MISSION M.B.BS

Date: 29/06/2022

Subject: ZOOLOGY

Topic : BIOMOLECULES - L4 Class: Standard XI

Instructions:

A

1. The phosphodiester bond in a nucleic acid is formed between

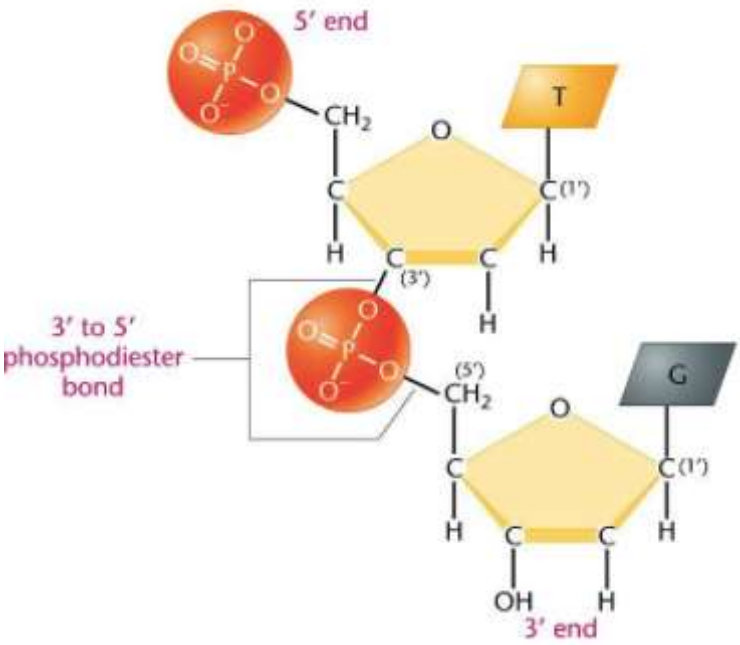
   ✗ **A.** 3’ carbon of one sugar of the nucleotide with the 5’ carbon of the sugar of the succeeding nucleotide

   ✗ **B.** 5’ carbon of one sugar of the nucleotide with the 3’ carbon of the sugar of the preceding nucleotide

   ✗ **C.** any two adjacent nucleotides in a nucleic acid in which 5’ and 3’ hydroxyls of two adjacent sugars form a double ester with phosphoric acid

   ✓ **D.** All the above statements are correct

A phosphodiester bond is formed between 3rd carbon of one ribose or deoxyribose sugar in one nucleotide and the 5th carbon atom of ribose or deoxyribose of the succeeding nucleotide. The reverse also holds true that a phosphodiester bond is formed between the 5th carbon of one sugar of the nucleotide with the 3rd carbon of the sugar of the preceding nucleotide. Another way of defining the phosphodiester bond is that it is formed between any two adjacent nucleotides in a nucleic acid in which 5' and 3' hydroxyls of two adjacent sugars form a double ester with phosphoric acid.

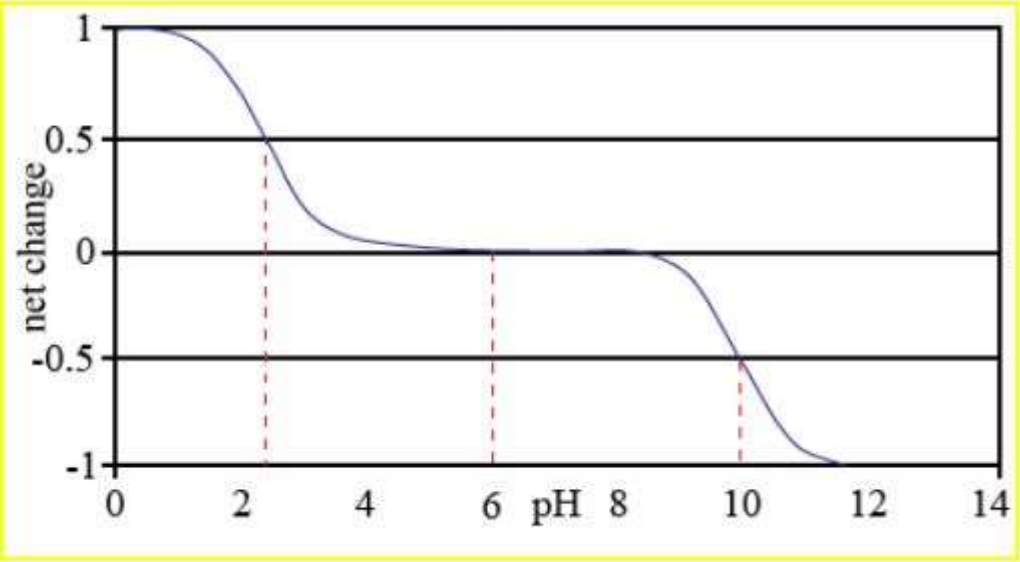


2. On hydrolysis, the nucleoside does not yield:

- ✗ **A.** Purine
- ✗ **B.** Pyrimidine
- ✗ **C.** Pentose sugar
- ✓ **D.** Phosphoric acid

Nucleosides are made up of pentose sugar (ribose/deoxyribose) and a nitrogen base which can be a purine (adenine or guanine) or a pyrimidine (cytosine, thymine or uracil). It does not contain phosphate. So hydrolysis of nucleoside does not yield phosphoric acid.

