

REACTION CENTER

Mg = MAGNESIUM

E-

ENERGIZED E-

Mg

**CHL-A
P680**

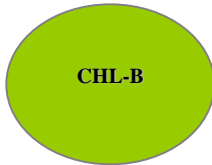
ANTENNA MOLECULES

CHL-A

CHL-B

CAROTENES

XANYHOPHYLLS





ENERGIZED E- POSSIBLE ENERGY ROUTES



E- ACCEPTOR ABSENT

REACTION CENTER

E- ACCEPTOR: ABSENT

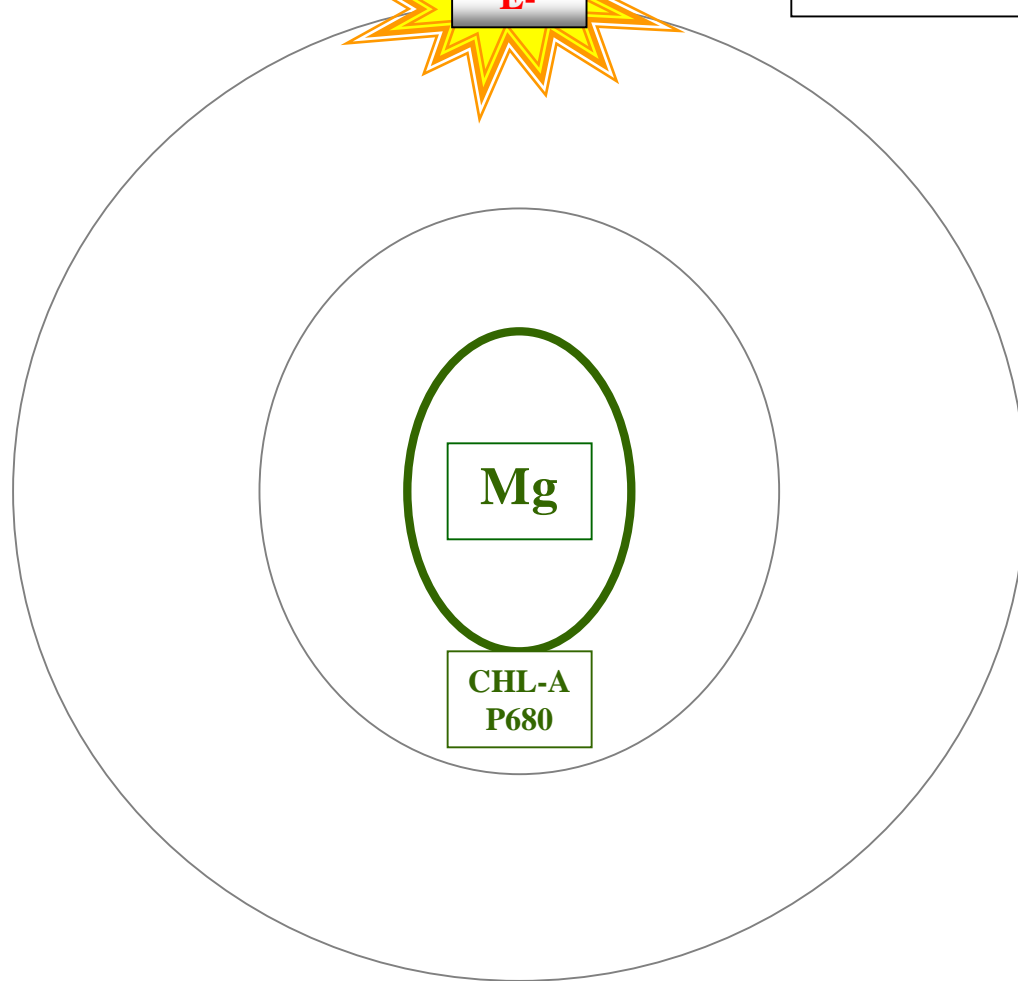
Mg = MAGNESIUM

ENERGIZED E-

E-

Mg

**CHL-A
P680**



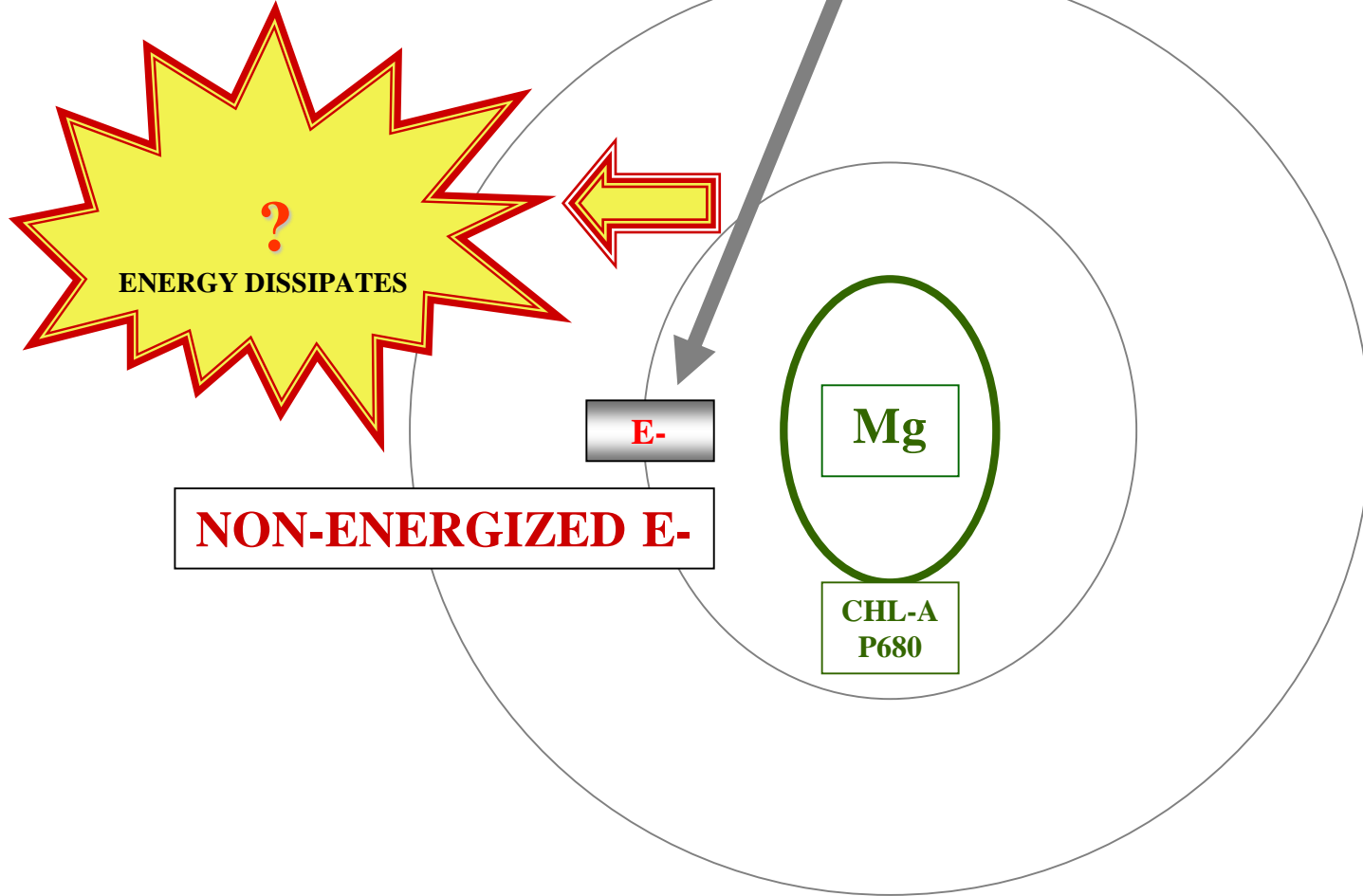
REACTION CENTER

E- ACCEPTOR: ABSENT

H

Mg = MAGNESIUM

ENERGIZED E-



NON-ENERGIZED E-

Mg

**CHL-A
P680**

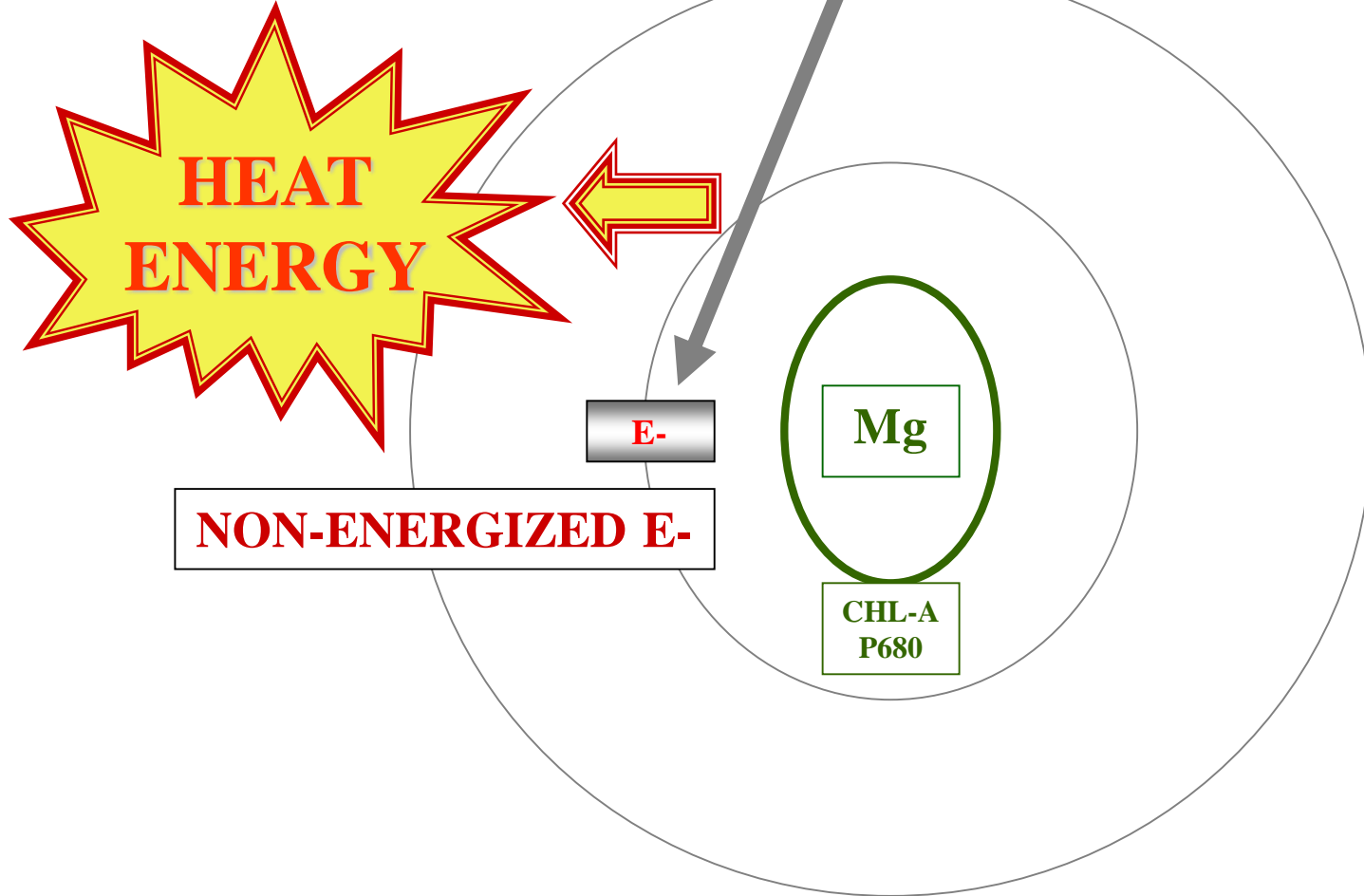
REACTION CENTER

E- ACCEPTOR: ABSENT



Mg = MAGNESIUM

ENERGIZED E-

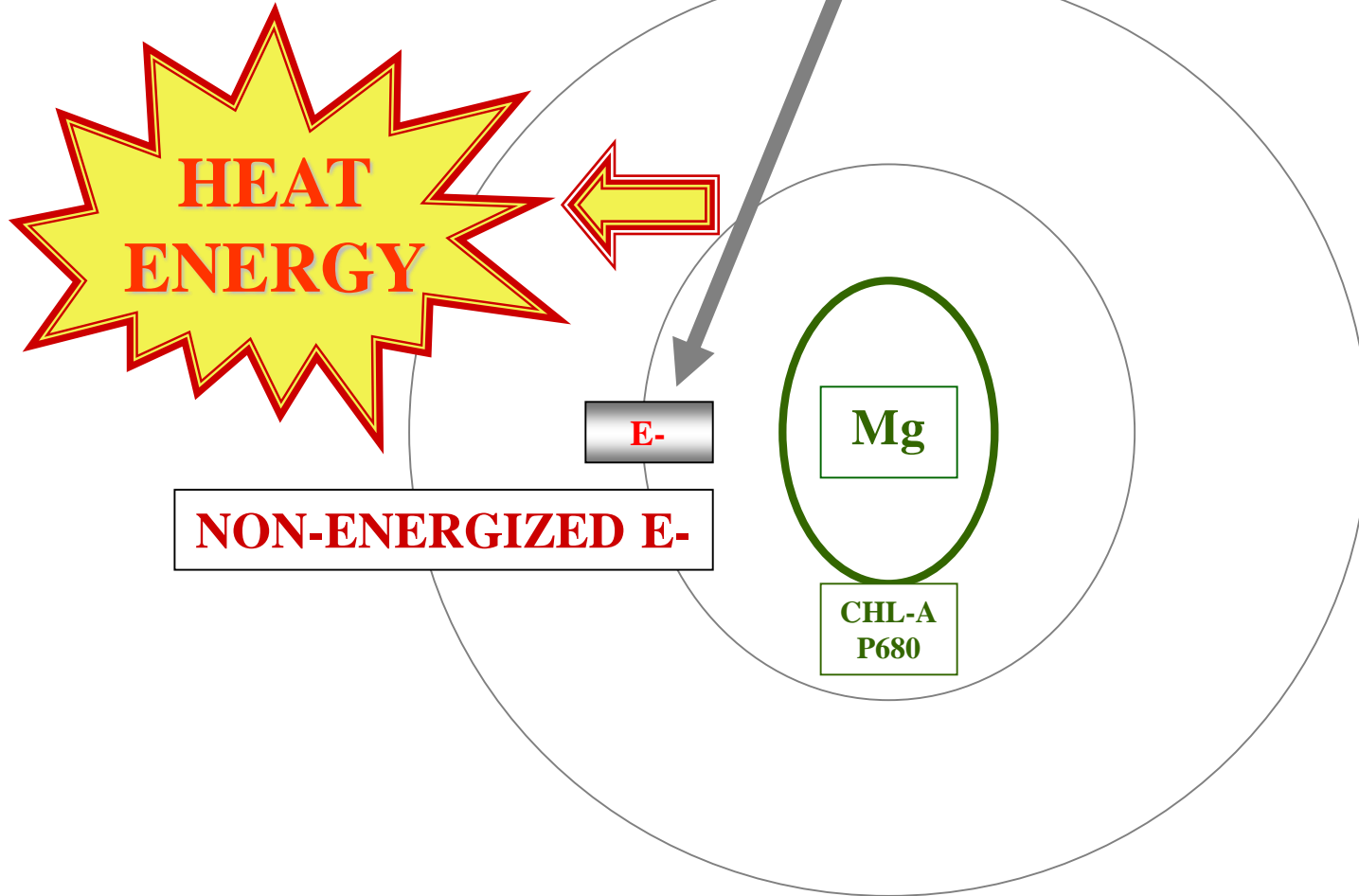


REACTION CENTER

E- ACCEPTOR: ABSENT

Mg = MAGNESIUM

ENERGIZED E-



DOES NOT OCCUR DURING PSYN

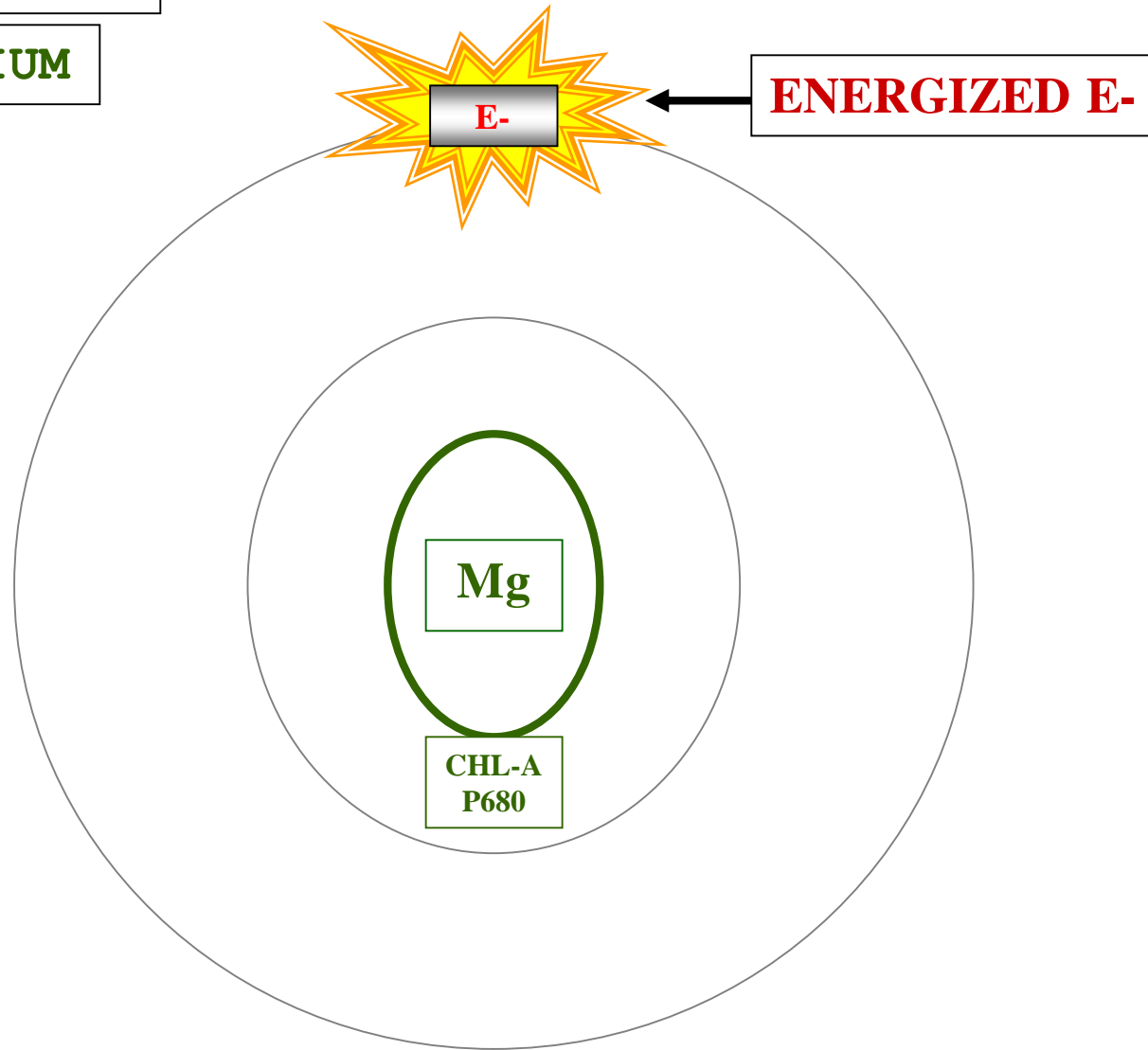


