

MCB 102 Citric Acid Cycle Worksheet Answer Key

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1. Which of the following is *not* true of the reaction catalyzed by the pyruvate dehydrogenase complex?
 - A) Biotin participates in the decarboxylation. *
 - B) Both NAD^+ and a flavin nucleotide act as electron carriers.
 - C) The reaction occurs in the mitochondrial matrix.
 - D) The substrate is held by the lipoyl-lysine "swinging arm."
 - E) Two different cofactors containing —SH groups participate.
2. Glucose labeled with ^{14}C in C-3 and C-4 is completely converted to acetyl-CoA via glycolysis and the pyruvate dehydrogenase complex. What percentage of the acetyl-CoA molecules formed will be labeled with ^{14}C , and in which position of the acetyl moiety will the ^{14}C label be found?
 - A) 100% of the acetyl-CoA will be labeled at C-1 (carboxyl).
 - B) 100% of the acetyl-CoA will be labeled at C-2.
 - C) 50% of the acetyl-CoA will be labeled, all at C-2 (methyl).
 - D) No label will be found in the acetyl-CoA molecules. *
 - E) Not enough information is given to answer this question.
3. Which of the following is *not* true of the citric acid cycle?
 - A) All enzymes of the cycle are located in the cytoplasm, except succinate dehydrogenase, which is bound to the inner mitochondrial membrane. *
 - B) In the presence of malonate, one would expect succinate to accumulate.
 - C) Oxaloacetate is used as a substrate but is not consumed in the cycle.
 - D) Succinate dehydrogenase channels electrons directly into the electron transfer chain.
 - E) The condensing enzyme is subject to allosteric regulation by ATP and NADH.
4. Malonate is a competitive inhibitor of succinate dehydrogenase. If malonate is added to a mitochondrial preparation that is oxidizing pyruvate as a substrate, which of the following compounds would you expect to decrease in concentration?
 - A) Citrate
 - B) Fumarate *
 - C) Isocitrate
 - D) Pyruvate
 - E) Succinate
5. Oxaloacetate uniformly labeled with ^{14}C (i.e., with equal amounts of ^{14}C in each of its carbon atoms) is condensed with unlabeled acetyl-CoA. After a single pass through the citric acid cycle back to oxaloacetate, what fraction of the original radioactivity will be found in the oxaloacetate?
 - A) all
 - B) $1/2$ *
 - C) $1/3$
 - D) $1/4$
 - E) $3/4$
6. Conversion of 1 mol of acetyl-CoA to 2 mol of CO_2 and CoA via the citric acid cycle results in the net production of:

- A) 1 mol of citrate.
- B) 1 mol of FADH₂. *
- C) 1 mol of NADH.
- D) 1 mol of oxaloacetate.
- E) 7 mol of ATP.

7. The two moles of CO₂ produced in the first turn of the citric acid cycle have their origin in the:

- A) carboxyl and methylene carbons of oxaloacetate
- B) carboxyl group of acetate and a carboxyl group of oxaloacetate.
- C) carboxyl group of acetate and the keto group of oxaloacetate.
- D) two carbon atoms of acetate.
- E) two carboxyl groups derived from oxaloacetate. *

8. The conversion of 1 mol of pyruvate to 3 mol of CO₂ via pyruvate dehydrogenase and the citric acid cycle also yields _____ mol of NADH, _____ mol of FADH₂, and _____ mol of ATP (or GTP).

- A) 2; 2; 2
- B) 3; 1; 1
- C) 3; 2; 0
- D) 4; 1; 1 *
- E) 4; 2; 1

9. Match the cofactors below with their roles in the pyruvate dehydrogenase complex reaction.

Cofactors:

- A. Coenzyme A (CoA-SH)
- B. NAD⁺
- C. Thiamine pyrophosphate (TPP)
- D. FAD
- E. Lipoic acid in oxidized form

Roles:

- _____ Attacks and attaches to the central carbon in pyruvate.
- _____ Oxidizes FADH₂.
- _____ Accepts the acetyl group from reduced lipoic acid.
- _____ Oxidizes the reduced form of lipoic acid.
- _____ Initial electron acceptor in oxidation of pyruvate.

Ans: C; B; A; D; E