Control measuring tools

List of practical skills for the discipline

Discipline: "Genes and Heredity" (Molecular biology)

Discipline code: GN 1204

EP: 6B10115 "Medicine"

Volume of study hours\ credits: 120 hours/4 credits

Course and semester of study: 1/2

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Topic №1: Structure and functions of proteins and nucleic acids

Student_____ group _____
Answer the questions, complete the tasks, fill in the tables, solve the problems given below:
1. Test tasks:

1.Protein biosynthesis involves ... amino acids.
А. 20
Б. 100
В. 50
Г. 10
Д. 30
2.Amino acids are monomers of ...
A. proteins.
B. lipids.
C. fats.
D. carbohydrates.
D. nucleic acids.
3.Amino acids have similar ...
A. amino groups.
B. radicals.
C. sulfide groups .
D. nitro groups .
D. oxide groups.
4.When cell proteins are heated, their .
A. denaturation .
B. sticking together .
C. fragmentation.
D. transformation.
D. lysis.
5. The primary structure of a protein is formed by..... bonds
A. hydrogen
B. peptide
C. ionic
D. disulfide
D. hydrophobic
6. A peptide bond is formed between.....
A. a carboxyl group and an amino group.
B. carboxyl group and hydrogen.
C. a radical and an amino group.
D. carboxyl group and radical.
D. radical and hydrogen.
7. A ... bond is involved in the formation of the secondary structure of a protein.
A. hydrogen
B. peptide

C. ionic
D. disulfide
D. hydrophobic
8. The tertiary structure of a protein is formed by the bonding between....
A. radicals
B. amino groups
C. carboxyl groups
D. hydrogen and nitrogen
D. radical and carboxyl group
9. The process of forming the correct spatial three-dimensional structure of a protein is called....
A. folding.
B. splicing.
C. processing.
D. clearing.
D. screening.
10.Amino acids can exhibit properties.....
A. acids.
B. bases.
C. acids and bases.
D. salts.
D. vitamins.
11. Complex protein structures are formed ....
A. in the channels of the endoplasmic reticulum and Golgi apparatus.
B. ribosomes.
C. in the matrix of the cytoplasm.
D. in the cell nucleus.
D. in lysosomes.
12. A polypeptide is formed by....
A. the interaction of the amino group of one amino acid and the carboxyl group of another amino acid.
B. the interaction of the carboxyl groups of two neighbouring amino acids.
C. interactions between the amino groups of two neighbouring amino acids.
D. interactions of the nucleotides of two neighbouring amino acids.
E. interactions of radicals of two neighbouring amino acids.
13. The degree of spiralisation of a protein characterises.....
A. the secondary structure of the protein.
B. the primary structure of a protein.
C. the tertiary structure of the protein.
D. the superspiralisation of a protein.
D. the quaternary structure of a protein.
14. The quaternary structure of a protein is characteristic of....
A. globular proteins.
B. oligomeric proteins.
C. fibrillar proteins.
D. oligopeptides.

D. dipeptides.
15. The proteins actin and myosin perform ..... function.
A. protective
B. transport
B. Receptor
D. energetic
D. contractile
16. Prion diseases include the disease .....
A. A. Creutzfeldt-Jakob disease.
B. accumulation of lysosomes
B. Wilson's disease
Г. Down's
Д. Edwards
17. Immunoglobulins perform .....function.
A. protective
B. transport
C. receptor
D. hereditary
D. contractile
18. Haemoglobins perform ..... function.
A. protective
B. transport
C. receptor
D. hereditary
D. contractile
19. Neurotransmitters perform ..... function.
A. protective
B. transport
C. receptor
D. hereditary
D. contractile
20. Globular proteins are ....
A. haemoglobins.
B. carotenes.
C. actins.
D. myosins
D. collagens.
21. Fibrillar proteins are.
A. keratins.
B. haemoglobins.
C. immunoglobulins.
D. antibodies.
D. enzymes.
22. Structural proteins include _____.
A. collagens.

B. haemoglobins.
C. immunoglobulins.
D. antibodies.
D. enzymes.
23. Simple proteins include ...
A. histones.
B. glycoproteins.
C. chromatin.
D. proteoglycans.
D. flavoproteins.
24. The primary structure of a protein is determined by....
A. the nucleotide sequence of a gene.
B. the sequence of amino acids in the gene.
C. the physicochemical properties of the primary structure of a protein.
D. physicochemical properties of the radicals of the primary structure of the protein.
E. physicochemical properties of the contact surfaces of the tertiary structure.
25. The secondary structure of a protein is determined by ...
A. the nucleotide sequence of a gene.
B. the sequence of amino acids in the gene.
C. physicochemical properties of the primary structure of a protein.
D. physicochemical properties of the radicals of the primary structure of the protein.
E. physicochemical properties of the contact surfaces of the tertiary structure.
26. The tertiary structure of a protein is determined by....
A. the nucleotide sequence of a gene.
B. the sequence of amino acids in the gene.
C. physicochemical properties of the primary structure of a protein.
D. physicochemical properties of the radicals of the primary structure of the protein.
E. physicochemical properties of the contact surfaces of the tertiary structure.
27. The termination of a polypeptide containing an amino group is called the....
A. the N-terminus.
B. the peptide bond.
B. C-terminus.
Г. 3'-end.
Д. 5'-end.
28. The termination of a polypeptide containing a carboxy group is called the
A. C-terminus.
B.N-terminus.
C.the peptide bond.
Г. 3'-end.
Д. 5'-end.
29. Hydrogen bonds between CO- and NH-groups in a protein molecule give it a helix shape characteristic of ..... structure
A. primary
B. secondary
C. tertiary

D. quaternary
30. The helix-shaped secondary structure of a protein is held together by ..... bonds.
A. peptide
B. ionic
C. hydrogen
D. covalent
31. Proteins produced in the body when bacteria or viruses enter the body perform ..... function.
A. regulatory
B. signalling
C. defence
D. enzymatic
32. Proteins that accelerate chemical reactions in the cell perform ..... function.
A. hormonal
B. signalling
C. enzymatic
D. informational
33. When proteins are heated in solutions of acids and alkalis, they undergo:
A. denaturation
B. hydrolysis
C. dissolution
D. precipitation of proteins
34. The tertiary structure of a protein is:
A. the configuration of the polypeptide helix in space
B. the main characteristic of a protein
C. the position of a protein molecule in a living cell of an organism
D. position of a protein molecule in a ternary coordinate system
35. The quaternary structure of a protein is:
A.an aggregate or complex of several protein macromolecules
B.the aggregate of all proteins in a living cell
C.the fourth level of protein organisation
D.four proteins connected by donor-acceptor bonds
36. Which organic matter in the cell is first in mass?
A. Carbohydrates.
Б. Lipids.
В. Proteins.
Г. Nucleic acids.
37. How many amino acids make up the entire variety of proteins?
А. 170.
Б. 26.
В. 20.
Г. 10.
Д. 15
38. Which bonds stabilise the secondary structure of proteins?
A. Covalent.
Б. Ionic.

B. Hydrogen.
Г. Disulfide.
39. What structure does the haemoglobin molecule have?
A. Primary.
Б. Tertiary.
B. Secondary.
Г. Quaternary.
40. An amino acid is a monomer of ....
A. proteins.
B. nucleic acids.
C. fats.
D. carbohydrates.
D. vitamins.
41.Simple proteins are made up of ....
A. only nucleotides.
B. of amino acids only.
C. of amino acids and non-protein compounds.
D. of phosphoric acid residues.
D. of deoxyribose.
42.Proteins that are soluble in both water and salt solution are called:
A. albumin
B. globulins
C. fibrillar proteins
D. immunoglobulins
D. repressor proteins
43.In the structure of proteins distinguish ...
A. two levels of molecule organisation.
B. three levels of molecular organisation.
C. four levels of organisation of the molecule.
D. one level of organisation of the molecule.
D. five levels of organisation of the molecule.
44.A polypeptide is formed by _____.
A. the interaction of the amino groups of two neighbouring amino acids.
B. interaction between the amino group of one amino acid and the carboxyl group of another amino acid.
C. interactions between the carboxyl groups of two neighbouring amino acids.
D. interactions between the nucleotides of two neighbouring amino acids.
E. interactions between the radicals of two neighbouring amino acids.

