

**Course Title: Medical Biochemistry II**  
**DT 2<sup>nd</sup>, Sec A**  
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**Student ID: 16502**

**Max Marks: 50**

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**Note: There are FIVE questions, each carry 10 marks with grand total of 50 marks**  
**ATTEMPT all questions**  
**Avoid copy paste material, as it may deduct your marks**

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Q1. Explain the process of “ATP synthesis coupled with electron flow”.

**Ans:-ATP Synthase:-**

ATP synthase moves H<sup>+</sup> ions that were pumped out of the matrix by the electron transport chain back into the matrix. The energy from the influx of protons into the matrix is used to generate ATP by the phosphorylation (addition of a phosphate) of ADP. The movement of ions across the selectively permeable mitochondrial membrane and down their electrochemical gradient is called chemiosmosis.

NADH generates more ATP than FADH<sub>2</sub>. For every NADH molecule that is oxidized, 10 H<sup>+</sup> ions are pumped into the intermembrane space. This yields about three ATP molecules. Because FADH<sub>2</sub> enters the chain at a later stage (Complex II), only six H<sup>+</sup> ions are transferred to the intermembrane space.

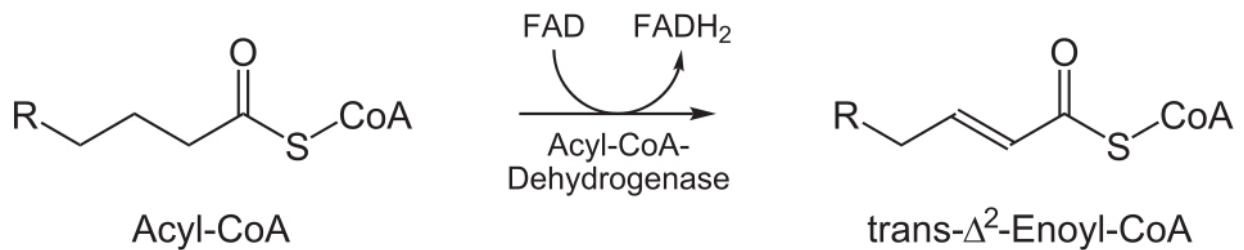
Q2. Write the reactions that are catalyzed by the following enzymes.

- i. Acyl CoA dehydrogenase

- ii. Adenosine deaminase
- iii. Nucleotidase
- iv. Gluconolactonase
- v. Enoyl-CoA hydratase

