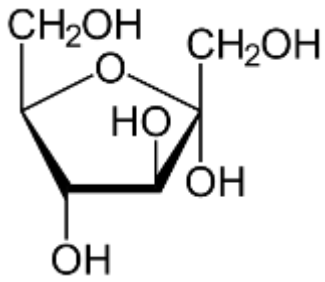
Q.P.Code: 40337 T

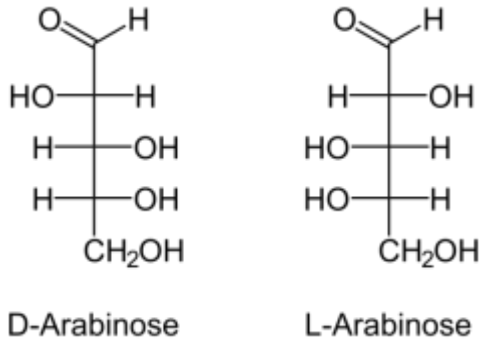
urn Over (3 hours) T otal Marks: 70

N.B.: All questions are compulsory

Q1a. Draw structure using Haworth projection formula for α-D-fructose



1b. Draw structure using Fisher projection formula for D- Arabinose

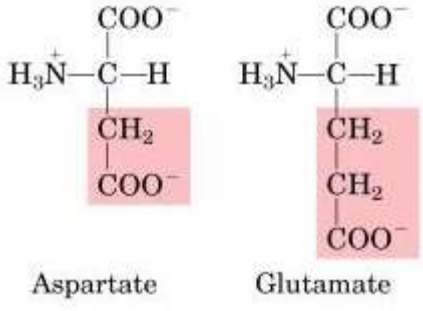


c. Define metabolism

the chemical processes that occur within a living organism in order to maintain life.

