

# Citric Acid cycle

Products per one turn:  $3\text{NADH} + 2\text{CO}_2 + 1\text{ATP} + 1\text{FADH}_2$

3 NADH

NADH

when Isocitrate is oxidized into  $\alpha$  ketoglutarate,  $\text{NAD}^+$  is reduced into NADH  
"step 3"

NADH

when  $\alpha$  ketoglutarate is oxidized into succinyl CoA,  $\text{NAD}^+$  is reduced into NADH  
"step 4"

NADH

when Malate is oxidized into oxaloacetate,  $\text{NAD}^+$  is reduced into NADH  
"step 8"

2 CO<sub>2</sub>

CO<sub>2</sub>

when Isocitrate is oxidized into  $\alpha$  ketoglutarate, CO<sub>2</sub> is released  
"step 3"

when  $\alpha$  ketoglutarate is oxidized into succinyl CoA, CO<sub>2</sub> is released.  
"step 4"

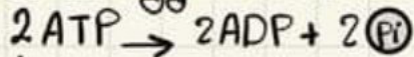
ATP: when succinyl CoA is converted to succinate, 1 ATP is generated  
"step 5"

FADH<sub>2</sub>: when succinate is oxidized into fumarate, 1 FAD is reduced into FADH<sub>2</sub>. "step 6"

Remember: These products are meant to be for one turn, since Glucose produces 2 Pyruvate molecules, thus 2 Acetyl CoA, it needs 2 turns thus the products per one Glucose molecule are 6 NADH, 4 CO<sub>2</sub>, 2 ATP, 2 FADH<sub>2</sub>

# Glycolysis

① Energy investment Phase:



↳ Glucose  $\rightarrow$  Glucose 6 Phosphate "step 1"

↳ Fructose 6 Phosphate  $\rightarrow$  Fructose 1,6 bisphosphate "step 3"

② Energy Payoff Phase:  $2 \text{NADH} + 2 \text{H}^+ // 2 \text{H}_2\text{O} // 4 \text{ATP}$

$2 \text{NADH} + 2 \text{H}^+ \xrightarrow{\text{reduction}} 2 \text{G3P}$  molecules oxidized into 1,3-bisphosphoglycerate thus reduced  $2 \text{NAD}^+$  into  $2 \text{NADH}$  "step 6"

$2 \text{H}_2\text{O} \xrightarrow{\text{reduction}} \text{From 2 molecules of 2-Phospho glycerate}$  "step 9"

4 ATP

2 ATP

2 ATP

when 2 molecules of 1,3-bisphosphoglycerate are converted into 2 molecules of 3-Phosphoglycerate, 2 ATP molecules are generated "step 7"

when 2 molecules of Phosphoenol-Pyruvate are converted to 2 molecules of Pyruvate, 2 ATP molecules are generated "step 10"

Net products of Glycolysis:-  $2 \text{NADH} + 2 \text{H}_2\text{O} + 2 \text{ATP}$

## Oxidation of Pyruvate to Acetyl CoA

Products:-  $2 \text{CO}_2 + 2 \text{NADH} + 2 \text{Acetyl CoA}$

هذا اذا سأل عن النواتج الجزئية. بروفيت واحد، و 2 اقسم كل نسبه و 2

# oxidative phosphorylation

aerobic respiration:- 26-28 ATP because of "Electron shuttle system"

