

Course Title: Basic Biochemistry

MLT

Summer Semester

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Section A



Q 1.

Ans:

Metabolism is a term that is used to describe all chemical reactions involved in maintaining the living state of the cells and the organism. Metabolism can be conveniently divided into two categories:

Catabolism : the breakdown of molecules to obtain energy

Anabolism : the synthesis of all compounds needed by the cells

Q 2.

Ans:

The term saccharide refers to the unit structure of carbohydrates. Carbohydrates are simple organic compounds that are aldehydes or ketones with many hydroxyl groups added usually on each carbon atom not part of the aldehyde or ketone functional group. The general chemical formula of carbohydrates is $C_n(H_2O)_n$.

Saccharides and their derivatives include many other important biomolecules that play key roles in the immune system, fertilization, preventing pathogenesis, blood clotting, and development. Carbohydrates are central to nutrition and are found in a wide variety of natural and processed foods.

The four primary functions of carbohydrates in the body are to provide energy, store energy, build macromolecules, and spare protein and fat for other uses. Glucose energy is stored as glycogen, with the majority of it in the muscle and liver.

When disaccharides like sucrose are digested, they are broken down into their simple sugars and used for energy. Lactose is found in breast milk and provides nutrition for infants.

Q 3.

Ans:

The principal components of the plasma membrane are lipids (phospholipids and cholesterol), proteins, and carbohydrate groups that are attached to some of the lipids and proteins. A phospholipid is a lipid made of glycerol, two fatty acid tails, and a phosphate-linked head group.

Lipid bilayers are semipermeable: Small uncharged molecules can pass more or less freely from one side of the membrane to the other, but for charged species or macromolecules, such as proteins and DNA, the lipid bilayer is a major obstacle to diffusion

When placed in water they assemble spontaneously into bilayers, which form sealed compartments that reseal if torn. There are three major classes of membrane lipid molecules—phospholipids, cholesterol, and glycolipids

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Q 4.

Ans:

Definition.

a white water-soluble crystalline compound with a saline taste and often an odour of ammonia, produced by protein metabolism and excreted in urine. A synthetic form is used as a fertilizer, animal feed, and in the manufacture of synthetic resins. Formula: $\text{CO}(\text{NH}_2)_2$ Also called: carbamide.

Formation of urea.

Urea forms when dietary proteins make amino acids after digestion. The liver breaks down excess amino acids to make ammonia, then converts this into urea, which is less toxic in the body than ammonia.

Organisms that cannot easily and safely remove nitrogen as ammonia convert it to a less toxic substance such as urea via the urea cycle, which occurs mainly in the liver. Urea produced by the liver is then released into the bloodstream where it travels to the kidneys and is ultimately excreted in urine

- ⇒ Urea is produced in the liver and is a metabolite (breakdown product) of amino acids. Ammonium ions are formed in the breakdown of amino acids. Some are used in the biosynthesis of nitrogen compounds. Excess ammonium ions are converted to urea.
- ⇒ Only the liver possesses all the enzymes required to synthesize urea from ammonia, and this pathway is strictly located in periportal hepatocytes. Five enzymes are involved: carbamoylphosphate synthase (CPS), ornithine carbamoyltransferase (OCT), argininosuccinate synthase, argininosuccinate lyase, and arginase.
- ⇒ to the relatively nontoxic excretion product urea at the cost of four "high-energy" phosphate bonds (3 ATP hydrolyzed to 2 ADP and one AMP). The conversion from ammonia to urea happens in five main steps. The first is needed for ammonia to enter the cycle and the following four are all a part of the cycle itself.

Urea cycle.

The main purpose of the urea cycle is to eliminate toxic ammonia from the body. About 10 to 20 g of ammonia is removed from the body of a healthy adult every day. A dysfunctional urea cycle would mean excess amount of ammonia in the body, which can lead to hyperammonemia and related diseases

The urea cycle converts excess ammonia into urea in the mitochondria of liver cells. The urea forms, then enters the blood stream, is filtered by the kidneys and is ultimately excreted in the urine. The urea cycle consists of 4 reactions. The first reaction occurs in the matrix of the mitochondria.

Q 5.

Ans:

Acidic amino acids

If acid is added to a solution containing the zwitterion, the carboxylate group captures a hydrogen (H⁺) ion, and the amino acid becomes positively charged. If base is added, ion removal of the H⁺ ion from the amino group of the zwitterion produces a negatively charged amino acid. It is determined by presence of number of carboxyl groups and amino groups. Carboxyl group amino group hai basic amino group hai basic nature. Which amino acid have more number of carboxylic group than amino group, called acidic amino acid. For example aspartic acid and glutamic acid.

Formula: Aspartic acid Asp^- Acidic

Aliphatic amino acids

An aliphatic amino acid is an amino acid containing an aliphatic side chain functional group. Aliphatic amino acids are non-polar and hydrophobic. Hydrophobicity increases as the number of carbon atoms on the hydrocarbon chain increases. Most aliphatic amino acids are found within protein molecules

Alanine

Valine

Isoleucine

Leucine

Aliphatic amino acids

Basic amino acids

There are three amino acids that have basic side chains at neutral pH. These are arginine (Arg), lysine (Lys), and histidine (His). Their side chains contain nitrogen and resemble ammonia, which is a base. Their pKa's are high enough that they tend to bind protons, gaining a positive charge in the process.

Histidine

Histidine is the most basic amino acid in the given compound. This can be attributed to the fact that the histidine contains the most number of a basic nitrogen atom.

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