Yield of ATP in Glycolysis and Aerobic Respiration:

ATP Yield in Eucaryotes from Glycolysis, TCA cycle, and electron transport:

Glycolytic Pathway:

SLP (ATP)	*2 ATPs*
OPL with 2 NADH	*6 ATPs*

2 pyruvates to 2 Acetyl CO-A

OP with 2 NADH	*6 ATPs*

TCA Cycle

SLP (GTP)	*2 ATPs*
OP with 6 NADH	*18 ATPs*
OP with 2 FADH2	*4 ATPs*
Total Aerobic Yield	*38 ATPs*

Aerobic Oxidation of glucose to 6 CO2 → 38 ATPS

Anaerobic Respiration:

- *Energy yielding process where the final electron acceptor is different than oxygen:*
- *The major acceptors are nitrate, sulfate, and CO2 (NO3-, SO4-, CO2)*
- *Bacteria can nitrate to nitrite to produce ATP, but it is not the most effective way to produce ATP.*
- *Because Nitrite is toxic, Nitrate is usually reduced to Nitrogen gas,* ***denitrification****.*

- *Anaerobic respiration does not yield as much ATp as aerobic respiration because less energy is available.*
- *Yet Anaerobic Respiration is useful bc it is more efficient than fermentation and allows ATP synthesis by ET and OP in the absence of oxygen.*
- *Find Anaerobic Respiration in oxygen depleted soils and sediments.*

Anaerobic Respiration

- *respiration in which a terminal electron acceptor other than O2 is used,*
- *less energy than aerobic respiration, but allows organisms to live in environments lacking O2.*

Photosynthesis

- *Light energy is trapped and converted to chemical energy.*
- *Photosynthetic pathways use light, rather than chemical compounds as a source of energy, move it through Photosystems I and II to synthesize ATP and NADH or NADPH.*
- *One of the most significant metabolic pathways on earth bc all our energy is ultimately derived from solar energy.*
- *Provides photosynthetic organisms with ATP and NADPH to synthesize organic cmpd needed for growth.*
- *Replenishing O2 supply*
- *Carried out by both Pro and Euc*

TWO parts to Photosynthesis*:*

1. ***Light Reactions****: light is trapped and converted to chemical energy.*
2. ***Dark Reactions:*** *Energy made during the light reaction is used here to reduce or fix CO2 and synthesize cell constituents.*

Chlorophyll

- *Photosynthetic organisms use chlorophyll to trap sunlight and extract the energy to drive ATP synthesis.*

- *Chlorophyll has a chemical structure that is similar to heme, but it contains a magnesium ion instead of iron*

- *Light energy is channeled to a chlorophyll molecule contained within a pigment complex called a* ***reaction center.***

- *Light hits the reaction center, and excites electrons*

- *The excited electron is then passed to a series of electron carriers, each one removing some of the energy, until the electron returns to its ground state where it is passed back to the reaction center complex.*

- *The energy derived from the excited electrons by the electron carrier molecules is used to* ***synthesize ATP****.*

- *This process of light driven ATP synthesis is called* ***cyclic phosphorylation*** *because electrons in a cyclic pathway and ATP is formed.*

- *Involving the activity of Photosystem I alone*

Non cyclic phosphorylation:

- *In order to reduce CO2 into more complex compounds, the cells require H atoms (or protons) and the reaction center complex does not have the strength required to strip H away from HOH*

- *Therefore the Photoautotroph increases the energy by coupling a second reaction center to the first one.*

- *Electrons are stripped from HOH and passed to RCII which is in turn stimulated to an excited state, and passed to RCI*

- *Which is stimulated, as the electron is passed through the carrier systems, they are passed to NADP+ to generate NADPH + H+ which in turn is used to reduce CO2*

- *This light driven reduction of NADP+ to NADPH + H+ is called* **non cyclic phosphorylation**

- *Involves both photosystem I & II*

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Photosystems

- *In higher plants and algae, reaction centers I and II are found in the chloroplast membranes,*
- *If the cyanobacteria, they are found in the cell membrane*

- *The purple and green photosynthetic bacteria do not have reaction center II complexes, only RCI*
- *Therefore they are incapable of using water as an electron donor and must use other compounds, such as H2S*