3. According to the graph given below, zwitterions for an amino acid X are most likely to be obtained in a solution of pH



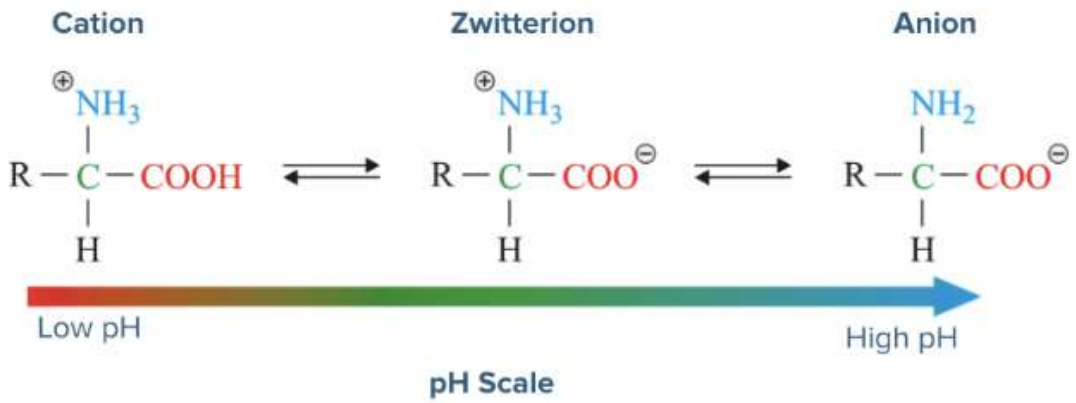
A. 1

B. 2

C. 6

D. 10

When an amino acid is dissolved in water at a particular pH, it exists in solution as dipolar ion or zwitterion. The ionisable nature of NH_2 and COOH groups can cause them to form NH_3^+ and COO^- by gain and loss of a proton respectively at a particular range of pH. At this point, the net charge on an amino acid becomes zero and the amino acid is said to be in the zwitterionic form. The pH at which an amino acid exists in zwitterion is called its iso-electric pH. From the graph, it is quite evident that the net charge on the amino acid is zero near pH=6. At this pH, the amino acid occurs as zwitterions.



4. The most abundant RNA in a cell

A. tRNA

B. mRNA

C. rRNA

D. snRNA

Ribosomal RNA (rRNA) is the largest, most abundant and most stable form of RNA found in a cell.
Messenger RNA (mRNA) is smaller and responsible for carrying information for protein synthesis.
Transfer RNA (tRNA) is the smallest and collects amino acids from the cytoplasm and takes it to the ribosome assembly for protein synthesis.

5. Amino acids are said to be amphoteric in nature because:

A. They act as both acids as well as bases

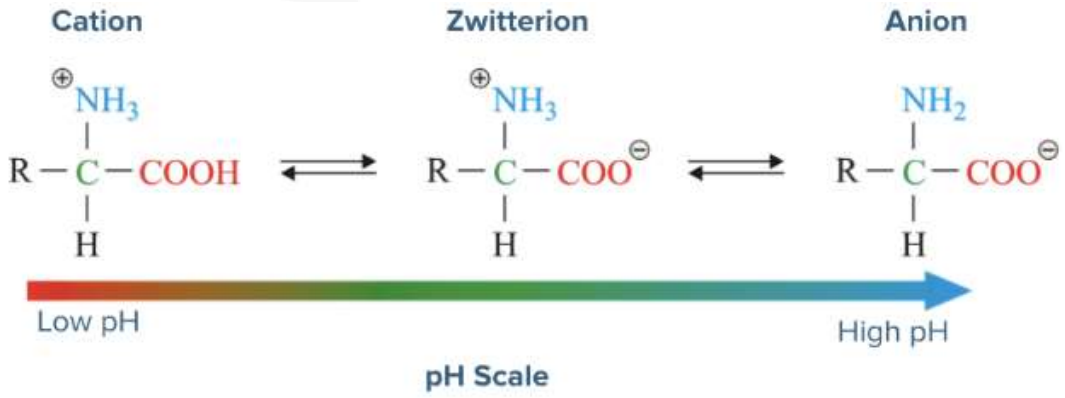
B. They have both primary and secondary structure

C. They are both aliphatic and aromatic

D. They can be essential or non-essential

Amino acids are said to be amphoteric in nature because they act as both acids as well as bases as they contain acidic COOH group and basic NH_2 group. When an amino acid is dissolved in water, at a particular pH, it exists in solution as dipolar ion or zwitterion. They can react with both acids and bases to give salts. The ionisable nature of NH_2 and COOH groups can cause them to form NH_3^+ and COO^- respectively.

