JRG College of Pharmacy

JRG COLLEGE OF PHARMACY

UNIVERSITY SOLVED QUESTION

WITH ANSWER

Year : 2021-22

Subject : BIOCHEMISTRY

Subject Code : 23PBP203

Subject In-Charge : Miss.Kiranmayee Bhatra &

Mr. Jyoti Prasanna Nanda

Registration No : | | | | | | | | | | |

Total Number of Pages : 02

B. PHARM.
BP203T

2nd Semester Regular / Back Examination: 2021-22
BIOCHEMISTRY
PHARMACY
Time : 3 Hour
Max Marks : 75
Q. Code: J585

Answer Question No.1 (Part-1) which is compulsory, any seven from Part-II and any two from Part-III.

The figures in the right hand margin indicate marks.

Part-I

Q1 **Answer the following questions:** **(2 x 10)**

a) Define free energy and give some examples of energy rich compounds.
b) What is ketosis? Write down the normal ketone body level.
c) Write down one purine and pyrimidine base with structure.
d) Define Transamination and Deamination.
e) What is enzyme induction & repression? Give examples.
f) What are essential fatty acids? Give examples.
g) Define gluconeogenesis. Name the key enzyme of gluconeogenesis.
h) Distinguish between DNA and RNA.
i) What are the inhibitors of oxidative phosphorylation?
j) Name the regulatory enzymes of TCA cycle.

Part-II

Q2 **Focused-Short Answer Type Questions- (Answer Any Seven)** **(5 × 7)**

a) Write down the oxidative phase of HMP pathway and mention the significance of HMP pathway.
b) Describe the process of Transcription.
c) Discuss the symptom and treatment of Hyperuricemia and Gout.
d) Describe the Urea cycle with its disorder.
e) Write notes on ETC.
f) Describe the reactions of β–oxidation of saturated fatty acid and mention the energy produced from Palmitic acid.
g) Write down the synthesis and significance of adrenaline.
h) What is enzyme inhibition? Classify it with examples.
i) What is ATP-ADP cycle? Write down notes on significance of ATP.

Part-III

Long Answer Type Questions (Answer Any Two)

Q3 Define carbohydrates. Classify it. Mention the importance of Carbohydrate. Write down the properties of monosaccharide. **(10)**

Q4 Define enzyme, classify it with examples. Write down the therapeutic and diagnostic applications of enzymes and isoenzymes. **(10)**

Q5 Discuss detail about E. M. Pathway with energetic. **(10)**

Q6 Write down the denovo synthesis of fatty acids. **(10)**

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2021-22

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Biochemistrey

PART-1

Q)1 a) Define free energy and give some examples of energy rich compounds.

ans:- => free energy are Gibbs free energy (G) is a thermodynamic property that measures the maximum amount of work that can be extracted from a system at a constant temperature and pressure.

=> Example:- Acetyl CoA, Adenosine triphosphate, phosphoenolpyruvate.

b) what is ketosis? write down the normal ketone body level.

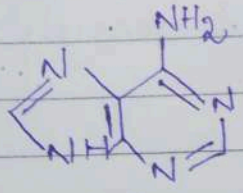
ans:- => ketosis is a metabolic state characterized by elevated levels of ketones bodies in the blood.

=> this resulting from the breakdown of fats for energy when carbohydrate intake is low or glucose is unavailable.

=> Normal range:- 0.2-0.5 mmol/L.

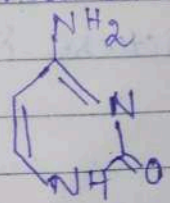
c) Write down one purine and pyrimidine base with structure.

ans:- => purines:-



Adenine

Pyrimidine:-



Cytosine

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d) Define Transamination and Deamination.

ans:- ⇒ Transamination:-

⇒ Transamination is the process in which an amino group ($-NH_2$) is transferred from an amino acid to take a ketoacid forming a new keto and amino acid. This reaction is catalyzed by enzymes called transamination.

