RAD II and DT II

Final term

BIOCHEMISTRY

Marks 50

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Write note on following questions each carries equal marks

1) Write down the 4 steps involve in beta oxidation?

Answer:

Beta-oxidation of fatty acids

Beta-oxidation is the process in which fatty acid molecules are break down to produce in energy. In eukaryotic cell , it takes place in mitochondrial matrix, this oxidation is occur at on β-carbon atom of fatty acid.

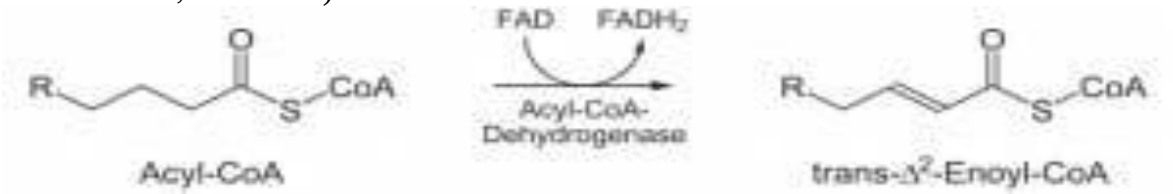
Four step of beta oxidation

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.

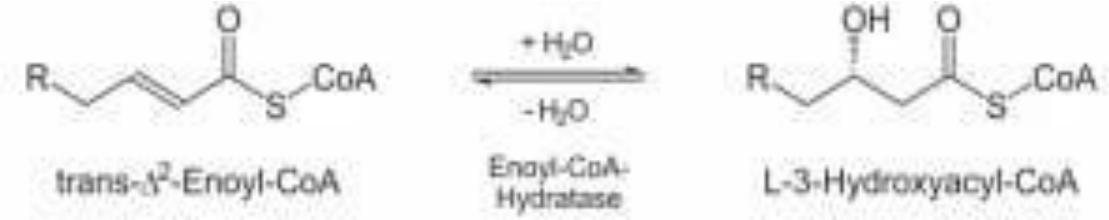
Dehydrogenation

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-Δ^2-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.)



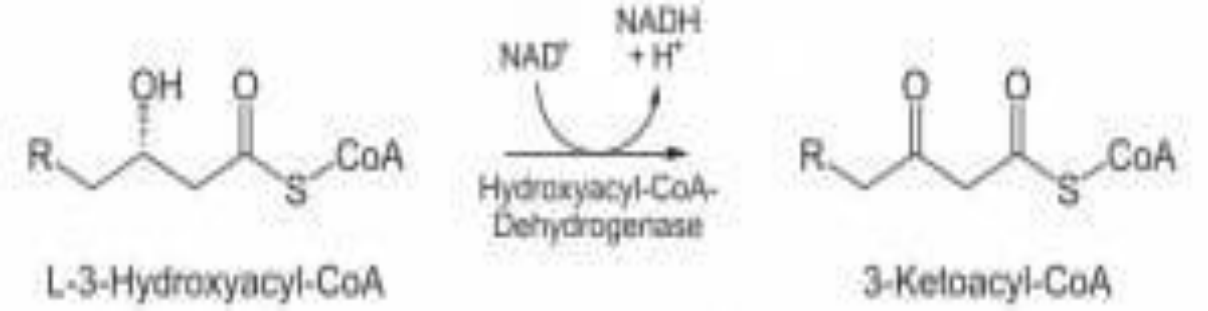
Hydration

In the second step, the double bond between C2 and C3 of trans-Δ^2-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.



