Marks-2

① What do you mean by Bohr effect?

CO_2 generated in peripheral tissues combines with H_2O to form H_2CO_3 (carbonic acid), which dissociates into protons and HCO_3^- (bicarbonate ions). Deoxyhaemoglobin acts as a buffer by binding protons and delivering them to lungs, the uptake of O_2 by Hb releases protons that combines with HCO_3^- forming H_2CO_3, which then dehydrated by carbonic anhydrase becomes CO_2, which then is exhaled. This is called Bohr effect.

$$CO_2 + H_2O \underset{\text{Lungs}}{\overset{\text{Carbonic anhydrase}}{\rightleftharpoons}} H_2CO_3 \underset{\text{Lungs}}{\overset{\text{Peripheral tissue}}{\rightleftharpoons}} H^+ + HCO_3^-$$

$$HbO_2 + H^+ \underset{\text{Lungs}}{\overset{\text{Peripheral tissue}}{\rightleftharpoons}} HHb + O_2$$

② Mention the difference between saturated and unsaturated fatty acids.

Ans: Fatty acids are long-chain monocarboxylic organic acids. Fatty acids which have no double-bond between the carbons in their molecular chain; all the valencies of their carbons other than the carboxyl-C are saturated with hydrogens. e.g. Palmitic acid (C_{16}), lignoceric acid (C_{24}). are known as saturated fatty acids.

Fatty acids contain double bonds between some carbons in their molecular chains, because the valencies of those carbons are not saturated with hydrogen are known as unsaturated fatty acids.

e.g. linolenic acid and linoleic acid.

Marks- 6

Classify enzymes

Enzymes are classified into 6 classes such as —

Class – I Oxidoreductase Transferases

Enzymes of this class transfer a particular group from one substrate to another. Transferases For example nicotinamide methyltransferase of liver is a C_1 - transferase because it transfers a one-C-methyl group from S-adenosylmethionine to nicotinamide.

Class – 2 Oxidoreductases:

Enzymes of this class catalyze oxidations and reductions of this substrates. Oxidation is either the removal of electron from or the addition of oxygen to a specific group of the substrate. Reduction is the opposite change.

e.g. glycerol 3 phosphate dehydrogenase.

class – 3. Hydrolases:

They cleave their substrates by hydrolyzing a covalent-bond. Hydrolases have different e.g. Pancreatic lipase belongs to the subclass of esterases as it hydrolyzes an ester bond in a triacylglycerol molecule.

class 4: Lyases:

They cleave non-hydrolytically a covalent-bond in the substrate to convert it to more than one product. Their action frequently produces a double bond a product. For example, L-aromatic

L-aromatic amino acid decarboxylase of liver is a C-C lyase because it cleaves a C-C bond in 3-hydroxy-tryptophan.

Class 5: Isomerases:

They change their substrates to their isomers and have subclasses according to types of isomerization. For example, phosphohexose isomerase of muscle is an aldose-ketose isomerase catalyzing the interconversion of glucose (aldohexose) and fructose (ketohexose).

class 6: Ligases:

These enzymes bind two substrate molecules together by forming a covalent bond. These endergonic reactions are driven by the simultaneous cleavage of some high energy bond. eg. acetyl CoA carboxylase of liver

Q2 - What is pH and the mention the biological significance of pH.

pH is the negative logarithm of the molar concentration of H^+ ions to the base 10.

$$pH = -\log[H^+] = \log\frac{1}{[H^+]}$$

Thus, for pure water or neutral aqueous solution at 25°C,

$$pH = -\log[H^+] = -\log[10^{-7}] = 7.$$

If the pH of a solution is lower than 7 it will be acidic and higher than 7 it will be alkaline.

Biological significance of pH:

1) Tautomeric forms of purine and pyramidines

Purine and pyramidines bases exist in different tautomeric forms according to pH. Their specific tautomers at the body pH of nearly 7.4 are essential for the hydrogen bonding of complementary base pairs of DNA double helices and RNA strands. So, pH maintains the natural three-dimensional forms of DNA and RNA.

2) Isomeric pH: pH influences the ionizable polar groups of amino acids, proteins, nucleic acids, phospholipids and mucopolysaccharides. At a specific pH called the isoelectric pH (PI) of the molecule, such a molecule exists as dipolar zwitterion bearing both anionic and cationic groups and a minimum net charge, it exist as a cation below its pI and as an anion above the pI.

3) Optimum pH:

By influencing ionized states of proteins pH affects the ionic and hydrogen bonds which stabilize their higher structures. Each protein or enzyme has an optimum pH where it can best maintain its three dimensional structure befitting its biological action, and also a specific ionized state of amino acid residues at its active site. Drastic changes in pH may destroy the ionic and hydrogen bonds, this change the three dimensional structure with denaturation and loss of activities.

4 pH and Serum K+:

During acidosis, an increase in the extracellular H^+ concentration, i.e. a fall in pH in the extracellular fluid (ECF), enhances the influx of H^+ into cells. To maintain electroneutrality, K^+ ions pass out from cells to the ECF, increasing the serum K^+ level (hyperkalemia). Simultaneously, more H^+ and less K^+ ions are eliminated in the urine in exchange of reabsorbed Na^+ ions, leading to K^+ retention in the body and adding to hyperKalemia. In alkalosis or while correcting acidosis, a rise in the extracellular pH enhances H^+ outflow from cells, thus increasing K^+ influx into cells from the blood and lowering the serum K^+ (hypokalemia). Also, renal reabsorption of filtered H^+ ions in the tubular filtrate may enhance urinary K^+ elimination to deplete body K^+.

(5) pH and excitable tissues:

Excitability and action potentials of muscles and nerves are affected by pH e.g. a fall in pH may decrease actin-myosin interactions, but may enhance lactate production in muscles.

(6) Separation of proteins and amino acids:

pH-dependant charged forms of proteins and amino acids is utilized in separating them from biological materials by isoelectric precipitation by heavy metals or acid ions, electrophoresis and ion-exchange chromatography.