

Activity 51: Lipid Metabolism (β Oxidation)

Learning Objectives

Predict the number of cycles of β oxidation needed to catabolize a saturated fatty acid

Predict the products of the complete catabolism of a saturated fatty acid

Count the total number of ATP produced from the complete catabolism of a saturated fatty acid

Estimated Completion Time 30–45 Minutes

Instructor Information

This activity assumes that an introduction to beta oxidation has been discussed. The answer key assumes the nucleotide output of 2.5 ATP per 1 NADH and 1.5 ATP per 1 FADH_2 . Some textbooks offer different values.

ANSWERS TO QUESTIONS

1. The fatty acyl CoA at the bottom contains two carbons less than the fatty acyl CoA at the top.
2. Two: 1 FADH_2 and 1 NADH.
3. One, with the exception of the last cycle where two are produced.
4. a. Eight b. 9 acetyl CoA c. 8 FADH_2 and 8 NADH
5. One molecule of stearic acid. Students can reason this just from the number of acetyl CoA produced. One molecule of glucose only produces 2 acetyl CoA (10 ATP in the citric acid cycle), whereas one molecule of stearic acid produces 9 acetyl CoA.

Activity 51: Skill Development

1. FAD and NAD⁺
2.
 - a. 10 acetyl CoA
 - b. 9 turns
 - c. $(9 \text{ FADH}_2 \times 1.5 \text{ ATP}) + (9 \text{ NADH} \times 2.5 \text{ ATP}) + (10 \text{ acetyl CoA} \times 10 \text{ ATP}) = 136 \text{ ATP}$
3. Because fatty acids can produce more energy per molecule, the weight of storing triglycerides (3 fatty acids per molecule) for the same amount of energy would be much less than storing glycogen. Because birds fly long distances and need to use lots of energy, the metabolic strategy of metabolizing mainly fats for energy makes sense.