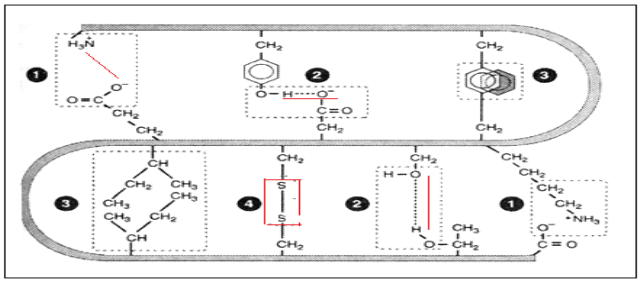
II. Oral questions:

1. What are peptides and proteins?
2. What is your understanding of simple and complex proteins?
3. What are the functional groups that make up amino acids?
4. What properties do amino acids possess?

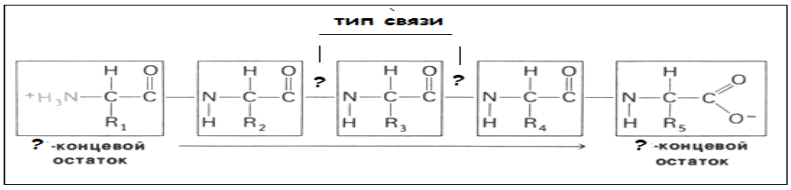
III. Cards:

Make a dipeptide, tripeptide, tetrapeptide, tetrapeptide, pentapeptide, octopeptide, from the amino acids given below. Identify the N- and C-termini on them. How many pentapeptides can be made from these amino acids?
Cys Tyr Gln Ile Asn Pro Lei Glu Phen Gly

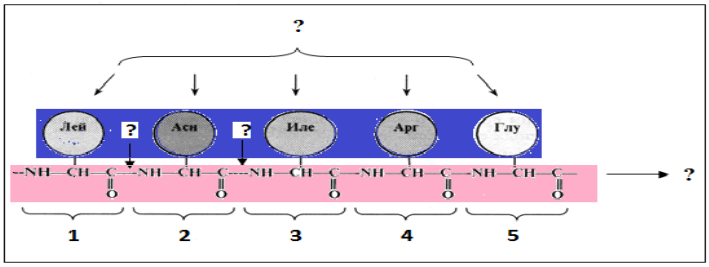
IV. Drawings:
Answer what is depicted in the figure. Sign what types of bonds are labelled with numbers, how they are formed.



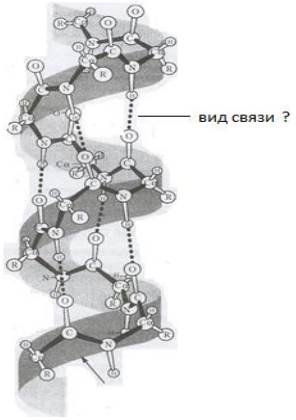
Answer what is shown in the figure. Answer the questions labeled in the figure.



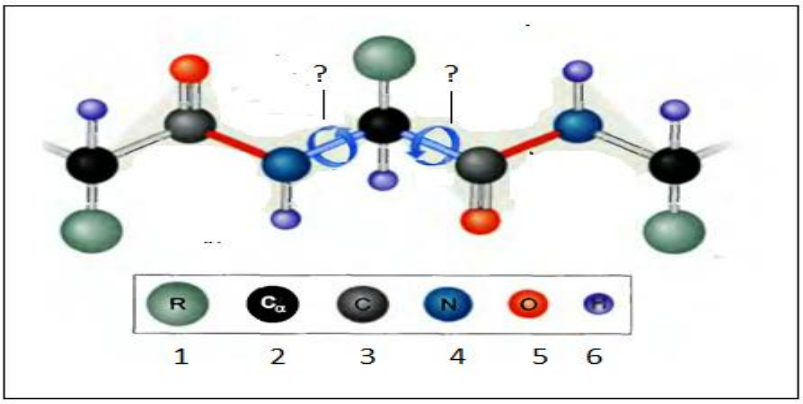
Answer what is shown in the figure. Answer the questions labeled in the figure.



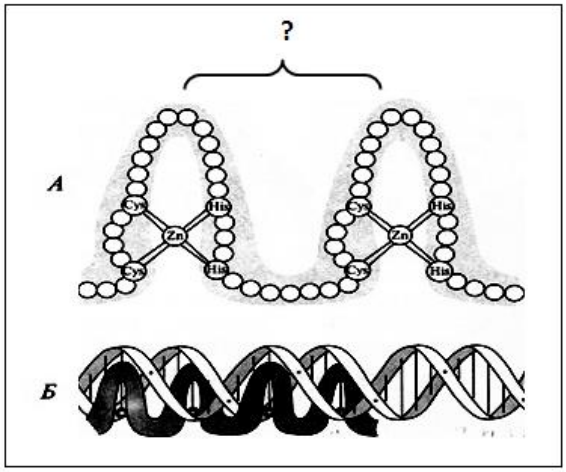
Answer what is depicted in the figure and the principle of formation of this structure.



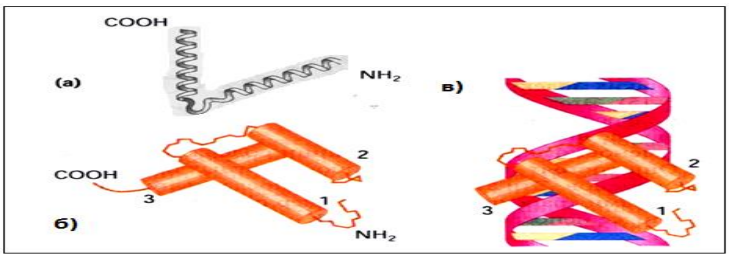
Answer what is shown in the diagram. Locate the element designations indicated by the numbers in the diagram. State what the arrows marked with a question mark indicates. Point out the site of formation of the peptide bond on the diagram.



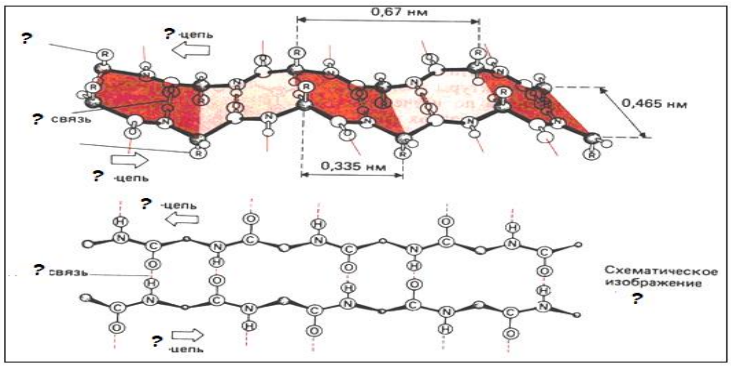
Answer what is shown in the figure. Which structures are labelled by the question, letters A and B? Explain the principle of formation of the structures labelled with the question and letter A. What function does this structure fulfil?



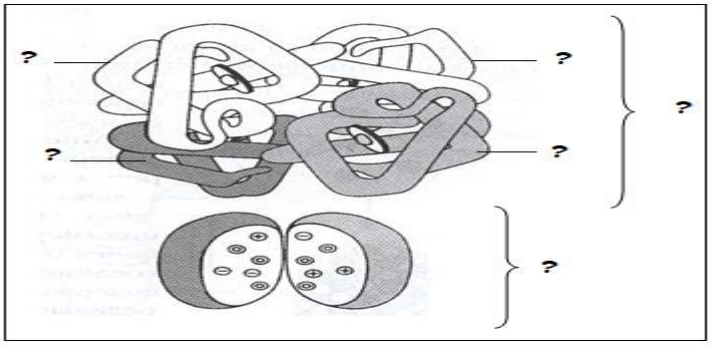
Answer what is shown in the figure. Which structures are labeled A, B and C? What is indicated by the numbers? What function does this structure fulfill?