⇒ Ex - Glutamate + ~~oxaloacetate~~ oxaloacetate → α-ketoglutarate + Aspartate.

⇒ Deamination:-

⇒ Deamination is the process by which the amino group ($-NH_2$) is removed from an amino acid, resulting in the formation of keto acid and release of ammonia.

⇒ Ex- Glutamate → α-ketoglutarate + NH_3

~~d) Define Transamination~~

e) What is enzyme induction and repression? Give examples.

ans:- ⇒ Enzyme induction:-

⇒ Enzyme induction is the process by which the synthesis of enzymes is increased in response to the presence of specific substrates.

Ex- Lactase in bacteria.

=> Enzyme Repression:-
=> Enzyme Repression is a process that reduces the rate at which an enzyme is produces.

=> Ex- Tryptophan, cholesterol synthesis.

f) what are essential fatty acid? give examples.

ans:- => Essential fatty acids are types of polyunsaturated fatty acids that cannot be synthesized by the body and must be obtained from the diet.

=> They are vital for various physiological functions, including cell membrane integrity, inflammation regulation.

=> Example:- Arachidonic acid, linoleic acid.

g) Define gluconeogenesis. Name the key enzyme of gluconeogenesis.

ans:- => Gluconeogenesis is the process of producing glucose from non-carbohydrate sources, like fats and proteins.

=> The key enzymes are:-
- pyruvate carboxylase
- phosphoenolpyruvate carboxykinase
- fructose-1,6-bisphosphate
- Glucose-6-phosphate.

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h) Distinguish between DNA and RNA.

ans:-

DNA	RNA
i) Deoxyribonucleic acid	i) Ribonucleic acid
ii) Very stable	ii) Less stable
iii) Contain thymine	iii) Contains uracil
iv) Found only in nucleus.	iv) Found through cells.

i) What are the inhibitors of oxidative phosphorylation?

ans:- => Inhibitors of oxidative phosphorylation are substances that prevent the production of ATP by blocking electron transfer in the electron transport chain (ETC).

=> Ex - Cyanide and Carbon monoxide.

j) Name the regulatory enzymes of TCA cycle.

ans:- => i) Citrate synthase
ii) Isocitrate dehydrogenase
iii) α-ketoglutarate dehydrogenase.

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UNIT-II

Q) 2) a) write down the oxidative phase of HMP pathway and mention the significance of HMP pathway.

ans:- → The oxidative phase of HMP pathway is the energy for this production is utilised by the conversion of glucose-6-phosphate to ribulose-5-phosphate.

→ The three steps of oxidative pathway are:-

- Glucose-6-phosphate is dehydrogenated to 6-phosphoglucono-δ-lactone in the presence of glucose-6-phosphate dehydrogenase.
- 6-phosphoglucono-δ-lactone is hydrolysed into to 6-phosphogluconate in ~~the presence of glucose-6-p~~ to 6-phosphogluconate in the presence of phosphogluconolactonase.
- 6-phosphogluconate is converted into ribulose-5-phosphate in the presence of 6-phosphogluconate dehydrogenase by oxidative decarboxylation.

→ Significance of HMP shunt:-

- It plays part in the synthesis of steroids and fatty acids.
- It is an important component of within phagolysosomes in the immune response.
- Glutathione is reduced by NADPH in the presence of glutathione reductase. This helps in quenching free oxygen radicals and peroxides from cells.
- The glyceraldehyde 3-phosphate and fructose 6-phosphate produced in the pathway.

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b) Describe the process of transcription.

ans:- ⇒ It is the one of process in gene expression the genetic information flows DNA to protein and this flow of information takes place in a sequential process of transcription & translation.

⇒ Stages of transcription are:-
i. Initiation
ii. Elongation
iii. Termination

i. Initiation:-
⇒ RNA polymerase attaches to DNA molecule and moves along the DNA strand until it recognises a promoter sequence.
These are known as the transcription start sites.

ii. Elongation:-
⇒ Ribonucleotides are added to the template strand that enables the growth of MRNA growth.

iii. Termination:-
⇒ RNA polymerase encounters a terminator sequence and the transcription stops. RNA polymerase then release the DNA template.

c) ...