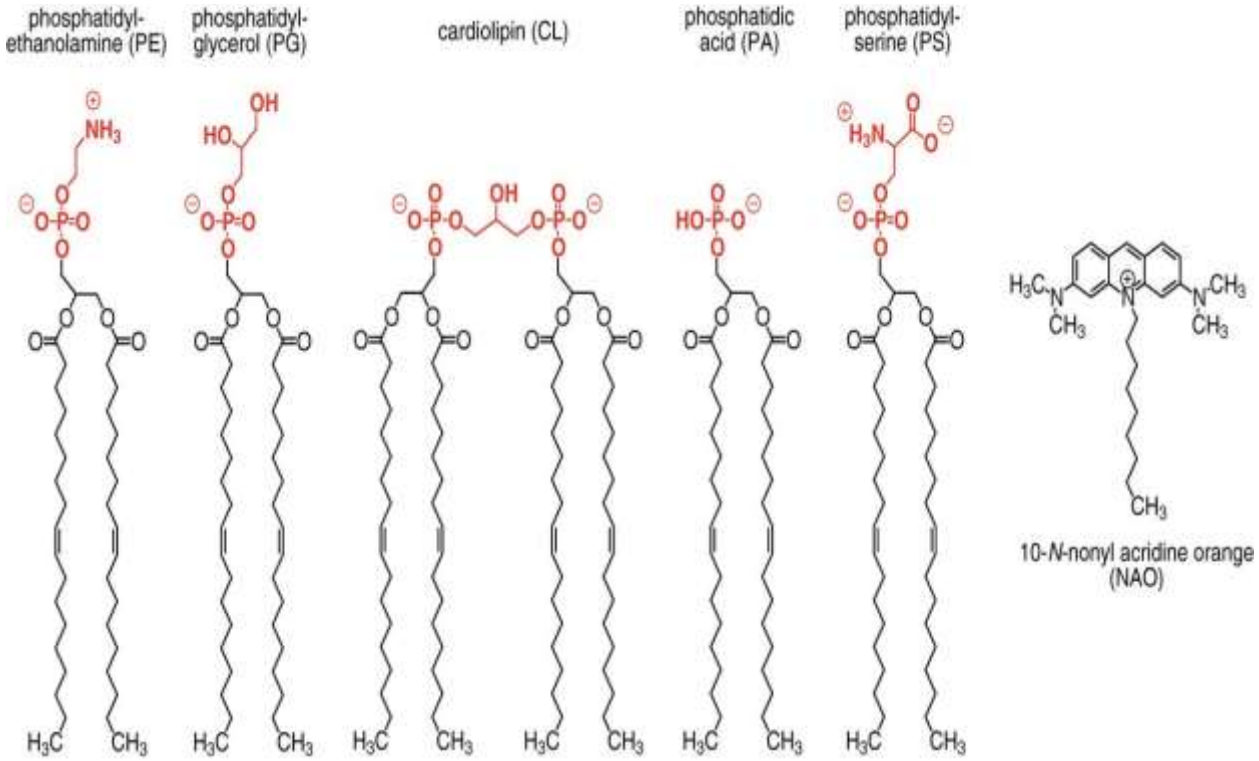
Metabolism= anabolism + catabolism

d. Give name and draw the structure of any one acidic amino acid with one three letter code

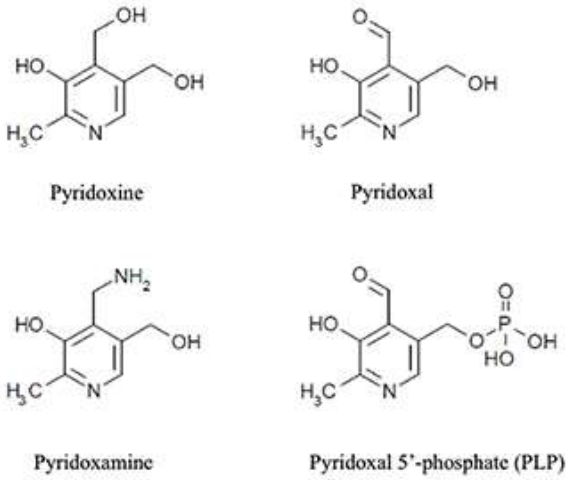


three letter code: Asp and Glu

e. Draw structure any one phoshpholipid



f. Draw the structure of coenzyme form of pyridoxine



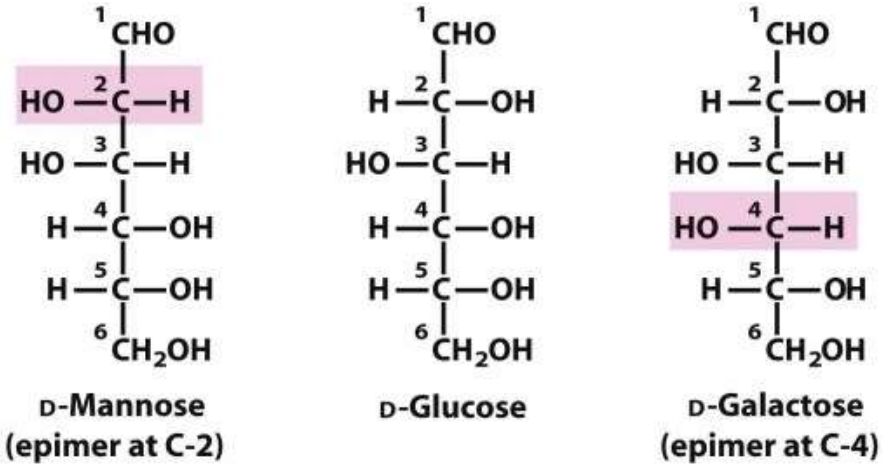
g. Scurvy is caused due to the deficiency of Vitamin -C

h. Name a Thymidylate synthase inhibitor: methotrexate, raltitrixade, flurouracil

i. Note the changes in Km and Vmax values during the competitive inhibition of enzyme