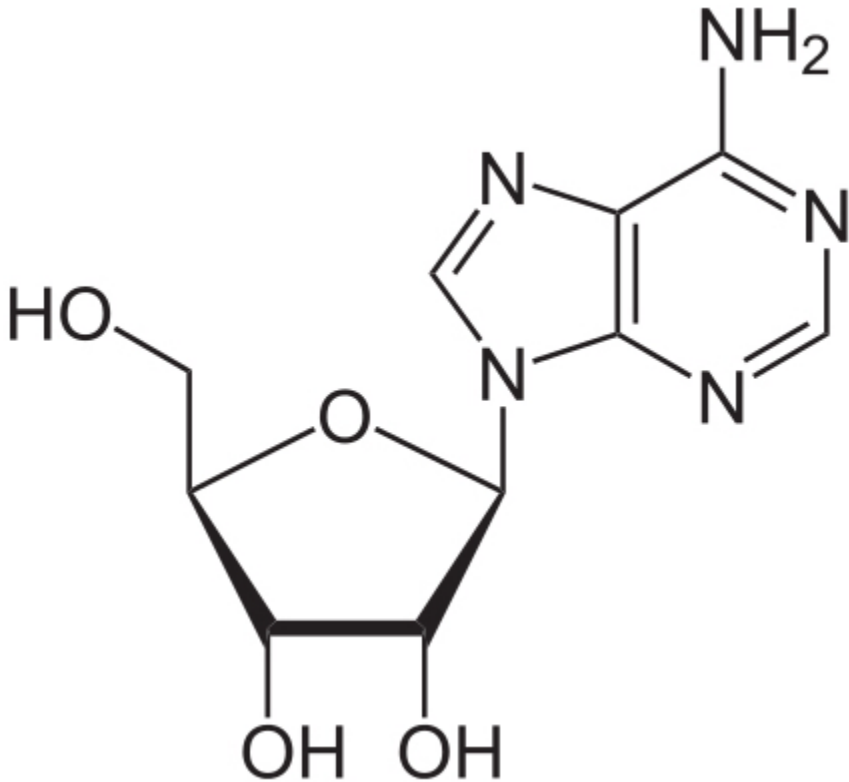
Ans:-Acyl CoA dehydrogenase:-

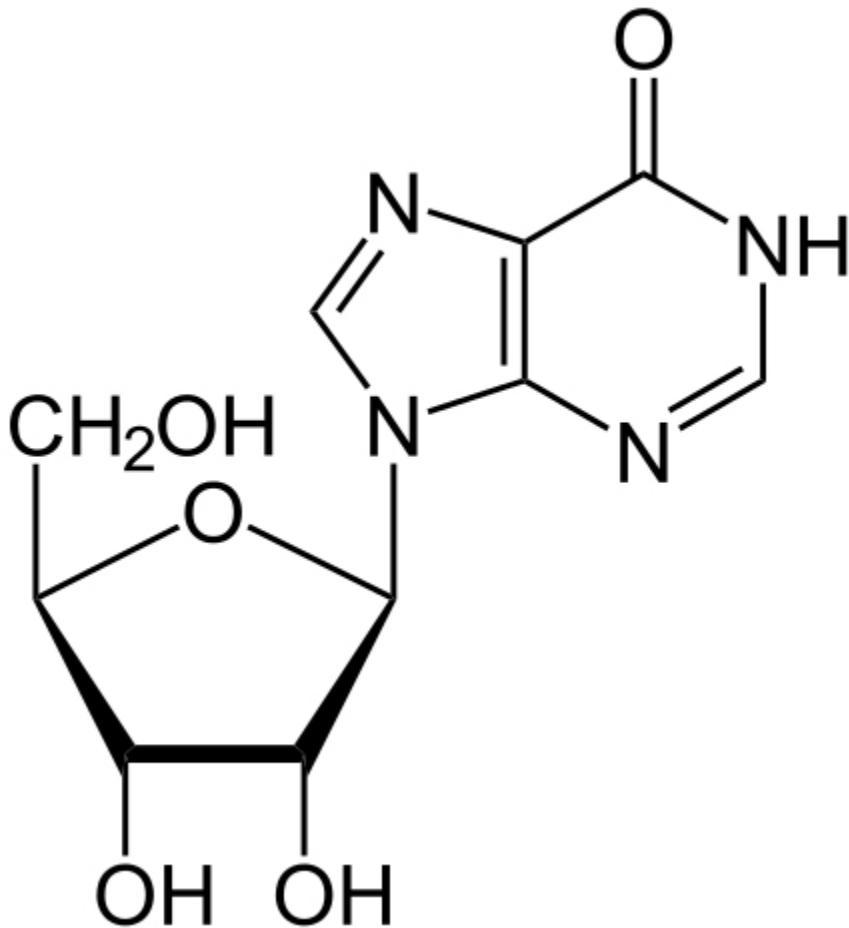
The following reaction is the oxidation of the fatty acid by FAD to afford an  $\alpha,\beta$ -unsaturated fatty acid thioester of Coenzyme A:



Adenosine deaminase:-

ADA irreversibly deaminates adenosine, converting it to the related nucleoside inosine by the substitution of the amino group by a keto group.



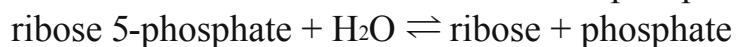
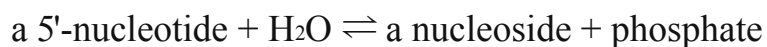


Inosine can then be deribosylated (removed from ribose) by another enzyme called purine nucleoside phosphorylase (PNP), converting it to hypoxanthine.

