

Name _____

Cellular Respiration Worksheet for the “advanced” student

- Which of the following statements correctly describe(s) catabolic pathways?
 - They do not depend on enzymes.
 - They consume energy to build molecules.
 - They release energy as they degrade molecules.
 - They lead to the synthesis of catabolic compounds.
 - both A and B
- Hexokinase, pyruvate kinase, phosphoglucosomerase, enolase, phosphofructokinase, phosphoglycerokinase, aldolase, isomerase, triose phosphate dehydrogenase, phosphoglyceromutase,
 - put the enzymes of glycolysis in order
 -
 -
 -
 -
 -
 -
 -
 -
 -
 -
- Which of the above enzymes “use” ATP and produce ADP? Write their names below and highlight or underline them from your list above in red/pink.
 - Which of the above enzymes are responsible for producing ATP? Write their names below and highlight or underline them from your list above in yellow.
- Which enzyme performs a crucial redox (oxidation/reduction) reaction that allows a free inorganic phosphate group (P) to be moved from the cytoplasm onto the substrate in glycolysis and at the same time reduces an NAD⁺ molecule. Write the name below and highlight or underline it from your list above in green.
- Describe the transition reaction of the citric acid cycle.

6. How many carbon dioxide molecules (CO_2) are generated per pyruvate in the transition reaction? in the citric acid cycle?

So therefore how many CO_2 are produced per glucose?

7. How many NADH molecules are generated per **glucose** in
a. glycolysis b. transition reaction c. Citric acid cycle
8. For every NADH and every FADH_2 molecule oxidized in the electron transport chain of the mitochondria, how many ATP are generated (the two compounds do not result in the exact same amount of ATP produced. Your textbooks may report slightly different numbers depending on how up-to-date it is).

1 NADH = _____ ATP 1 FADH_2 = _____ ATP

9. What is the mechanism for ATP powering cellular reactions (i.e. how does ATP work as a source of cellular energy)?

10. What powers ATP synthase? (one phrase/sentence)

11. Oligomycin is a topical antibiotic and has the effect of blocking the hydrogen ion channel and thus the activity of ATP synthase. What would happen to the production of ATP in the affected microbes?

12. Carbon monoxide (CO), the poison cyanide, and the pesticide Rotenone all act to block electron transport. What effect would they have on ATP production?

13. The former diet drug dinitrophenol (DNP) makes the membrane of the mitochondrion leaky to hydrogen ions. What effect would this have on ATP production?

What specific component of ATP production is affected by this effect?

If you were told that sometimes people die of “overheating” when on this drug, how would you explain that phenomenon?

Recall that infants have a high surface to volume ratio. They use the protein thermogenin in the mitochondria of their brown fat which makes the mitochondrion leaky to hydrogen ions like the DNP drug does. Why would this be advantageous to an infant?