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MATRIC NO - 18/MHSD71002

COURSE TITLE - MEDICAL BIOCHEMISTRY II

COURSE CODE - BCH 204

DATE - 21/4/20

QUESTION - Describe the three stages of beta Oxidation. [show Pathways where necessary].

ANSWER

B Oxidation

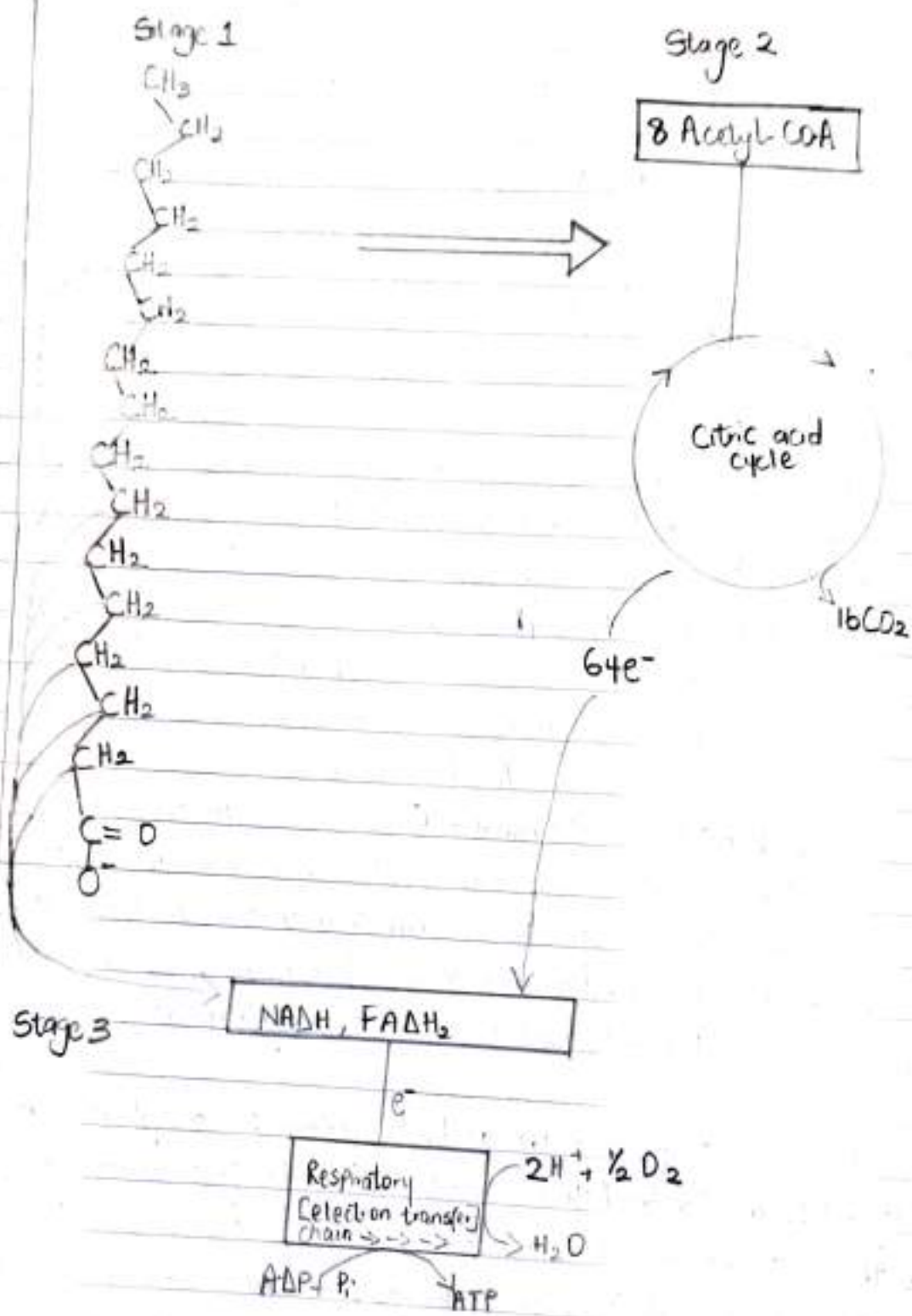
Mitochondrial Oxidation of fatty acids takes place in three stages.

I. In the first stage - β Oxidation - the fatty acids undergo Oxidative removal of successive two-carbon units in the form of acetyl-CoA, starting from the Carboxyl end of the fatty acid chain.