Increase in Km and no change in Vmax

j. Define epimer and draw structure of C2 epimer of glucose



k. Explain in brief compartmentation strategy for regulation of enzyme activity

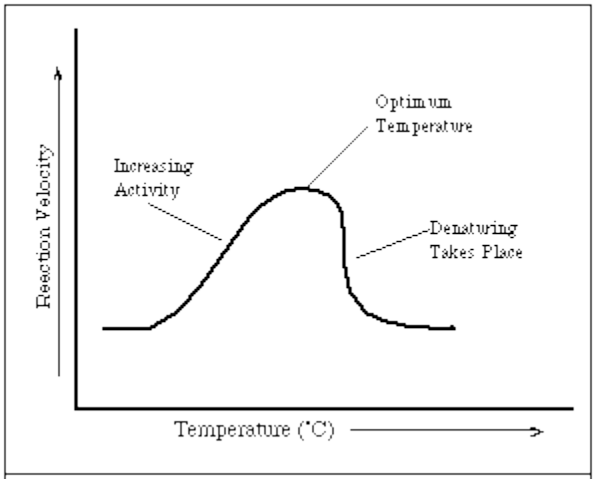
enzyme compartmentalization is efficiently carried out by biomembrane or biological membrane that permits to confine specific functions given by enzymes in a precise space. The enzymes can be localized inside the delimited compartments or on the membrane surface.

In eukaryotic cells the corresponding delimited spaces or compartments are called organelles, from which the main are the endoplasmic reticulum, Golgi apparatus, nucleus, mitochondria, lysosomes, endosomes, and peroxisomes. Each membrane-enclosed organelle contains a specific set of proteins free or on the membrane surface that regulates many vital biochemical processes. For instance, lipid metabolism is catalyzed mostly by membrane-bound enzymes.

l. Explain the effect of temperature on enzyme activity

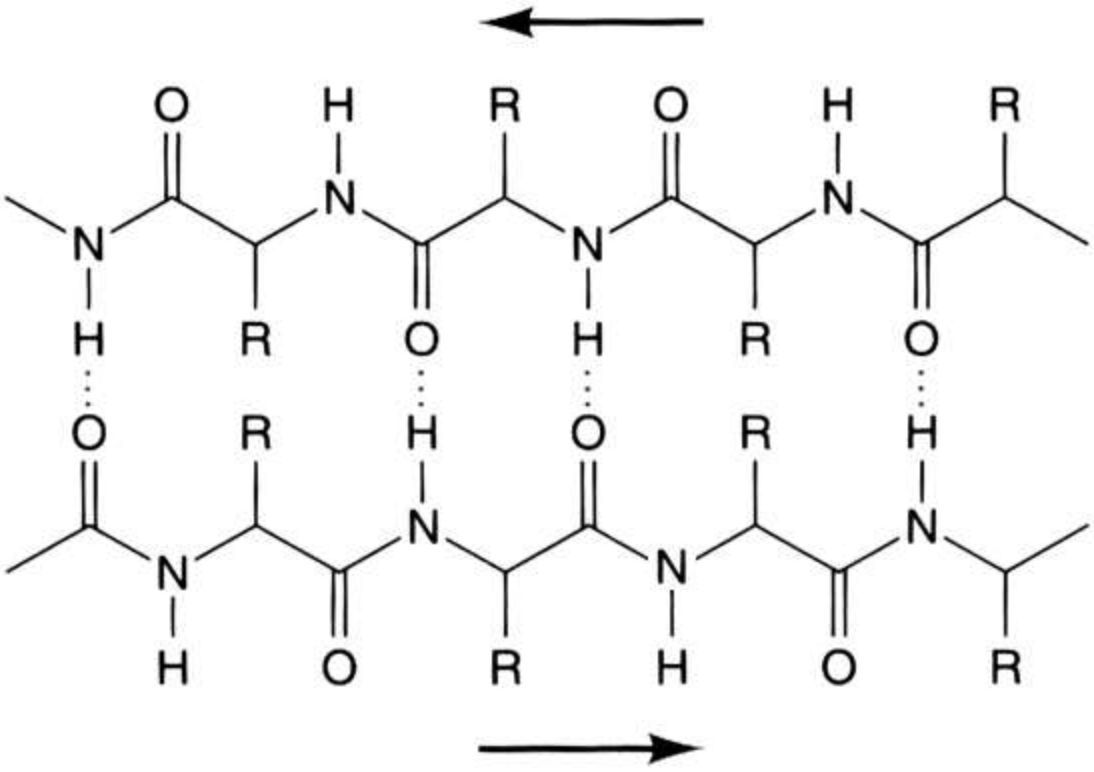
temperature affects the reaction rate of enzymes, as do pH, substrate concentration and enzyme concentration. At low temperatures, enzymes have low activity. As the temperature rises the rate of reaction increases, usually 2-fold for every 10 degree Celsius rise.