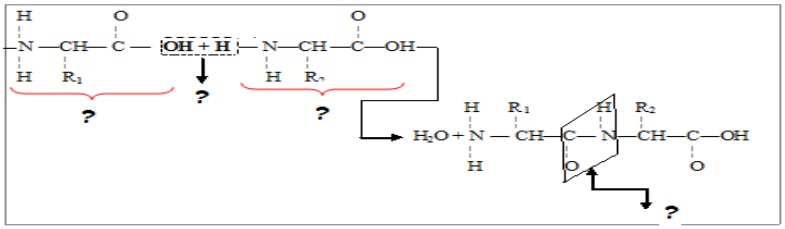
Answer what is shown in the picture. What is labeled by the questions?
What function does this structure fulfill?



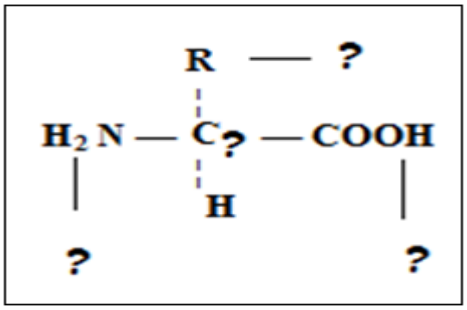
Answer what is shown in the picture. What is labeled by the questions?
What types of bonds are involved in the formation of this structure?



Answer which process is depicted in the figure. What is labeled by the questions?
What type of bond is involved in the formation of this structure?
How is this bond formed?



Answer what is shown in the picture. What is labeled by the questions? What structures does this structure belong to?



Topic: protein folding

I.Tests:

1.Folding enzymes are.
A. foldases.
B. nucleases.
C. hydrolases.
D. polymerases.
E. catalases.
2.Folding enzymes are ....
A. chaperones
B. nucleases.
C. hydrolases.
D. polymerases.
E. catalases.
3.Foldase is an enzyme that is ....
A. TFIID.
B.TFIID.
C.PCNA.
D.SSB.
E.MAP.
4.Molecules involved in protein folding are called ....
A. folding regulators.
B. enhancers of folding.

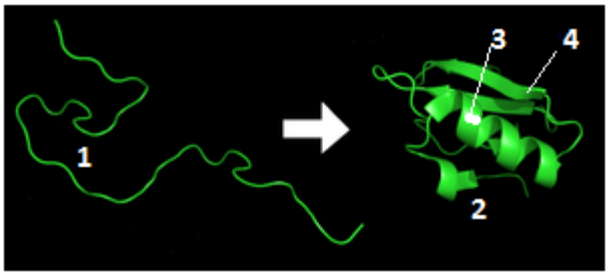
C. Repressors of folding.
D. folding cortexes.
E. Folding suppressors.

5.The shape of a protein molecule is determined by ....
A. amino acid sequence and folding factors.
B. amino acids and protein synthesis enzymes.
C. temperature and humidity.
D. amino acid sequence and temperature.
E. folding factors and humidity.
6.Molecules that accelerate folding are called....
A. folding catalysts.
B. folding chaperones.
C. retention chaperones.
D. disaggregating chaperones.
E. secretory chaperones.
7.Molecules that ensure proper protein folding are called ....
A. folding catalysts.
B. folding chaperones.
C. retention chaperones.
D. disaggregating chaperones.
E. secretory chaperones.
8.Chaperones that unfold misfolded proteins are called....
A. folding catalysts.
B. folding chaperones.
C. retention chaperones.
D. disaggregating chaperones.
E. secretory chaperones.
9.Chaperones that accompany proteins transported across the cell membrane are called ....
A. folding catalysts.
B. folding chaperones.
C. retention chaperones.
D. disaggregating chaperones.
E. secretory chaperones.
10.The process of spontaneous folding of a polypeptide chain into a unique native spatial structure (tertiary structure) is called ....
A. protein folding
B. protein translation
C. protein replication
D. protein homing
E. protein trimming
11.The definite spatial three-dimensional structure of a protein formed as a result of protein folding is called ....
A. conformation.
B. transformation

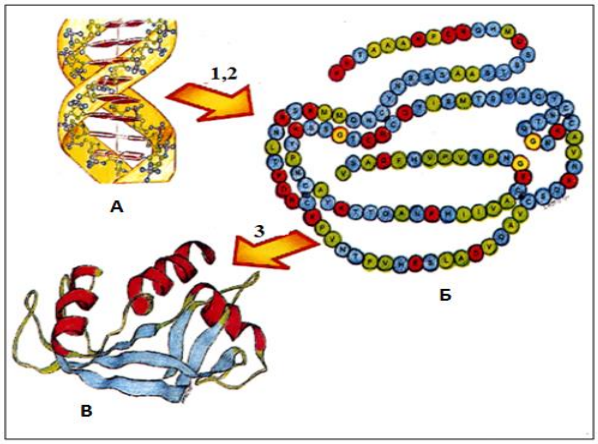
C. transduction.
D. conjugation.
E. 12.convergence.
12.The formation of an inactive protein with different properties occurs as a result of errors in....
A. protein folding
B. protein translation
C. protein replication
D. protein homing
E. protein trimming
13.Chaperones do not include....
A. constitutive proteins.
B. inducible proteins.
C. heat shock proteins.
D. Ubiquitin.
E. vasopressin.
14. Chaperones ensure ....
A. misfolding of newly synthesised proteins.
B. correction of misfolding of newly synthesised proteins.
C. control of refolding.
D. participation in some types of intracellular transport of substances.
E. synthesis of intracellular proteins.
15. The process of returning denatured proteins to their original native state is called....
A. folding.
B. refolding.
C. Aggregation.
D. Labilisation.
E. conformation.

Figures:

1.Which process is depicted in the figure? Sign the structures indicated by the arrows



2. Answer what is shown in the figure? Sign the numbers and name the processes indicated by the arrow. Sign the letters and give a brief characterization of these structures.



Topic №2: Molecular mechanisms of genetic information realization. Replication.

I.Tests:

1. Monomers of nucleic acids are ....
A) nucleotides.
B) sugars.
C) amino acids.
D) genes.
E) fatty acids.

2. The complementary nucleotides are ....
A) A - T.
B)T - U.
C)G - T.
D)TS - A.
D)T - G.

3.Watson and Crick deciphered the structure of the DNA molecule in ... year.
A) 1953
B)1930
C)1900
D)1961
E)1970

4.In pre-mRNA, the 5′-end side of the pre-mRNA is joined during maturation by ....
A)7-methylguanylate.
B)5-inosine phosphate.
C)3-methyluridine.
D)pseudouridine.
E)dihydrouridine.

5.A nucleotide consists of.

A)a sugar, a phosphate group, and a nitrogenous base.
B)A, G, T, and C.
C)nitrogenous bases.
D)sugar-phosphate backbone.
E) phosphoric acid and sugar residues.
6.The structure of the DNA molecule was first deciphered by ....
A) Watson and Crick.
B)Malpighi and Grew.
C)Mendel and Morgan.
D) Jacob and Monod.
E)Brown and Purkinje.
~ ... are not part of the cell membrane.
A) Nucleic acids
B) Phospholipids
C) Carbohydrates
D) Proteins
E) Sphingolipids
7.Transmembrane proteins are embedded in the membrane ...
A) through its lipid bilayer.
B) superficially, acting as receptors.
C) superficially, acting as transport channels.
D) deep, but do not penetrate the lipid bilayer.
E) superficially, acting as intracellular receptors.
8.The first to prove the major role of DNA in the transfer of hereditary information were.....
A) Mendel and Morgan.
B) Beadle and Tatum.
C) Griffith and Avery.
D) Watson and Crick.
E) Sturtevant and Steel.
9. The primary structure of DNA is formed by ... bonds.
A) 3′5′- phosphodiester bond
B) hydrogen
C) ionic
D) polar
E) vanderwaals
10. The chains in a DNA molecule are ...
A) antiparallel.
B) parallel.
C) are not linked.
D) are linked by a phosphodiester bond.
E) are linked by a peptide bond.
11.The structure of RNA contains all nucleotides except ....
A) thymine.
B) uracil.
C) adenine.