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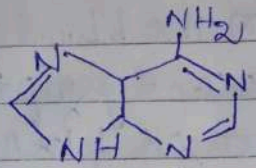
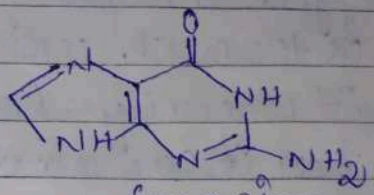
c) write down one purine and pyrimidine base with structure.

⇒ purine:-

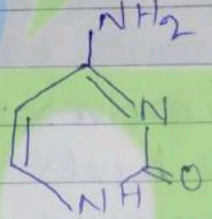


Adenine

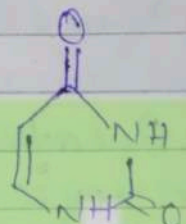


Guanine

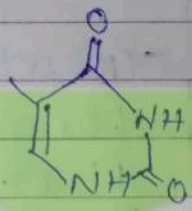
⇒ pyrimidines:-



Cytosine



Uracil



Thymine

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c) Discuss the symptom and treatment of hyperuricemia and gout.

ans:-> Hyperuricemia is a condition where there is too much uric acid in the blood. It usually doesn't cause sysmptoms, but it can lead to gout or kidney stones.

⇒ Hyperuricemia Symptoms:-
usually doesn't cause symptoms, but can lead to gout or kidney stones.

Treatment:-
⇒ Long-terem treatment involves medications that lower uric acid levels. These include allopurinol, febuxostat, and uricosuric drugs.

Gout Symptoms:-
⇒ ~~A~~ Sudden and intense pain in the joints, especially the big toe, ankles or knees. Other symptoms including swelling, redness, stiffness, and tenderness.

Treatment:-
⇒ Non-steroidal anti-inflammatory drugs are the primary treatment for acute gout attacks.

d) De
ans:-> u
i
-> e

d) Describe the urea cycle with its disorders.

ans:- → urea cycle is defined as the cyclic process in which Ammonia is converted into urea.
→ urea cycle is also defined as the first cyclic process or first metabolism pathway discovered by Hans krebs and kurt Henseleit, hence also known as 'krebs Henseleit cycle'. It is also called ornithine cycle.

STEPS OF UREA CYCLE:-

① Synthesis of carbomoyl phosphate:-
→ NH_3 condensed with CO_2 and activated in the presence of carbomoyl phosphate synthase-I to form carbomoyl phosphate.

② formation of citrulline:-
→ Citrulline is synthesized from carbomoyl phosphate and ornithine by ornithine transcarbomylase.
→ ornithine is again regenerated & ureacycle continues.

③ Synthesis of Arginosuccinate:-
→ citrulline is condenses with Aspartate to produce Arginosuccinate in the presence of Arginosuccinate synthase.
→ ATP is converted into AMP & Pyrophosphate.

④ formation of Arginine
→ Arginosuccinate cleaves to produce Arginine & fumarate in the presence of Arginosuccinase.

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(5) formation of urea:-
⇒ Arginine finally in the presence of Arginase converted into urea and ornithine.
⇒ ornithine again used in urea cycle while urea is excreted out from body through kidney.

e) write notes on ETC.
ans:- ⇒ Electron transport chain is a series of compounds where it make use of electron from electron carrier to develop a chemical gradient. It could be used to power oxidative phosphorylation. The molecules present in the chain comprises enzyme that are protein complex are proteins, peptides & much more.
⇒ Larger amounts of ATP could be produced through a highly efficient method termed oxidative phosphorylation. ATP is a fundamental unit of metabolic process. The electrons are transferred from electron donor to the electron acceptor leading to the production of ATP. It is one of the vital phases in the electron transport.

f) Describe the reaction of β-oxidation of saturated fatty acid and mention the energy produced from palmitic acid.
ans:- ⇒ β-oxidation process that breaks down fatty acid to produce acetyl-CoA and energy. It takes place in the mitochondria and peroxisomes of eukaryotes.

