Biology 20
Cellular Respiration

What is respiration? (p. 90, fig 6.2)

What is the main function of cellular respiration? (p. 90, fig 6.2)

RESPIRATION EQUATION: (p. 91, fig 6.3)

Reduction

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

Oxidation

Reference: p. 92; Fig. 6.5 → *Key = follow the H^+s.

Oxidation:

Reduction:

Is cellular respiration a catabolic or anabolic reaction?

Overview of Cellular Respiration (p. 93; Fig. 6.9):
Aerobic respiration:

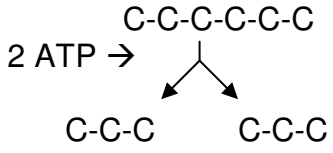
1)
2))
3)

Anaerobic respiration:

1)
2)
   a)
   b)

Glycolysis: (p. 94; Fig. 6.7A-C)
Refers to:
Occurs:

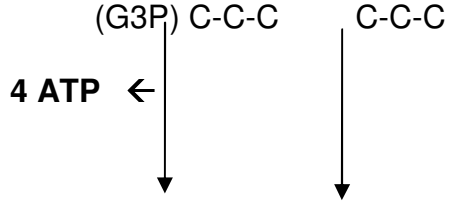
Energy investment phase: Steps 1 – 4



How many ATP's required (used)?
Results in 2 molecules of 3 phosphoglyceraldehyde (G3P)

Note: Step 5 is an isomeration step between G3P & Dihydixyacetone phosphate

Energy yielding phase: Steps 6 – 10



Results in: ___ pyruvates

____ ATP produced
____ NADH produced

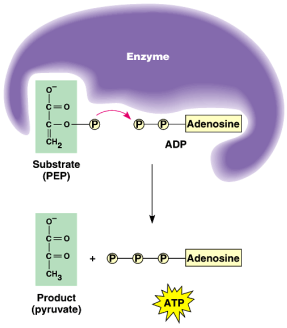
2 NADH ←

(PYR) C-C-C C-C-C (PYR)

Nicotinamide adenine dinucleotide (NADH) – energy rich molecule which will be shuttled to the ETC & undergo oxidative phosphorylation to yield more (Think: Disney dollars - can only get this energy converted to ATP at the ETC)

Glycolysis Net Yield: pyruvates:
ATP:
NADH:

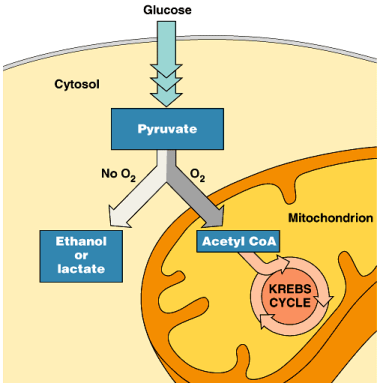
What is Substrate-level phosphorylation? (p. 94, Fig. 6.7B)



Two fates of pyruvate depend on O_2:

1) If O_2 is present:

2) If O_2 is not present:



Aerobic Respiration:
Glycolysis → Citric Acid Cycle (Kreb's Cycle):
Occurs:

Grooming phase: (p. 96; Fig. 6.8)
Occurs where:

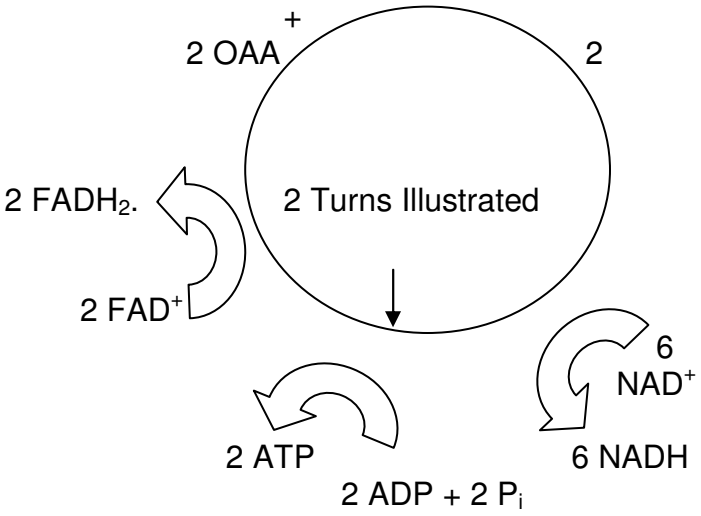
2 pyruvate (3C) → 2 acetyl CoA (2C)
2 CO_2.
2 $NAD^+ + H^+$. **2 NADH**