The activity peaks at a specific temperature unique to the enzyme. This is known as the optimum temperature - the temperature at which an enzyme is maximally active. Beyond the optimum temperature the activity of the enzyme decreases. At extreme temperatures, the enzymes are denatured and activity ceases.



2 Q

a. Give detail account on β-plated structure of protein
Beta pleated sheet



This secondary structure has been defined as the secondary level of protein organization in which the backbone of the peptide chain (Beta-strands) is extended into a zigzag arrangement resembling a series of pleats, with the peptide bonds organized in planes of alternating slopes (alternating ascending and descending direction). The Beta pleated sheet can be formed between two peptide chains or between different segments of the same peptide chain.

Characteristics of the Beta-pleated sheet include;

1. – Each peptide bond is planar and has the trans conformation
2.- The C=O and N-H groups of peptide bonds from adjacent chains point toward each other and are in the same plane so that hydrogen bonding is possible between them
3.- All R- groups on any one chain alternate, first above, then below the plane of the sheet, etc.

There are two kinds of Beta pleated sheets:

Antiparallel: when the adjacent polypeptide chains run in opposite direction

b. Explain effect of substrate concentration on enzyme activity
   Machelis manten equation derivation

c. 'ATP is considered as energy rich molecule' comment

The total quantity of ATP in the human body is about 0.1 mole. The energy used daily by an adult calls for the hydrolysis of 200 to 300 moles of ATP. This means that each ATP molecule has to be recycled 2000 to 3000 times during the day. ATP cannot be stored and so its synthesis has to closely follow its consumption.

Other triphosphates

Living cells also have other "high-energy" nucleoside triphosphates, such as guanine triphosphate. Between them and ATP, energy can be easily transferred with reactions such as those catalyzed by nucleoside diphosphokinase: Energy is released when hydrolysis of the phosphate-phosphate bonds is carried out. This energy can be used by a variety of enzymes, motor proteins, and transport proteins to carry out the work of the cell. Also, the hydrolysis yields free inorganic phosphate and adenosine diphosphate, which can be broken down further to another phosphate ion and adenosine monophosphate. ATP can also be broken down to adenosine monophosphate directly, with the formation of pyrophosphate. This last reaction has the advantage of being an effectively irreversible process in aqueous solution.

Reaction of ADP with GTP

ADP + GTP > ATP + GDP

c. Write note on digestion of carbohydrate

-Carbohydrate digestion begins in the mouth. The salivary glands in the mouth secrete saliva, which helps to moisten the food. The food is then chewed while the salivary glands also release the enzyme salivary amylase, which begins the process of breaking down the polysaccharides in the carbohydrate food.

-After the carbohydrate food is chewed into smaller pieces and mixed with salivary amylase and other salivary juices, it is swallowed and passed through the esophagus. The mixture enters the stomach where it is known as chyme. There is no further digestion of chyme, as the stomach produces acid which destroys bacteria in the food and stops the action of the salivary amylase.

-After being in the stomach, the chyme enters the beginning portion of the small intestine, or the duodenum. In response to chyme being in the duodenum, the pancreas releases the enzyme pancreatic amylase, which breaks the polysaccharide down into a disaccharide, a chain of of only two sugars linked together. The small intestine then produces enzymes called lactase, sucrase and maltase, which break down the disaccharides into monosaccharides. The monosaccharides are single sugars that are then absorbed in the small intestine.

-Carbohydrates that were not digested and absorbed by the small intestine reach the colon where they are partly broken down by intestinal bacteria. Fiber, which cannot be digested like other carbohydrates, is excreted with feces or partly digested by the intestinal bacteria.