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Steps of β-oxidation:-

1. Dehydrogenation:-
   → Acyl-CoA dehydrogenase removes two hydrogen between carbon 2 & 3, forming a double bond.
2. Hydration:-
   → Enoyl-CoA hydrates adds a water molecule across the double bond, creating a hydroxyl group on carbon 3.
3. Oxidation:-
   → Hydroxylacyl-CoA dehydrogenase converts the hydroxyl group to carbonyl group, generating NADH and H^+.
4. Thiolysis:-
   → β-ketothiolase cleaves off an acetyl-CoA molecule, forming a new acyl-CoA that is two carbons shorter.

2) The energy produced by palmitic acid are:-
   - 131 ATP molecules which forms by the oxidation of palmitic acid.
   - However, 2ATP molecules are used to activate the fatty acid.
   - Therefore, the total ATP yields is 131-2 = 129 ATP.

9) write down the synthesis & significance of adrenaline.

ans:- → Synthesis:- Adrenaline is synthesized in the adrenal glands and the medulla oblongata of the brain.

→ steps are:-

1. the amino acid tyrosine is converted into L-DOPA.
2. L-DOPA is converted into dopamine.

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3. Dopamine is converted in to norepinephrine.
4. Norepinephrine is methylated to produce adrenaline.

Significance:-
⇒ Adrenaline makes your heart beat faster and your lungs breathe more efficiently.
⇒ It causes your blood vessels to send more blood to your brain and muscles, increases your blood pressure, makes your breath more alert, & raise blood sugar levels to give you energy.
⇒ your pupils grow larger & your sweat.

b) what is enzyme inhibition? classify it with examples.

ans:- ⇒ Enzymes are biological catalysts; they speed up chemical reactions but they are not changed by the reaction. Enzymes are reusable; because they are not consumed by the reaction one enzyme can carry out hundreds ~~of~~ reactions.
⇒ There are 3 types of enzyme inhibition are:-
1. Competitive inhibition
2. Non-competitive inhibition
3. uncompetitive inhibition

1. Competitive Inhibition:- It is a biochemical process that occures when a substance competes with another substance for binding to an enzyme.
Ex- Ritonavir is an HIV protease inhibitor.

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2) Non-competitive inhibition:-
→ It is a type of enzyme inhibition that occurs when an inhibitor binds to an enzyme at a site other than the active site. The binding prevents the enzymes from forming its product, which decreases the rate of the reaction.
Ex- cyanide, mercury, silver.

3) uncompetitive inhibition:-
→ It is a type of enzyme inhibition when an inhibitor binds to the enzyme-substrate complex, preventing the release of a product.
Ex- Hydrazine and aryl sulphatase.

i) what is ATP-ADP cycle? write down notes on significance of ATP.

ans:- → The ATP cycle is the process of converting adenosine triphosphate into adenosine diphosphate (ADP) and then back to ATP. ATP is a molecule that stores energy in cells, and the ATP cycle allows cells to continuously use ATP.

→ Significance of ATP are:-
- It stores and release energy in cells, making it a vital molecule for life.
- Transportation of different molecule across cell membranes.
- Supply the energy required for muscle contraction.

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Q) 3) Define Carbohydrates, classify it. mention the importance of carbohydrate. write down the properties of monosaccharide.

ans:-> Carbohydrates are organic compounds that are classified based on the number of sugar units they contain. The four main types of carbohydrates are monosaccharides, disaccharides, oligosaccharides & polysaccharides.

1) monosaccharides:-
-> The smallest carbohydrate molecules consisting of one sugar unit.
-> Ex- glucose & fructose.

2) Disaccharides:-
-> made of two sugar units.
-> Ex- Sucrose, ~~~~ lactose

3) oligosaccharides:-
-> made of three to ten sugar units.
-> Ex- raffinose, stachyose.