E- ACCEPTOR PRESENT

REACTION CENTER

Mg = MAGNESIUM

PR

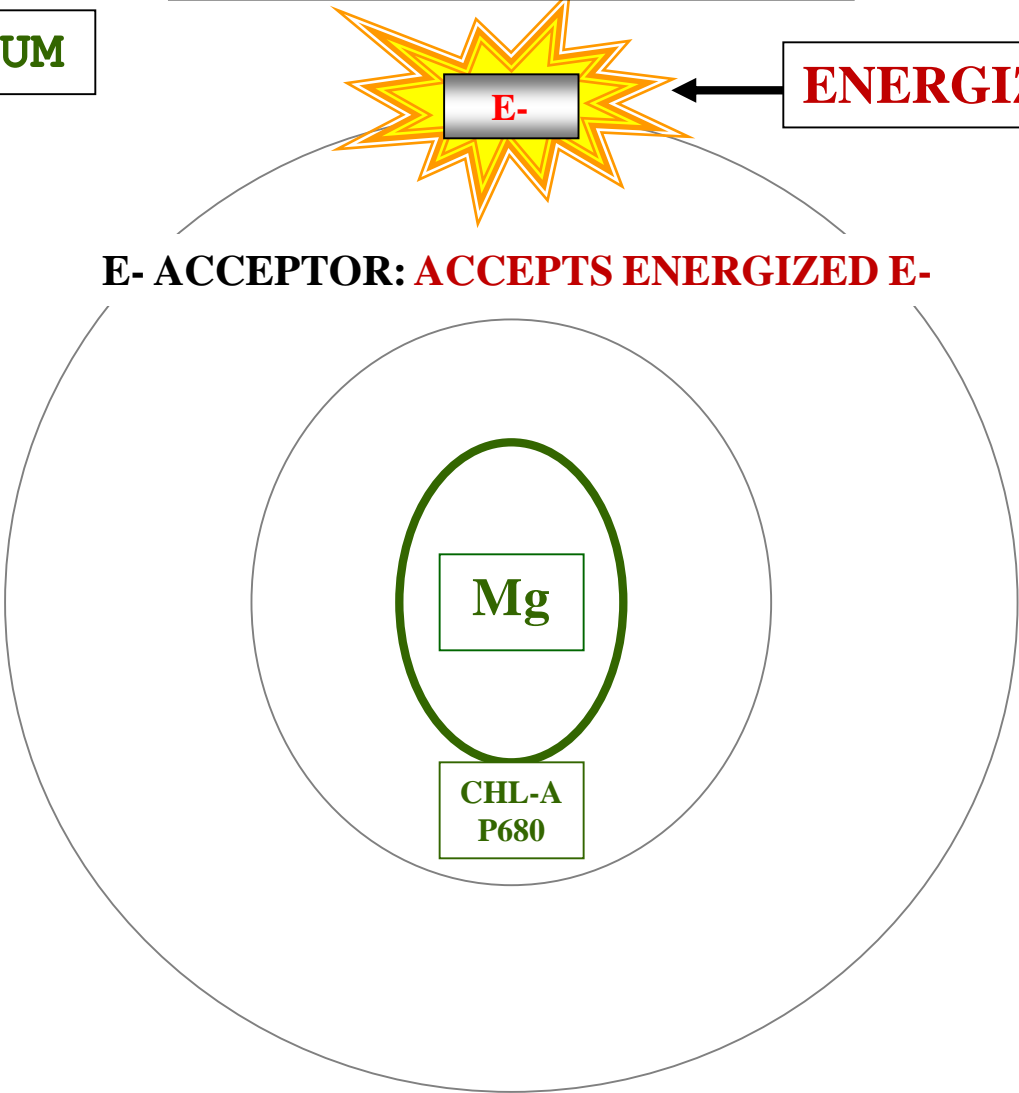


REACTION CENTER

E- ACCEPTOR: PRESENT

Mg = MAGNESIUM

ENERGIZED E-

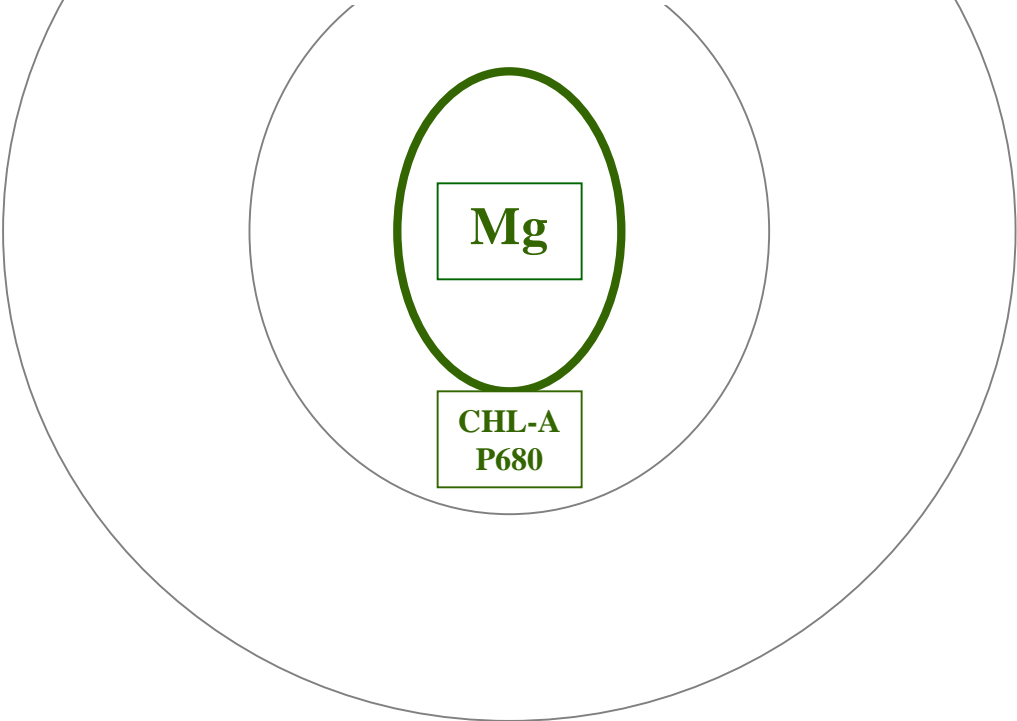


REACTION CENTER

Mg = MAGNESIUM



E- ACCEPTOR: ACCEPTS ENERGIZED E-



REACTION CENTER

Mg = MAGNESIUM

E- ACCEPTOR

E-

CHEM EGY

E- ACCEPTOR: ACCEPTS ENERGIZED E-

Mg

**CHL-A
P680**



REACTION CENTER

Mg = MAGNESIUM

E- ACCEPTOR

E-

CHEM EGY

E- ACCEPTOR: ACCEPTS ENERGIZED E-

Mg

**CHL-A
P680**

DOES OCCUR DURING PSYN



REACTION CENTER

Mg = MAGNESIUM

E- ACCEPTOR

E-

CHEM EGY

E- ACCEPTOR: ACCEPTS ENERGIZED E-

Mg

**CHL-A
P680**

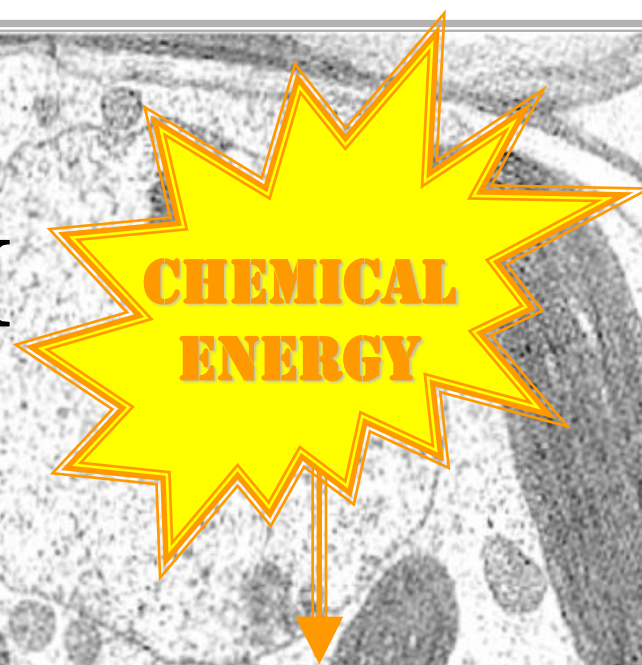


REACTION ESSENTIAL TO LIFE

CELL METABOLISM

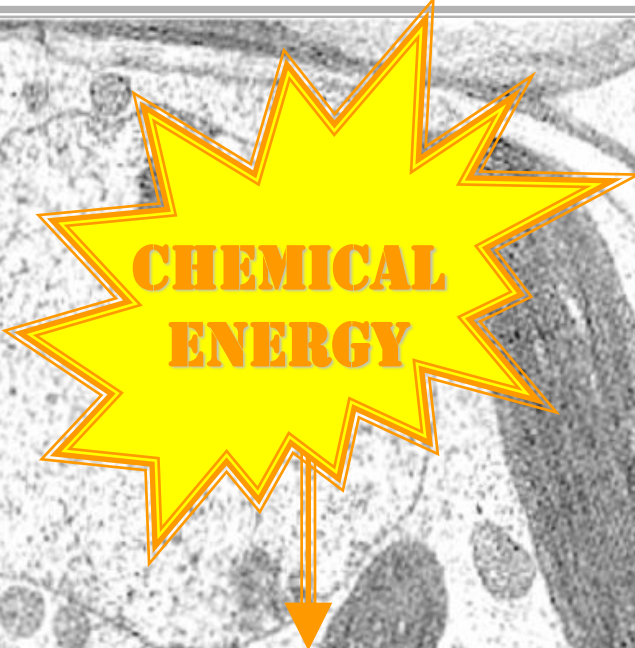
?