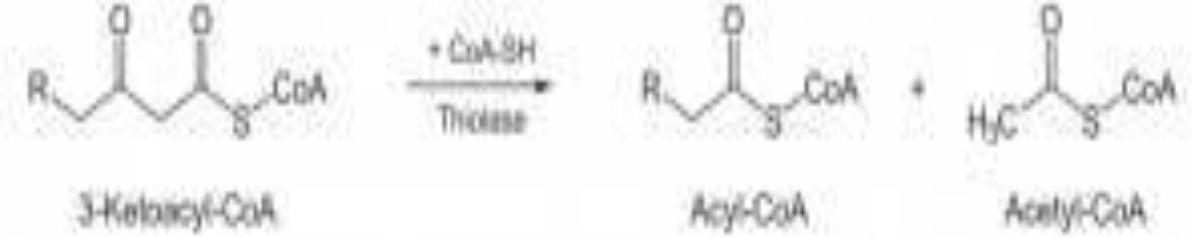
Oxidation

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.



2) Write down clinical significance of the following enzymes

a) Alkaline phosphatase

b) Creatine kinase

c) gamma-glutamyl transferase

Answer:

Alkaline phosphatase (ALP)

Alkaline phosphatase (ALP). ALP is and enzyme that found in the liver and bone and is important for breaking down proteins. Higher-than-normal levels of ALP. May indicate liver damage or disease, such as a blocked bile duct,or certain bone disease.

Creatine kinase (CK)

Creatine kinase (CK) is an enzyme found in the heart brain skeletal muscle, and other tissues. Increased amounts of CK are released into the blood when there is muscle damage. This text measure the amount of creatine kinase in the blood. The small amount of CK that is normally in the blood comes primarily from skeletal muscles. Any condition that causes muscle damage and /or interferes with muscle energy production or use can cause an increase in CK muscles disease caused by high level of CK.

Gamma-glutamyl transferase (GGT)

Gamma-glutamyl transferase (GGT) test may be used to determine the cause of elevated alkaline phosphates (ALP) Both ALP and GGT are elevated in disease of

the bile ducts and in soe liver disease, but only ALP will be elevated in bone disease.

3) How many proteins are involve in electron transport chain and how do electrons move in the electron transport chain?

Answer:

The electron transport chain: The electron transport chain is a series of electron transporters embedded in the inner mitochondrial membrane that shuttles electrons from NADH and $FADH_2$ to molecular oxygen. In the process, protons are pumped from the mitochondrial matrix to the intermembrane space, and oxygen is reduced to form water.

Complex 1

To start, two electrons are carried to the first complex aboard NADH. Complex I is composed of flavin mononucleotide (FMN) and an enzyme containing iron-sulfur (Fe-S). FMN, which is derived from vitamin B_2 (also called riboflavin), is one of several prosthetic groups or co-factors in the electron transport chain. A prosthetic group is a non-protein molecule required for the activity of a protein. Prosthetic groups can be organic or inorganic and are non-peptide molecules bound to a protein that facilitate its function.

Prosthetic groups include co-enzymes, which are the prosthetic groups of enzymes. The enzyme in complex I is NADH dehydrogenase, a very large protein containing 45 amino acid chains. Complex I can pump four hydrogen ions across the membrane from the matrix into the intermembrane space; it is in this way that the hydrogen ion gradient is established and maintained between the two compartments separated by the inner mitochondrial membrane.