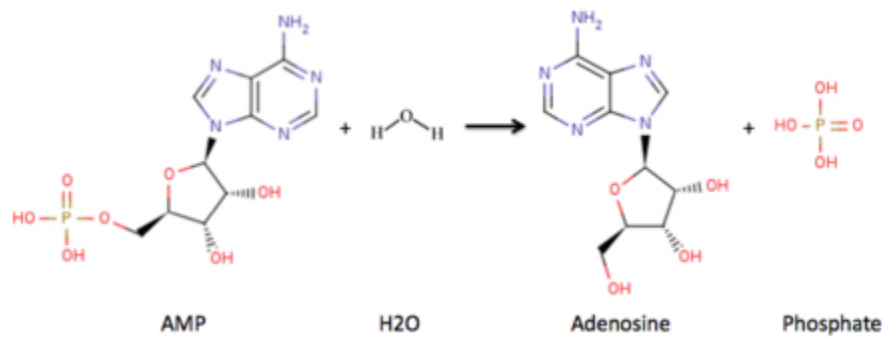
#### Nucleotidase:-

The enzyme has a wide substrate specificity for nucleotides and has been shown to hydrolyze 5'nucleotides rapidly, ribose-5-phosphate slowly, and other phosphate esters extremely slowly (if at all).[6]

For example, the 5'nucleotidase enzyme catalyses the following chemical reactions



The 5'nucleotidase catalyzed reaction of an AMP nucleotide to adenosine nucleoside is shown below:

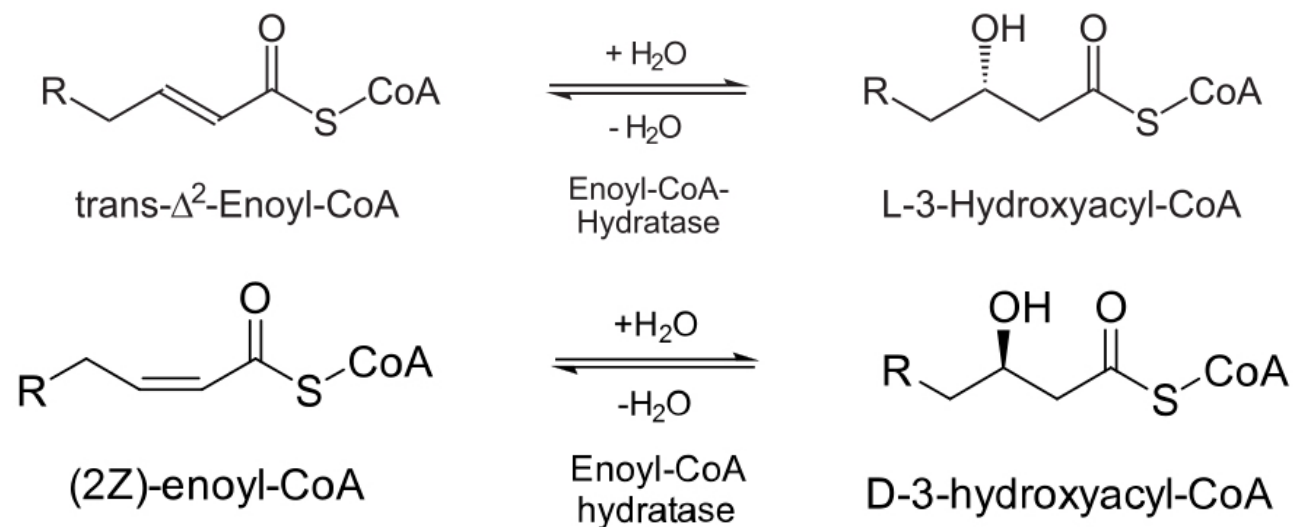


### Gluconolactonase:-

This enzyme belongs to the family of hydrolases, specifically those acting on carboxylic ester bonds. The systematic name of this enzyme class is D-glucono-1,5-lactone lactonohydrolase. Other names in common use include lactonase, aldonolactonase, glucono-delta-lactonase, and gulonolactonase. This enzyme participates in 3 metabolic pathways: pentose phosphate pathway, ascorbate and aldarate metabolism, and caprolactam degradation.