Krebs Cycle: (p. 96 - 97; Fig. 6.9 A & B)
Occurs:

Acetyl CoA + Oxaloacetate (OAA) → citrate
(2 C) (4 C) (6 C)
citrate synthase

2 acetyl CoA

Citrate

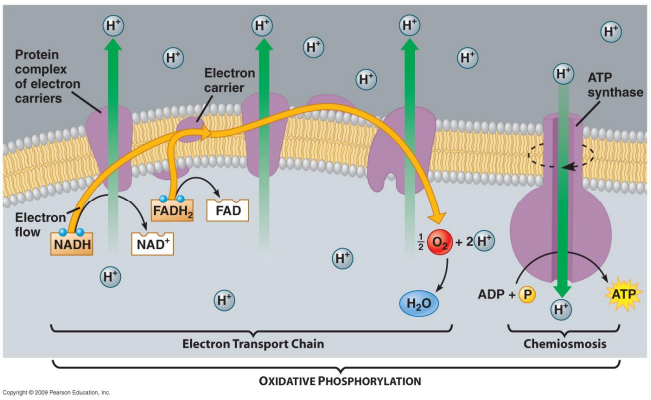


Why does it require 2 turns of the Krebs Cycle to **completely oxidize 1 glucose molecule**? (Hint: Think back to glycolysis)

Krebs Cycle Net Yield: ATP
NADH
$FADH_2$.
CO_2.

Electron Transport Chain & Oxidative Phosphorylation: (p. 98; Fig. 6.10)

Location:
Proteins complexes & ATP synthase



What is chemiosmosis?

What is oxidative phosphorylation?

Is ATP produced directly?

Each NADH = _____ ATP
Each $FADH_2$ = _____ ATP

Final electron acceptor?
Where does the O_2 come from?

How does the O_2 get to the cells?

Where does the water (metabolic water) come from?

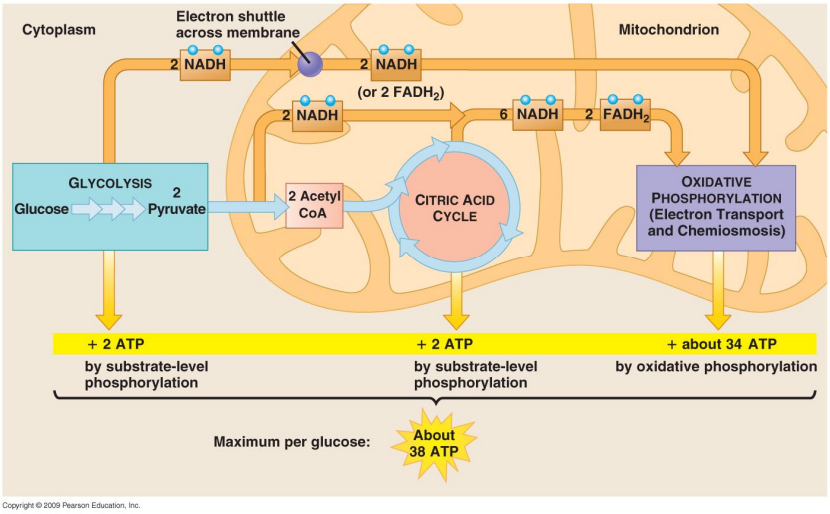
What happens when cyanide & carbon monoxide accumulate in our bodies? (p. 99, Fig. 6.11)

Energy yield from aerobic respiration: (p. 100, Fig. 6.12)