4) polysaccharides:-
-> made of ten or more sugar units.
-> Ex- Starch, glycogen, cellulose.

Importance of Carbohydrate are:-
-> Carbohydrates are the body's main source of energy.
-> some carbohydrate, like fiber, help with digestion

-> fiber can ... smaller ... manage...

Properti...
-> Crysta... and ...
-> Sweet...
-> Reduci...

Q) 4) Define ... write ... applic...

ans:-> Are en... is a... reacti... the ...

-> There...
1) oxid... Cat... ele... M...
Ex-
2) Tra... of ... con...
Ex-
3) Hy... of ... pe...

=> fiber can help you feel full and satisfied with smaller portion which can help in weight management.

Properties of monosaccharides are:-
=> Crystalline solids at room temperature and quite soluble in water.
=> Sweet in taste.
=> Reducing in nature.

Q) 4) Define enzyme, classify it with examples. write down the therapeutic and diagnostic applications of enzymes & isoenzymes.

ans:- => An enzyme is a biological catalyst and is almost always a protein. It speeds up the rate of a specific chemical reaction in the cell.

=> There are 6 types of enzymes and they are:-
1) oxidoreductases:- The enzyme oxidoreductase catalyzes the oxidation reaction where the electrons tend to travel from one form of a molecule to the other.
Ex- pyruvate dehydrogenase etc.
2) Transferases:- These catalyze transferring of the chemical group from one to another compound.
Ex- Transaminase etc.
3) Hydrolases:- The catalyze the hydrolysis of a bond. Ex- The enzyme pepsin hydrolyzes peptide bonds in proteins.

4) Lyases:- These catalyze the breakage of bonds without catalysis.
Ex- aldolase.

5) Isomerase:- The catalyze the formation of an isomer of a compound.
Ex- phosphoglucomutase catalyses the conversion of glucose-1-phosphate to glucose-6-phosphate.

6) Ligases:- Ligases catalyze the association of two molecules.
Ex- DNA ligase catalyses the joining of two fragments of DNA by forming a phosphodiester bond.

Enzymes:-
Therapeutic application:-
- Enzymes are used for aiding digestion. Ex- Amylase, protease
- They are used a debooremeing agent.
- They act as anti-clotting agents like fibrinolytic and thrombolytic.
- They act to treat atherosclerosis.

Diagnostic application:-
- They are also used in the diagnosis purpose.
- Eye disease.
- Heart attacks.
- Myocardial infection.

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=) Isoenzymes :-
Diagnostic effect :-
=) Tissue damage.
=) Organ damage.
=) Heart failure
=) Muscular dystrophy

