

1. Biochemistry: The Chemistry of Life

Almost all enzymes are protein catalysts made by living organisms. Enzymes speed up favorable (spontaneous) reactions by reducing the activation energy required for the reaction, but they are not consumed in the reactions they promote. The effect of various environmental factors, such as pH, temperature, and substrate concentration can change the rate of reaction.

Questions

1. Define the following:

- a. Enzyme -
- b. Catalyst -
- c. Substrate -
- d. pH -

2. How do enzymes speed up reactions?

3. Which type of macromolecule are enzymes?

4. What happens to enzymes after they speed up a biochemical reaction?

Many of the large carbon compound molecules necessary for life (e.g., polysaccharides, nucleic acids, proteins, and lipids) are polymers of smaller monomers. Polysaccharides are composed of monosaccharides; proteins are composed of amino acids; lipids are composed of fatty acids, glycerol, and other components; and nucleic acids are composed of nucleotides.

Questions

5. Define the following:

- a. Macromolecule
- b. Polysaccharide
- c. Nucleic acid –
- d. Protein –
- e. Lipid –
- f. Polymer –
- g. Monomer –

6. Amino acids bond together to form _____.

7. Which monomers make up lipids?

8. What are two examples of nucleic acids? What is a nucleotide made up of

9. Give an example of a polysaccharide and the monosaccharides that it is composed of.

10. What are the functions of the following macromolecules in living organisms?

- a. Polysaccharides -
- b. nucleic acids -
- c. proteins -
- d. lipids –

The genetic composition of cells can be altered by incorporation of exogenous DNA into the cells. As a basis for understanding this concept: a. Students know the general structures and functions of DNA, RNA, and protein. Protein molecules vary from about 50 to 3,000 amino acids in length. The types, sequences, and numbers of amino acids used determine the type of protein produced.

Questions

11. The hemoglobin protein is 144 amino acids long. This protein is a(n) _____ (small, large, average) sized protein.
12. What 3 factors determine the type of protein produced by a cell?
13. Protein A has 2,560 amino acids and protein B has 2,560 amino acids. These two proteins may not be the same protein because _____.

Nucleic acids are polymers composed of monomers called nucleotides. Each nucleotide consists of three subunits: a five-carbon pentose sugar, a phosphoric acid group, and one of four nitrogen bases. (For DNA these nitrogen bases are adenine, guanine, cytosine, or thymine.) DNA and RNA differ in a number of major ways. A DNA nucleotide contains a deoxyribose sugar, but RNA contains ribose sugar.

The nitrogen bases in RNA are the same as those in DNA except that thymine is replaced by uracil. RNA consists of only one strand of nucleotides instead of two as in DNA.

The DNA molecule consists of two strands twisted around each other into a double helix resembling a ladder twisted around its long axis. The outside, or uprights, of the ladder are formed by the two sugar-phosphate backbones. The rungs of the ladder are composed of pairs of nitrogen bases, one extending from each upright. In DNA these nitrogen bases always pair so that T pairs with A, and G pairs with C. This pairing is the reason DNA acts as a template for its own replication. RNA exists in many structural forms, many of which play different roles in protein synthesis. The mRNA form serves as a template during protein synthesis, and its codons are recognized by tRNAs. Protein and rRNA make up the structure of the ribosome.

Proteins are polymers composed of amino acid monomers. Different types of proteins function as enzymes and transport molecules, hormones, structural components of cells, and antibodies that fight infection. Most cells in an individual organism carry the same set of DNA instructions but do not use the entire DNA set all the time. Only a small amount of the DNA appropriate to the function of that cell is expressed. Genes are, therefore, turned on or turned off as needed by the cell, and the products coded by these genes are produced only when required.

Questions

14. Define the following:
 - a. Nucleic acid –
 - b. Nucleotide –
 - c. Nitrogen base –
15. What are the 3 subunits that make up a nucleotide?
16. What are the four nitrogen bases in DNA? What are the four nitrogen bases in RNA?
17. Describe 3 ways that DNA different that RNA.
18. Describe the structure of DNA.
19. What are DNA backbones made of?
20. How do nitrogen bases pair in DNA? Why is the pairing of nitrogen bases important?
21. Describe the functions of the following:
 - a. DNA –
 - b. mRNA –
 - c. tRNA –