Complex 2

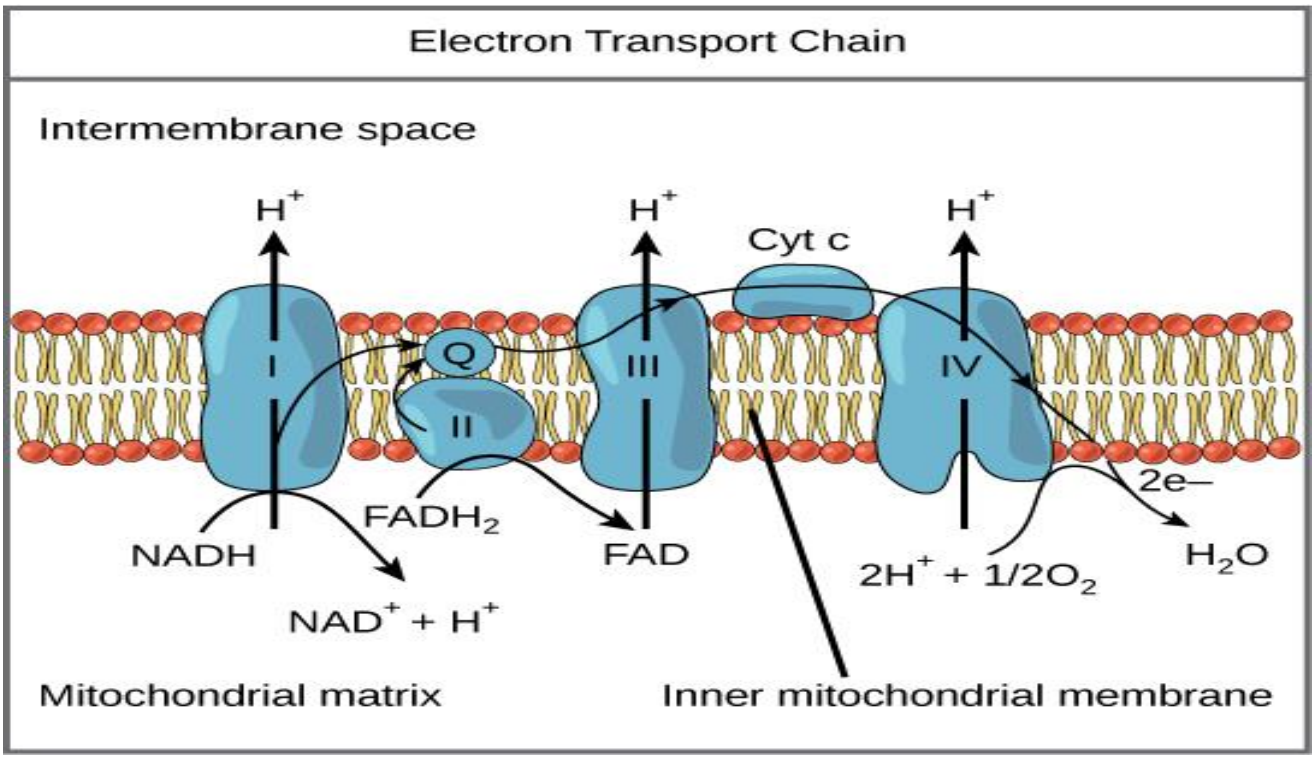
Complex II directly receives $FADH_2$, which does not pass through complex I. The compound connecting the first and second complexes to the third is ubiquinone (Q). The Q molecule is lipid soluble and freely moves through the hydrophobic core of the membrane. Once it is reduced to QH_2, ubiquinone delivers its electrons to the next complex in the electron transport chain. Q receives the electrons derived from NADH from complex I and the electrons derived from $FADH_2$ from complex II, including succinate dehydrogenase. This enzyme and $FADH_2$ form a small complex that delivers electrons directly to the electron transport chain, bypassing the first complex. Since these electrons bypass, and thus do not energize, the proton pump in the first complex, fewer ATP molecules are made from the $FADH_2$ electrons. The number of ATP molecules ultimately obtained is directly proportional to the number of protons pumped across the inner mitochondrial membrane.

Complex 3

The third complex is composed of cytochrome b, another Fe-S protein, Rieske center (2Fe-2S center), and cytochrome c proteins; this complex is also called cytochrome oxidoreductase. Cytochrome proteins have a prosthetic heme group. The heme molecule is similar to the heme in hemoglobin, but it carries electrons, not oxygen. As a result, the iron ion at its core is reduced and oxidized as it passes the electrons, fluctuating between different oxidation states: Fe^{2+} (reduced) and Fe^{3+} (oxidized). The heme molecules in the cytochromes have slightly different characteristics due to the effects of the different proteins binding them, which makes each complex. Complex III pumps protons through the membrane and passes its electrons to cytochrome c for transport to the fourth complex of proteins and enzymes. Cytochrome c is the acceptor of electrons from Q; however, whereas Q carries pairs of electrons, cytochrome c can accept only one at a time.