Q3

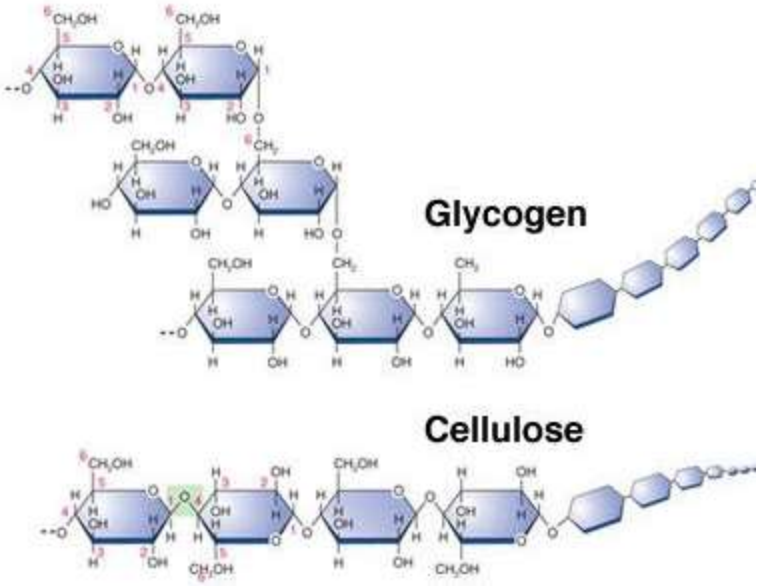
a.Compare glycogen and cellulose in terms of structure and function

Glycogen

Glycogen is a glucose polymer, which is analogous to starch, but this is more branched and complex than starch. Glycogen is the main storage polysaccharide in our bodies and also in some micro organisms. In our bodies, it is synthesized and stored mainly in the liver. When high level of glucose is in our blood, those glucose molecules are converted to glycogen, and this process is stimulated by glycogen hormone. When the blood glucose level is lower than the standard value, glycogen is converted back to glucose with the help of insulin. This glycogen, glucose homeostasis is important in our bodies. If there is an abnormality in maintaining glycogen levels, diabetes, hypoglycemia can be resulted. Glycogen has a similar structure to amylopectine. Glycogen polymer has $\alpha(1\rightarrow4)$-glycosidic bonds. At the branching points, 1,6- glycosdic bonds are formed.

Cellulose

Cellulose is a polysaccharide which is made out of glucose. Glucose units are bonded together by β(1→4) glycosidic bonds. Cellulose doesn't branch, but due to the hydrogen bonds between molecules it can form very rigid fibers. Cellulose is abundant in the cell walls of green plants and algae. Therefore, this is the most common carbohydrate on the earth. Cellulose is used to make paper and other useful derivatives. It is further used to produce bio fuels.



b. Explain biochemical role of Nicotinamide or Riboflavin

Structure of reduced and oxidized forms and minimum 4-5 biological roles of both

d. Describe multiple cascade system for regulation of enzyme activity

In an **enzyme cascade**, you may have a rate-limiting step which consists of the**enzyme** catalysing the slowest reaction of the **cascade**. You may also have**regulation** through feedback of products inhibiting the activity of **enzymes** further back in the **cascade**. You may also have control through a "feed-forward" mechanism

Diagram refer corn and stump

Q.4

a) Amino acid with aliphatic side chain - Glycin, alanine
b) Amino acid containing Hydroxyl group- Serine, tyrosine
c) Sulfur containing-Cystein, Methionine
d) Acidic amino acid- Glutamic acid, Aspartic acid

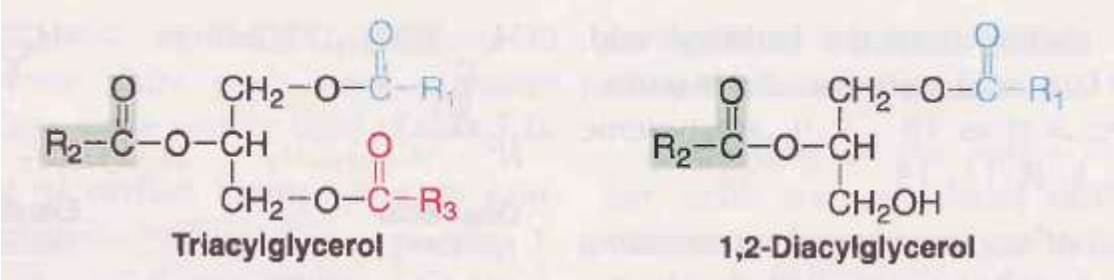
e) Basic amino acid-Lyseine,argentine
f) Aromatic -phenylalanine,tyrosine
g) Imino acids- Proline

b) triacylglycerides

Triacylglycerols of plants in general, have higher content of unsaturated fatty acids compared to that of animals.