EN



BIOCHEMICAL REACTION

CELL METABOLISM



ENDERGONIC BIOCHEMICAL REACTIONS

CELL METABOLISM



**CHEMICAL
ENERGY**



**CHEMICAL ENERGY
DRIVES
ENDERGONIC REACTIONS
TO A PRODUCT**

O



***EFFICIENT
METABOLISM***



E



ORGANIZATION INCREASES



***ENTROPY
DECREASES***





HOMEOSTASIS



ENERGIZED E- APPLIED



EXAMPLE

SUMMER BEACH

SUMMER BEACH

SAND

PLANT





SUMMER BEACH

SAND



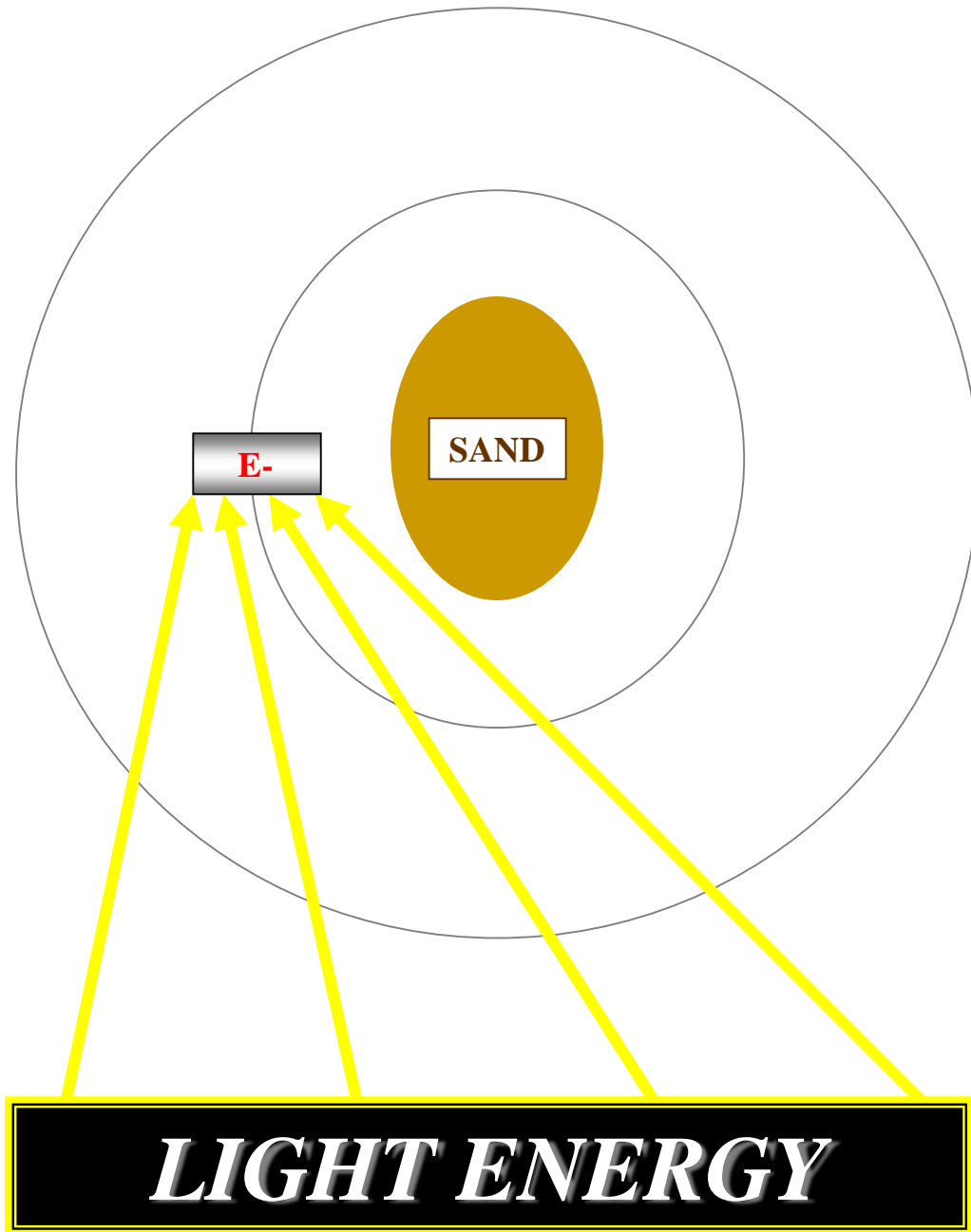


LIGHT ENERGY



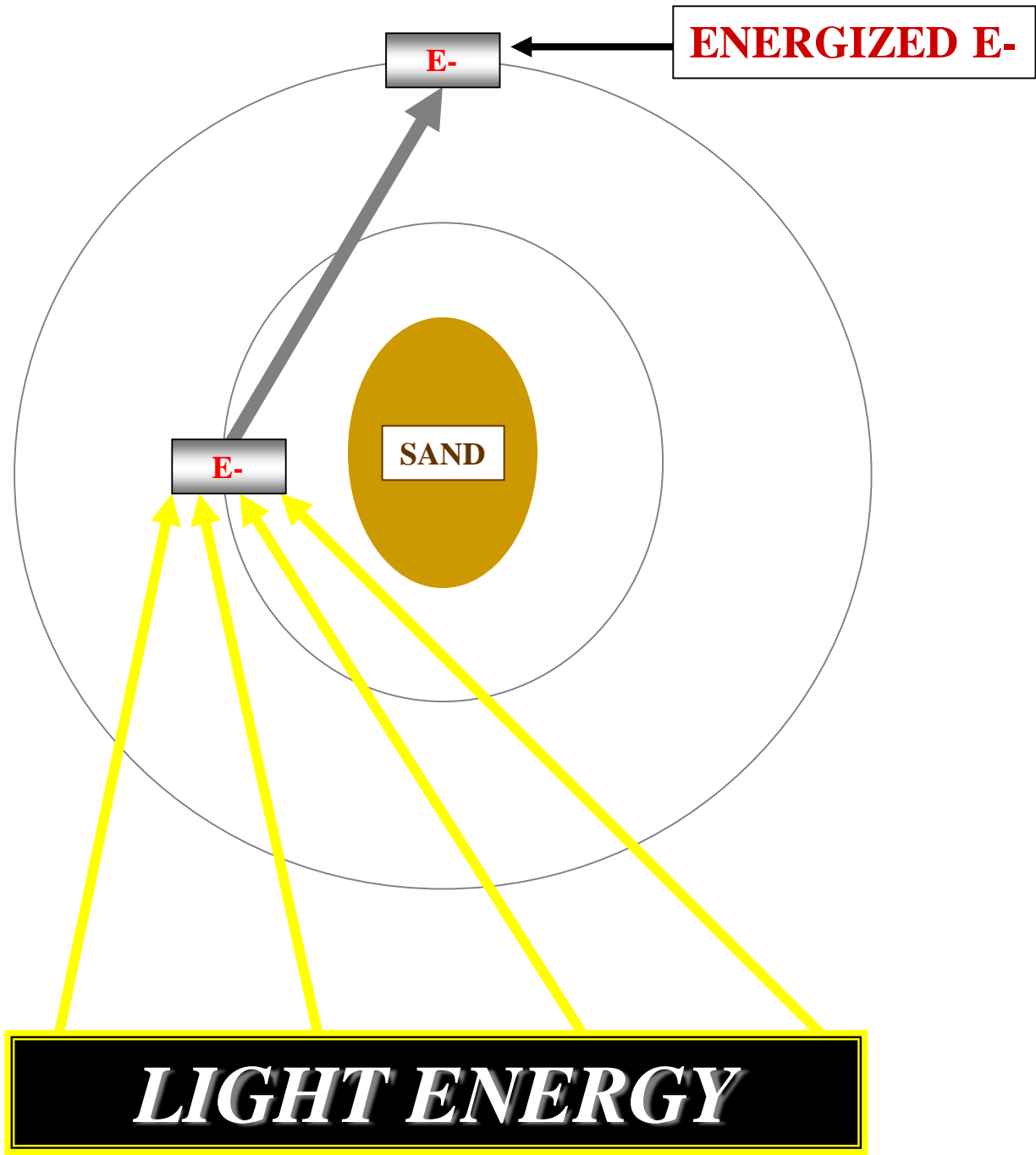
SAND

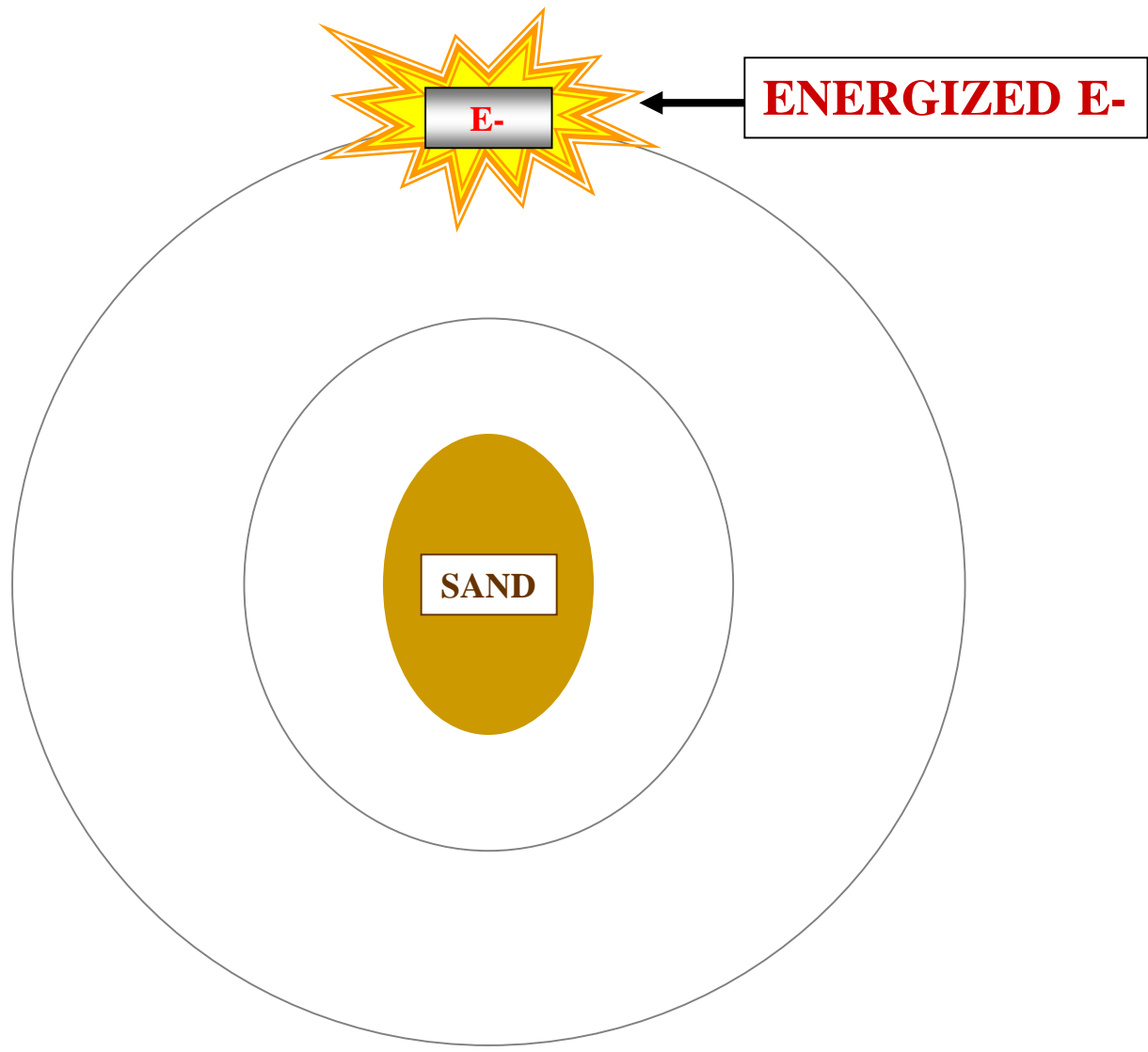




E-







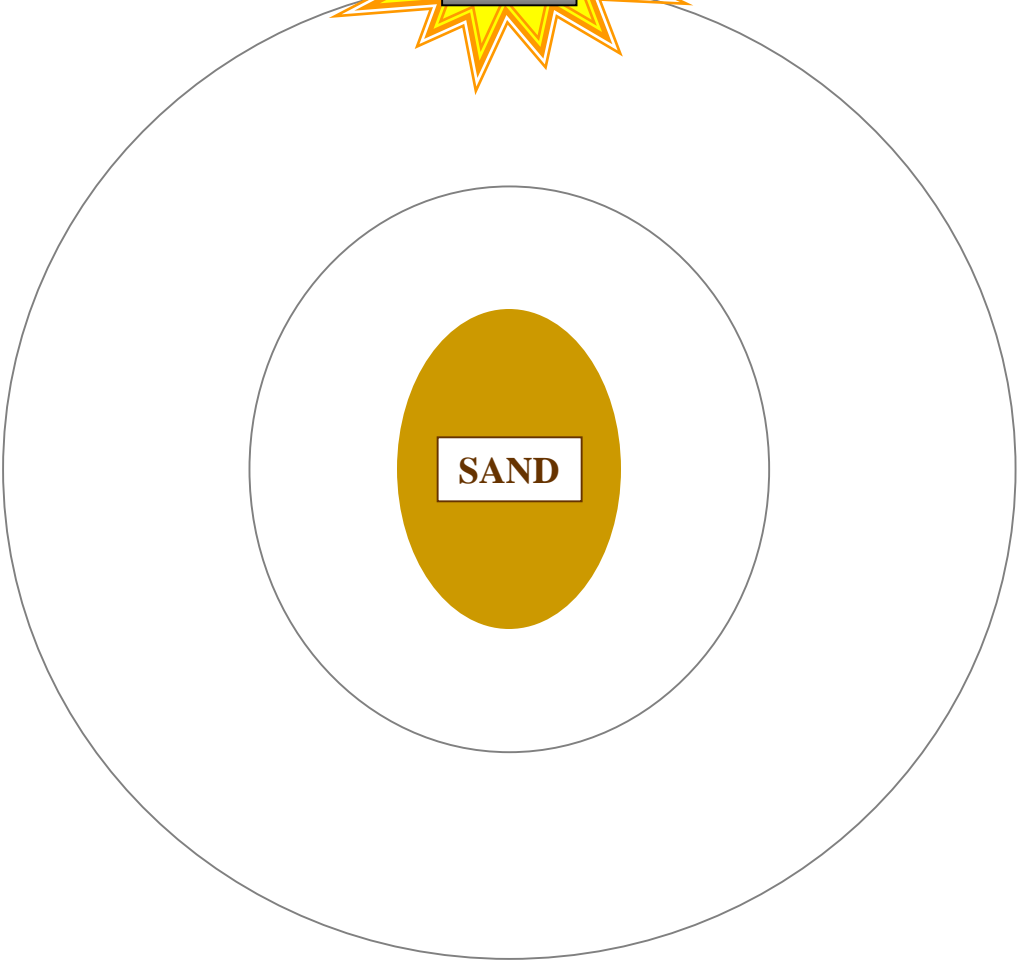


E- ACCEPTOR: ABSENT

ENERGIZED E-

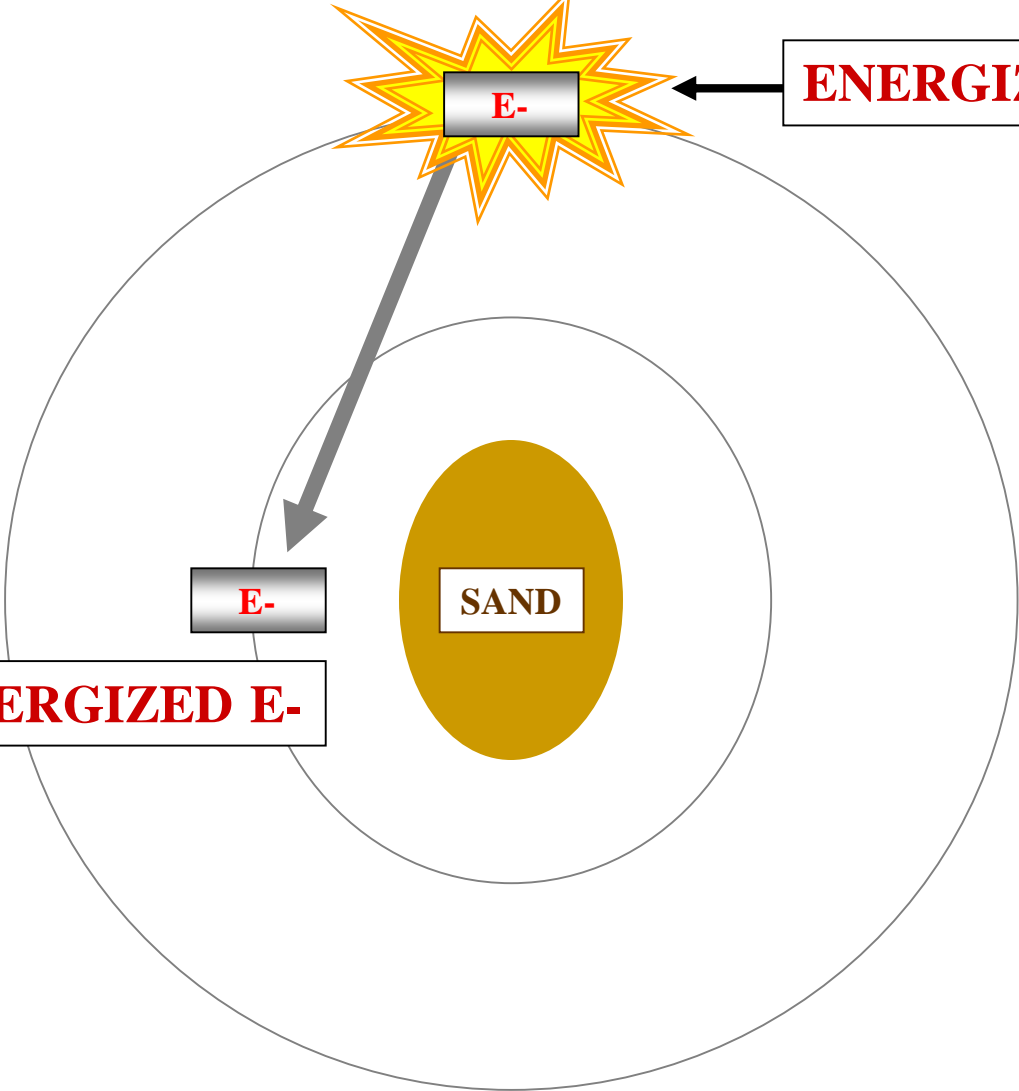
E-

SAND



E- ACCEPTOR: ABSENT

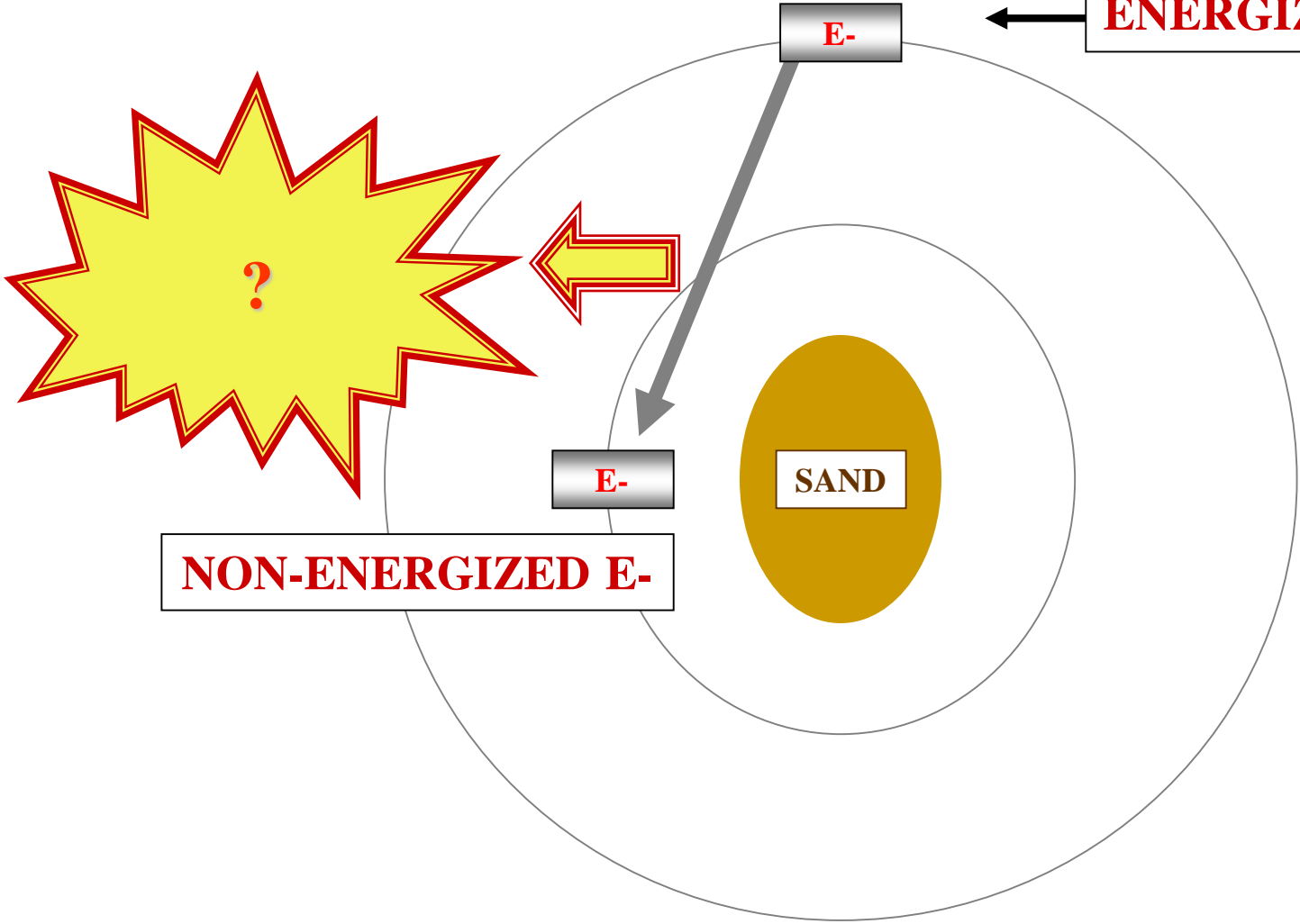
ENERGIZED E-



NON-ENERGIZED E-

E- ACCEPTOR: ABSENT

ENERGIZED E-

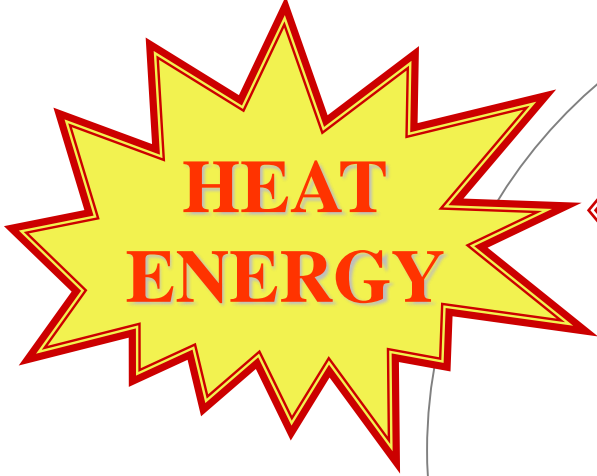


NON-ENERGIZED E-



E- ACCEPTOR: ABSENT

ENERGIZED E-