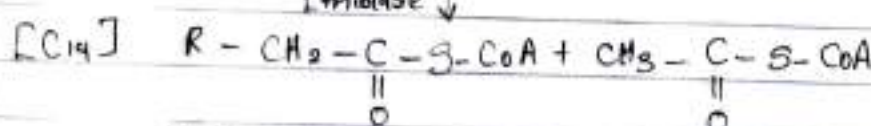
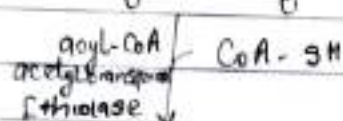
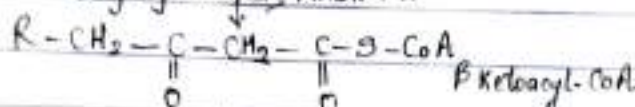
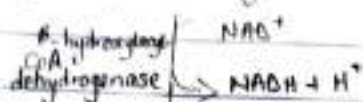
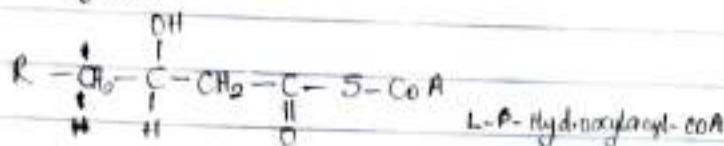
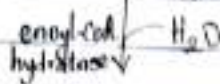
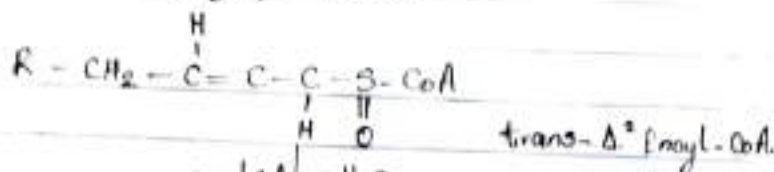
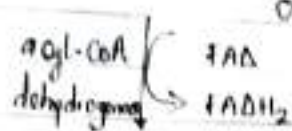
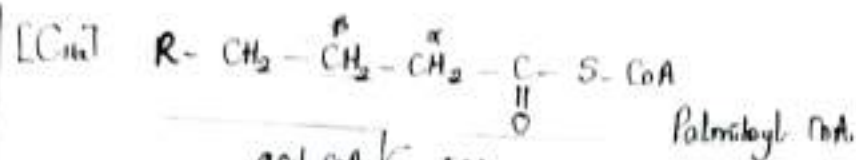
For example, the 16-carbon fatty acid Palmitic acid (Palmitate at PM7) undergoes seven passes through this Oxidative Sequence, in each pass losing two carbons as acetyl-CoA. At the end of seven cycles the last two carbons of Palmitic acid [Originally C-15 and C-16] are left as acetyl-CoA. The overall result is the conversion of 16-carbon chain of Palmitate to eight two-carbon acetyl-CoA molecules. Formation of each molecule of acetyl-CoA requires removal of four hydrogen atoms [two pairs of electrons and four H^+] from the fatty acid moiety by the action of dehydrogenases.

II. In the second stage of fatty acid Oxidation the acetyl residues of acetyl-CoA are Oxidized to CO_2 via the Citric acid Cycle, which also takes place in the Mitochondrial Matrix. Acetyl-CoA derived from fatty acid Oxidation thus enters a final common pathway of Oxidation along with acetyl-CoA derived from glucose via glycolysis and Pyruvate Oxidation.

The first two stages of fatty acid Oxidation produce the reduced electron carriers NADH and $FADH_2$, which in the third stage donate electrons are carried to Oxygen. Coupled to this flow of electrons is the Phosphorylation of ADP to ATP, to be described, thus energy released by fatty acid Oxidation is conserved to ATP.



We will now look in more details at the first stage of fatty acid oxidation, for the simple case of a saturated chain with an even number of carbons, and for the slightly more complicated cases of unsaturated and odd number chains. We then consider the regulation of fatty acid oxidation, and the β -oxidation processes occurring in organelles other than mitochondria.



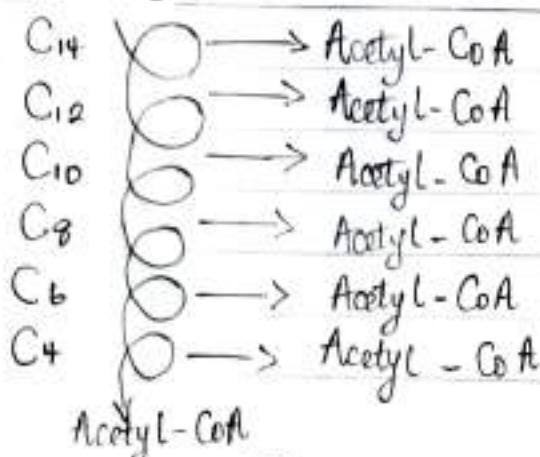
[C₁₄] Acyl-CoA

Acetyl-CoA

The fatty acid Oxidation (β -Oxidation) pathway. (a) in each Pass through the sequence, one acetyl residue is removed in the form of acetyl-CoA from the Carboxyl end of palmitate (C₁₆), which enters as Palmitoyl-CoA.

(b) Six more Passes through the pathway yield seven more molecules of acetyl-CoA, the Seventh arising from the last two Carbon atoms of 16-Carbon chain, Eight molecules of acetyl-CoA are formed in all.

(a)



(b)