D) guanine.
E) cystosine.
12.At the 5′-end of the mRNA is a ....
A) a cap.
B) a 5′-untranslated region.
C) a poly - (A) - fragment.
D) an initiating codon.
E) a termination codon.
13.At the 3′-end of the mRNA is ....
A) a poly-(A)-fragment.
B) a cap.
C) a 5′-untranslated region.
D) an initiating codon.
E) a termination codon.
14.The 5′-untranslated region of mRNA serves to bind to ....
A) the small subunit of the ribosome.
B) the membrane of the nucleus.
C) the membrane of the EPS.
D) rRNA.
E) tRNA.
15.Mature mRNA lacks ....
A) introns.
B) exons.
C) operators.
D) terminators.
E) cistrons.
16.In all mRNAs, the initiating codon is ....
A) AUG
B) HGC
C) AGA
D) AAG
E) UAA
17.The section of tRNA that binds an amino acid is called ....
A) acceptor.
B) anticodon.
C) dihydrouridyl.
D) pseudouridyl.
E) additive.
18.The section of tRNA that interacts complimentarily with a codon in the mRNA chain is called ....
A) anticodon.
B) acceptor.
C) pseudouridyl.
D) additive.
E) dihydrouridyl.
19.The binding of tRNA to an amino acid occurs with the participation of the enzyme ....

A) aminoacyl-tRNA synthetase.
B) DNA polymerase III.
C) adenylate cyclase
D) peptidylprollysomerase
E) revertase
20.tRNA binds to 3 types of codons if the anticodon contains the nucleotide ...
A) inosine.
B) dihydrouridine.
C) methyluridine.
D) cytosine.
E) guanine.
21.RNA precursors have all but ....
A) enhancers.
B) exons.
C) introns.
D) spacers.
E) nucleotide sequences.
22.The main property of nucleic acid as a store and transmitter of hereditary information is the ability to....
A) self-reproduction
B) methylation
C) nucleosome formation
D) double-chain structure
E) antiparallelism of chains
23.RNA molecule contains
a) ribose, uracil, minor bases.
b) deoxyribose, adenine, uracil.
c) ribose, adenine, thymine.
d) deoxyribose, minor bases, uracil.
e) uracil, adenine, thymine, deoxyribose.
24.The mRNA molecule is able to fulfil its function only in
a) in a single-stranded state
b) in a double-stranded state
c) in a three-stranded state
d) in a four-stranded state
25.Secondary and tertiary structure is characteristic of;
a) mRNA, tRNA;
b) iRNA, rRNA;
c) rRNA, tRNA;
d) mRNA, rRNA;
e) mRNA, tRNA, rRNA;
26. An RNA molecule consists of....
a) cap, 5′-untranslated, initiator codon, coding portion, terminator, 3′-untranslated, poly(A)-fragment;
b) cap, 5′-untranslated, initiator, initiator, terminator, 3′-untranslated, poly (A) fragment;
c) cap, initiator, coding, terminator, 3′-untranslated region, poly (A) fragment;
d) 5′-untranslated, initiator, coding, terminal, 3′-untranslated region, poly (A) fragment;

e) cap, 5′-untranslated, initiator, coding, terminating, 3′-untranslated site, poly (A) fragment; d) cap, 5′-untranslated, initiator, coding, terminating, 3′-untranslated site;

27.The t-RNA molecule consists of the following regions
a) 4 double-stranded and 5 single-stranded;
b) 5 single-stranded and 4 double-stranded;
c) only single-stranded;
d) only double-stranded;

28.The nucleotides found in the t-RNA molecule are as follows
a) A, G, C, U; inosine, methylinosine, methyluridine.
b) A, G, C, U, dihydrouridine;
c) A, G, C, U, dihydrouridine, inosine;
d) A, G, C, U, dihydrouridine, inosine, methylinosine, methyluridine;
e) A, G, CD, U, dihydrouridine, pseudouridine, inosine, methylinosine, methyluridine;

29.In eukaryotes, the following types of p-RNAs are distinguished....
a) 28 S rRNA, 18 S rRNA; 5,8 S rRNA, 5 S rRNA;
b) 23S-rRNA, 16S-rRNA; 5 S-rRNA;
c) 18 S-rRNA; 5,8 S-rRNA, 5 S-rRNA;
d) 28 spRNAs, 18 spRNAs, 5 spRNAs;
e) 28 spRNAs, 18 spRNAs; 5,8 spRNAs;

30.In prokaryotes, the following types of p-RNAs are distinguished :
(a) 28 S-rRNA, 18 S-rRNA; 5.8 S-rRNA, 5 S-rRNAs
b) 23S-rRNA, 16S-rRNA; 5 S-rRNA;
c) 18 S-rRNA; 5,8 S-rRNA, 5 S-rRNA;
d) 28 spRNAs, 18 spRNAs, 5 spRNAs;
e) 28 spRNA, 18 spRNA; 5,8 spRNA;

31.A nucleotide is a monomer of a molecule.....
a) protein
b) DNA+
c) fat
d) carbohydrate
e) vitamin

32.The..... bases are complementary to each other in the DNA molecule.
a) A to T; G to C
b) A - C; G - T
c) A - G; C - T
d) A - Y; C - Y
e) A - G; C - T

33.The primary structural organisation of DNA includes:
a) three-dimensional helix
b) two complementary antiparallel polynucleotide chains
chains
(c) polynucleotide chain
(e) polypeptide chain
(d) superhelix

34. The secondary structure of DNA was discovered....

a) Watson and Crick
(b) Nathans and Smith
c) Avery, McLeod and McCarthy
(e) Darwin and Wallace
(d) Mendel and Morgan

35. How many levels of organisation has chromatin.....
a) 1
b) 2
c) 3
e) 4
d) 5

36.The main universal function of nucleic acids is to ....
a) storage and transmission of hereditary information
b) energy supply for cell life activity
c) O2 transport
d) providing enzymatic catalysis

37.The reaction with amino acids involves:
a) t-RNA
b) i-RNA
c) r-RNA
d) DNA

38. A model of the structure of the DNA molecule was proposed by:
A) Schleiden and Schwann
b) Mendel and Morgan
c) Watson and Crick
d) Darwin and Wallace

39.DNA in eukaryotic cells is contained in.....
a) nucleus.
b) ribosomes.
c) the Golgi complex.
d) cytoplasm.

40.The cell stores hereditary information about the traits of an organism, so it is called ..... unit of living:
a) functional
b) structural
c) genetic
d) biochemical

41.A DNA molecule contains nitrogenous bases:
a) adenine, guanine, uracil, cytosine
b) cytosine, guanine, adenine, thymine
c) thymine, uracil, thymine, cytosine
d) adenine, uracil, thymine, cytosine.

42.The RNA molecule contains nitrogenous bases:
a) adenine,guanine,uracil,cytosine
b) cytosine, guanine, adenine, thymine
c) thymine, uracil, adenine, guanine

d) adenine, uracil, thymine, cytosine.
43.The composition of monomers of DNA and RNA molecules differs from each other by the content of:
a) sugars and phosphoric acid residues
b) nitrogenous bases
c) sugars and nitrogenous bases
d) nitrogenous bases and phosphoric acid residues.
44.The purine nitrogenous bases that make up DNA include:
a) adenine and thymine
b) uracil and cytosine
c) adenine and guanine
d) cytosine and thymine
45.The pyrimidine nitrogenous bases that make up DNA include:
a) adenine and thymine
b) uracil and cytosine
c) adenine and guanine
d) cytosine and thymine
46.The purine nitrogenous bases that make up RNA include:
a) adenine and uracil
b) adenine and guanine
c) cytosine and thymine
d) cytosine and uracil
47.The pyrimidine nitrogenous bases that make up RNA include:
a) adenine and uracil
b) adenine and guanine
c) cytosine and thymine
d) cytosine and uracil

