**Ose Ogheneruona**

**18/MHS03/013**

**ANSWER**

Beta oxidation takes place in four steps: dehydrogenation, hydration,

oxidation and thyolisis. Each step is catalyzed by a distinct enzyme.

Briefly, each cycle of this process begins with an acyl-CoA chain and

ends with one acetyl-CoA, one FADH2, one NADH and water, and the

acyl-CoA chain becomes two carbons shorter. The total energy yield

per cycle is 17 ATP molecules (see below for details on the

breakdown). This cycle is repeated until two acetyl-CoA molecules are

formed as opposed to one acyl-CoA and one acetyl-CoA. The four

steps of beta oxidation are described below.

Beta oxidation takes place in four steps: dehydrogenation, hydration,

oxidation and thyolisis. Each step is catalyzed by a distinct enzyme.

**Dehydrogenation**

In the first step, acyl-CoA is oxidized by the enzyme acyl CoA

dehydrogenase. A double bond is formed between the second and

third carbons (C2 and C3) of the acyl-CoA chain entering the beta

oxidation cycle; the end product of this reaction is trans-Δ2-enoyl-CoA

(trans-delta 2-enoyl CoA). This step uses FAD and produces FADH2,

which will enter the citric acid cycle and form ATP to be used as

energy. (Notice in the following figure that the carbon count starts on

the right side: the rightmost carbon below the oxygen atom is C1,

then C2 on the left forming a double bond with C3, and so on.)

**Hydration**

In the second step, the double bond between C2 and C3 of

trans-Δ2-enoyl-CoA is hydrated, forming the end product

L-β-hydroxyacyl CoA, which has a hydroxyl group (OH) in C2, in place

of the double bond. This reaction is catalyzed by another enzyme:

enoyl CoA hydratase. This step requires water.

**Oxidation**

In the third step, the hydroxyl group in C2 of L-β-hydroxyacyl CoA is

oxidized by NAD+ in a reaction that is catalyzed by 3-hydroxyacyl-CoA

dehydrogenase. The end products are β-ketoacyl CoA and NADH + H.

NADH will enter the citric acid cycle and produce ATP that will be used

as energy.

**Thiolysis**

Finally, in the fourth step, β-ketoacyl CoA is cleaved by a thiol group

(SH) of another CoA molecule (CoA-SH). The enzyme that catalyzes

this reaction is β-ketothiolase. The cleavage takes place between C2

and C3; therefore, the end products are an acetyl-CoA molecule with

the original two first carbons (C1 and C2), and an acyl-CoA chain two

carbons shorter than the original acyl-CoA chain that entered the beta

oxidation cycle.