Simple triacyglycerol: Contain fatty acid residue with three carbon.

Mixed triacylglycerol: They contain 2 or 3 different types of fatty acid residues .In general fatty acid attached to C_1 is saturated, that attached to C_2 is unsaturated while that on C_3 can be either.



c) Panathonic acid

Panthonic acid consists of two components pantoic acid and beta alanine. The functions of pantothenic acid are exerted through coenzyme A or CoA Coenzyme A has a terminal thiol or sulfhydryl group (-SH) which is the reactive site; hence CoA-SH is also used. Coenzyme A serves as a carrier of activated acetyl or acyl groups.

Pyruvate $\xrightarrow[\text{Pyruvate dehydrogenase}]{\text{CoA}}$ Acetyl CoA

Fatty acid $\xrightarrow[\text{thiokinase}]{\text{CoA}}$ Acyl CoA

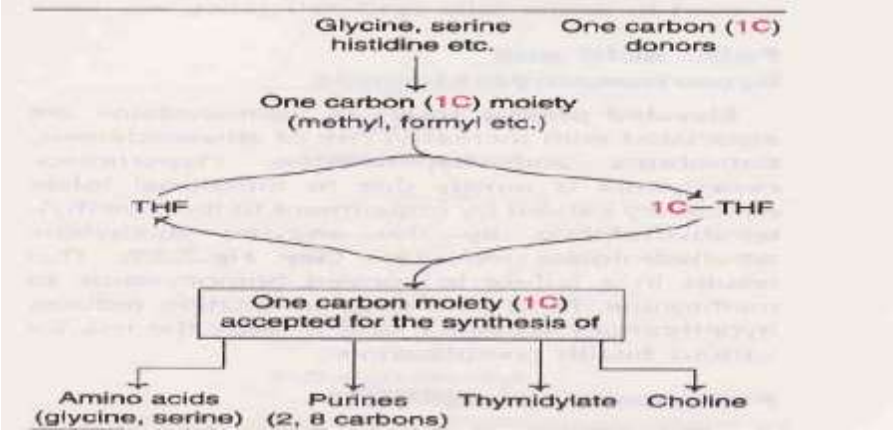
AcetylC oA + Choline $\longrightarrow$ A cetylcholine+ CoA

Acetyl CoA + Oxaloacetat $\longrightarrow$ Citrate + CoA

OR

Folic acid

The active form of folic acid is tetrahydrofolate lt is synthesized from folic acid by the enzyme dihydrofolate Reductas, Tetrahydrofolate (T HF or FHa),the coenzyme of folic acid, is actively involved in the one carbon metabolism. THF serves as an acceptor or donor of one carbon units (formyl, methyl etc.) in a variety of reactions involving amino acid and nucleotide metabolism.



Q.5

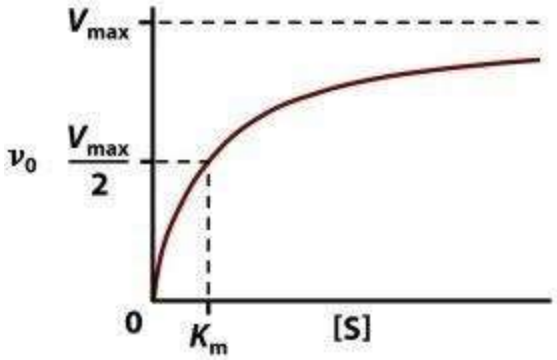
a) **Michaelis-Menten equation is as given below:**

$$V_0 = \frac{V_{max}[S]}{K_m + [S]}$$

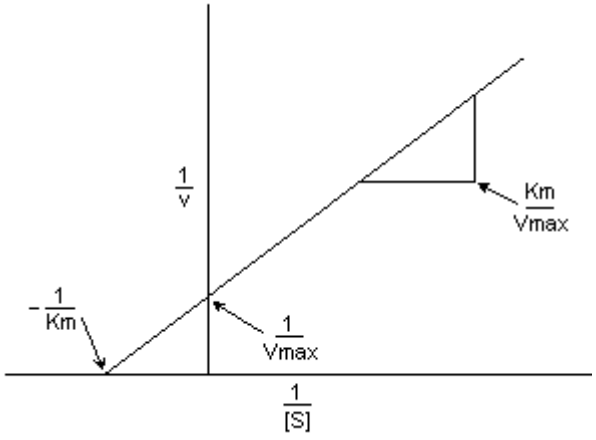
Vmax = The maximum velocity achieved by the system, at maximum (saturating) substrate concentrations

