

RESPIRATION Worksheet

- In the conversion of glucose and oxygen to carbon dioxide and water
 - which molecule becomes reduced? _____
 - which molecule becomes oxidized? _____
 - what happens to the energy that is released in this redox reaction?

- NAD⁺ is called an _____
It's reduced form is _____
- Fill in the three stages of respiration. Indicate whether ATP is produced by substrate-level phosphorylation or oxidative phosphorylation. Label the arrows indicating electrons carried by NADH.

4. Fill in the blanks in this summary diagram of glycolysis.

5. Fill in the blanks in this summary diagram of the citric acid cycle.

6. Label this diagram of oxidative phosphorylation in a mitochondrial membrane.

7. Fill in the table below to summarize the major inputs and outputs of respiration.

8. A substrate that is phosphorylated
- has lost a phosphate group
 - has been formed by the reaction $\text{ADP} + \text{P}_i \rightleftharpoons \text{ATP}$
 - has an increased reactivity; it is primed to do work
 - has been oxidized
 - will pass its electrons to the electron transport chain
9. Which of the following is not true of oxidative phosphorylation?
- it produces approx. three ATP for every NADH oxidized
 - it involves the redox reactions of the electron transport chain
 - it involves an ATP synthase located in the inner mitochondrial membrane
 - it uses oxygen as the initial electron donor
 - it is an example of chemiosmosis
10. Substrate-level phosphorylation
- involves the shifting of a phosphate group from ATP to a substrate
 - can use NADH or FADH₂
 - takes place only in the cytosol
 - accounts for 10% of the ATP formed by fermentation
 - is the energy source for facultative anaerobes under anaerobic conditions
11. The major reason that glycolysis is not as energy productive as respiration is
- NAD⁺ is regenerated by alcohol or lactate production, without the high energy electrons passing through the electron transport chain
 - it is the pathway common to fermentation and respiration
 - it does not take place in a specialized membrane bound organelles
 - pyruvate is more reduced than CO₂ it still contains much of the energy from glucose
 - substrate-level phosphorylation is not as energy efficient as oxidative phosphorylation
12. When pyruvate is converted to acetyl CoA,
- CO₂ and ATP are released
 - a multienzyme complex removes a carboxyl group, transfers electrons to NAD⁺ and attaches a coenzyme
 - one turn of the citric acid cycle is completed
 - NAD⁺ is regenerated so that glycolysis can continue to produce ATP by substrate-level phosphorylation
 - pyruvate is activated and glycolysis continues
13. How many molecules of CO₂ are generated for each molecule of acetyl CoA introduced in to the citric acid cycle?
- | | | |
|------|------|------|
| a. 1 | c. 3 | e. 6 |
| b. 2 | d. 4 | |

14. In the chemiosmotic mechanism
- ATP production is linked to the proton gradient established by the electron transport chain
 - the difference in pH between the intermembrane space and the cytosol drives the formation of ATP
 - the flow of H^+ through ATP synthase from the matrix to the intermembrane space drives the phosphorylation of ATP
 - the energy released by the reduction and oxidation of components of the electron transport chain is transferred as a phosphate to ADP
 - the production of water in the matrix by the reduction of oxygen leads to a net flow of water out of a mitochondrion
15. When glucose is oxidized to CO_2 and water, approx. 40% of its energy is transferred to
- heat
 - ATP
 - acetyl CoA
 - water
 - the citric acid cycle
16. List the order of the following compounds as you first encounter them during cellular respiration.
- pyruvate
 - CO_2
 - glucose
 - acetyl CoA
 - H_2O
17. Fats and proteins can be used as fuel in the cell because they
- can be converted to glucose by enzymes
 - can be converted to intermediates of glycolysis or the citric acid cycle
 - can pass through the mitochondrial membrane to enter the citric acid cycle
 - contain more energy than glucose
18. Why is glycolysis considered one of the first metabolic pathways to have evolved?
- it relies on fermentation, which is characteristic of bacteria
 - it is found only in prokaryotes, whereas eukaryotes use their mitochondria to produce ATP
 - it produces much less ATP than oxidative phosphorylation
 - it relies totally on enzymes that are produced by free ribosomes, and bacteria have only free ribosomes and no bound ribosomes
 - it is nearly universal, is located in the cytosol and does not involve O_2

19. The oxidation of a molecule of FADH₂ yields less ATP than molecule of NADH because FADH₂
- carries fewer electrons
 - is formed in the cytosol and energy is lost when it shuttles its electrons across the mitochondrial membrane
 - passes its electrons to a transport molecule later in the chain and at a lower energy level
 - is the last molecule produced by the citric acid cycle, and little energy is left to be captured
 - has a much lower energy conformation than NADH
20. What is the role of oxygen in cellular respiration?
- it is reduced in glycolysis as glucose is oxidized
 - it provides electrons to the electron transport chain
 - it provides the activation energy needed for the oxidation to occur
 - it is the final electron acceptor for the electron chain
 - it combines with the carbon removed during the citric acid cycle to form CO₂