At low pH, the carboxylic group in a zwitterion accepts a proton and becomes uncharged, so that the overall charge on the molecule is positive (cation). At high pH, a proton is released from NH_3^+ group of the zwitterion and becomes uncharged, so that the overall charge on the molecule is negative (anion).



6. Identify the correct combination with respect to DNA.

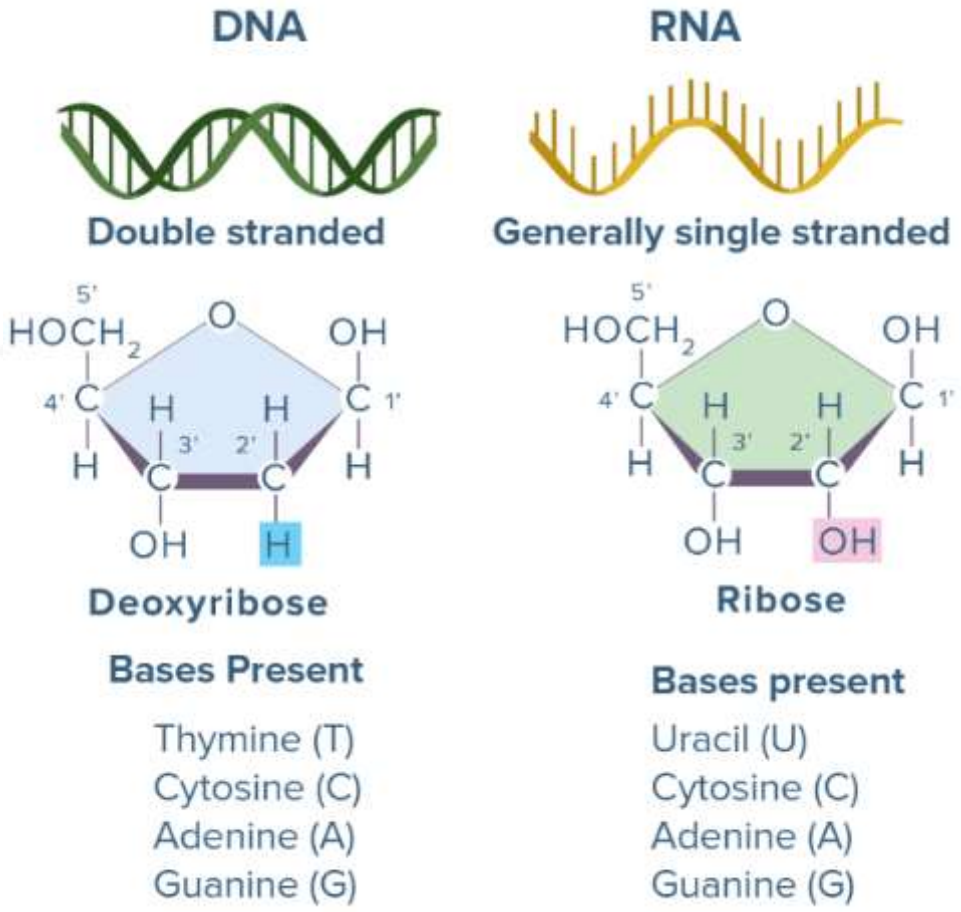
A. Adenine, thymine, cytosine, uracil

B. Adenine, guanine, cytosine, thymine

C. Adenine, cytosine, guanine, uracil

D. Cytosine, guanine, Uracil, thymine

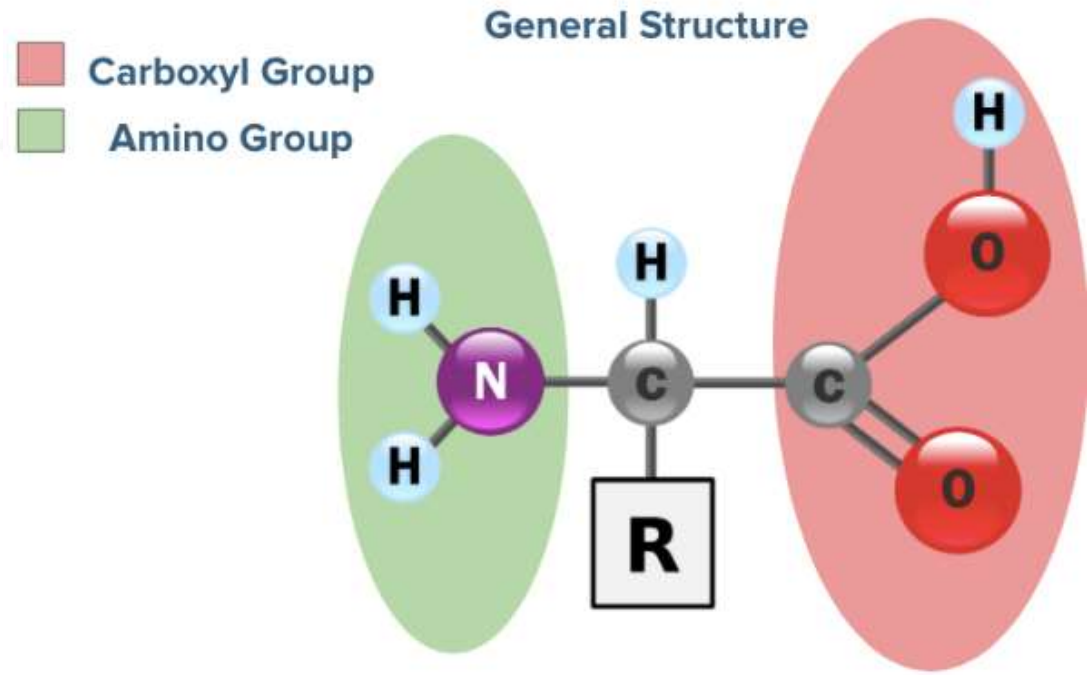
DNA is made up of purine - adenine and guanine and pyrimidines - thymine and cytosine.
RNA is made up of purine - adenine and guanine and pyrimidines - uracil and cytosine.



7. Each amino acid is unique due to the presence of:

- ✔ **A.** R-group
- ✘ **B.** Carboxylic group
- ✘ **C.** Amine group
- ✘ **D.** Benzene ring

Amino acids are organic compounds having carbon, hydrogen, oxygen and nitrogen (and sometimes sulphur). Each amino acid has at least one amino group $(-NH_2)$ and one carboxyl group (-COOH) around a central carbon atom (α-carbon). The remaining valencies of tetravalent carbon are satisfied with one hydrogen atom and one R (alkyl) group. The differences in the R group gives rise to different types of amino acids. Hence, each amino acid is unique due to the presence of R-group. The other three substituents (carboxyl group, amino group and hydrogen) remain the same in all the amino acids.



8. A zwitterion is kept in a uniform electric field. Select the correct statement with regard to the movement of the zwitterion.

A. It moves towards the anode

B. It moves towards the cathode

C. It moves along the direction of the electric field

D. It neither moves towards anode nor towards the cathode