KM (the Michaelis constant)= substrate concentration at which the reaction velocity is 50% of the Vmax. Its unit is mM. It is also the concentration at which concentration of substrate is half the maximal velocity is observed.

[S] = concentration of the substrate S



Line weaver burk plot

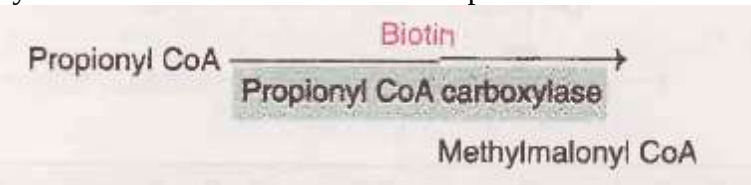


b) Biotin

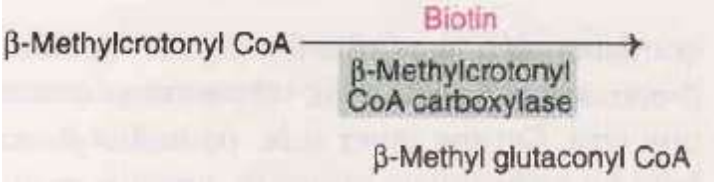
Biotin serves as a carrier of COz in carboxylation reactions. The reaction cataiysed by pyruvate carboxylase converting pyruvate to oxalo acetat Biotin-enzyme reacts with CO2 in presence of ATP to form carboxy biotin enzyme complex.
Co enzyme involve in following metabolic cycle.

- Gluconeogenesis and citric acid cycle
- Fatty acid synthesis

Propionyl CoA is produced in the metabolism of certain amino acids and degradation of odd chain fatty acids. lts further metabolism is dependent on biotin.



- Metabolism of lucine is followed by



OR

Ascorbic acid

1. Collagen formation
2. Bone formation
3. lron and hemoglobin metabolism
4. Tryptophan metabolism
5. Tyrosine metabolism
6. Peptide hormone synthesis

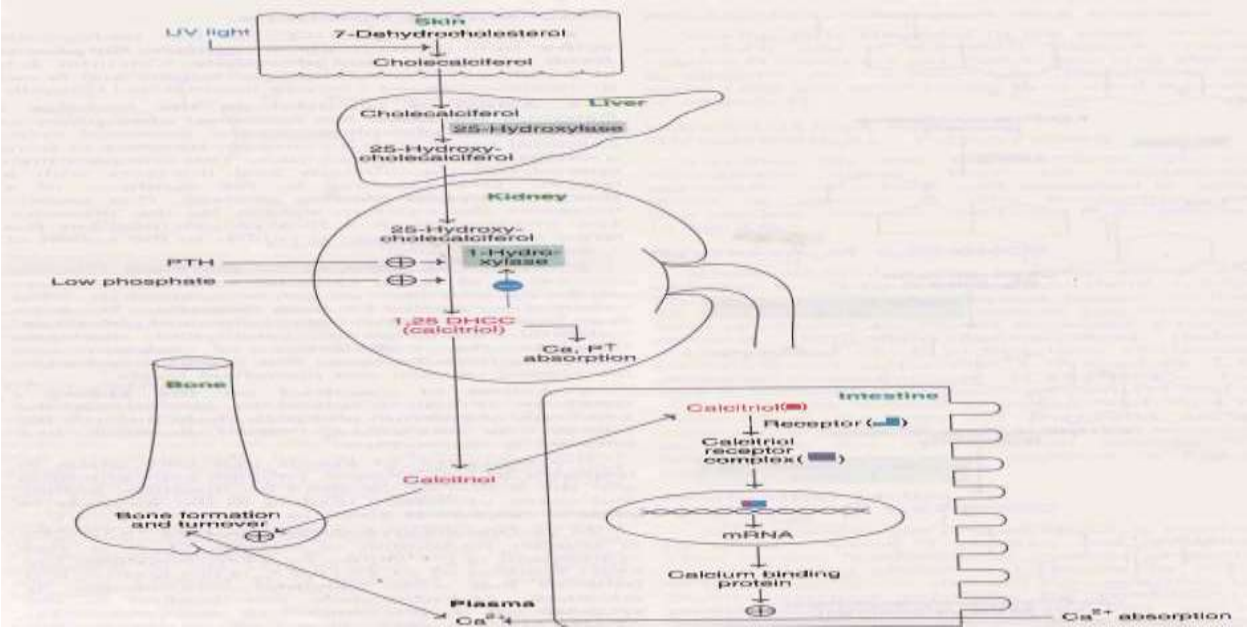
c) The Second Law of Thermodynamics states that the state of entropy of the entire universe, as an isolated system, will always increase over time. The second law also states that the changes in the entropy in the universe can never be negative.

