MCB 102: Pantea's Sxn **Chapter 17 Problem Set Answer Key**

1) Page: 636 Ans: B

Which of these is able to cross the inner mitochondrial membrane?

A) Acetyl–CoA
B) Fatty acyl–carnitine
C) Fatty acyl–CoA
D) Malonyl–CoA
E) None of the above can cross.

2) Pages: 637-638 Ans: C

What is the correct order of function of the following enzymes of β oxidation?

1. β-Hydroxyacyl-CoA dehydrogenase
2. Thiolase
3. Enoyl-CoA hydratase
4. Acyl-CoA dehydrogenase

A) 1, 2, 3, 4
B) 3, 1, 4, 2
C) **4, 3, 1, 2**
D) 1, 4, 3, 2
E) 4, 2, 3, 1

3) Page: 639 Ans: D

If the 16-carbon saturated fatty acid palmitate is oxidized completely to carbon dioxide and water (via the β-oxidation pathway and the citric acid cycle), and all of the energy-conserving products are used to drive ATP synthesis in the mitochondrion, the net yield of ATP per molecule of palmitate is:

A) 3.
B) 10.
C) 25.
D) **108.**
E) 1,000.

4) Pages: 634-639 Ans: B

Which of the following is (are) true of the oxidation of 1 mol of palmitate (a 16-carbon saturated fatty acid; 16:0) by the β-oxidation pathway, beginning with the free fatty acid in the cytoplasm?

1. Activation of the free fatty acid requires the equivalent of two ATPs.
2. Inorganic pyrophosphate (PP_i) is produced.
3. Carnitine functions as an electron acceptor.
4. 8 mol of $FADH_2$ are formed.
5. 8 mol of acetyl-CoA are formed.
6. There is no direct involvement of NAD^+.

A) 1 and 5 only
B) **1, 2, and 5**
C) 1, 2, and 6
D) 1, 3, and 5
E) 5 only

5) Pages: 635-639 Ans: A

The balanced equation for the degradation of $CH_3(CH_2)_{10}COOH$ via the β-oxidation pathway is:

A) $CH_3(CH_2)_{10}COOH + 5FAD + 5NAD^+ + 6CoA—SH + 5H_2O + ATP \rightarrow$
6 Acetyl-CoA $+ 5FADH_2 + 5NADH + 5H^+ + AMP + PP_i$

B) $CH_3(CH_2)_{10}COOH + 5FAD + 5NAD^+ + 6CoA—SH + 5H_2O \rightarrow$
6 Acetyl-CoA $+ 5FADH_2 + 5NADH + 5H^+$

C) $CH_3(CH_2)_{10}COOH + 6FAD + 6NAD^+ + 6CoA—SH + 6H_2O + ATP \rightarrow$
6 Acetyl-CoA $+ 6FADH_2 + 6NADH + 6H^+ + AMP + PP_i$

D) $CH_3(CH_2)_{10}COOH + 6FAD + 6NAD^+ + 6CoA—SH + 6H_2O \rightarrow$
6 Acetyl-CoA $+ 6FADH_2 + 6NADH + 6H^+$

6) Page: 638 Ans: A

The conversion of palmitoyl-CoA (16:0) to myristoyl-CoA (14:0) and 1 mol of acetyl-CoA by the β-oxidation pathway results in the net formation of:

A) **1 $FADH_2$ and 1 NADH.**
B) 1 $FADH_2$ and 1 NADPH.
C) 1 $FADH_2$, 1 NADH, and 1 ATP.
D) 2 $FADH_2$ and 2 NADH.
E) 2 $FADH_2$, 2 NADH, and 1 ATP.

7) Page: 642 Ans: E

The following fatty acid, in which the indicated carbon is labeled with ^{14}C, is fed to an animal:
$^{14}CH_3(CH_2)_9COOH$

After allowing 30 minutes for fatty acid β oxidation, the label would most likely be recovered in:
A) acetyl-CoA.
B) beta-hydroxy butyryl-CoA.
C) both acetyl-CoA and propionyl-CoA.
D) palmitoyl-CoA.
E) **propionyl-CoA.**

8) Page: 642 Ans: D

The carbon atoms from a fatty acid with an odd number of carbons will enter the citric acid cycle as acetyl-CoA and:

A) butyrate.
B) citrate.
C) malate.
D) **succinyl-CoA.**
E) α-ketoglutarate.

9) Page: 650 Ans: C

Ketone bodies are formed in the liver and transported to the extrahepatic tissues mainly as:

A) acetoacetyl-CoA.
B) acetone.
C) **beta-hydroxybutyric acid.**
D) beta-hydroxybutyryl-CoA.
E) lactic acid.

10) Page: 631

Why is it more efficient to store energy as lipid rather than as glycogen?

Ans: First, the energy yield per gram of lipid (about 38 kJ/g) is more than twice that for carbohydrate (about 17 kJ/g). Second, lipid is stored as anhydrous lipid droplets, but carbohydrates such as glycogen and starch are stored hydrated, and the water of hydration roughly triples the effective weight of the carbohydrate, reducing the energy yield to about 6 kJ/g.

11) Page: 638

Draw the four basic steps in the oxidation of a saturated fatty acid (the β-oxidation pathway). Show structures, name enzymes, and indicate where any cofactors participate.

Ans: See Fig. 17-8a, p. 638.

12) Page: 638

The β oxidation of fatty acids begins with this activation reaction:

$$R–CH_2–CH_2–CH_2–COOH + ATP + CoA–SH \rightarrow$$

$$R–CH_2–CH_2–CH_2–CO–S–CoA + AMP + PP_i$$

What are the next two steps (after transport into the mitochondria)? Show structures and indicate where any cofactors participate.

Ans: The reactions are those catalyzed by fatty acyl–CoA dehydrogenase and enoyl hydratase. See Fig. 17-8a, p. 638.

13) Pages: 651-652

What are ketone bodies and why do they form during fasting?

Ans: The ketone bodies, acetoacetate, β-hydroxybutyrate, and acetone, are overproduced during fasting, when fatty acids from stored triacylglycerols become the principle oxidizable fuel. Accumulation of acetyl-CoA and its precursor acetoacetyl-CoA favors ketone body formation. Because oxaloacetate is used for gluconeogenesis, it is withdrawn from the citric acid cycle, bringing that cycle to a near halt. The acetyl-CoA that is produced by β oxidation can no longer be oxidized via the citric acid cycle so it accumulates.