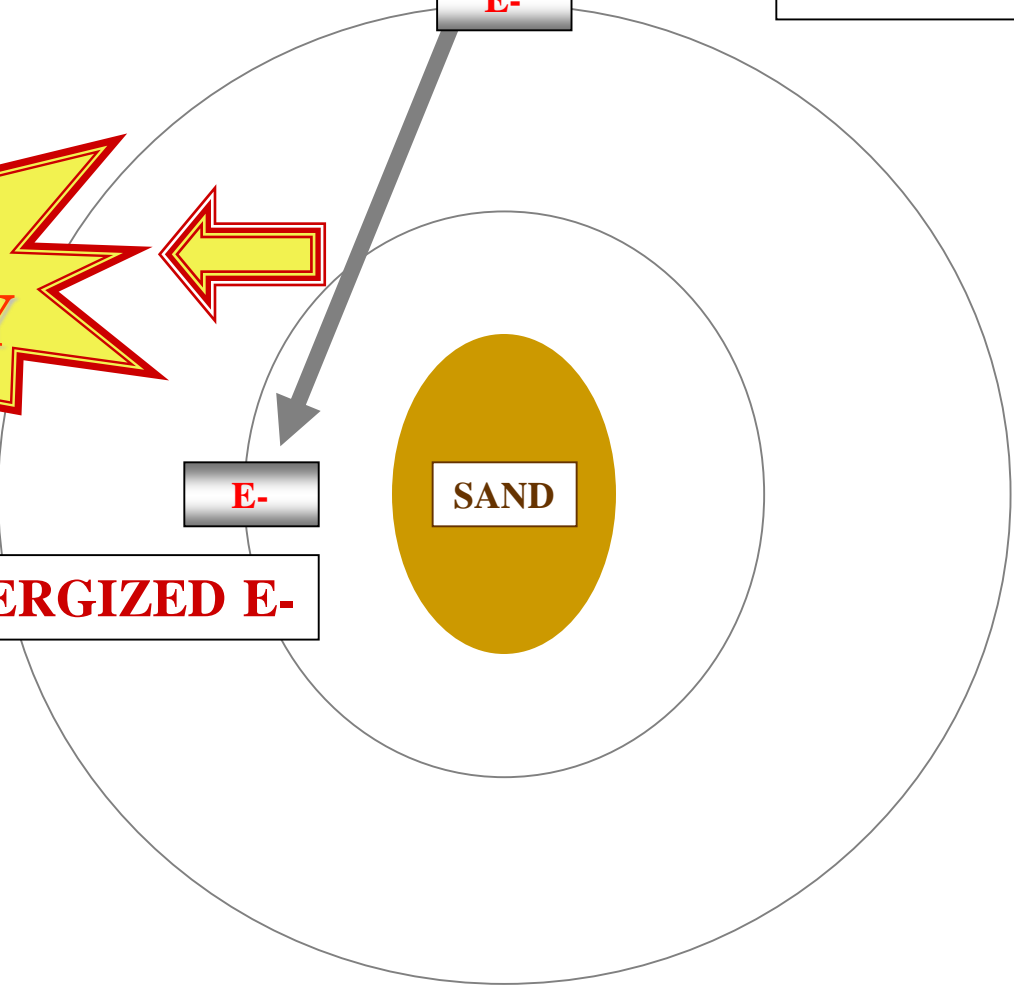
E-



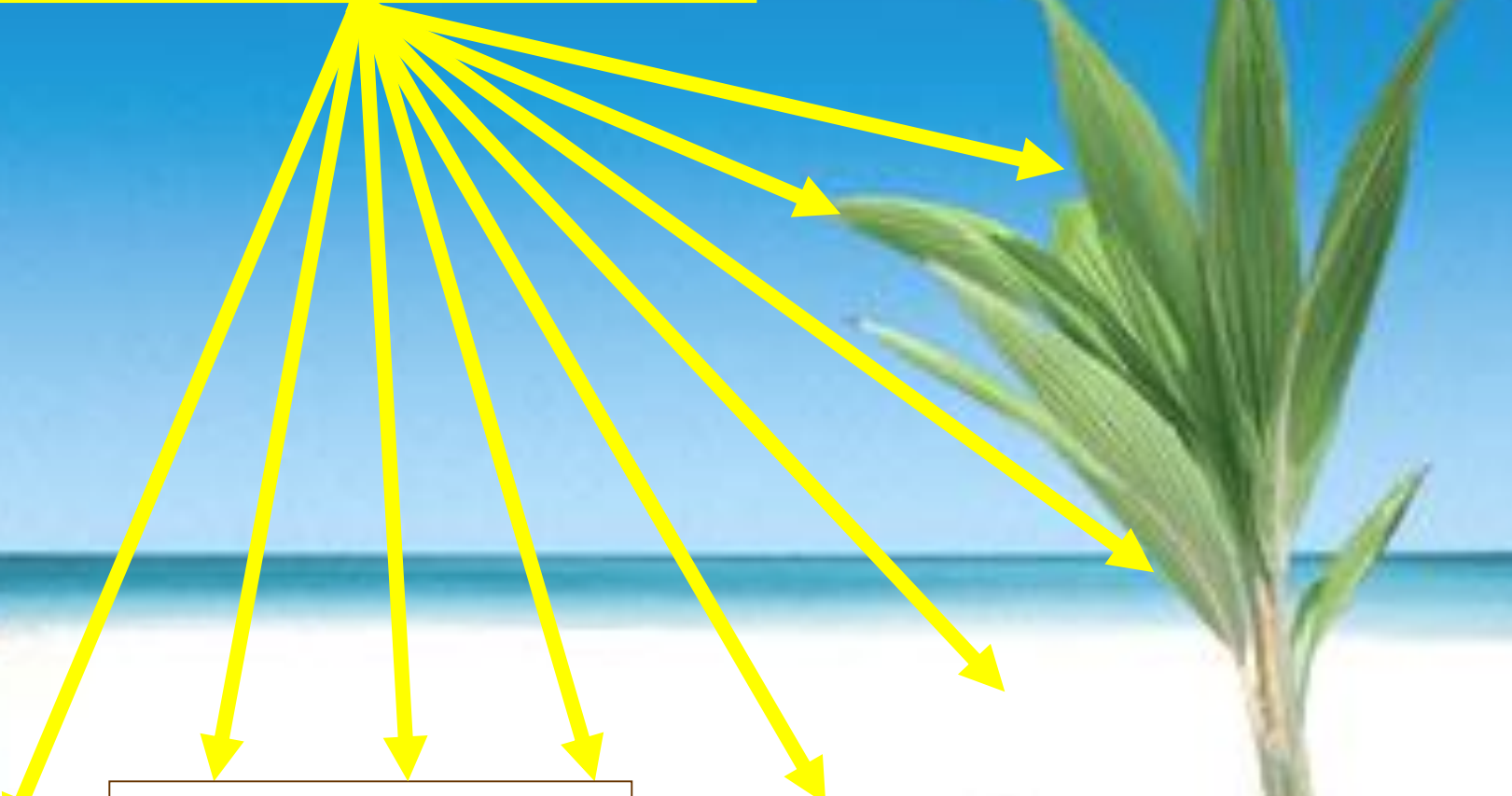
SAND

E-

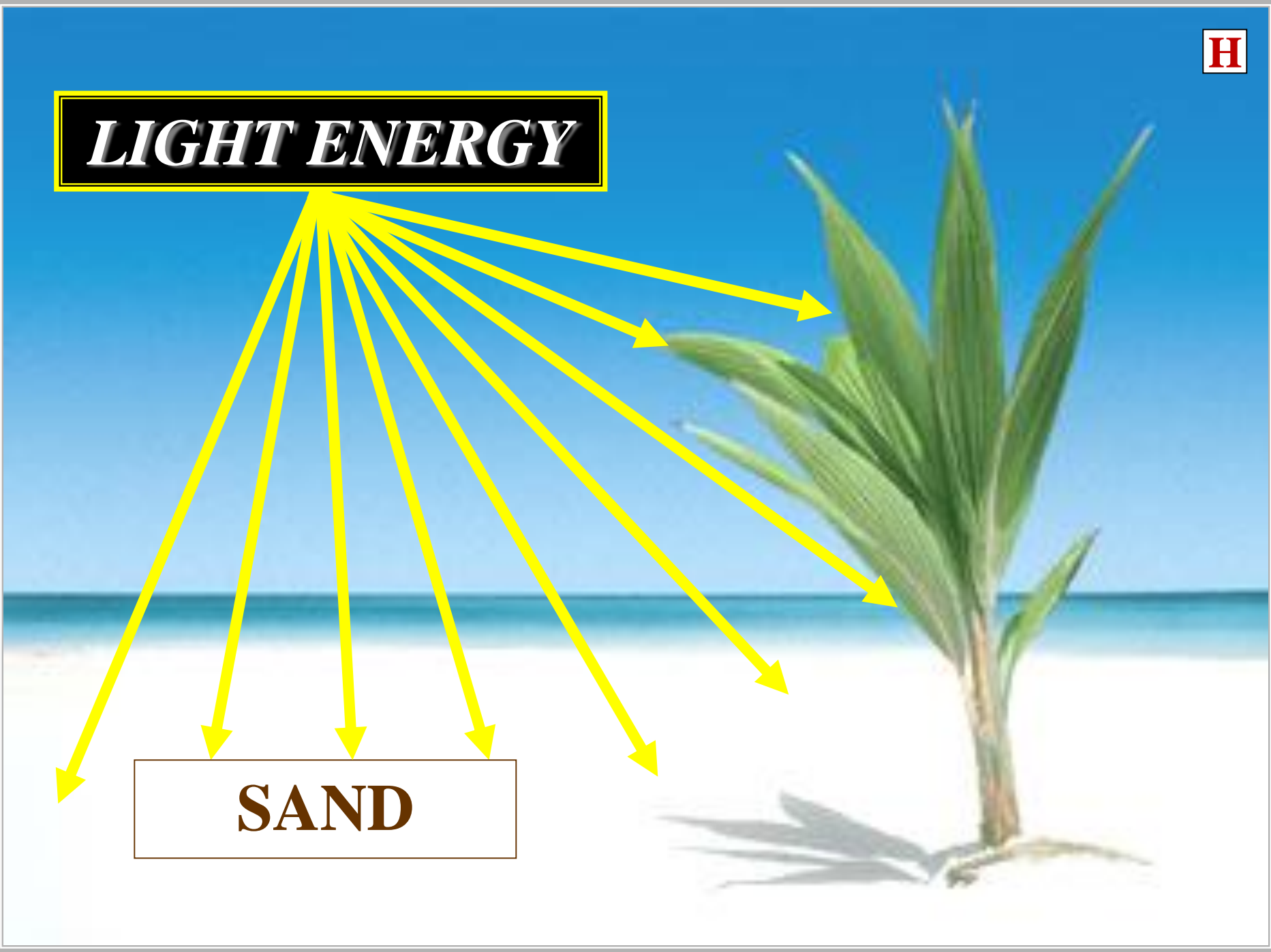
NON-ENERGIZED E-



LIGHT ENERGY



SAND



LIGHT ENERGY



SUMMER BEACH

SAND

PLANT





SUMMER BEACH



PLANT

LIGHT ENERGY

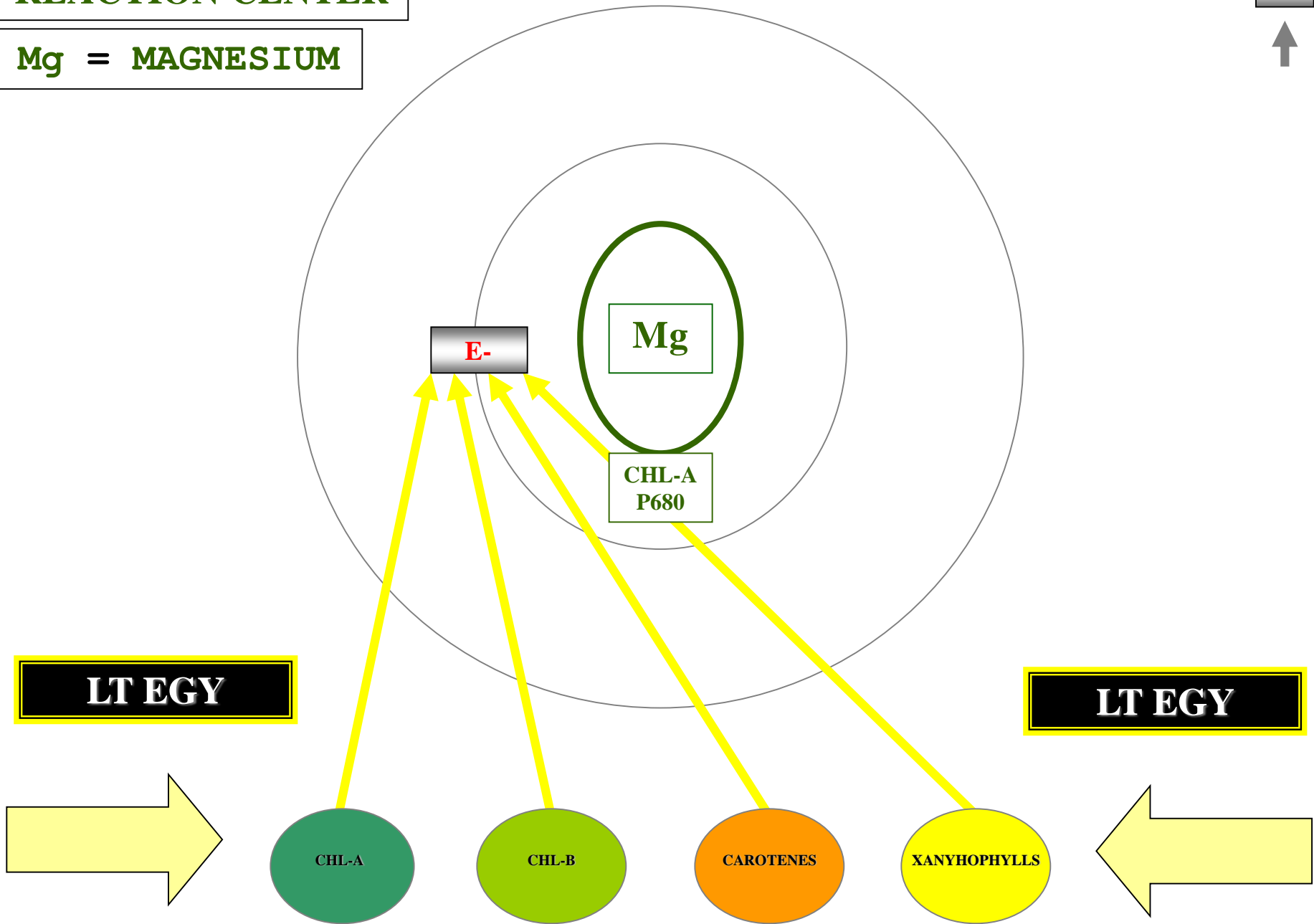


PLANT

REACTION CENTER

Mg = MAGNESIUM

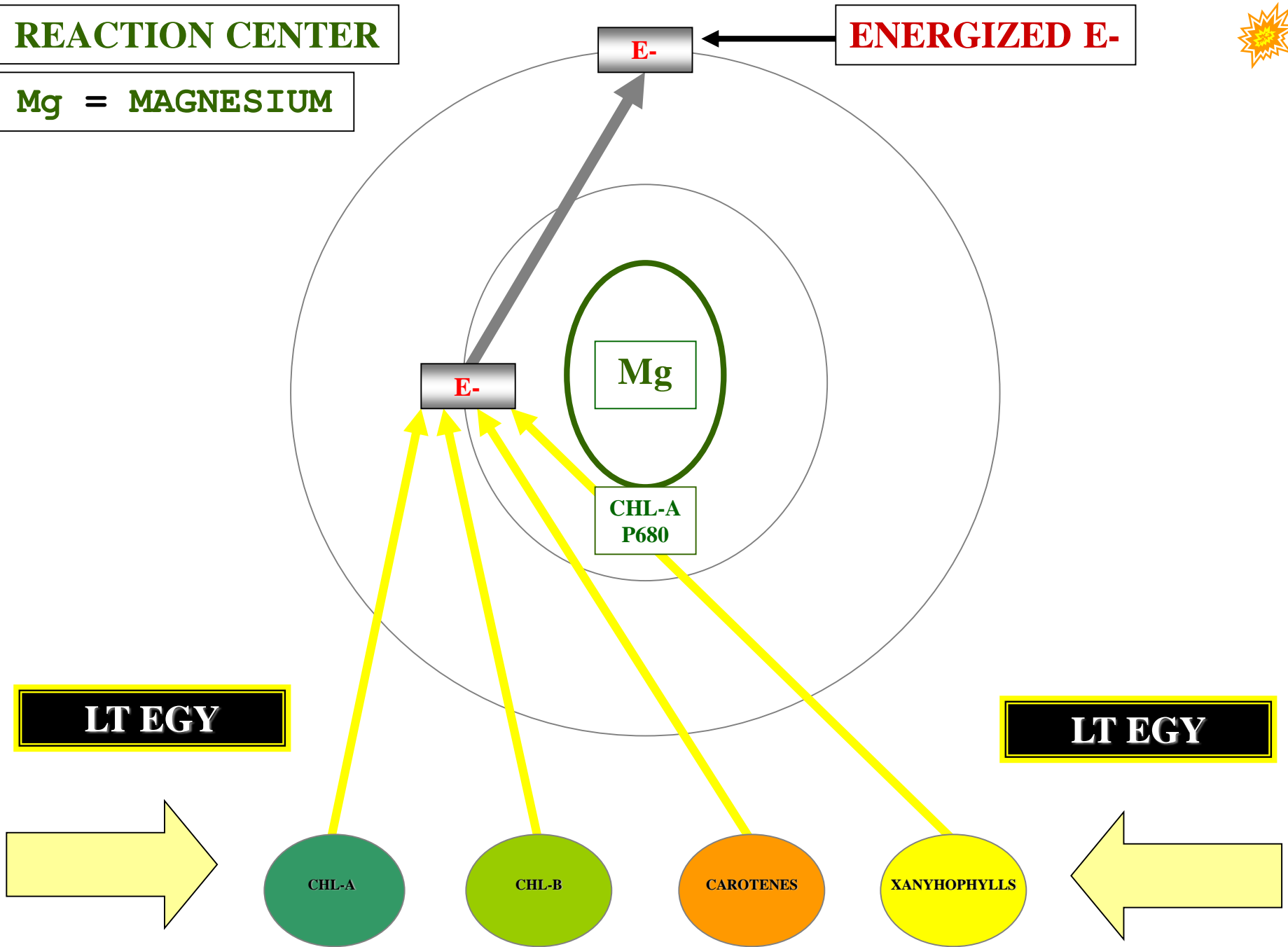
E-
↑



REACTION CENTER

Mg = MAGNESIUM

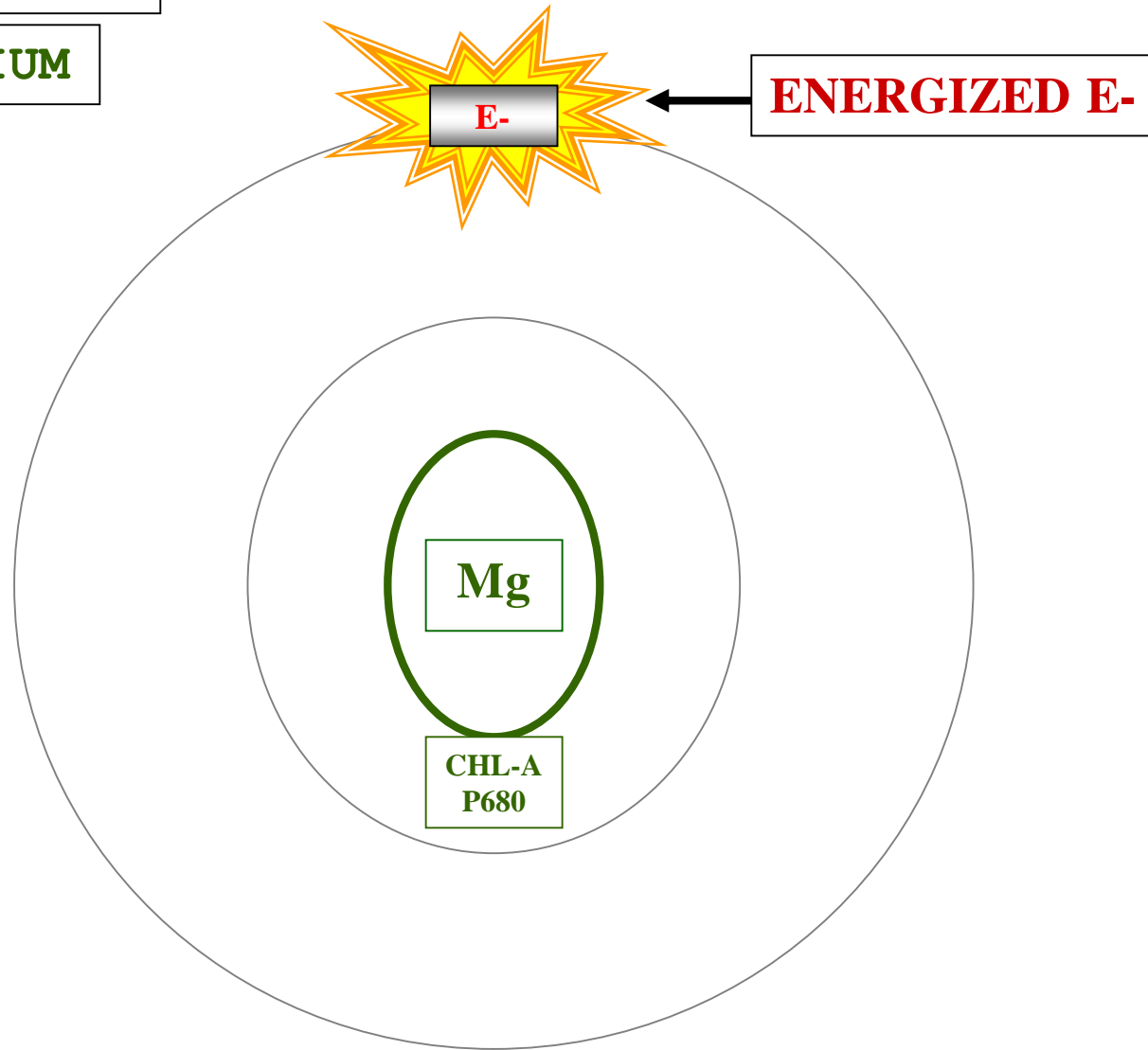
ENERGIZED E-



REACTION CENTER

Mg = MAGNESIUM

PR



REACTION CENTER

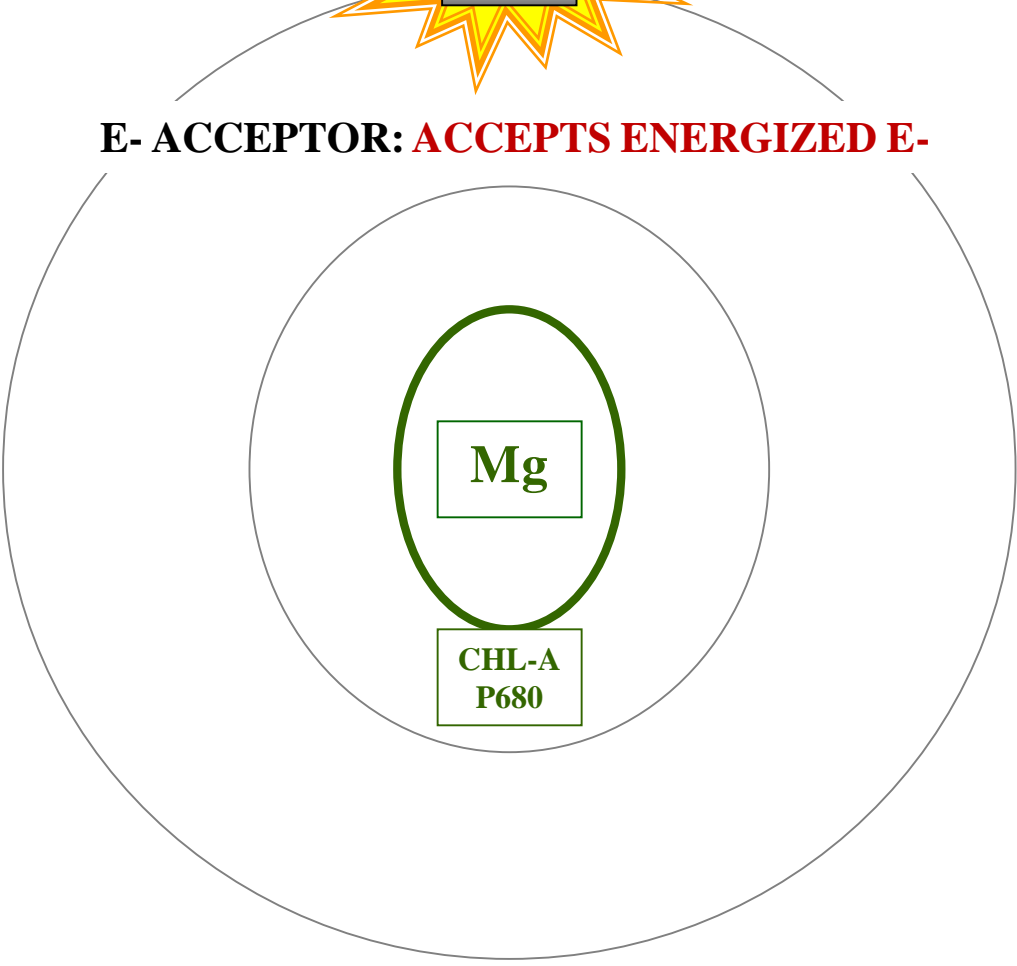
E- ACCEPTOR: PRESENT

Mg = MAGNESIUM

ENERGIZED E-

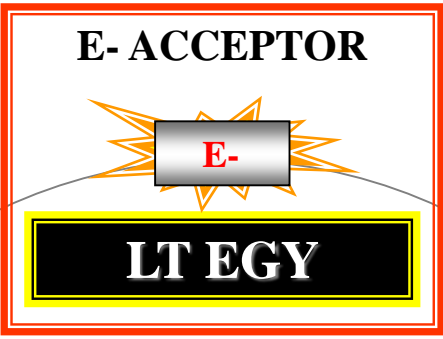
E-

E- ACCEPTOR: ACCEPTS ENERGIZED E-

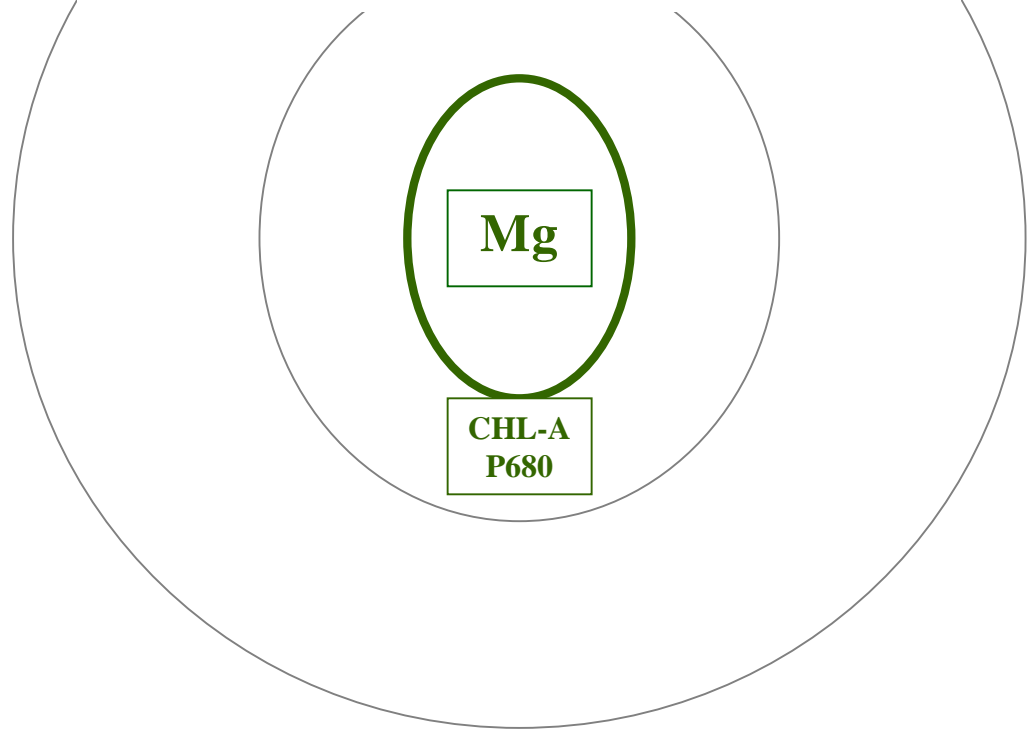


REACTION CENTER

Mg = MAGNESIUM



E- ACCEPTOR: ACCEPTS ENERGIZED E-



REACTION CENTER

Mg = MAGNESIUM

E- ACCEPTOR

E-

CHEM EGY

E- ACCEPTOR: ACCEPTS ENERGIZED E-

Mg