48.The ratio of nucleotides is constant in the composition of DNA
a) A+T/G+C.
b) A+T/G+C
c) A+C/T+G
d) A/G, T/C.
49.In the composition of RNA, the ratio of nucleotides is constant:
a) A+G/T+C
b) A+G/U+C
c) A+U/G+C.
d) A/G,U/C.
50.The polynucleotide chain in the synthesis of DNA and RNA molecules is formed by bonds between:
a) residues of sugars and nucleotides
b) phosphoric acid and sugar residues of nucleotides
c) nitrogenous bases and sugar residues of nucleotides
d) nitrogenous bases and phosphoric acid residues of nucleotides.
51.DNA strands in a helix are held relative to each other by bonds between:
a) neighbouring nucleotides of one of the strands
b) phosphoric acid residues of nucleotides in two chains

c) complementary nitrogenous bases in two chains
d) non-complementary nitrogenous bases of nucleotides in two chains.
52.The joining of two polynucleotide chains into a DNA helix is accomplished by bonds:
a) ionic
b) hydrogen
c) hydrophobic
d) electrostatic.
53.The number of bonds occurring in a complementary adenine-thymine base pair of a DNA molecule is equal to
a)1.
b)2.
c) 3.
d) 4.
54.The number of bonds occurring in the complementary guanine-cytosine base pair of a DNA molecule is equal to
a) 1.
b) 2.
c) 3.
d) 4.
55.A complete turn of the DNA double helix occurs in:
a) 5 nucleotide pairs
b) 10 nucleotide pairs
c) 15 nucleotide pairs
d) 20 nucleotide pairs

II.Cards:

1.The monomers of DNA are nucleotides which consist of nitrogenous base, deoxyribose sugar, phosphoric acid residue.

Sketch a diagram of a nucleotide. Show how these structures are joined together in a nucleotide.

2. Insert in place of the blanks in the text the necessary words indicated below and labeled with the letter A:

Different nitrogenous bases are found in the DNA molecule: ...; ...; ....; ..... The DNA chain ..... is made of alternating ..... linked by ..... bonds: a sugar of one nucleotide and ..... another nucleotide. It is not just DNA made up of .... but a more complex formation that is found in the cell. In this formation ..... linked by nitrogenous bases .... bonds according to the principle .....The DNA strand is folded in ..... because of the different number of hydrogen bonds between nitrogenous bases of different chains (two bonds between ...., three bonds -.....) and thus takes the most favorable form. DNA fulfills the function of ..... hereditary information, ... hereditary information and ..... hereditary information.

A. Nucleotides; covalent; consists of ;(A), (T), (G), (C), phosphoric acid residue; one strand; two strands; storage; nucleotides; hydrogen; complementarity; reproduction; helix; phosphodiester bond; (A and T) (G and C); transmission.

3. Insert in place of the blanks in the text the correct words below labelled with the letter A:

Ribonucleic acid (RNA), a linear... but much shorter than ..... The bases of RNA are complementary to ..... DNA, but in the RNA molecule, one .... base is replaced by ...., and just ....., which has one more oxygen atom, is used instead of ..... In addition, RNA is ..... structure.

There are three main types of RNA molecules:

- .....- these are molecules that read information from DNA;? -RNA connects to the ribosome and works as a ..... (therefore also called and, or ?-RNA);
- .....- are RNA molecules that are much smaller and have about 33 varieties. Molecules of this type .... to the site of protein synthesis on the ribosome.
- ..... - is a molecule that does not carry genetic information, but .... into the .....

A. Polymer; DNA; input; bases; thymine (T); uracil (U); deoxyribose; ribose; single-stranded; deliver; ribosome; information RNA (i-RNA); transport RNA (t-RNA); ribosomal RNA (p-RNA); matrix; matrix; amino acids.

4. Insert in place of the blanks in the text the correct words listed below and labelled with the letter A:

Adenosine triphosphoric acid. Universal Biological .... High-calorie cellular .... Contains .... macroenergetic .... Macroenergetic are compounds in whose chemical bonds are stored .... in a form available for use in biological processes.

1) АТФ + H_2O —► А?Ф + Ф + Е (?kJ/mol)
2) АДФ + H_2O —► А?Ф + Ф + Е (?kJ/mol)

The energy efficiency of two macroergic bonds is kJ/mol. ATP is formed in.... animal cells and .... plants. ATP energy is used for movement, biosynthesis, division, etc. Average life span of 1 ATP molecule is less than 1 min, because it is split and restored 2400 times a day.

A .Accumulator; energy; "fuel"; 2; communication; energy; mitochondria; chloroplasts;

5.Characterise the structure and function of DNA molecules using the answers below:

1. Single-stranded molecule.
2. A double-stranded molecule.
3. Contains adenine, uracil, guanine, and cytosine.
4. Contains adenine, thymine, guanine, cytosine.
5. Nucleotides contain ribose.
6. Nucleotides contain deoxyribose.
7. Found in the nucleus, chloroplasts, mitochondria, centrioles, ribosomes, and cytoplasm.
8. Contained in the nucleus, chloroplasts, and mitochondria.
9. Participates in the storage, reproduction, and transmission of hereditary information.
10. Participates in the transmission of hereditary information.

6. Characterise the structure and function of RNA molecules using the answers below:

1. single-stranded molecule.
2. A double-stranded molecule.

3. Contains adenine, uracil, guanine, and cytosine.
4. Contains adenine, thymine, guanine, cytosine.
5. Nucleotides contain ribose.
6. Nucleotides contain deoxyribose.
7. Found in the nucleus, chloroplasts, mitochondria, centrioles, ribosomes, and cytoplasm.
8. Contained in the nucleus, chloroplasts, and mitochondria.
9. Participates in the storage, reproduction, and transmission of hereditary information.
10. Participates in the transmission of hereditary information.

III. Oral Questions:

-Explain what are nucleic acids (NA)?
- What types of NA do you know?
- Are NA polymers?
- What is the composition of a DNA nucleotide?
- What is the composition of an RNA nucleotide?
- What are the similarities and differences between RNA and DNA nucleotides?
- ATP is a constant source of energy for the cell. Its role can be compared to that of an accumulator. Explain what this similarity is.
- What is the structure of ATP?
-What role does ATP play in a living organism?
- What low molecular weight NA do you know?
- What are the nitrogenous bases of which NA are composed? Write the corresponding formulae.
- What functions do NA fulfill in a living organism?
- What shape do NA macromolecules have?
- What features of DNA structure cause its doubling?
- How does the structure of DNA and RNA molecules differ?
- How do RNA and DNA nucleotides differ?
- What species are there in the cell?

IV.Objectives:

Task:

One of the chains of a fragment of a DNA molecule has the following structure:
3′ -G-G-G-A -T-A-A-C-A-G-A-T-5′
a) Specify the structure of the opposite chain.
b) Specify the sequence of nucleotides in the mRNA molecule built on this section of the DNA chain.
c) Explain what property of DNA you were guided by.
Task:
One of the chains of a fragment of a DNA molecule has the following structure:
3′ -A-A-T-T-T-G-G-G-G-C-C-C-C-C-5′
a) Specify the structure of the opposite chain
b) Specify the sequence of nucleotides in the mRNA molecule built on this section of the DNA chain.
c) Explain what property of DNA you were guided by.
Task:
One of the chains of a fragment of a DNA molecule has the following structure:
3′ -T-T-T-G-G-G-A-A-A-A-C-C-C-C-T-T-5′
a) Specify the structure of the opposite chain