When an amino acid is dissolved in water at a particular pH, it exists in solution as dipolar ion or zwitterion. The ionisable nature of NH_2 and COOH groups can cause them to form NH_3^+ and COO^- by gain and loss of a proton respectively at a particular range of pH. At this point, the net charge on an amino acid becomes zero. Since the net charge on zwitterion is zero, it will neither move towards anode nor towards the cathode.

9. A mutation in the gene encoding for a protein causes a change in the amino acid sequence can lead to changes in

A. primary structure

B. secondary structure

C. the function of the protein

D. all of the above

A change in amino acid sequence due to mutation changes the primary structure of the protein. A change in the primary structure affects the secondary structure which, in turn, affects the tertiary structure. A change in the tertiary structure affects the quaternary structure. A change in even a single amino acid may change its structure entirely. Due to the change in the shape of the protein, its function will also be hampered or completely lost. We see that everything is connected. A change in the amino acid sequence may alter the positioning of bonds (H-bonds, disulphide bonds). Also, the spatial arrangement of the amino acids may change with respect to the normal arrangement. All these reasons can lead to loss of function of the polypeptides.

10. The double helix structure of the DNA was proposed by

- ✔ **A.** Watson and Crick
- ✘ **B.** Gregor Mendel
- ✘ **C.** Carolus Linnaeus
- ✘ **D.** Robert Whittaker

James Watson and Francis Crick determined the double-helical structure of DNA in 1953 for which they received the Nobel prize along with Maurice Wilkins.

Gregor Mendel discovered inheritable units and called them factors.
Carolus Linnaeus is the father of taxonomy.
Robert Whittaker proposed the five-kingdom classification of living organisms.