**CHL-A
P680**





SUMMER BEACH

SAND

PLANT



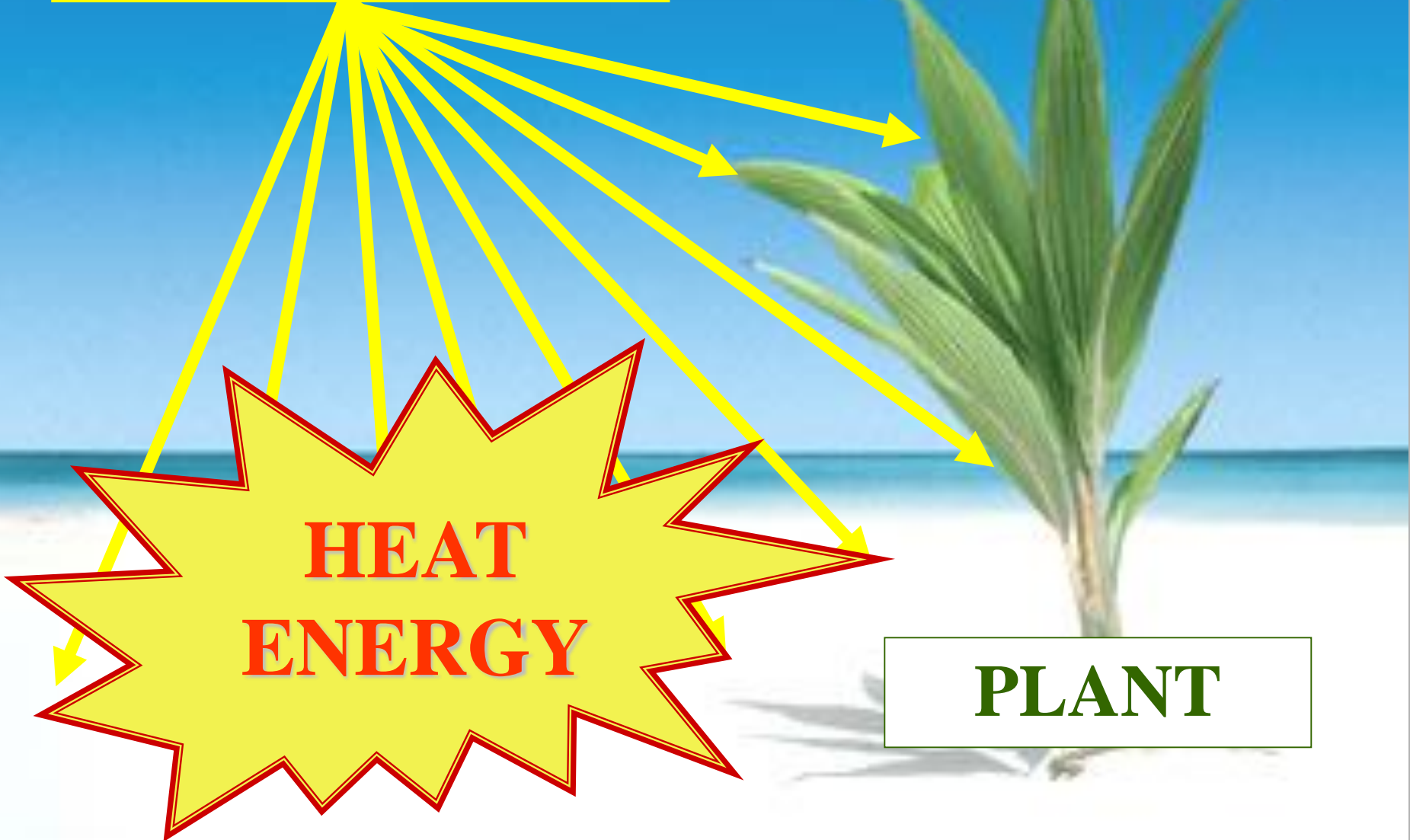
LIGHT ENERGY



SAND

PLANT

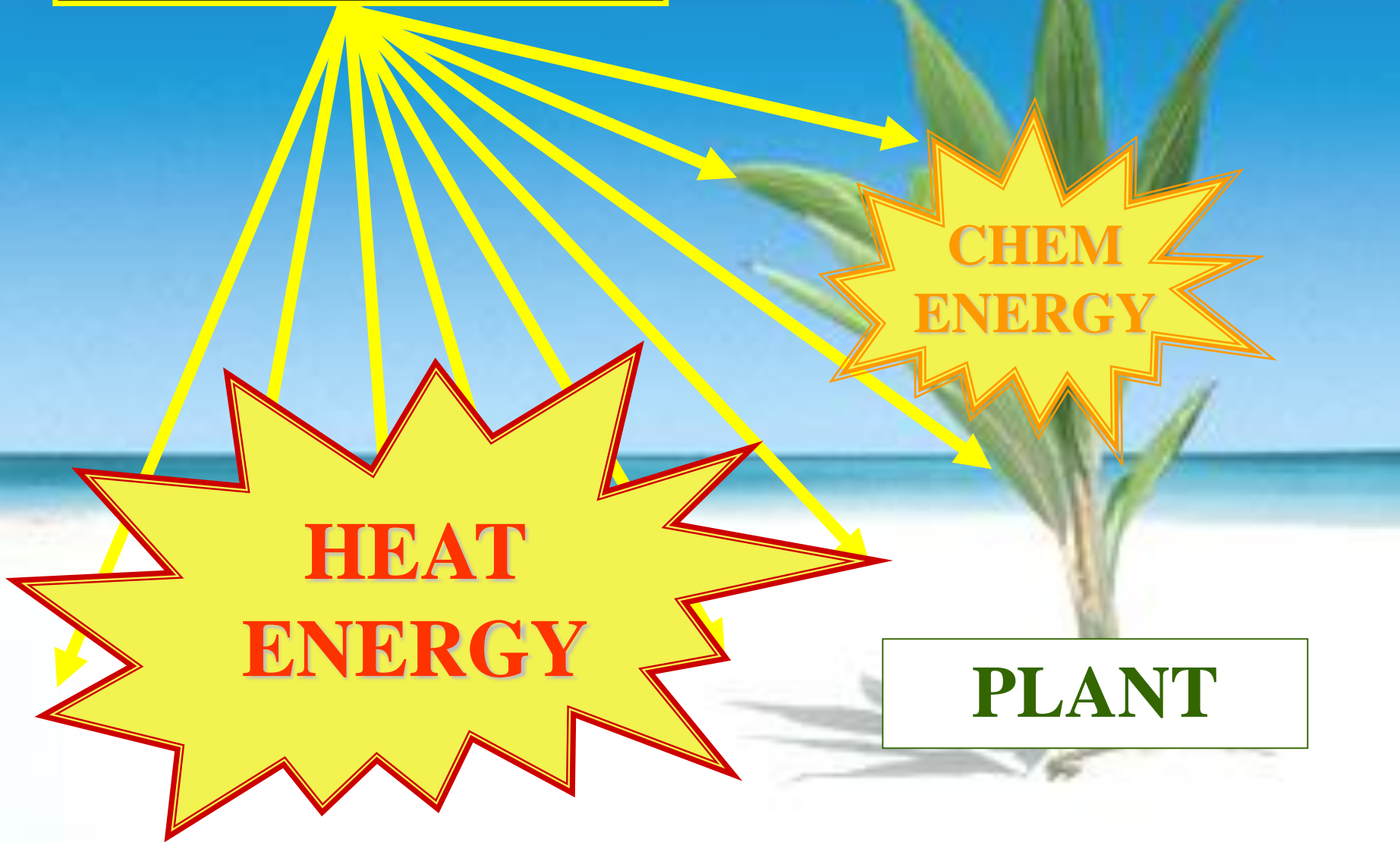
LIGHT ENERGY



PLANT



LIGHT ENERGY

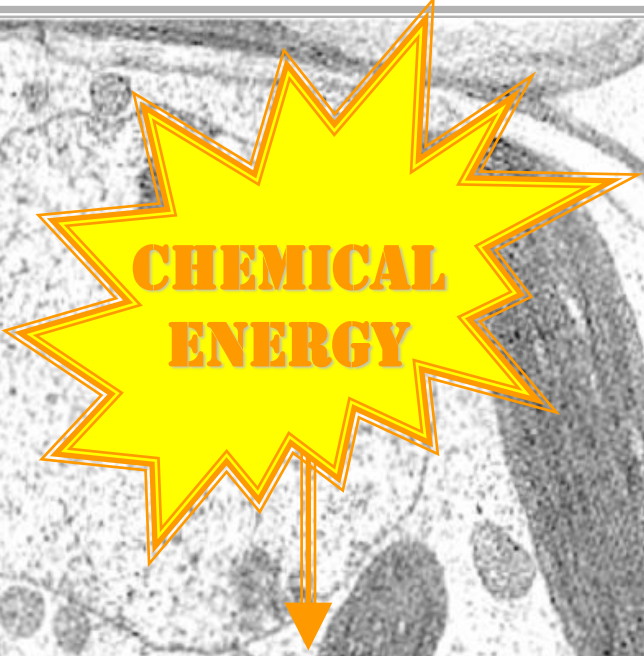


**CHEM
ENERGY**

**HEAT
ENERGY**

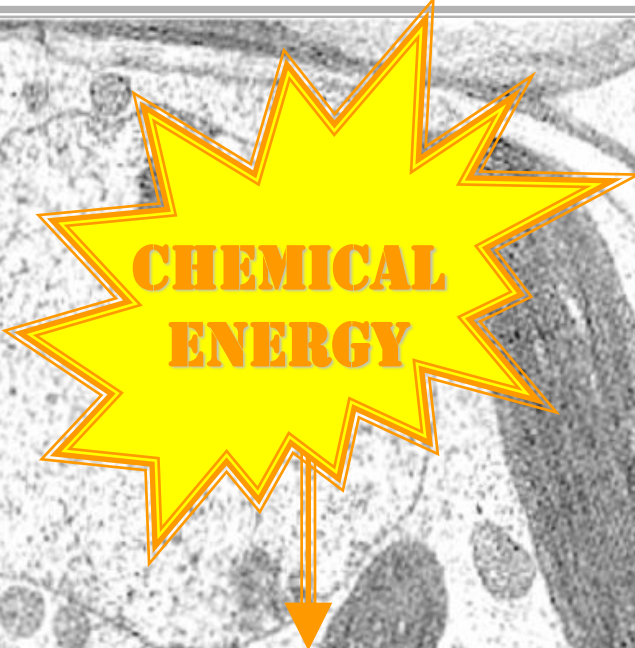
PLANT

CELL METABOLISM



BIOCHEMICAL REACTION

CELL METABOLISM



**ENDERGONIC
BIOCHEMICAL REACTIONS**

CELL METABOLISM



**CHEMICAL
ENERGY**



**CHEMICAL ENERGY
DRIVES
ENDERGONIC REACTIONS
TO A PRODUCT**

O



***EFFICIENT
METABOLISM***



E



ORGANIZATION INCREASES



***ENTROPY
DECREASES***

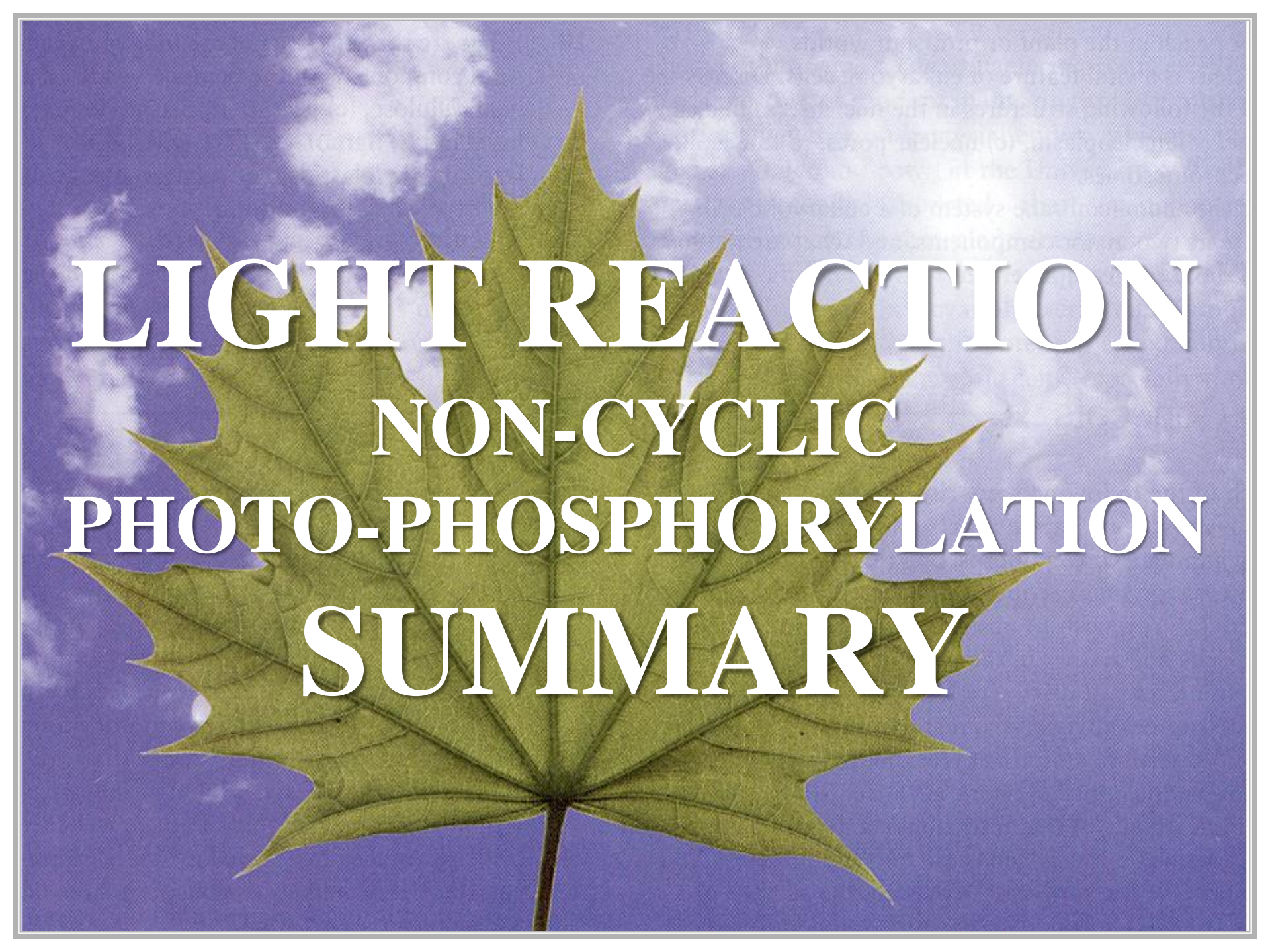


\$

NC

HOMEOSTASIS



A large, vibrant green maple leaf is the central focus, set against a background of a bright blue sky with scattered white clouds. The leaf's veins are clearly visible, and its stem extends downwards. The overall image has a slightly grainy texture.

