Date:

Biology Lab Activities: Cellular Respiration

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> **Background Questions**

Based on what you've learned in class, in your textbook, and from using Visible Body, answer the following questions about cellular respiration.

- 1. Fill in the blanks in the cellular respiration equation: $C_6H_{12}O_6 + 6 _ \rightarrow 6$ $CO_2 + 6 _ + up to 38$ molecules of $_$.
- 2. What are the reactants involved in cellular respiration?
- 3. What are the products of cellular respiration?
- 4. Cellular respiration consists of four main phases. Complete the following sentences about these phases and where they take place.
 - a. ______ takes place in the cytosol.
 - b. Pyruvate oxidation takes place in the _____
 - c. The ______ cycle takes place in the mitochondrial matrix.
 - d. Oxidative phosphorylation takes place in the ______.
- 5. In 2–3 sentences, explain why cellular respiration is important for a eukaryote's survival.

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Lab 1: Mitochondria Structures, Reactants, and Products of Cellular Respiration

> Activity 1: Label a mitochondrion

- 1. Launch the view
 - Launch Visible Body.
 - Browse or use the Search tool to view the Mitochondrion (Cellular Respiration) model.
- 2. Label the image below
 - Explore the 3D model of the mitochondrion going through cellular respiration to find the structures you need to label.
 - Fill in the blanks to label the structures from the list below.

Part A: Label the mitochondria structures

| <u>Word List:</u> | |
|-------------------|--|
| Cristae | |
| Inner membrane | |
| Matrix | |
| Outer membrane | |



> Part B: Label the reactants and products of glycolysis

Word List:ATPADPGlucose ($C_6H_{12}O_6$) moleculePyruvates







> Part C: Label the reactants and products of pyruvate oxidation and the citric acid cycle

Word List: Acetyl-CoA ATP Carbon dioxide (CO₂) molecules





> Part D: Label the reactants and products of oxidative phosphorylation

Word List:ATPOxygen (O_2) moleculesWater (H_2O) molecules



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Lab 1: Mitochondria Structures, Reactants, and Products of Cellular Respiration

> Activity 2: Explore the roles mitochondria structures play in cellular respiration

Refer to your labeled mitochondrion model from Activity 1 and the content in Visible Body. Based on what you've learned, match each of the following structures with the brief description of its role in cellular respiration.

Structures:

- a. Inner membrane
- b. Matrix
- c. Cristae
- d. Cytosol

Descriptions:

____ This structure contains the electron transport chain, and chemiosmosis occurs across this structure to produce water molecules and ATP.

____ These structures increase the surface area of the inner mitochondrial membrane to facilitate gas exchange.

____ This fluid surrounds the mitochondria, and it's where glycolysis takes place.

____ This is the fluid-filled inner part of the mitochondrion, where the citric acid cycle takes place.

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Lab 1: Mitochondria Structures, Reactants, and Products of Cellular Respiration

> Activity 3: Explore the reactants and products of cellular respiration

Refer to your labeled reactants and products of cellular respiration from Activity 1 and the content in Visible Body. Based on what you've learned, complete the following table on the molecules involved in cellular respiration.

| Molecule Type | Reactant /Product | Where It Comes From | Stage(s) It's Part of | Its Significance |
|-------------------|----------------------|---|--|---|
| Carbon Dioxide | Product | Made in the | Pyruvate oxidation and citric acid cycle | It is a byproduct of cellular respiration essential for |
| Oxygen | Reactant | From from the lungs or the surrounding the cell | Oxidative phosphorylation | It combines with to form water molecules during oxidative phosphorylation. |
| Glucose | Reactant | From an animal/human consumes or produced by plants via | Glycolysis | It is converted into two during glycolysis. |
| Water | Product | Made in the | Oxidative phosphorylation | It is a byproduct of cellular respiration essential for |

| АТР | Product | Made in the cytosol and the mitochondrial and inner membrane | Glycolysis, citric acid cycle, and oxidative phosphorylation | It provides the energy that powers many |
|-----|---------|--|---|---|
| | | | | |

Based on what you've learned from labeling the mitochondrion (cellular respiration) model and completing the table, fill in the blanks to balance the cellular respiration equation:

 $C_6H_{12}O_6 + 6 ___ \rightarrow 6 ___ + 6 H_2O + up \text{ to } 38 \text{ molecules of } ___.$

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Lab 2: Cellular Respiration in the Mitochondrion

Refer to your labeled reactants and products of cellular respiration image from Lab 1, Activity 1.

- 1. In the space that follows, draw a mitochondrion (or paste a screenshot of your drawing). Your drawing should include the following:
 - a. Inside the mitochondrion, draw the inner and outer membranes, cristae, and matrix.
 - b. Outside the mitochondrion, draw the cytosol, as well as the ATP molecules, carbon dioxide (CO₂) molecules, water (H₂O) molecules, oxygen (O₂) molecules, glucose (C₆H₁₂O₆) molecules, NAD+, NADH, FAD, FADH₂, and electrons with arrows showing how they move into, out of, or through the mitochondrion. Be sure to accurately portray the number of each of these molecules in your drawing.

 Based on your drawing and what you've learned about cellular respiration, put the following steps of cellular respiration into the correct order (from 1– 5).

Within the mitochondrion, the pyruvates are converted into acetyl-CoA.
Glucose is converted into fructose, which is converted into two pyruvates.

____ The electron transport chain and chemiosmosis produce water molecules and ATP.

____ Acetyl-CoA goes into the citric acid cycle, producing carbon dioxide, ATP, NADH, FADH₂, and electrons.

____ NADH and FADH₂ bring electrons to the electron transport chain.

- 3. In your own words, briefly describe the cellular respiration equation.
- 4. The equation for photosynthesis is $6CO_2 + 6H_2O \rightarrow C_6H_{12}O_2 + 6O_2$. Based on this equation and what you've learned about cellular respiration, how do these two processes relate to each other?