d) Denaturation is a process in which a protein loses its native shape due to the disruption of weak chemical bonds and interactions, thereby becoming biologically inactive. When proteins denature, the cells go through a series of changes, first loosening, then tightening. In case of proteins

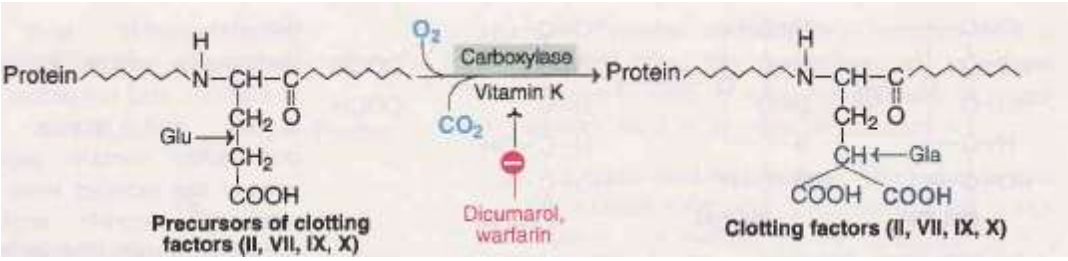
- A loss of three-dimensional structure, sufficient to cause loss of function
- Loss of secondary, tertiary and quaternary structure of proteins.
- Change in physical, chemical and biological properties of protein molecules.

Q.6

A) Vit D



Vit k



b) 1) HMG-CoA reductase

is the rate-controlling enzyme of the mevalonate pathway, the metabolic pathway that produces cholesterol and other isoprenoids.

e.g- atorvastatin, Simvastatin.

2) The DNA polymerases - are enzymes that create DNA molecules by assembling nucleotides, the building blocks of DNA. These enzymes are essential to DNA replication and usually work in pairs to create two identical DNA strands from one original DNA molecule. During this

process, DNA polymerase “reads” the existing DNA strands to create two new strands that match the existing ones.

3) Monoamine oxidase is involved in removing the neurotransmitters norepinephrine, serotonin and dopamine from the brain

e.g. selegiline, phenelzine

c) They are mainly classified into three groups:

Monosaccharides

Disaccharides

Polysaccharides

- Monosaccharides or simply sugars are formed by only one polyhydroxy aldehydeidic or ketonic unit.
  The most abundant monosaccharide is D-glucose, also called dextrose.

- Disaccharides

A disaccharide consists of two monosaccharide’s units held together by Glycosidic bond.

Types

1. Reducing Disaccharides with free aldehyde or Keto group. Eg Maltose, Lactose
2. Non reducing Disaccharides with no free aldehyde or Keto group Eg. Sucrose

- Polysaccharides

Polysaccharides contain long monosaccharide units joined together by glycosidic linkage. Most of them act as food storage for e.g. Starch. Starch is the main storage polysaccharide for plants. It is a polymer of α glucose and consists of two components-Amylose and Amylopectin.

d) Rancidity is the complete or incomplete oxidation or hydrolysis of fats and oils when exposed to air, light, moisture or by bacterial action, resulting in unpleasant taste and odor.