LIGHT REACTION
NON-CYCLIC
PHOTO-PHOSPHORYLATION
SUMMARY

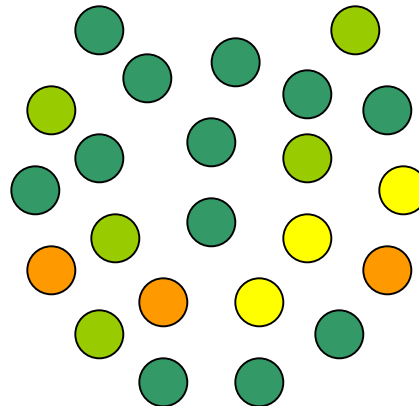
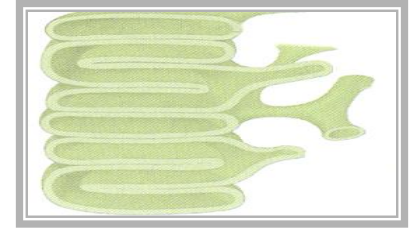
CHLOROPLAST

PS-II

THYLAKOID



**ANTENNA
MOLECULES**



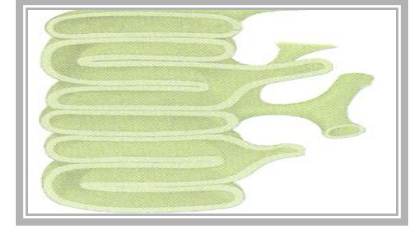
CHLOROPLAST

PS-II

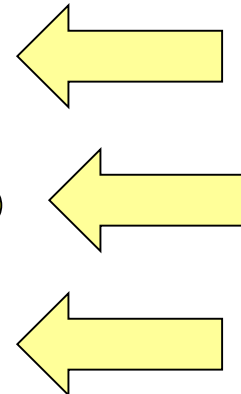
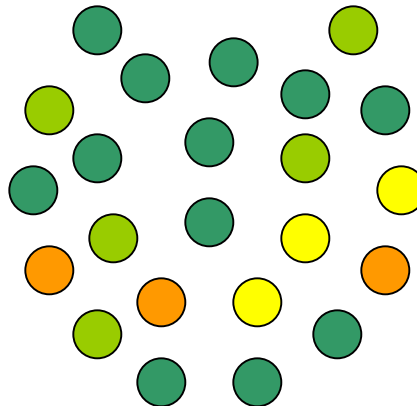
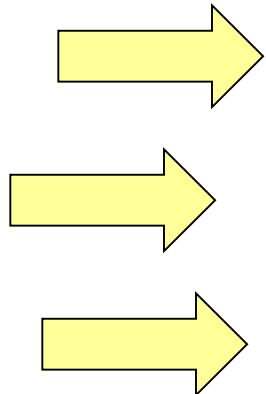
THYLAKOID



**ANTENNA
MOLECULES**



LTEGY



LTEGY

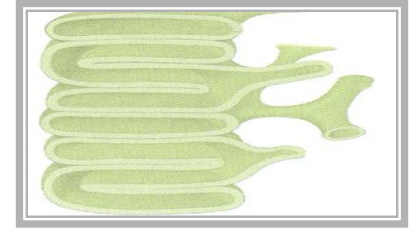
CHLOROPLAST

PS-II

THYLAKOID



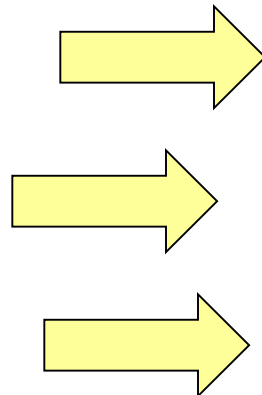
**ANTENNA
MOLECULES**



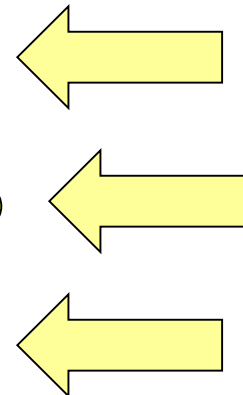
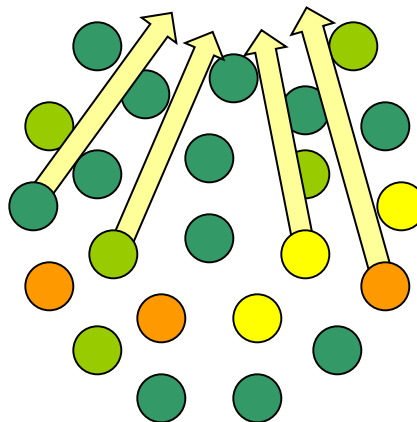
RC



LTEGY



LTEGY



LTEGY

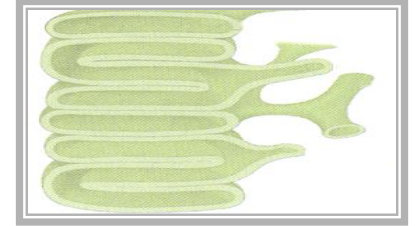
CHLOROPLAST

PS-II

THYLAKOID



**ANTENNA
MOLECULES**



E-

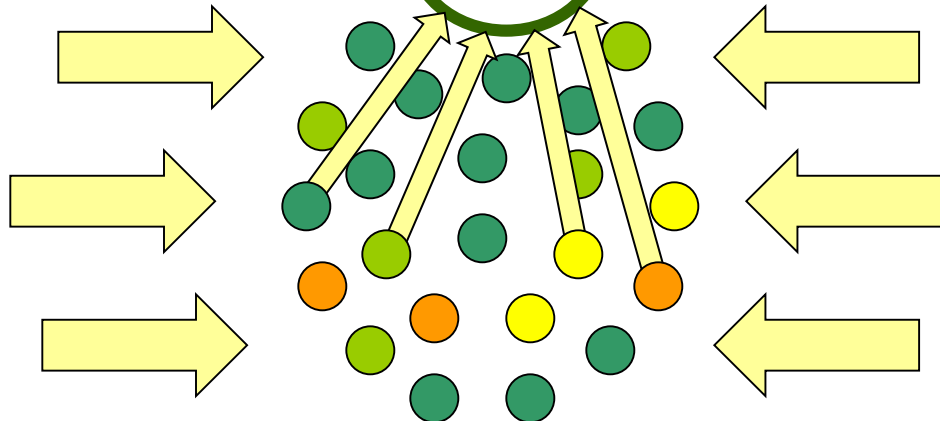


REACTION CENTER: ABSORBS SUFFICIENT LIGHT ENERGY

REACTION CENTER



LTEGY



LTEGY

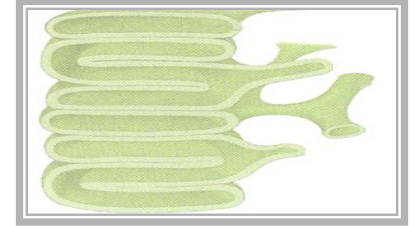
CHLOROPLAST



PS-II



THYLAKOID



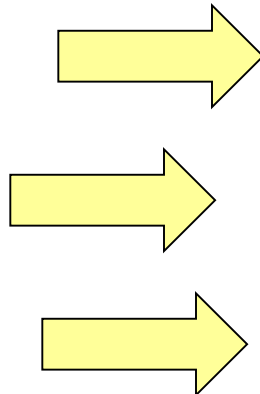
ENERGIZED E-



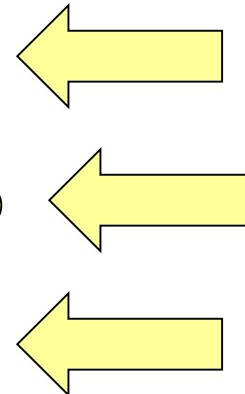
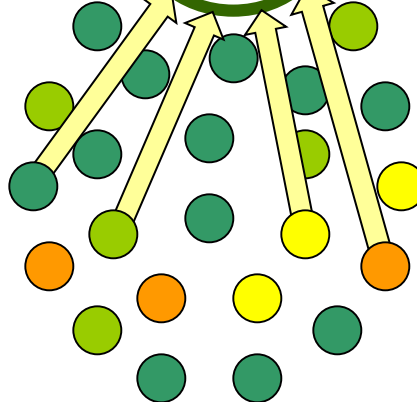
A
Q



LTEGY



**CHL-A
P680**



LTEGY

CHLOROPLAST

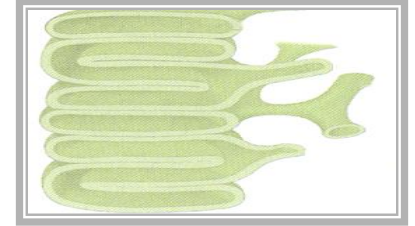


E- ACCEPTOR "Q"

E-

LTEGY

THYLAKOID

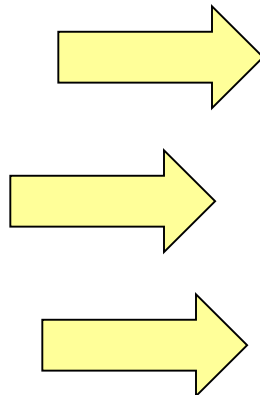


E- ACCEPTOR "Q": ACCEPTS ENERGIZED E-

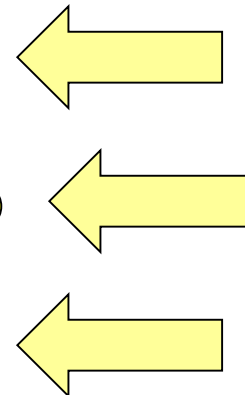
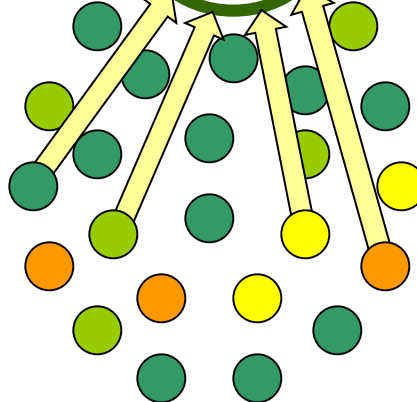
C



LTEGY



CHL-A
P680



LTEGY

CHLOROPLAST

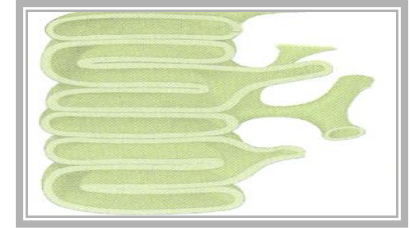


E- ACCEPTOR "Q"



CHEM EGY

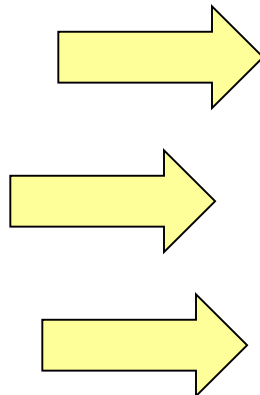
THYLAKOID



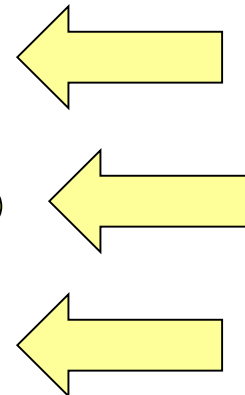
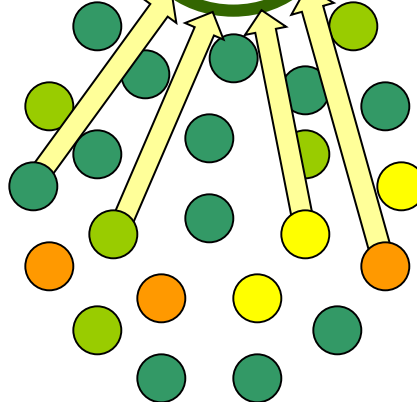
E- ACCEPTOR "Q": ACCEPTS ENERGIZED E-



LTEGY



CHL-A
P680



LTEGY



P680

REDOX RXT

CHLOROPLAST

E- ACCEPTOR "Q"

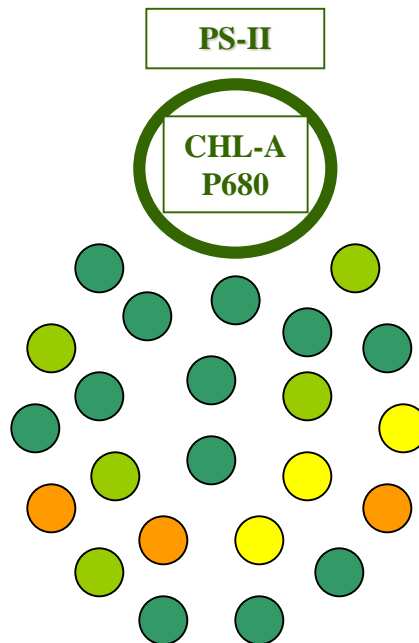


CHEM EGY

THYLAKOID

R

E- ACCEPTOR "Q": ACCEPTS ENERGIZED E-



CHLOROPLAST

E- ACCEPTOR "Q"



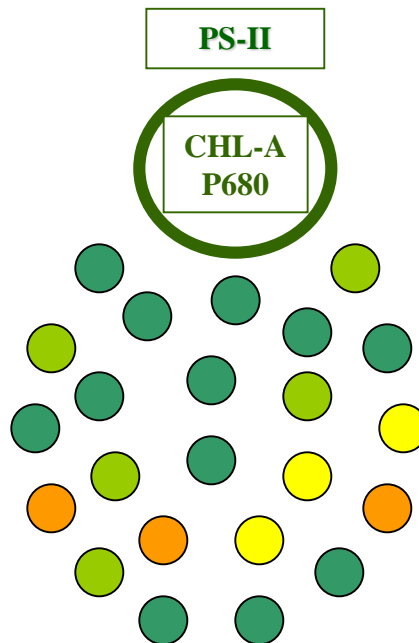
CHEM EGY

THYLAKOID

"Q" REDUCED

O

E- ACCEPTOR "Q": ACCEPTS ENERGIZED E-



CHLOROPLAST

E- ACCEPTOR "Q"



CHEM EGY

THYLAKOID

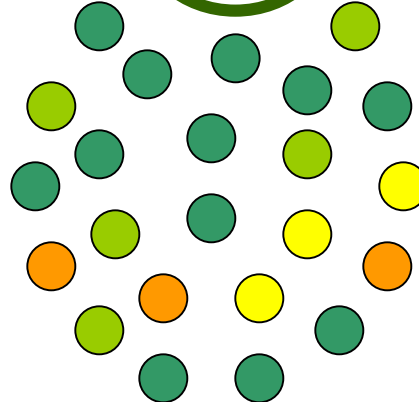
"Q" REDUCED

C

E- ACCEPTOR "Q": ACCEPTS ENERGIZED E-

PS-II

**CHL-A
P680**



P680 OXIDIZED

CHLOROPLAST

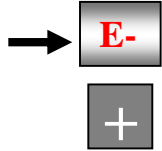
E- ACCEPTOR "Q"



CHEM EGY

THYLAKOID

"Q" REDUCED

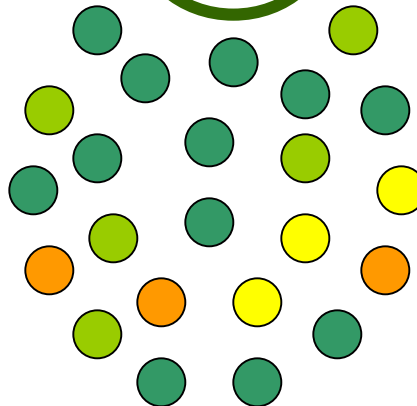


COUPLED

P680 OXIDIZED

PS-II

CHL-A
P680



CHLOROPLAST

E- ACCEPTOR "Q"



CHEM EGY

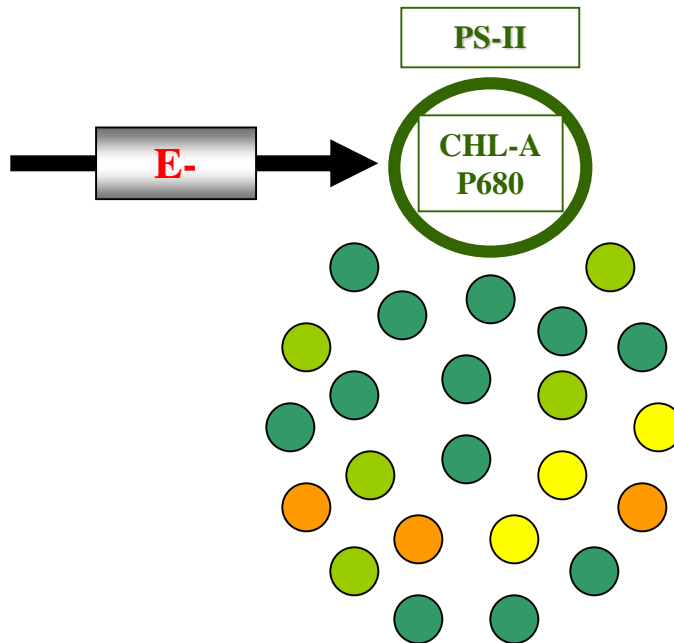
THYLAKOID

"Q" REDUCED



COUPLED

P680 OXIDIZED



CHLOROPLAST

E- ACCEPTOR "Q"



CHEM EGY

THYLAKOID

"Q" REDUCED

P

COUPLED

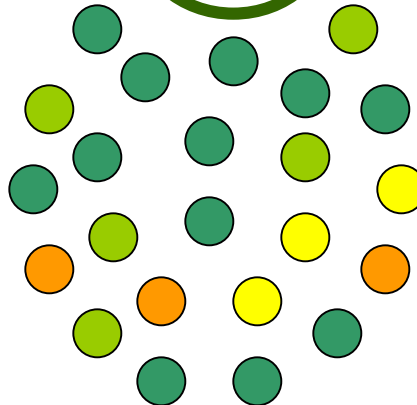
P680 OXIDIZED

WATER

E-

PS-II

CHL-A
P680



CHLOROPLAST

E- ACCEPTOR "Q"