b) Specify the sequence of nucleotides in the mRNA molecule built on this section of the DNA chain.
c) Explain what property of DNA you were guided by.
Task:
One of the chains of a fragment of a DNA molecule has the following structure:
3′ -A-A-T-T-C-G-C-G-T-A-T-T-A-G-G-5′
a) Specify the structure of the opposite chain
b) Specify the sequence of nucleotides in the mRNA molecule built on this section of the DNA chain.
c) Explain what property of DNA you were guided by.
Task:
RNA molecule has the following structure:
3′ -U-U-G-G-C-G-G-U-G-G-C-A-C-C-G-U-5′
Construct the section of the DNA molecule to which this RNA molecule corresponds.
Complete the second strand of DNA.
Explain what property of DNA you were guided by.
Task:
An RNA molecule has the following structure:
3′ -A-U-U-U-G-G-C-C-U-U-A-A-U-5′
Construct the section of the DNA molecule to which this RNA molecule corresponds.
Complete the second strand of DNA.
Explain what property of DNA you were guided by.
Task:
An RNA molecule has the following structure:
3′ -G-G-A-A-C-C-U-U-A-A-G-5′
Construct the section of the DNA molecule to which this RNA molecule corresponds.
Complete the second strand of DNA.
Explain what property of DNA you were guided by.
Task:
An RNA molecule has the following structure:
3′ -A-A-G-G-A-G-G-C-C-U-C-U-U-U-5′
Construct the section of the DNA molecule to which this RNA molecule corresponds.
Complete the second strand of DNA.
Explain what property of DNA you were guided by.
Task:
An RNA molecule has the following structure:
3′ -U-U-G-G-C-G-G-U-G-G-C-A-C-C-G-U-5′
Construct the section of the DNA molecule to which this RNA molecule corresponds.
Complete the second strand of DNA.
Explain what property of DNA you were guided by.
Task:
Chemical analysis has shown that 28% of the total number of nucleotides of this i-RNA is adenine, 6% is guanine, and 40% is uracil. What should be the nucleotide composition of the corresponding section of double-stranded DNA, the information from which is "rewritten" by this i-RNA?
Task:
On a fragment of one DNA chain, the nucleotides are arranged in the sequence: A-A-G-T-T-C-T-A-A-C-G-T-A-T. Draw a diagram of the structure of a double-stranded DNA molecule. What is the length of this

fragment of a single strand of DNA? How many (in %) nucleotides are in this DNA chain if you count 13 nucleotides as 100%? The length of one nucleotide is 0.34 nm.
Problem: On a fragment of one DNA chain, nucleotides are arranged in the sequence: A-A-G-T-C-T-A-C-G-T-A-T....
1. Draw a diagram of the structure of the second chain of this DNA molecule.
2. What is the length in nm of this DNA fragment if one nucleotide occupies about 0.34 nm?
3. How many (in %) nucleotides are contained in this fragment of the DNA molecule?
Task:
What is the composition of the second DNA strand if the first strand contains 18% guanine, 30% adenine, and 20% thymine?

SAMPLE PROBLEM SOLUTION

Task:
In a DNA molecule there are 23% of adenyl nucleotides from the total number of nucleotides. Determine the number of thymidyl and cytosyl nucleotides.
Solution:
1. Using Chargaff's rule, find the content of thymidyl nucleotides in the given DNA molecule: A=T=23%.
2. Find the sum (in %) of the content of adenyl and thymidyl nucleotides in the given DNA molecule: 23% + 23% = 46%.
3. Find the sum (in %) of the content of guanyl and cytosyl nucleotides in the given DNA molecule: 100% - 46% = 54%.
4. According to Chargaff's rule, in a DNA molecule G=C, the sum of these nucleotides accounts for 54%, and individually: 54% : 2 = 27%.
Answer: T=23%; C=27%

Task:
A DNA molecule with a relative molecular mass of 69 thousand is given, of which 8625 are adenyl nucleotides. The relative molecular mass of one nucleotide is 345 on average. How many nucleotides are contained individually in this DNA? What is the length of its molecule?
Solution:
1. Determine how many adenyl nucleotides are in a given DNA molecule: 8625 : 345 = 25.
2. According to Chargaff's rule, A=G, i.e. in a given DNA molecule, A=T=25.
3. Determine how much of the total molecular weight of this DNA is guanyl nucleotides: 69,000 - (8625x2) = 51,750.
4. Determine the total number of guanyl and cytosyl nucleotides in this DNA: 51,750:345=150.
5. We determine the content of guanyl and cytosyl nucleotides separately: 150:2 = 75;
6. Determine the length of the given DNA molecule: (25 + 75) x 0.34 = 34 nm.

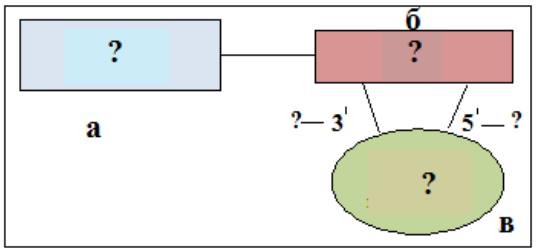
Answer: A=T=25; G=C=75; 34 nm.

Task. According to some scientists, the total length of all DNA molecules in the nucleus of one human sex cell is about 102 cm. How many total nucleotide pairs are contained in the DNA of one cell (1 nm = 10-9mm)?
Solution:
1. Convert centimetres to millimetres and nanometres: 102 cm = 1,020 mm = 1,020,000,000,000 nm.

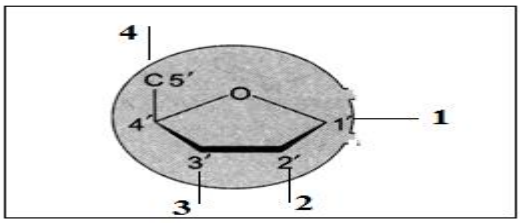
2. Knowing the length of one nucleotide (0.34 nm), determine the number of nucleotide pairs contained in the DNA molecules of the human gamete:1,020,000,000 nm: 0.34 = 3 x 109 pairs.
Answer: 3x109 pairs.

V. Drawings:

Answer what is shown in the figure. Sign what is indicated by the questions and letters.

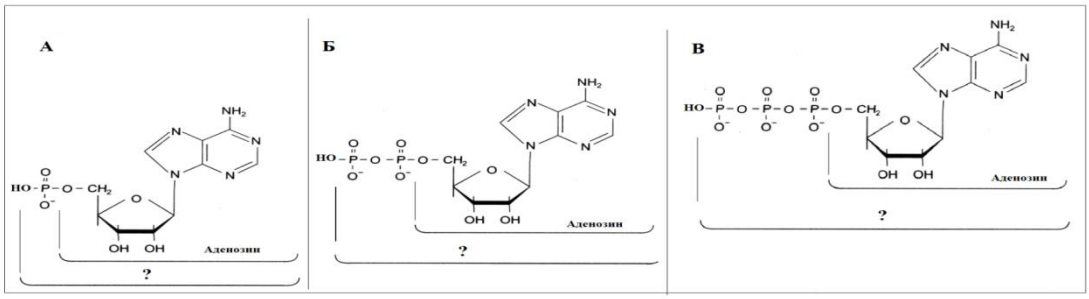


Answer what is shown in the figure. Sign what the numbers indicate about the structure in the DNA and RNA molecules.

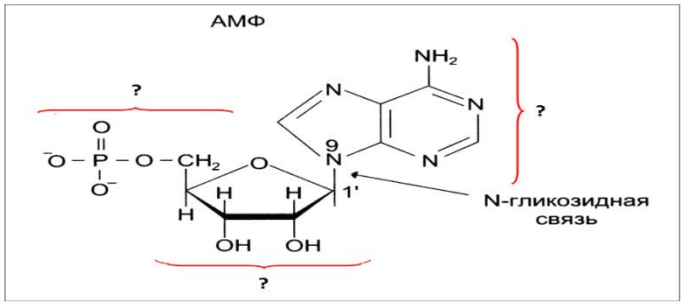


Answer which diagrams of which structures are shown in the figure under the letters A.B.C and labeled with the questions.

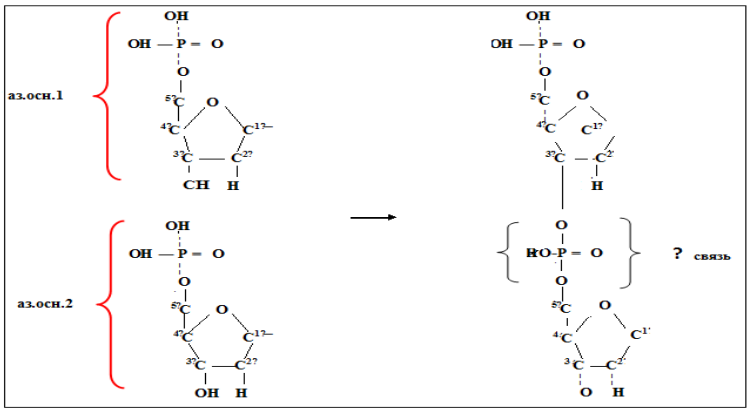
Which structure is shown in the figure?



