

TOPIC 8.2: AEROBIC RESPIRATION

Redox Reactions

Biological energy can be stored or released by *redox reactions*

- **Oxidation is the Loss** of electrons / hydrogen (OIL)
- **Reduction is the Gain** of electrons / hydrogen (RIG)

	Oxidation	Reduction
Electrons	Loss	Gain
Hydrogen	Loss	Gain
Oxygen	Gain	Loss



OIL RIG

Electron carriers transfer chemical energy via *redox reactions*

- Organic molecules are oxidised to form reduced carriers
- The reduced carriers may then be oxidised to form ATP

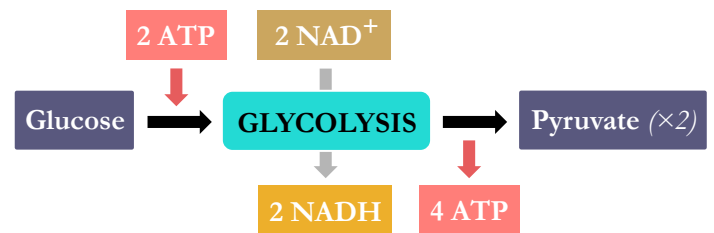
Glycolysis

Aerobic respiration is preceded by glycolysis (anaerobic)

- Glucose is broken down to form two pyruvate molecules

The process of glycolysis involves four basic stages:

- Glucose is *phosphorylated* by ATP (becomes less stable)
- The 6C sugar splits (*lysis*) into two triose phosphates (3C)
- 3C sugars are *oxidised* to form reduced carriers (NADH)
- A small amount of ATP is produced (net gain = 2 ATP)



Aerobic Respiration

Link Reaction:

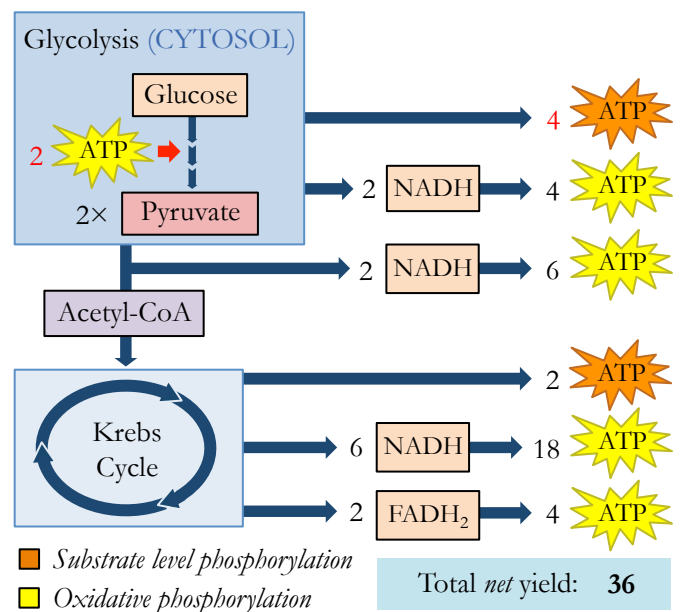
- Pyruvate transported from cytosol to mitochondrial matrix
- Pyruvate oxidised to produce a reduced carrier (*NADH*)
- Pyruvate decarboxylated to form acetyl CoA (*CO₂ produced*)

Krebs Cycle:

- Acetyl CoA is combined with a 4C compound (*forms 6C*)
- 6C compound broken down into original 4C (*CO₂ produced*)
- This involves oxidation reactions (*NADH / FADH₂ formed*)
- There is also a small yield of ATP (*one per cycle*)

Electron Transport Chain:

- Reduced carriers are oxidised at the electron transport chain
- The energy is used to make ATP (*via oxidative phosphorylation*)
- 32 ATP molecules are made from the reduced carriers



Oxidative Phosphorylation

- Carrier molecules donate electrons (*oxidation*) to an electron transport chain located on the mitochondrial cristae
- The electrons lose energy as they are passed along the chain, which is used to pump protons (H^+ ions) from the matrix
- The build up of protons in the intermembrane space creates an electrochemical gradient (*proton motive force*)
- Protons return to the matrix via a transmembrane enzyme (*ATP synthase*), which uses the translocation to make ATP
- The de-energised electrons are removed from the chain by oxygen (*final electron acceptor*), forming water as a by-product