CHEM EGY

THYLAKOID

"Q" REDUCED



COUPLED

P680 OXIDIZED

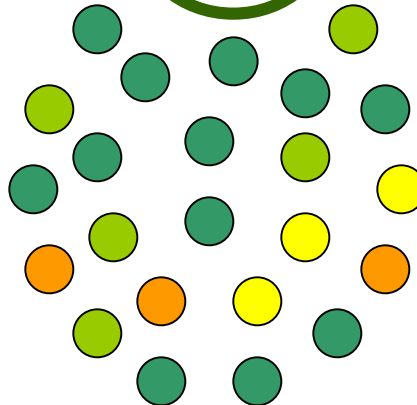
PHOTOLYSIS

WATER

E-

PS-II

CHL-A
P680



PHOTOLYSIS

PHOTOLYSIS



PHOTOLYSIS

LIGHT ENERGY

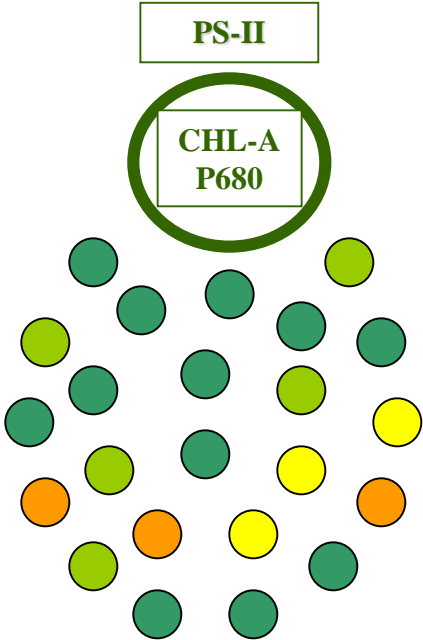
SPLITTING OF WATER

PHOTOLYSIS

LIGHT ENERGY

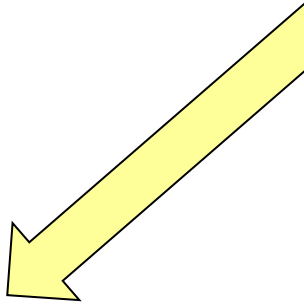


PHOTOLYSIS



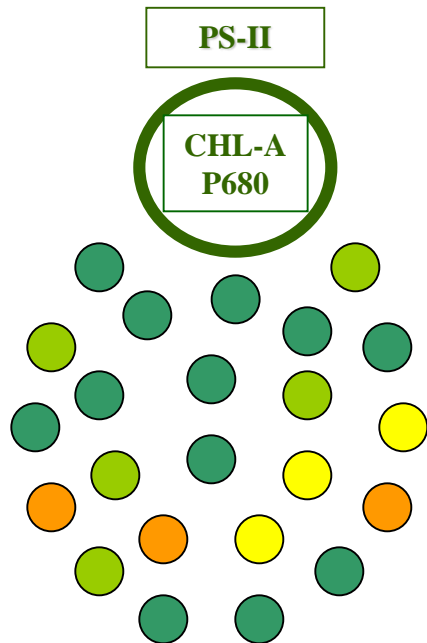
P680 OXIDIZED

LIGHT ENERGY



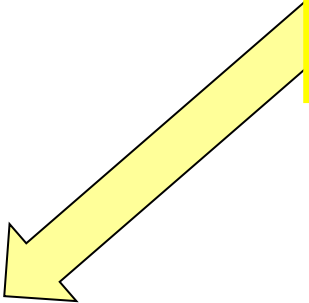
WATER

PHOTOLYSIS



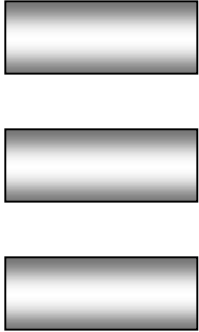
P680 OXIDIZED

LIGHT ENERGY



WATER

SPLIT →

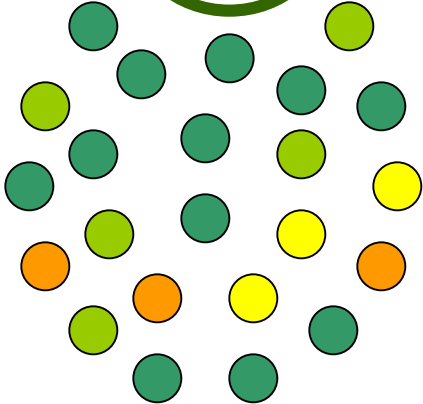


PHOTOLYSIS

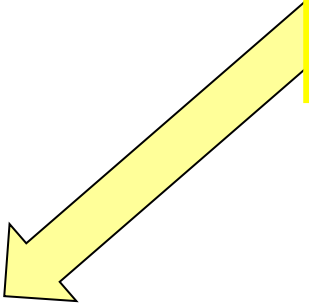
PS-II



P680 OXIDIZED



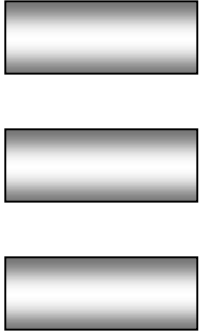
LIGHT ENERGY



WATER

SPLIT

ENZYME
COMPLEX
REQUIRED

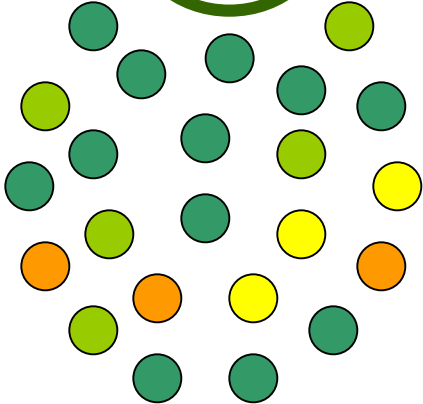


PHOTOLYSIS

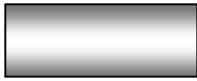
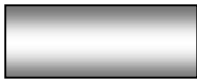
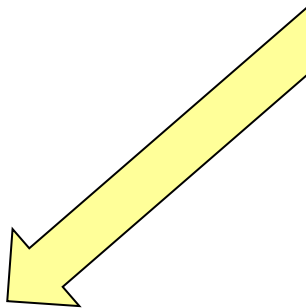
PS-II



P680 OXIDIZED



LIGHT ENERGY



WATER

SPLIT

ENZYME
COMPLEX

Mn

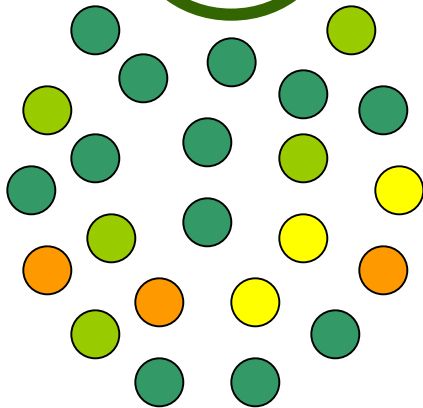
Manganese
REQUIRED

PHOTOLYSIS

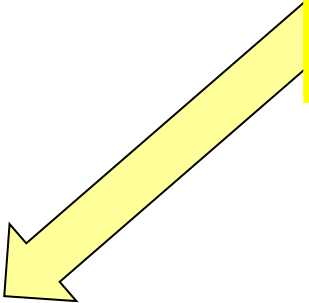
PS-II

CHL-A
P680

P680 OXIDIZED



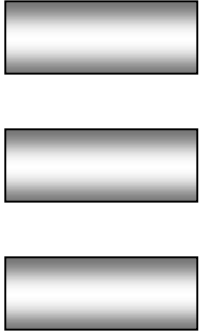
LIGHT ENERGY



WATER

SPLIT

ENZYME
COMPLEX
Mn
Manganese
COFACTOR

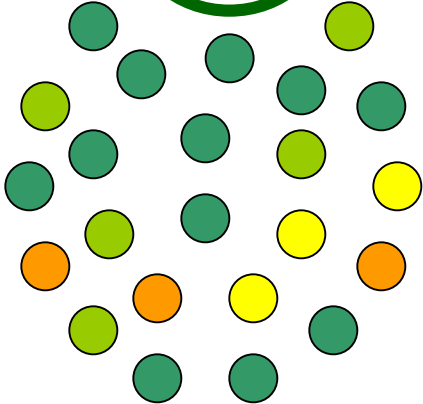


PHOTOLYSIS

PS-II

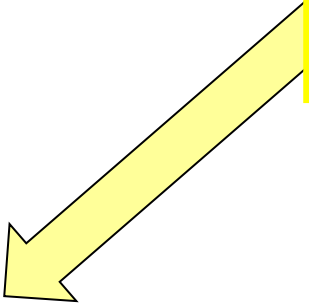


P680 OXIDIZED





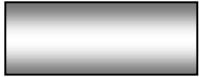
LIGHT ENERGY



WATER

SPLIT

H⁺



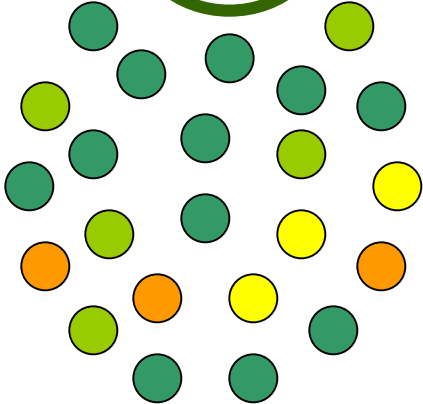
ENZYME
COMPLEX
Mn
Manganese
COFACTOR

PHOTOLYSIS

PS-II

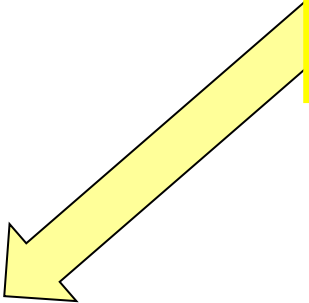


P680 OXIDIZED





LIGHT ENERGY



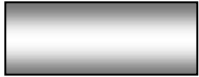
WATER

SPLIT

H⁺

O

ENZYME
COMPLEX
Mn
Manganese
COFACTOR

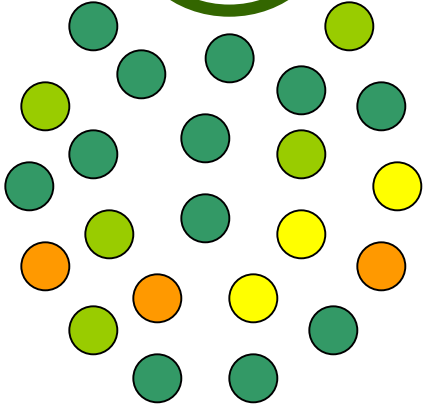


PHOTOLYSIS

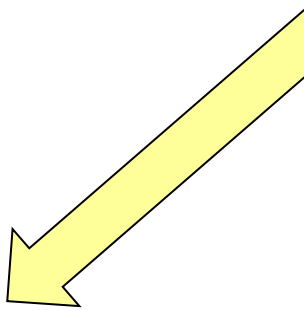
PS-II



P680 OXIDIZED



LIGHT ENERGY



WATER

SPLIT →

**ENZYME
COMPLEX**
Mn
Manganese
COFACTOR

H+

O

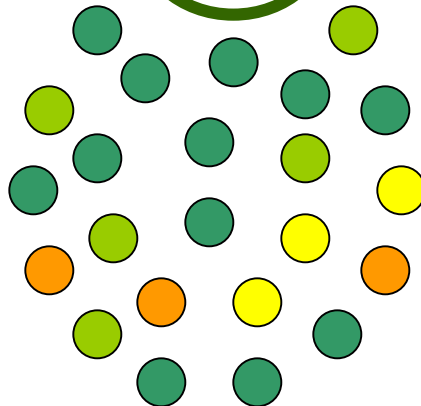
E-

PHOTOLYSIS

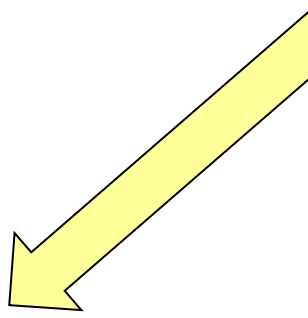
PS-II

CHL-A
P680

P680 OXIDIZED



LIGHT ENERGY



WATER

SPLIT

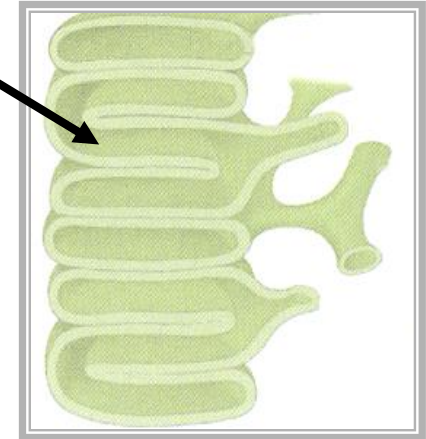
ENZYME
COMPLEX
Mn
Manganese
COFACTOR

H+

O

E-

THYLAKOID SPACE

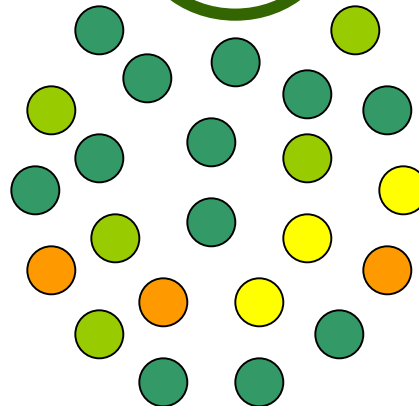


PHOTOLYSIS

PS-II

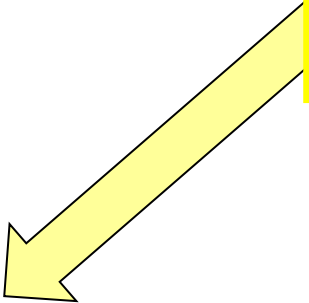
CHL-A
P680

P680 OXIDIZED





LIGHT ENERGY



WATER

SPLIT

ENZYME
COMPLEX
Mn
Manganese
COFACTOR

H+



THYLAKOID SPACE

O



ATMOSPHERE

E-

PHOTOLYSIS

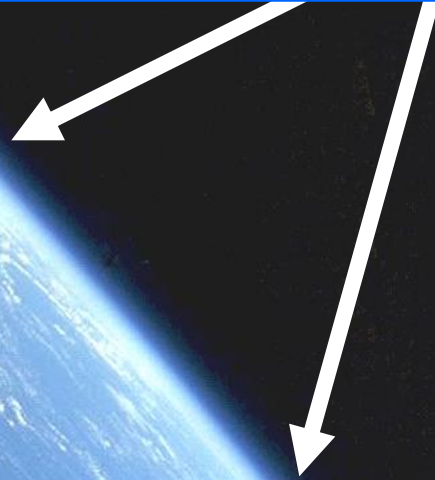
PS-II



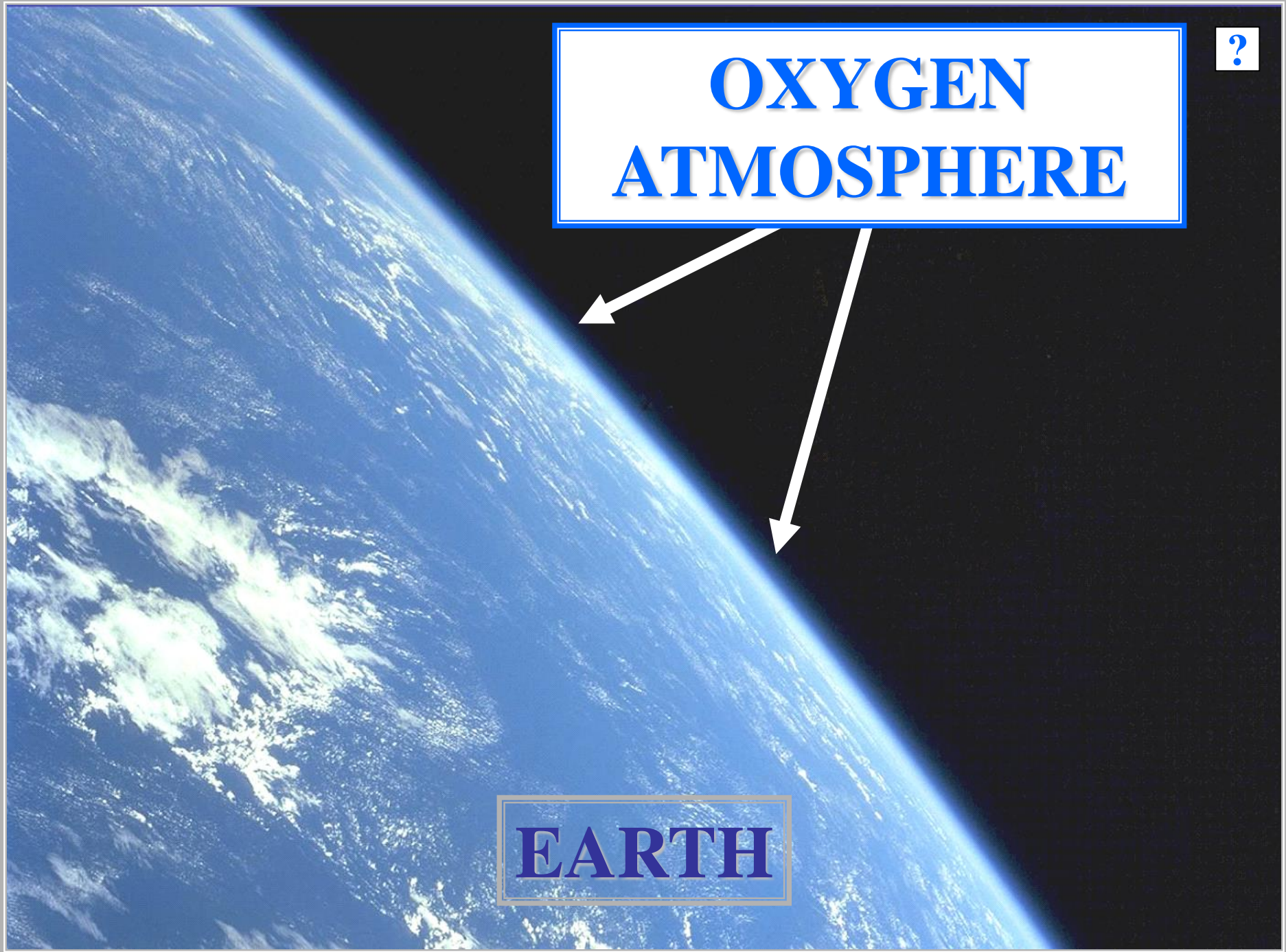
P680 OXIDIZED



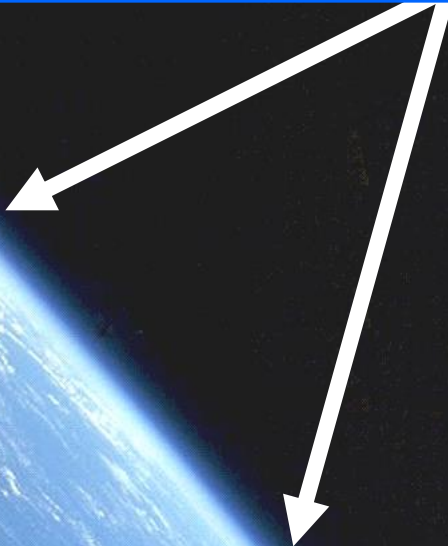
OXYGEN ATMOSPHERE



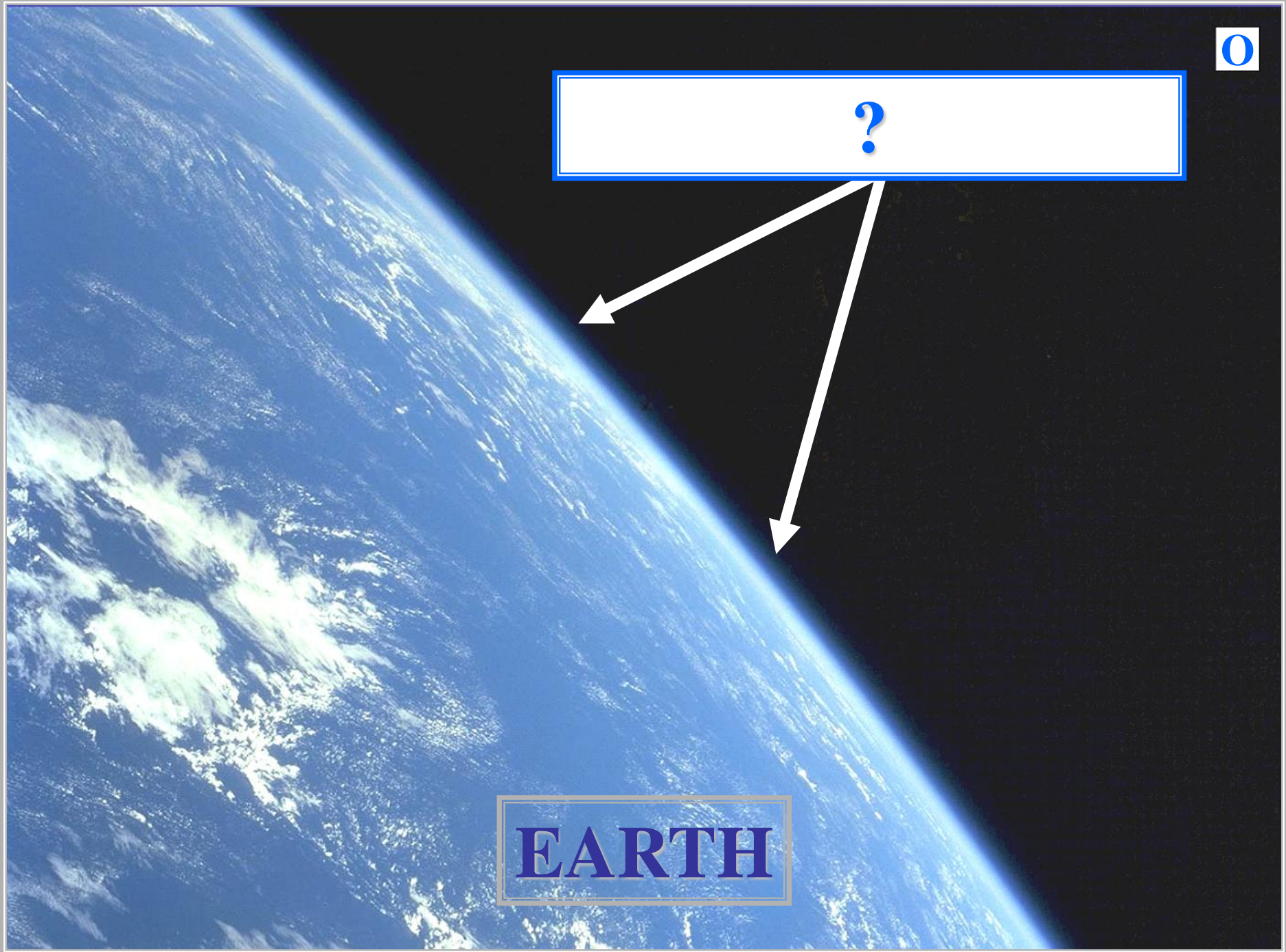
EARTH



?