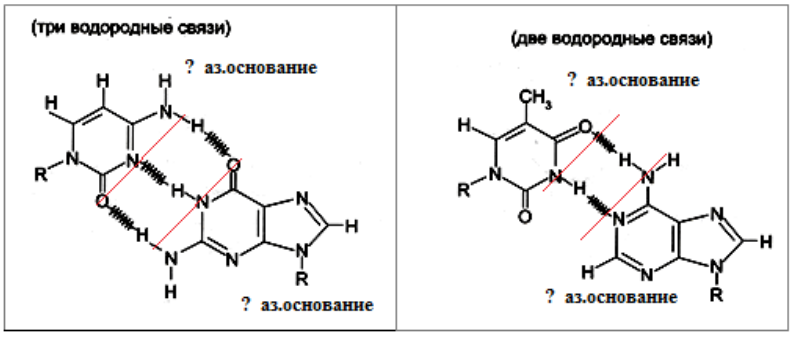
Sign its parts indicated by the question



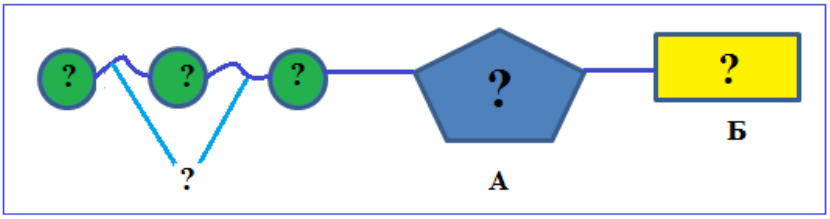
Answer, what reaction will occur between the two nitrogenous bases shown on the left side of the figure, what structure will be formed as a result of this process? What is the name of the type of bond indicated by the question?



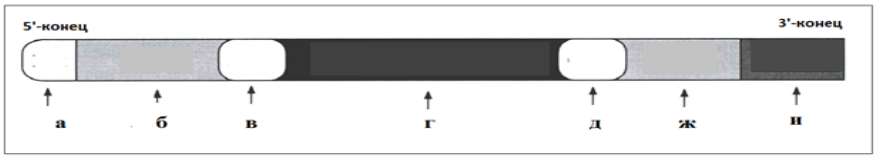
The figure shows nitrogenous bases forming bonds. What are the bases, what kinds of bonds are they, and what structure do they form?



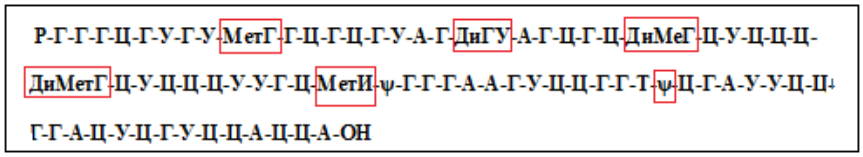
Which structure is shown in the figure? What parts of the structure are labeled with questions? What are the different types of parts of the structure labeled with letters?



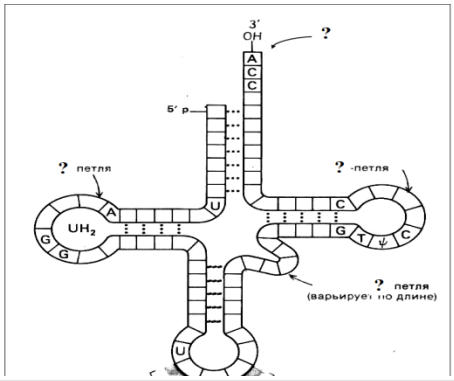
What is depicted in the figure? What function does this structure fulfill? Which structural parts are labeled with letters?

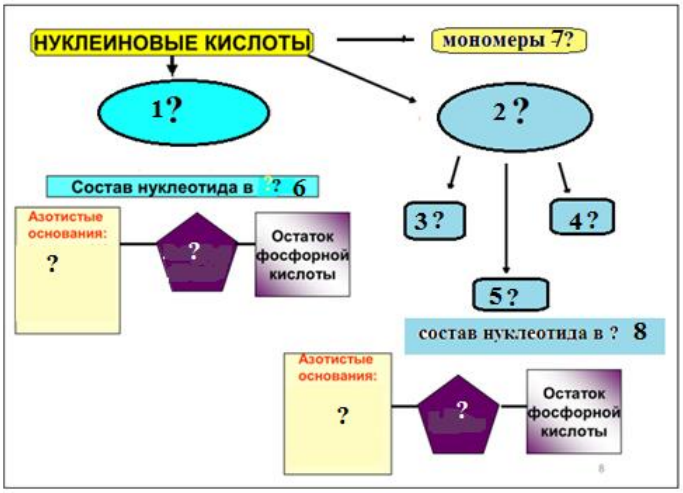


What is depicted in the figure? How is this structure formed? What is the principle behind the formation of this structure?



What is depicted in the figure? What function does this structure fulfill? Answer what is indicated by the questions? What is the principle behind the formation of this structure?





Answer what is indicated by the questions? What function do the structures labeled by questions 1, 2, 3,4,5 fulfill?

Topic №3: Expression of genetic material. Transcription.

I. Answer the quiz questions:

1. The enzymes helicase, SSB protein, and topoisomerase provide ....
A. formation of the replicative fork.
B. formation of RNA inoculum.
C. cross-linking of Okazaki fragments.
D. DNA synthesis.
E. DNA repair.
2. The process of transforming heterogeneous nuclear RNA (gya - RNA) into mature RNA is called ....
A. splicing.
B. conjugation.
C. initiation.
D. processing.
E. conversion.
3. Splicing is the process of _____.
A. shortening of the information site and - RNA.
B. cross-linking of the information region of gya-i - RNA
C. deletion of a DNA information site.
D. deletion of a non-information-carrying region of i-RNA.
E. elongation of the information site of i-RNA.
4. transcription occurs in ....
A. metaphase of the cell cycle.
B. prophase of the cell cycle.
C. anaphase of the cell cycle.
D. pro-metaphase of the cell cycle.
E. interphase of the cell cycle.
5. Transcription is- ....
A. the synthesis of protein fragments at any site on DNA.
B. the process of doubling DNA molecules.
C. the synthesis of an iRNA molecule at a specific site on DNA
D. the process of semi-conservative DNA replication.
E. synthesis of a protein molecule at a specific site on DNA.
6.The effect of transcriptional silence is called ....
A. splicing
B. choling
C. processing
D. silencing
E. banking
7. During telomere replication, telomerase acts as ... - an enzyme that performs DNA synthesis on the RNA matrix.
A. helicase
B. reverse transcriptase
C. topoisomerase
D. DNA polymerase
E. RNA polymerase

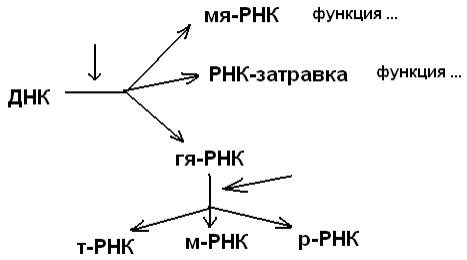
8. The p53 protein functions primarily as a .
A. replication factor.
B. a translational factor.
C. a folding factor
D. mutation factor
E. a transcription factor.
9. Uncoupling of RNA from DNA during transcription is facilitated by ....
A. Nus A.
B. sigma subunit.
C. RNA polymerase.
D. ro-factor.
E. DNA polymerase.
10. The signal for transcription termination in eukaryotes is provided by ....
A. GC-rich sites.
B. AT-rich sites.
C. TATA box.
D. Pribnow's box.
E. CAAT box.
11. The result of splicing is:
A. construction of a complementary strand of DNA
B. construction of a mature mRNA
C. construction of a polypeptide chain
D. construction of pre-tRNA
E. construction of pre-mRNA
12. Splicing is the process of:
A. exon deletion
B. construction of pre-mRNA
C. removal of introns
D. recombination
E. cross-linking of exons.
13. The process of pre-mRNA formation is called:
A. replication
B. translation
C. transcription
D. elongation
E. splicing
14. Nucleotide sequences removed during processing:
A. cap site
B. exons
C. introns
D. RNA polymerase
E. mutons
15. During transcription initiation, RNA polymerase binds to the:
A. cap site
B. enhancer

C. terminator
D. adenyl residue
E. promoter

I. Answer the questions:

1. Describe the major similarities of DNA replication and transcription
2. Describe the features of transcription in eukaryotes.
3. Describe the fundamental differences between DNA replication and transcription.
4. Describe the peculiarities of transcription in prokaryotes.