### Enoyl coA hydratase:-

Enoyl-CoA hydratase (ECH) or crotonase[1] is an enzyme that hydrates the double bond between the second and third carbons on 2-trans/cis-enoyl-CoA:



ECH is essential to metabolizing fatty acids in beta oxidation to produce both acetyl CoA and energy in the form of ATP

Q3. Define nucleotide, nucleoside and differentiate between DNA and RNA.

**Ans:-nucleotide:-**

A nucleotide is the basic building block of nucleic acids. RNA and DNA are polymers made of long chains of nucleotides. A nucleotide consists of a sugar molecule (either ribose in RNA or deoxyribose in DNA) attached to a phosphate group and a nitrogen-containing base.

**Nucleoside:-**

a compound (such as guanosine or adenosine) that consists of a purine or pyrimidine base combined with deoxyribose or ribose and is found especially in DNA or RNA.

<b>Main Differences Between DNA and RNA</b>		
<b>Comparison</b>	<b>DNA</b>	<b>RNA</b>
Name	DeoxyriboNucleic Acid	RiboNucleic Acid
Function	Long-term storage of genetic information; transmission of genetic information to make other cells and new organisms.	Used to transfer the genetic code from the nucleus to the ribosomes to make proteins. RNA is used to transmit genetic information in some organisms and may have been the molecule used to store genetic blueprints in primitive organisms.
Structural Features	B-form double helix. DNA is a double-stranded molecule consisting of a long chain of nucleotides.	A-form helix. RNA usually is a single-strand helix consisting of shorter chains of nucleotides.
Composition of Bases and Sugars	deoxyribose sugar phosphate backbone adenine, guanine, cytosine, thymine bases	ribose sugar phosphate backbone adenine, guanine, cytosine, uracil bases
Propagation	DNA is self-replicating.	RNA is synthesized from DNA on an as-needed basis.
Base Pairing	AT (adenine-thymine) GC (guanine-cytosine)	AU (adenine-uracil) GC (guanine-cytosine)

Q4. Why Dickens and Horecker's Pathway is called HMP pathway. Enlist the enzymes used in PPP Pathway.

Ans:- **HMP PATHWAY :**

Dickens and Horeckers pathway is called HMP pathway because it It occurs in the cytoplasm and is a major source of NADPH and 5-carbon ... generates NADPH and pentose (5-carbon sugars), a precursor for the synthesis of nucleotides.

**ENZYMES USED IN PPP PATHWAY :**

**ENZYME INVOLVED IN OXIDATIVE PHASE**

- Glucose-6-phosphate dehydrogenase
- 6-Phosphogluconolactone hydrolase / Gluconolactonase
- 6- Phosphogluconate dehydrogenase in PPP Pathway.

**ENZYMES INVOLVED IN NON OXIDATIVE PHASE**

- Isomerase enzyme
- Epimerase enzyme
- Transketulase enzyme

Q5. What is the function of carnitine shuttle system? Write down the stages and steps involved in Beta oxidation of Lipids.

Ans:- **function of carnitine shuttle system:-**

1) The carnitine shuttle is responsible for transferring long-chain fatty acids across the barrier of the inner mitochondrial membrane to gain access

to the enzymes of beta-oxidation. ... The fatty acid-carnitine is transported into the matrix by a transporter protein in the inner mitochondrial membrane.

2)The carnitine shuttle represents a mechanism by which long-chain fatty acids, which are impermeable to the mitochondrial membranes, are transported into the mitochondrial matrix for the purpose  $\beta$ -oxidation and energy production.

#### stages involved in Beta oxidation of Lipids:-

1. Activation of fatty acids occurring in the cytoplasm.
2. Transport of fatty acids into mitochondria.
3. Beta-Oxidation in the mitochondrial matrix.

#### Steps involved in beta oxidation of lipids:-

- I. Dehydrogenation
- II. Hydration
- III. Dehydrogenation
- IV. Cleavage