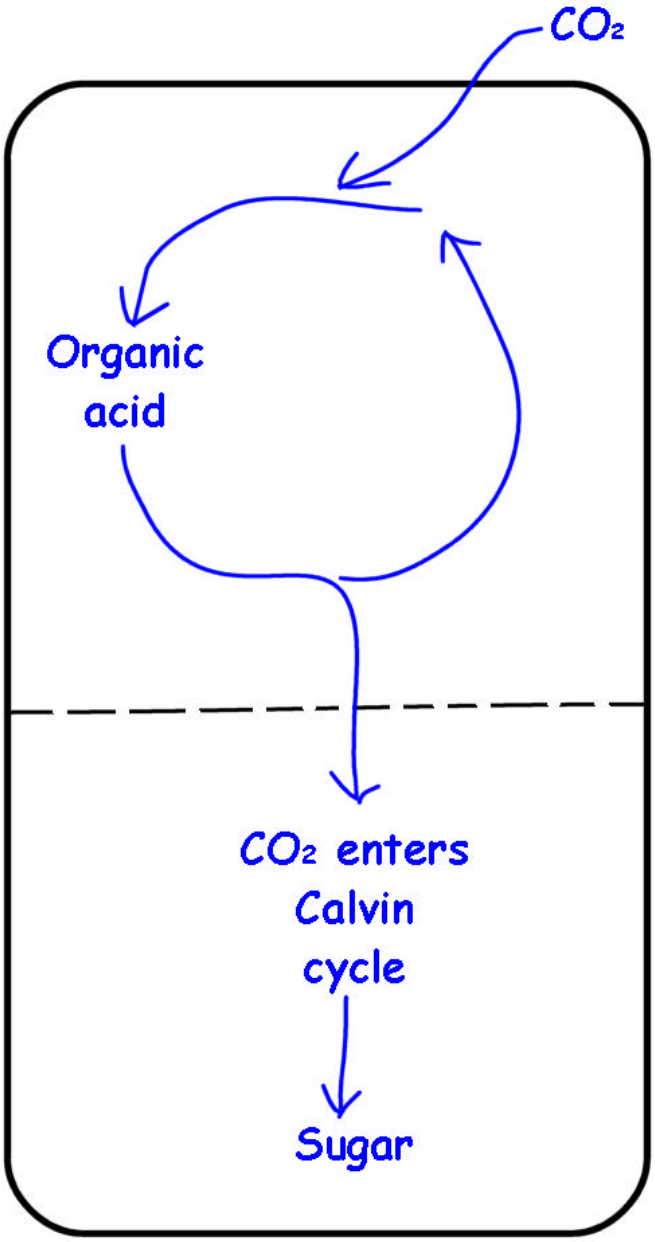
- Fix CO_2 as 4-
- Segregate CO_2 fixation from Calvin cycle
- Acts as CO_2 pump
- PEP phosphoenlopyruvate carboxylase has lower affinity for O_2 than rubisco
- Adaptation in hot regions with intense light



Corn, Sugarcane, grasses

CAM PLANTS Crassulacean Acid Metabolism - similar to C4 only

Ex: cacti, aloe vera, pineapples *same structures, different times of day



Night
stomata open
CO_2 enters
Acid conc. increases

Day
stomata closed
Acid broken down
CO_2 released