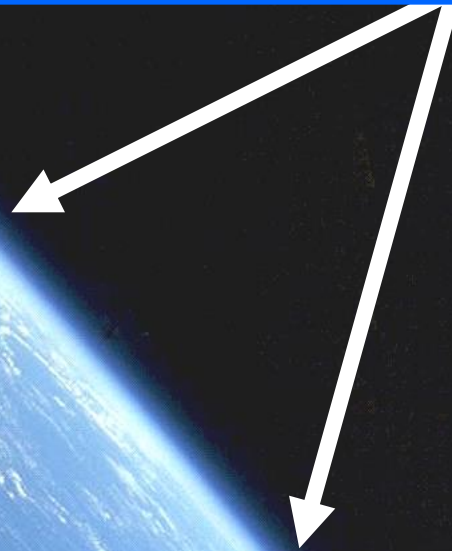


EARTH





OZONE LAYER



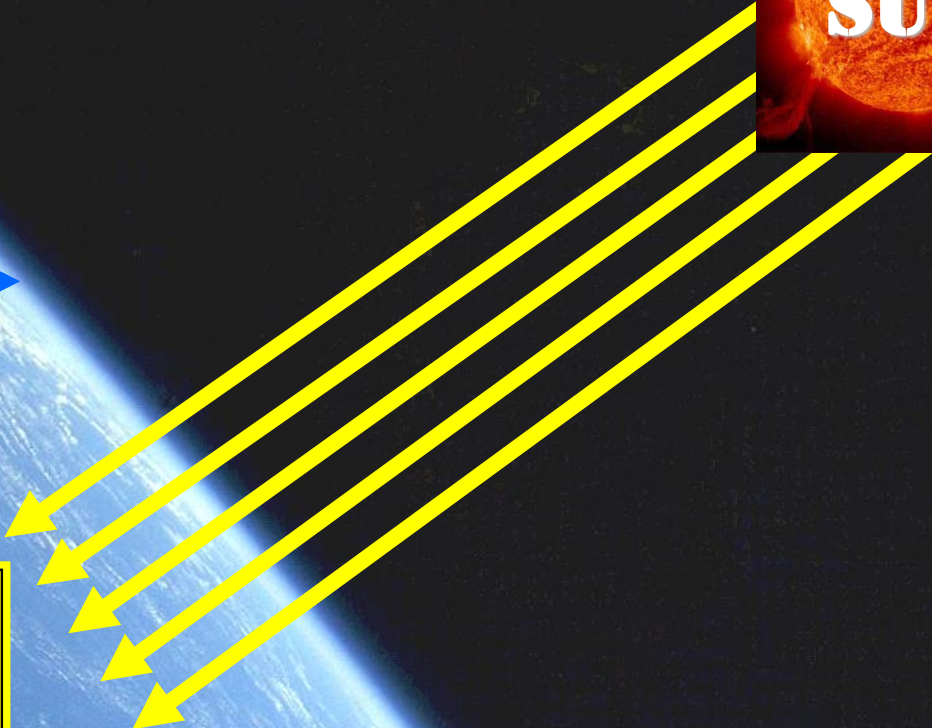
EARTH



OZONE LAYER



**ELECTROMAGNETIC
ENERGY
RADIATION**



EARTH





HARMFUL RADIATION

OZONE LAYER

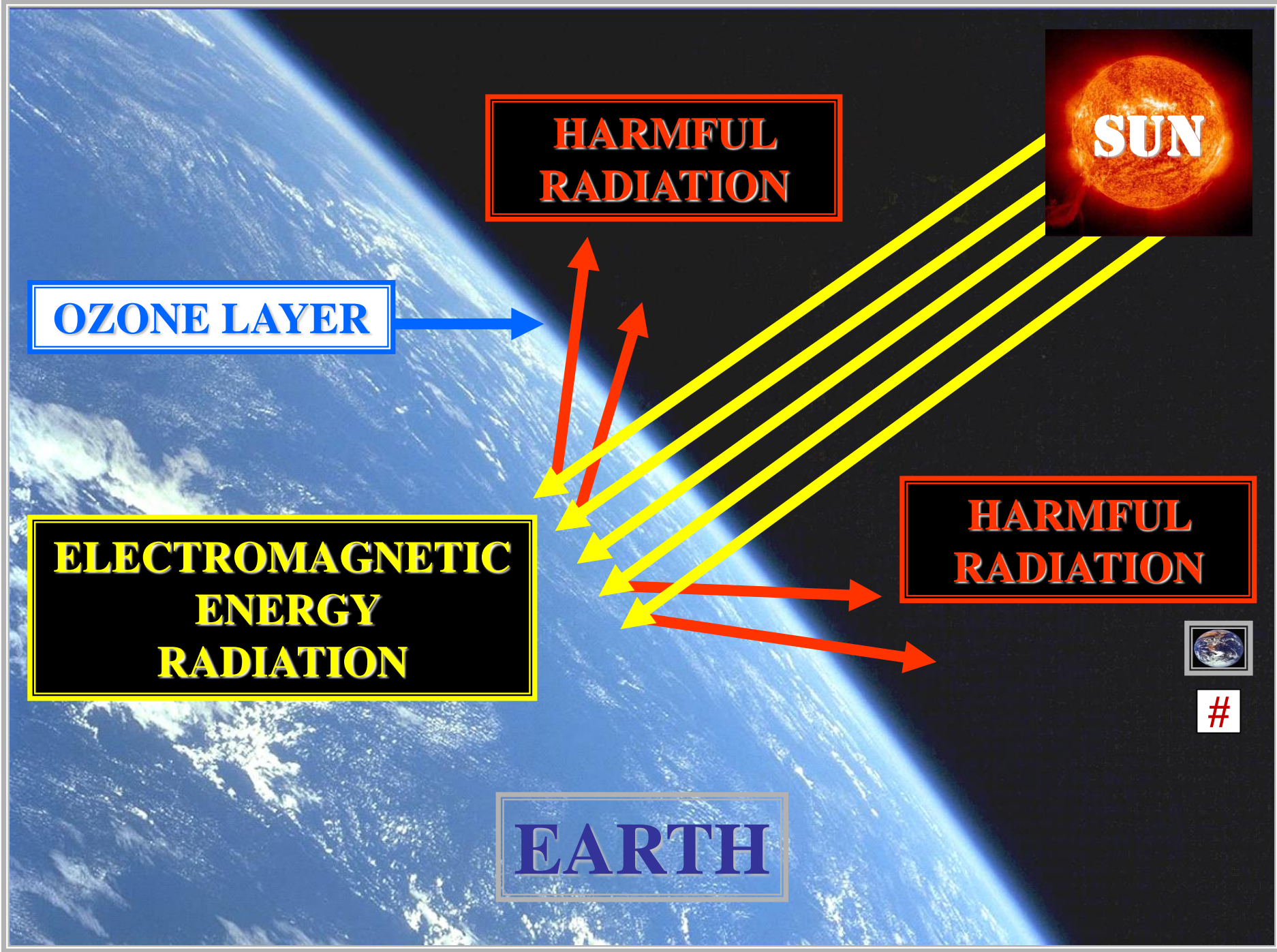
ELECTROMAGNETIC ENERGY RADIATION

HARMFUL RADIATION

EARTH



#





~10 MILLION SPECIES



EARTH



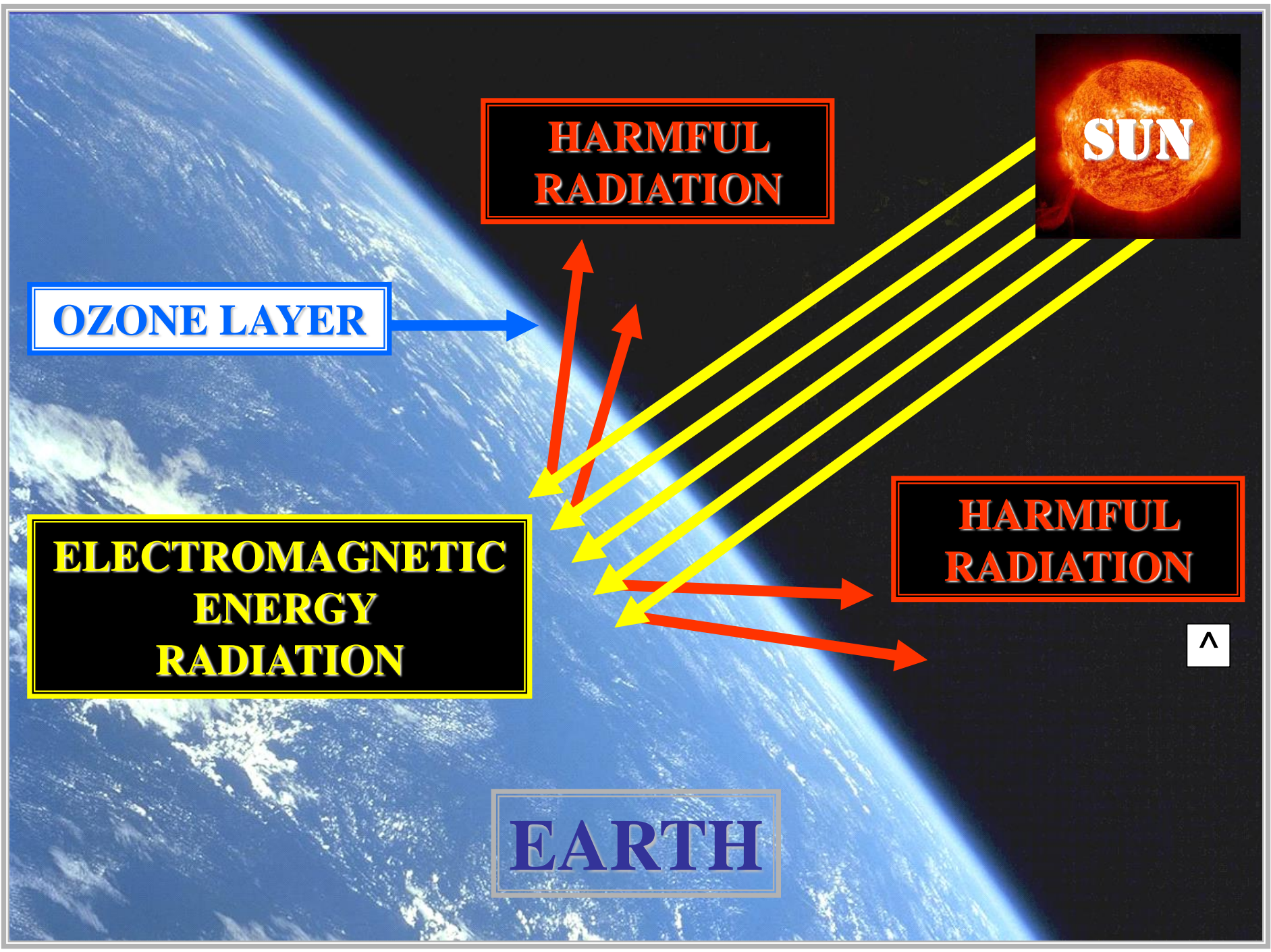
HARMFUL RADIATION

OZONE LAYER

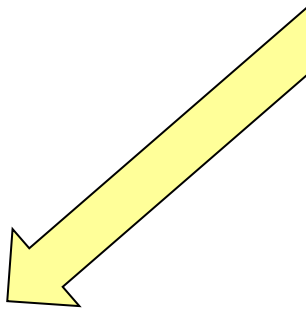
ELECTROMAGNETIC ENERGY RADIATION

HARMFUL RADIATION

EARTH



LIGHT ENERGY



WATER

SPLIT

ENZYME
COMPLEX
Mn
Manganese
COFACTOR

H+

THYLAKOID SPACE

O

ATMOSPHERE

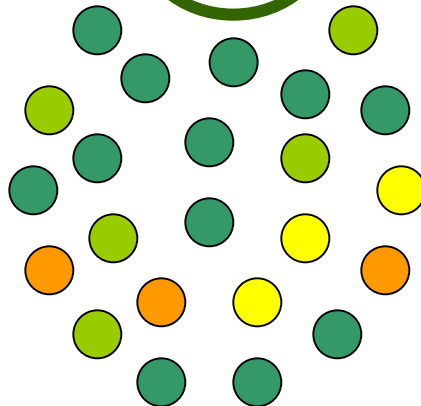
E-

PHOTOLYSIS

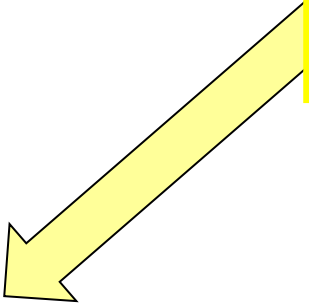
PS-II

CHL-A
P680

P680 OXIDIZED



LIGHT ENERGY



WATER

SPLIT

ENZYME
COMPLEX
Mn
Manganese
COFACTOR

H+



THYLAKOID SPACE

O



ATMOSPHERE

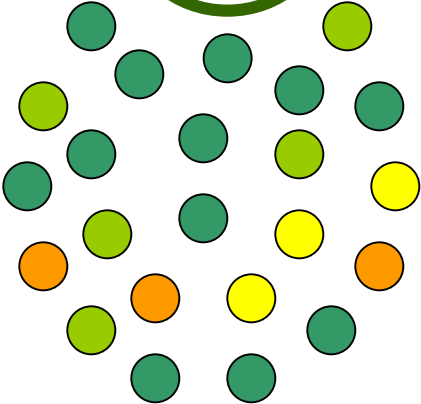
E-



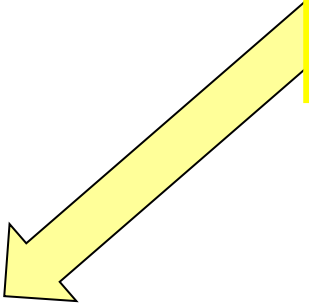
PHOTOLYSIS



P680 OXIDIZED



LIGHT ENERGY



WATER

SPLIT

ENZYME
COMPLEX
Mn
Manganese
COFACTOR

H+



THYLAKOID SPACE

O



ATMOSPHERE

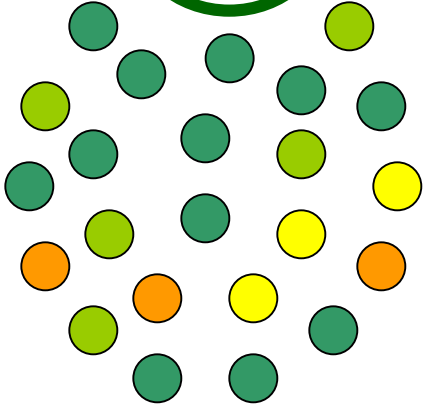
E-

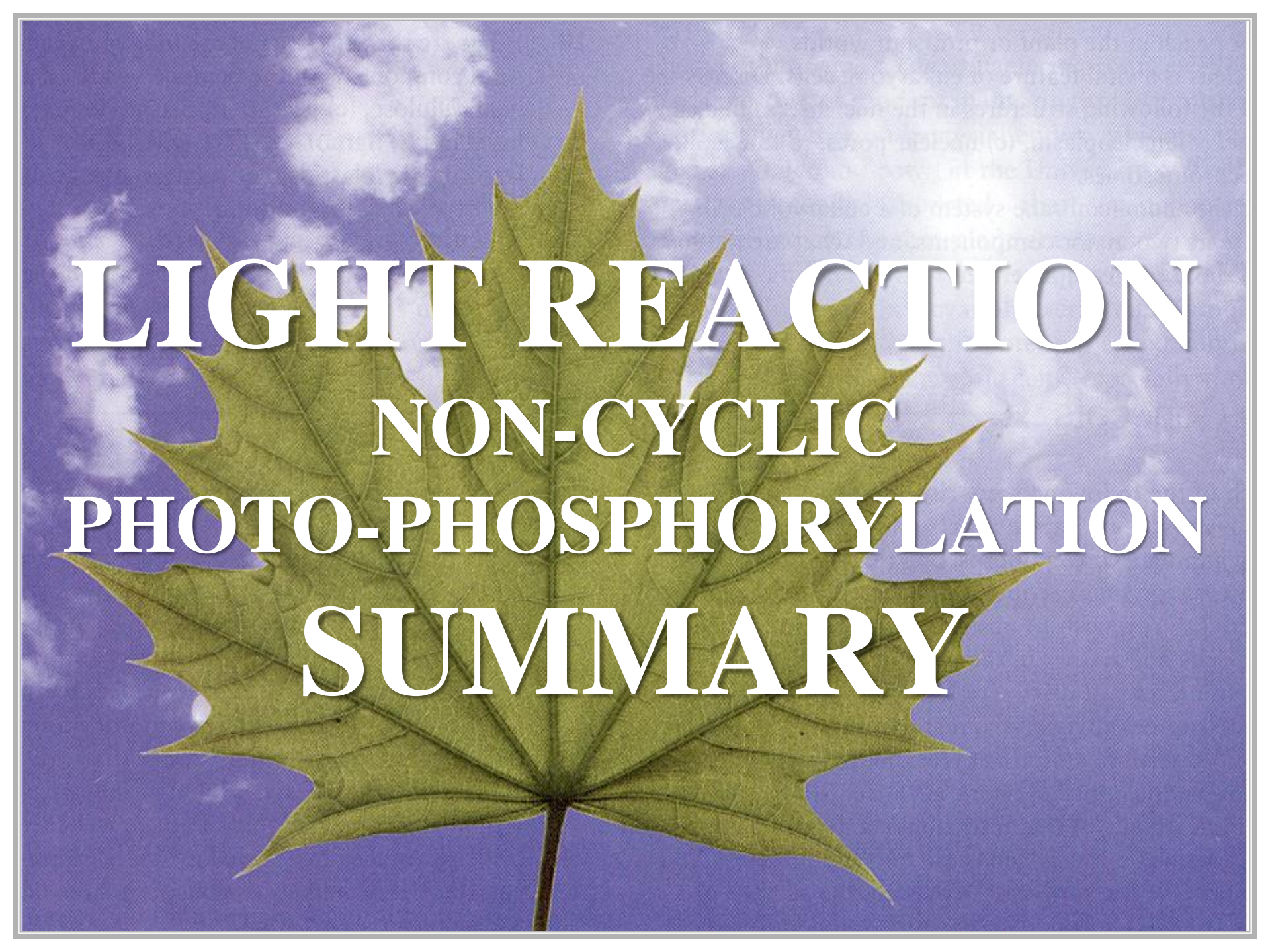


PHOTOLYSIS

CHL-A
P680

P680 REDUCED



A large, vibrant green maple leaf is the central focus, set against a background of a clear blue sky with scattered white clouds. The leaf's veins are clearly visible, and its stem extends downwards. The overall composition is bright and natural, suggesting a connection to photosynthesis.

LIGHT REACTION
NON-CYCLIC
PHOTO-PHOSPHORYLATION
SUMMARY



***LIGHT
ENERGY***

RC