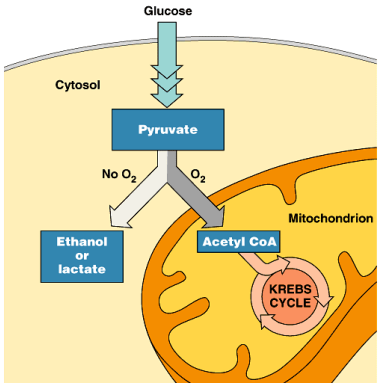
		# of ATPs
Glycolysis:	2 ATP →	
	2 NADH →	
Primer RXN:	2 NADH →	
Krebs Cycle:	2 ATP →	
	6 NADH →	
	2 $FADH_2$. →	
		Total ATPs

NOTE: Eukaryotes = 36 – 38 ATPs

Do the numbers agree? Why or why not?



Fermentation:



a) **Lactic Acid Fermentation** (Fig. 6.15b) 2 pyruvates → 2 Lactic acid (lactate)
Occurs when:
Location:
Results in:

Lactic acid build-up results in: 1)

2)

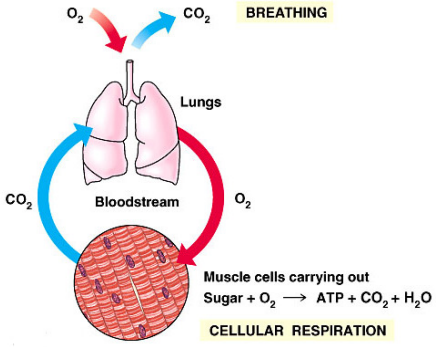
Cori cycle:
1) **In skeletal muscles**:

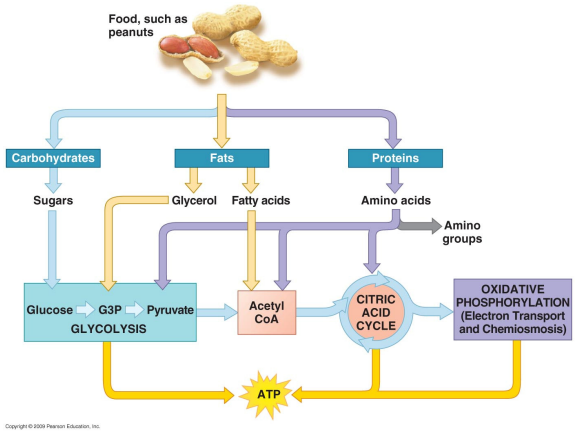
2) **In the liver**: Two fates lactic acid:
a)
b)

b) **Alcohol Fermentation** (Fig. 6.15 A) 2 pyruvates → 2 ethanol (ethyl alcohol)
Occurs when:
Location:
Results in:

What organisms undergo this type of metabolism?

What is the connection between breathing and cellular respiration? (p. 90; Fig. 6.2)





<u>LIPID METABOLISM</u>: (p. 102; Fig. 6.15)
Lipolysis:

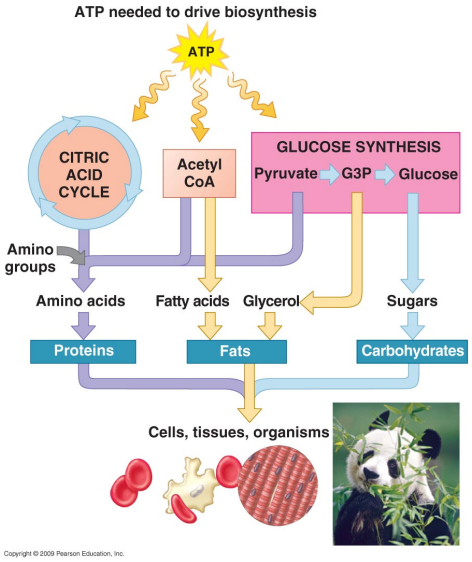
Ketone bodies:
As a result of:

ketosis:
results in:
causes:

ketoacidosis:

<u>AMINO ACID METABOLISM:</u> (p. 102; Fig. 6.15)

Are all the foodstuff that we eat converted into energy (ATP)? (p. 103; Fig. 6.16)



Where does the fuel for respiration ultimately come from?