

Review Sheet Cell Respiration

Lester BIOL 150

General things to do to prepare for the exam:

- study the PowerPoints
- write out the answers to the learning objectives found with each PowerPoint
- listen to my lecture recordings

Chapter 9

How does energy typically enter and leave an ecosystem? Are there any exceptions? Give an example.

In general, what is the difference between aerobic respiration and anaerobic respiration?

Write the overall equation for aerobic cell respiration. Is this reaction exergonic or endergonic? Spontaneous or non-spontaneous? Catabolic or anabolic? Overall ΔG positive or negative?

Define oxidation and reduction. Why are these reactions coupled?

Define reducing agent and oxidizing agent.

Indicate which substances are being oxidized and which are being reduced in the overall equation for aerobic cell respiration.

Explain the role of NAD⁺ and FAD in aerobic cell respiration.

What are the 3 stages of aerobic cell respiration?

In the first stage, describe what is being broken down and what is being formed at the end of the process.

Describe what happens during the intermediate step before the second stage.

In the second stage, describe what is being broken down and what is being formed at the end of the process.

Describe what happens during stage three (ETC).

Where inside of a eukaryotic cell does each stage occur?

What kind of energy is in the glucose molecule? What is the form (particles) of that energy?

What is the form of energy used during the final stage of aerobic cell respiration that allows a cell to make a lot of ATP?

Explain the difference between substrate level phosphorylation and oxidative phosphorylation. How many ATP does a cell make for each one (theoretical)?

Summarize the amount (theoretical) of ATP produced at each stage.

What exactly is the proton-motive force?

What is the role of oxygen in cell respiration? What happens to the process of aerobic cell respiration when there is no oxygen?

Explain why each NADH yields 3 ATP and FADH₂ yields only 2 ATP (theoretical) during ETC?

What are the two common types of fermentation and how are they similar and different?

Define: obligate anaerobe and facultative anaerobe.

Why do fats (triglycerides) yield more than twice as much energy (calories) as either carbohydrates or proteins, gram for gram?

Describe beta oxidation of fatty acids to produce energy.

What is the most common mechanism of control for cell respiration and how does it work?

Explain the endosymbiotic theory. This theory tries to explain the origin of what?

Sample Test Questions

In which reactions of cellular respiration and fermentation does substrate-level phosphorylation occur?

- A) only in glycolysis
B) only in the citric acid cycle
C) only in the electron transport chain
D) in both glycolysis and the citric acid cycle

When a molecule of NAD⁺ (nicotinamide adenine dinucleotide) gains a hydrogen atom, the molecule becomes:

- A) dehydrogenated B) oxidized C) reduced D) redoxed

The oxygen consumed during cellular respiration is directly involved in which of the following processes or events?

- A) glycolysis
B) accepting electrons at the end of the electron transport chain
C) the citric acid cycle
D) the oxidation of pyruvate to acetyl CoA

Substrate-level phosphorylation accounts for approximately what percentage of the ATP formed by the reactions of glycolysis?

- A) 0% B) 2% C) 38% D) 100%

Starting with one molecule of glucose, glycolysis results in the net production of which of the following sets of energy-containing products?

- A) 2 NAD⁺, 2 pyruvate, and 2 ATP
B) 2 NADH, 2 pyruvate, and 2 ATP
C) 4 NADH, 2 pyruvate, and 4 ATP
D) 6 CO₂, 2 pyruvate, and 2 ATP

During which of the following metabolic processes is most of the CO₂ from the catabolism of glucose is released?

- A) glycolysis B) electron transport
C) oxidation of pyruvate to acetyl-CoA
D) the citric acid cycle

Carbon dioxide (CO₂) is released during which of the following stages of cellular respiration?

- A) glycolysis and the oxidation of pyruvate to acetyl CoA
B) oxidation of pyruvate to acetyl CoA and the citric acid cycle
C) oxidative phosphorylation and fermentation
D) fermentation and glycolysis

Which one of the following is formed by the removal of a carbon (as CO₂) from a molecule of pyruvate?

- A) ATP B) acetyl CoA
C) citrate D) water

Which of the following statements about the electron transport chain is true?

- A) It is driven by ATP hydrolysis.
B) It includes a series of hydrolysis reactions associated with mitochondrial membranes.
C) It consists of a series of redox reactions
D) It occurs in the cytoplasm of both prokaryotic and eukaryotic cells.

During aerobic respiration, which of the following molecules directly donates electrons to the electron transport chain at the lowest energy level?

- A) NADH B) ATP C) water D) FADH₂

In chemiosmosis, what is the most direct source of energy that is used to convert ADP + P_i to ATP?

- A) energy released as electrons flow through the electron transport chain
B) energy released from substrate-level phosphorylation
C) energy released from movement of protons through ATP synthase, down their electrochemical gradient
D) energy released as electrons are transported across the inner mitochondrial membrane

In liver cells, the inner mitochondrial membranes are about five times the area of the outer mitochondrial membranes. What purpose must this serve?

- A) It allows for an increased rate of glycolysis.
B) It allows for an increased rate of the citric acid cycle.
C) It increases the surface for oxidative phosphorylation.
D) It increases the surface for substrate-level phosphorylation.

In the absence of oxygen, yeast cells can obtain energy by fermentation, which results in the production of which of the following sets of molecules?

- A) ATP, CO₂, and ethanol (ethyl alcohol) B) ATP, CO₂, and lactate
C) ATP, NADH, and ethanol D) ATP, CO₂, and acetyl CoA

Yeast cells that have defective mitochondria incapable of respiration will be able to grow by catabolizing which of the following carbon sources for energy?

- A) glucose B) cholesterol C) fatty acids D) amino acids

High levels of citric acid inhibit the enzyme phosphofructokinase, a key enzyme in glycolysis. Citric acid binds to the enzyme at a different location from the active site. This is an example of:

- A) competitive inhibition
B) allosteric regulation
C) the specificity of enzymes for their substrates
D) positive feedback regulation

Beta oxidation generates substrates for cellular respiration through which of the following processes?

- A) catabolism of glucose B) catabolism of glycogen
C) catabolism of proteins D) catabolism of fatty acids