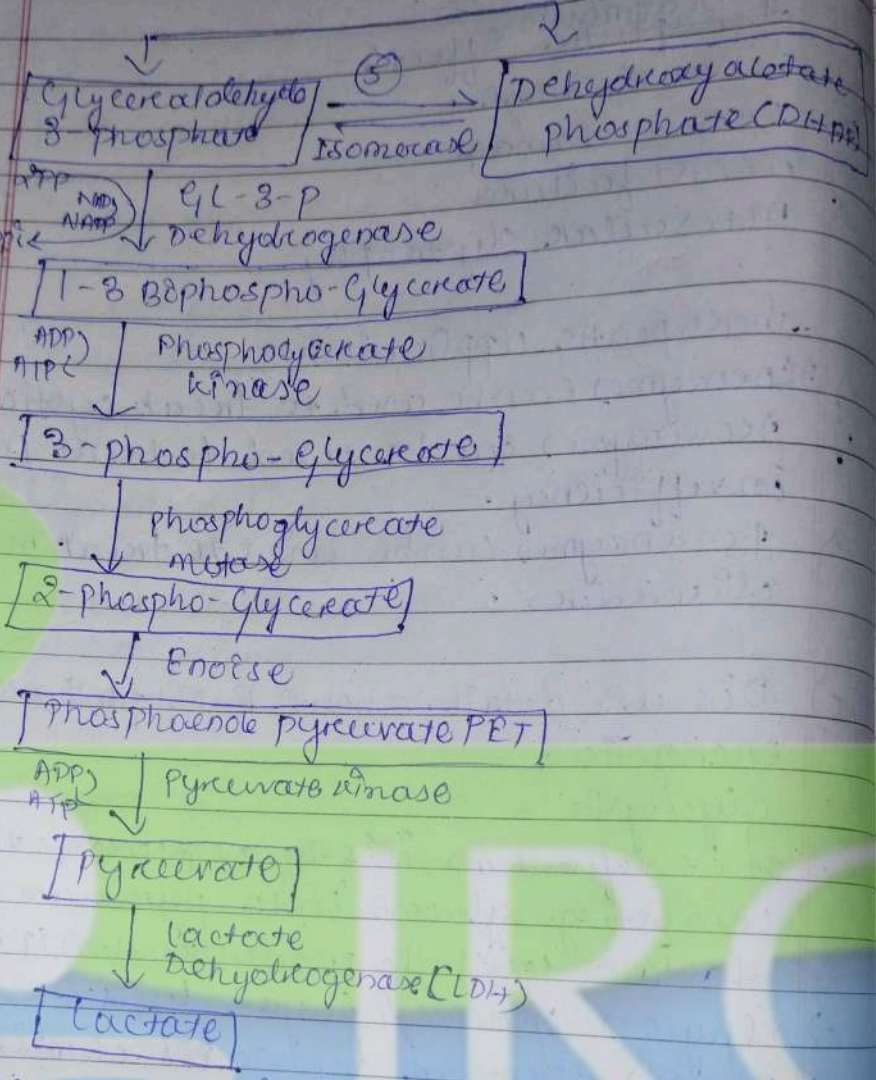
Therapeutic application :-
=) Isoenzymes can be used to treat cystic fibrosis.
=) Isoenzymes can be used to treat pancreatic insufficiency.
=) Isoenzymes can be used to treat metabolic disorders.

Q) Discuss detail about E.M pathway with energetic.

Glycolysis :-
-) It is defined as, it is the sequence of the most converting glucose into pyruvate and lactate with the production of ATP.
-) Glyco → Glucose / Sugar. lysis → Breakdown.
-) It was discovered by two-Bio chemist Embeden and Meyerhof.
-) It takes place in the cytosol of cells.

Steps :-

Glucose
↓ ATP2 ADP — HEXOKINASE
Glucose - 6 - phosphate
↓ Isomerase
Fructose - 6 - phosphate
↓ ATP2 ADP — Phospho-fructokinase
Fructose - 1, 6 - Biphosphate
↓ ALDOLASE



This pathway is divided into three phase,

1. Energy investment phase
2. Splitting phase
3. Energy generation phase

1. Energy investment phase:-

a) It requires 2 ATP molecules before phosphorylation.

→ Glucose is phosphorylated to Glucose-6-phosphate with the help of enzyme hexokinase and utilization of one ATP.

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-) Glucose-6-phosphate isomerised into fructose-6-phosphate in the presence of phosphohexomerase.
-) fructose-6-phosphate is phosphorylated to fructose 1,6-biphosphate by phosphofructokinase enzyme and utilization of 1 ATP.

b) Splitting phase:-
-) Now fructose 1-6 biphosphate splits into two equal 3 carbon containing compound i.e glyceraldehyde-3-phosphate and dehydroxy-acetone phosphate by Aldolase enzyme.
-) DHAP undergoes isomerisation to glyceraldehyde 3-phosphate under phosphotriose isomerase.

c) Energy generation phase:-
-) Glyceraldehyde-3-phosphate is converted in to 3-Biphosphoglycerate with the help of enzyme dehydrogenase.
-) 1,3-Biphosphoglycerate is converted into 3-phosphoglycerate with the help of enzyme phosphoglycerate kinase.
-) These two steps generate 2 NADH & 2 ATP.
-) 3 phosphoglycerate is converted into 2 phospho glycerate with the help of enzyme phosphoglycerate.
-) 2 phosphoglycerate converts into phosphoenol pyruvate (PEP) by enzyme enolase.
-) Now PEP convert into pyruvate kinase & generate 2 ATP.

