

AP BIOLOGY CELLULAR ENERGETICS ACTIVITY #2

DATE HOUR

CELLULAR RESPIRATION

SUMMARY EQUATION

 $C_6H_{12}O_6 + O_2 \rightarrow 6CO_2 + 6H_2O + energy (ATP)$

STEPWISE REDOX REACTION



-	Coenzyme	Dehydrogenases	
•	e- acceptor	Remove 2 H (2e- & 2H+) from	
•	Traps high energy e- from glucose	substrate ■ Delivers 2e- & 1H+ to NAD+ ■ NAD+ + 2e- + 1H+ → NADH	

ROLE OF NAD+ Nicotinamide adenine dinuleotide

PHOSPHORYLATION

SUBSTRATE LEVEL	OXIDATIVE	
ATP produced	ATP produced	
• ADP + $P_i \rightarrow ATP$	• ADP + $P_i \rightarrow ATP$	
Direct transfer of P _i from	Exergonic slide of e- used	
intermediate compound to	to create H+ gradient; KE	
ADP	of H+ moving down conc.	
	gradient used to add P _i to	
	ADP	

STRUCTURE OF MITOCHONDRION



GYCOLYSIS Energy Investment



GLYCOLYSIS – Energy Yielding (times 2 once for each glyceraldehyde phosphate

2	Glyceraldehyde phosphate
	 Dehydrogenases remove 2 H from glyceraldehyde phosphate deliver 2 e⁻ & 1 H+ to NAD+ 2e⁻ + 2H+ + NAD+ → NADH P added to glyceraldehyde phosphate
••••••	1,3 - diphosphoglycerate
	P from carbon 1 added to ADP ADP + P \rightarrow ATP
0000	3 - phosphoglycerate
Ŷ	enzyme moves P to carbon 2
000	2 - phosphoglycerate
Û	enzyme removes water
000	phosphoenolpyruvate (PEP)
ADP	enzyme transfers P to ADP ADP + P \rightarrow ATP
	Pyruvate (3-carbon compound)

GLYCOLYSIS SUMMARY

ENERGY INVESTMENT

Uses 2 ATP molecules Glucose split

ENERGY YIELDING

Produces 4 ATP molecules by substrate level phosphorylation

IN	Ουτ
Glucose	2 pyruvate
2 ATP	4 ATP
	2 NADH

KREBS CYCLE – ACETYL COA PREP (Times two – once for each

pyruvale)	
©-©-©	Pyruvate (3-carbon compound)
	 Pyruvate converted into 2-carbon compound; CO₂ released 2 H removed from 2-carbon compound 2e⁻ and H+ added to NAD+ NAD+ + 2e⁻ + H+ → NADH Coenzyme A added to acetyl group
<u>∆-</u> œ-©	Acetyl CoA

ACETYL CO A PREP PER PYRUVATE

In	OUT
Pyruvate	
	NADH
	Acetyl CoA

ACETYL CO A PREP PER GLUCOSE

In	OUT
2 Pyruvate	2 CO ₂
	2 NADH
	2 Acetyl CoA

KREBS CYCLE

<u> </u>	 Coenzyme A removed from acetyl group (2-C) Acetyl group added to oxaloacetate (4-C)
Ţ	
	 Citrate (6-C) produced Coenzyme A released
Ŷ	Water removed Water added
0-0-0-0-0	Isocitrate (6-C) produced
	 CO₂ removed 2H removed from isocitrate 2e⁻ + H+ + NAD+ → NADH
0-0-0-0-0	α - Ketoglutarate (5-C) produced
	 CO₂ removed 2H removed from isocitrate 2e⁻ + H+ + NAD+ → NADH
©-©-©-©	Coenzyme A added to 4-C compound



Back to the beginning of the Krebs cycle

KREBS CYCLE SUMMARY PER PYRUVATE

KREBS CYCLE IN	KREBS CYCLE OUT
1 acetyl CoA	• 2 CO ₂
	• 3 NADH
	• 1 FADH ₂
	• 1 ATP

KREBS CYCLE SUMMARY PER GLUCOSE

KREBS CYCLE IN	KREBS CYCLE OUT
2 acetyl CoA	• 4 CO ₂
	6 NADH
	• 2 FADH ₂
	• 2 ATP

ELECTRON TRANSPORT & OXIDATIVE PHOSPHORYLATION



ELECTRON TRANSPORT & OXIDATIVE PHOSPHORYLATION

Red = path of e-Green = H+