Complex 4

The fourth complex is composed of cytochrome proteins c, a, and a_3. This complex contains two heme groups (one in each of the cytochromes a and a_3) and three copper ions (a pair of Cu_A and one Cu_B in cytochrome a_3). The cytochromes hold an oxygen molecule very tightly between the iron and copper ions until the oxygen is completely reduced. The reduced oxygen then picks up two hydrogen ions from the surrounding medium to produce water (H_2O). The removal of the hydrogen ions from the system also contributes to the ion gradient used in the process of chemiosmosis.



4) Write down step involve uric acid formation?

Answer:

URIC ACID FORMATION.

MAJOR PATH WAY: major path way of nitrogen excretion being is urea which is synthesis is the liver release into blood streem and excreted by the kidney.

SITE OF SYNTHESIS: Urea formation take place in liver and all enzyme involved in urea formation are isolated from liver tissues.

PROCESS OF UREA FORMATION: part of urea cycle occur in mitochondria and part of it occur in cytoplasm.

SYNTHESIS OF CARBOMYL PHOSPHATE: In the first step ammonium ion CO2 and phosphate of ATP combine together to from carbomyl phosphate in presence of enzyme C/ D Synthesis I.this reaction occur in the mitochondria.

SYNTHESIS OF CITRULLINE: in 2nd step the carbomal react with ornithin in presence of catalyst called orinithine Trans carbo my lase which Will from citrulline and organic phosphate.

The above reaction occur in mitochondria wheraas the orinthinne utilized in above reaction is transport from cytoplasm into mitochondria.

Orinthine used in above step as itselp produced in last step of urea cycle.

SYNTHESIS OF ARGININOSUCCINATE: 3TD step the citrulline formed in 2nd step is now trasnfare out of mitochondria into cytoplasm. This prosis occur in the presence of enzyme called Argininoscuinate synthesis.

CLEAVAGE OF ARGININOSUCCINATE: in 4 step cleavage of argininosuccinate occur in presence of an enzyme called Arginino succinase which result in formations of arginine and fumarate.

The Fumarate formed in above step enter in citric aid cycle.this show a relationship between the urea cycle and citric acid cycle..

CLEAVAGE OF ARGININE: in last step of urea cycle the arginine form4 steps is cleaved to form orinthine and urea . the reaction is catalyzed by in enzyme called arginine.

The Ornithine priduced in final step is transport to mitochondria where is used a subtrate in 2 step of UC for the formation of citrulline to result the cycle.

The Urea produced in reaction enter blood circulation and is excreted in urea.

ADVNTAGE: Ammonia is toxic substance which is produced during metabolism of dietory protein, carbohydrates and lipid . so with help of urea cycle toxic ammonia is converted into non toxic substance called urea.

5) How uric acid formation takes place in body?

Answer:

Normal range of uric acid in the human body

Most of it is excreted (removed from youir body) in your urine, or passes though your intestines to regulate "normal" levels. Normal uric acid levels are 2.4-6.0 mg/dL (female) and 3.4-7.0 mg/dL (male). Normal values will vary from laboratory to laboratory. Also important to blood uric acid levels are purines.

Uric acid compound

Uric acid formed by break down purine nucleotide, purine nucleotide are (Adenosine, Guanine and Inosine) generally we have

Uric acid is heterocyclic compound of carbon, nitrogen, oxygen, and hydrogen with the formula $C_5H_4N_4O_3$ it forms ions and salts known as urates and acid urates, such as ammonium acid urate. Uric acid is a product of the metabolic breakdown of purine nucleotides, and it is a normal component of urine. High blood concentrations of uric acid can lead to gout and are associated with other medial condition, including diabetes and the formation of ammonium acid urate kidney stones.

(AM P) Adenosine monophosphate

(GMP) guanine monophosphate

(IMP) Inosine monophosphate

(AMP) change form Adenosine

(GMP) change form Guanosine

(IMP) change form Inosine