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Q6) write down the denovo synthesis of fatty acid

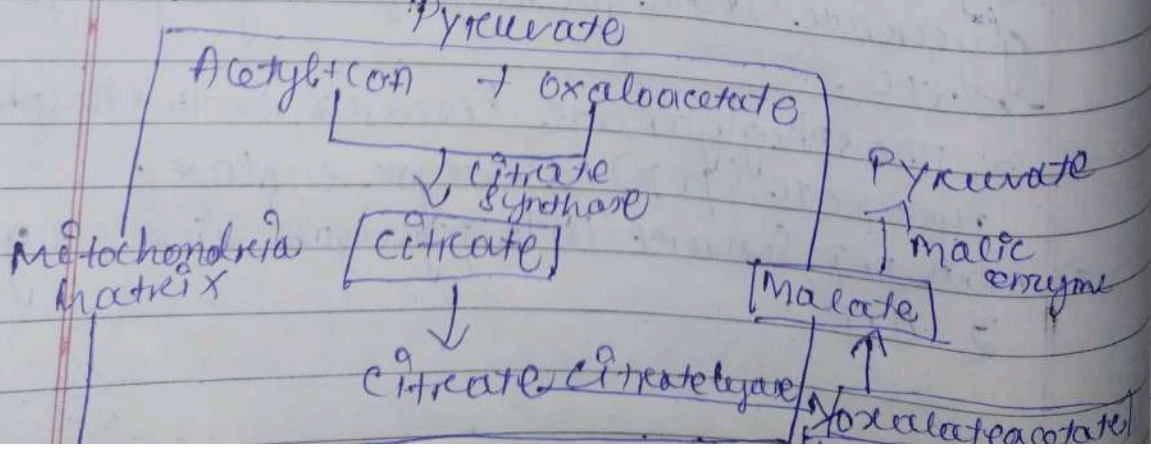
-) It involves the synthesis of fatty acids cytosol from the precursor acetyl CoA & ends by forming palmitic acids.
-) It mainly occur in liver cells, kidney and adipose tissue.
-) The major fatty acid synthesis in palmitic acid the 16c saturated fatty acid.

Stages:

-) It mainly occure in three stages.
1) Production of Acetyl CoA & NADPH.
2) Conversion of Acetyl CoA & NADPH.
3) Reaction of fatty acid synthase.

1) production of Acetyl CoA & NADPH:-

-) Acetyl co-A produced in mitochondria which doesn't cross mitochondria membrane so it react with oxalo acetate and form citrate.
-) Now this citrate easily transports to cytosol where it again release acetyl CoA and generate NADPH.



2) Conversion of Acetyl CoA to malonyl CoA:-
-) It convert acetyl CoA to malonyl CoA in the presence of enzyme carboxylase & biotin.
-) It also required ATP & CO_2.

Acetyl CoA
↓ ATP, CO_2 → ADP + Pi; Acetyl CoA carboxylase and Biotin
Malonyl CoA

3) Reaction of fatty acid synthase complex:-
-) fatty acid synthase complex is a multifunctional enzyme which performed reactions of fore synthesis of fatty acids

Malonyl CoA + Acetyl S-ACP
↓ CoASH ← Malonyl CoA - ACP transacylase
Malonyl-ACP
↓ CO_2 ← β-ketoacyl & ACP synthase
β-ketoacyl ACP
↓ NADPH+H ← NADP+ ; β-ketoacyl ACP reductase
β-Hydroxyacyl ACP
↓ H_2O ← β-hydroxyacyl ACP dehydratase
Enoyl ACP
↓ NADPH+H ← NADP+ ; Enoyl reductase
Butyryl ACP
↓ Repeated 2-6 more times
Palmitoyl thioesterase
Palmitate