

Final Exam Study Guide: Chapter 16: Citric Acid Cycle

Matching Or Fill In

Choose the correct answer from the list. Not all the answers will be used.

1) _____ (omit red questions) Another name for the citric acid cycle is the _____.

2) _____ _____ is one of the products of the citric acid cycle that is used by plants.

3) _____ _____ is the first compound that is oxidized in the citric acid cycle.

4) _____ _____ is an enzyme that catalyzes a substrate-level phosphorylation.

5) _____ The citric acid cycle intermediate _____ is found at the beginning and at the end of the citric acid cycle.

6) _____ The only membrane-bound enzyme of the citric acid cycle is _____.

7) _____ The name of this citric acid cycle intermediate, _____, is derived from “apple.”

8) _____ The enzyme _____ contains an iron–sulfur cluster.

9) _____ The compound _____ is a competitive inhibitor of succinate dehydrogenase.

10) _____ The enzyme _____ is part of the glyoxylate cycle.

- A) oxaloacetate
- B) malate synthase
- C) malate
- D) malonate
- E) Krebs cycle
- F) aconitase
- G) succinyl-CoA synthetase
- H) α -ketoglutarate
- I) carbon dioxide
- J) malate dehydrogenase
- K) isocitrate
- L) succinate dehydrogenase

Fill In Questions

11) _____ is an intermediate between citrate and isocitrate in the citric acid cycle.

12) _____ is the metabolic intermediate that condenses with oxaloacetate to form citrate.

13) During the oxidation of isocitrate, the intermediate that is decarboxylated to form α -ketoglutarate is _____.

14) In eukaryotes, the enzymes of the citric acid cycle are located in the _____.

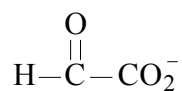
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- 15) One FAD, one GTP and _____ NADH are produced when one acetyl group is oxidized in the citric acid cycle.

Multiple Choice Questions

- 16) The two main purposes of the citric acid cycle are:
- A) synthesis of citrate and gluconeogenesis.
 - B) degradation of acetyl-CoA to produce energy and to supply precursors for anabolism.
 - C) degradation of pyruvate to produce energy and to supply precursors for anabolism.
 - D) degradation of glucose to produce energy and to supply precursors for anabolism.
 - E) degradation of pyruvate to produce energy and to synthesize oxaloacetate for gluconeogenesis
- 17) The isomerization of citrate to isocitrate:
- A) is the only unnecessary step of the citric acid cycle.
 - B) protects cells from the toxic effects of arsenite ion.
 - C) converts a tertiary alcohol, which cannot easily be oxidized, to a secondary alcohol that can be oxidized.
 - D) is a major regulatory step for the citric acid cycle.
 - E) is an oxidation reaction.
- 18) Which of the following causes pyruvate dehydrogenase kinase to catalyze the phosphorylation and inactivation of E₁ in the pyruvate dehydrogenase complex?
- A) elevated concentrations of NADH and ATP
 - B) elevated concentrations of NAD⁺ and ADP
 - C) Ca²⁺
 - D) insulin
 - E) elevated concentrations of acetyl-CoA
- 19) Which of the following structures corresponds to glyoxylate?
- A)
$$^{-}\text{O}_2\text{C}-\overset{\text{O}}{\parallel}{\text{C}}-\text{CO}_2^{-}$$
 - B)
$$\text{CH}_3-\overset{\text{O}}{\parallel}{\text{C}}-\text{O}^{-}$$
 - C)
$$^{-}\text{O}_2\text{CCH}_2-\overset{\text{O}}{\parallel}{\text{C}}-\text{CO}_2^{-}$$
 - D)
$$^{-}\text{O}-\overset{\text{O}}{\parallel}{\text{C}}-\overset{\text{O}}{\parallel}{\text{C}}-\text{O}^{-}$$
 - E)

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Short Answer Questions

Write your answer in the space provided or on a separate sheet of paper.

- 20) Write the net equation of the citric acid cycle.
- 21) Write the citric acid cycle reaction in which energy is conserved in the formation of a phosphoanhydride bond by substrate-level phosphorylation. Name the enzyme that catalyzes this reaction and provide the formulas of the reactants and products of this reaction.
- 22) Write the first reaction of the citric acid cycle. Name the enzyme that catalyzes this reaction and provide the formulas of the reactants and the products of this reaction.
- 23) $\Delta G^{\circ\prime} = + 29.7 \text{ kJ/mol}$ for the reaction $\text{malate} + \text{NAD}^+ \rightarrow \text{oxaloacetate} + \text{NADH} + \text{H}^+$. Describe the factors that allow this unfavorable reaction to occur in the direction of malate to oxaloacetate.
- 24) How many electrons are transferred from one acetyl group when it is converted to two carbon dioxide molecules in the citric acid cycle? Briefly explain your answer.
- 25) Briefly describe how the citric acid cycle is regulated. Identify the key regulatory enzymes and the factors that determine whether the flux of the cycle increases or decreases.
- 26) How many ATP equivalents are produced from the complete oxidation of one pyruvate to three CO_2 ?