II. Fill in the scheme



IV. Fill in the blanks

1) Processing includes the following events:
1.
2.
3.

2) Transcription factors:
a) in prokaryotes -.
b) in eukaryotes -

V. Complete the sentences

1. σ-subunit fulfils the function of ....
2. TFIID consists of ...
3. Splicing is ....
4. Nucleotide modification is the result of ....
5.TBP is ...
6.TAF is ...

Topic №4: Protein biosynthesis. Translation.

I. Answer the test questions:

1. The enzymes helicase, SSB protein, and topoisomerase provide ....

A. replicative fork formation.

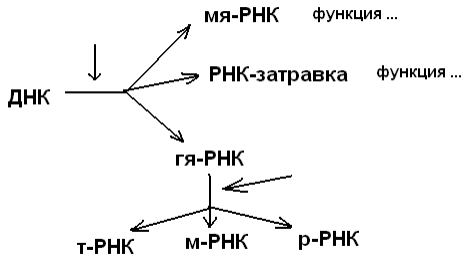
B. formation of RNA inoculum.
C. cross-linking of Okazaki fragments.
D. DNA synthesis.
E. DNA repair.
2. The process of transforming heterogeneous nuclear RNA (gya - RNA) into mature RNA is called ....
A. splicing.
B. conjugation.
C. initiation.
D. processing.
E. conversion.
3. Splicing is the process of _____.
A. shortening of the information site and - RNA.
B. cross-linking of the information region of gya-i - RNA
C. deletion of a DNA information site.
D. deletion of a non-information-carrying region of i-RNA.
E. elongation of the information site of i-RNA.
4. transcription occurs in ....
A. metaphase of the cell cycle.
B. prophase of the cell cycle.
C. anaphase of the cell cycle.
D. pro-metaphase of the cell cycle.
E. interphase of the cell cycle.
5. Transcription is- ....
A. the synthesis of protein fragments at any site on DNA.
B. the process of doubling DNA molecules.
C. the synthesis of an iRNA molecule at a specific site on DNA
D. the process of semi-conservative DNA replication.
E. synthesis of a protein molecule at a specific site on DNA.
6.The effect of transcriptional silence is called ....
A. splicing
B. choling
C. processing
D. silencing
E. banking
7. During telomere replication, telomerase acts as ... - an enzyme that performs DNA synthesis on the RNA matrix.
A. helicase
B. reverse transcriptase
C. topoisomerase
D. DNA polymerase
E. RNA polymerase
8. The p53 protein functions primarily as a …
A. a replication factor.
B. a translational factor.

C. a folding factor
D. mutation factor
E. a transcription factor.
9. Uncoupling of RNA from DNA during transcription is facilitated by ....
A. Nus A.
B. sigma subunit.
C. RNA polymerase.
D. ro-factor.
E. DNA polymerase.
10. The signal for transcription termination in eukaryotes is provided by ....
A. GC-rich sites.
B. AT-rich sites.
C. TATA box.
D. Pribnow's box.
E. CAAT box.
11. The result of splicing is:
A. construction of a complementary strand of DNA
B. construction of a mature mRNA
C. construction of a polypeptide chain
D. construction of pre-tRNA
E. construction of pre-mRNA
12. Splicing is the process of:
A. exon deletion
B. construction of pre-mRNA
C. removal of introns
D. recombination
E. cross-linking of exons.
13. The process of pre-mRNA formation is called:
A. replication
B. translation
C. transcription
D. elongation
E. splicing
14. Nucleotide sequences removed during processing:
A. cap site
B. exons
C. introns
D. RNA polymerase
E. mutons
15. During transcription initiation, RNA polymerase binds to the:
A. cap site
B. enhancer
C. terminator
D. adenyl residue
E. promoter

I. Answer the questions:

1. Describe the major similarities of DNA replication and transcription
2. Describe the features of transcription in eukaryotes.
3. Describe the fundamental differences between DNA replication and transcription.
4. Describe the peculiarities of transcription in prokaryotes.

II. Fill in the scheme



IV. Fill in the blanks

1) Processing includes the following events:

1.
2.
3.

2) Transcription factors:

a) in prokaryotes -.
b) in eukaryotes -

V. Complete the sentences

1. σ-subunit fulfils the function of ....
2. TFIID consists of ...
3. Splicing is ....
4. Nucleotide modification is the result of ....
5.TBP is ...
6.TAF is ...

Topic №6: The hereditary apparatus of the cell.

I.Tests:

1. the authors of the "one gene - one enzyme" hypothesis are ....
A A A. Beadle and E. Tattum.
B B. Temin and G. Baltimore.
C C. F. Jacob and C. Monod.
D D. N. Zinder and D.J. Lederberg.
E. Rapoport and N. Dubinin.

2.Structural genes are genes that ....
A.suppressing the action of another gene
B.enhancing the action of another gene
C. controlling the action of another gene
D. carrying information about the structure of a polypeptide
E. coordinating the action of another gene.
3.Regulatory genes are genes that ....
A.coordinating the action of another gene.
B.carrying information about a polypeptide.
C. carrying information about amino acids.
D.enhancing the action of another gene.
E.decreasing the activity of another gene.
4.A section of DNA that encodes a single polypeptide chain is called a ....
A. promoter
B.chromosome.
C.genome.
D.attenuator.
E.enhancer.
5.A section of DNA that encodes a single polypeptide chain is called an ....
A.attenuator.
B.chromosome.
C.promoter.
D.cistron.
E.enhancer.
6.Non-coding stretches of DNA within genes are called ...
A.introns.
B.exons.
C.genomics.
|cistrons.
|repressors.
7.The non-coding stretches of DNA between genes are called ....
A.spacers.
B.|operators.
C.repressors.
D.suppressors.
E.modulators.
8.Genes that follow each other tandemly are called ....
A.terminatorial.
B.operator.
C.repressor.
D.clustered.
E.attenuator
9.Genes in clusters are separated by ....
A.spacers.
B.terminators.

C.regressors.
D.enhancers.
E.operators.
10.A cluster of three rRNA genes is transcribed as a single unit except for ....
A.5S rRNA.
B.5,8S-rRNA.
C.18S-rRNA.
Г. 28S-rRNA.
D. 23S-rRNA.
11.Acrocentric chromosomes are ....
A.chromosomes that have virtually no shoulders.
B.large equal-shouldered chromosomes.
C.chromosomes that have one arm longer than the other.
D. small equal-shouldered chromosomes.
E. large unequal-shouldered chromosomes.
12.Metacentric chromosomes are ....
A.rod-shaped chromosomes.
B.unequal-shouldered chromosomes.
C.chromosomes that have no shoulders.
D. small unequal-shouldered chromosomes.
E. equal-shouldered chromosomes.
13.The centromeres in acrocentric chromosomes are located ...
A.in the middle of the chromosome.
B.closer to the middle of the chromosome.
C.closer to the telomere.
D.in the telomere.
E.in the satellite part of the chromosome.
14.According to the Denver Karyotype Classification, the 4th and 5th pairs of chromosomes belong to the ... group.
A. B
Б. E
B. A
Г. Д
D. |C
15.The sex Y chromosome has a ... shape.
A. metacentric
B. acrocentric
C. submetacentric
D. dicentric
E. monocentric
16.The sex U chromosome is ....
A.acrocentric.
B.metacentric.
C.submetacentric.
D.dicentric.

E.monocentric.
17.The Denver classification of karyotype was developed in ...year.
A.1940
Б.1960
B.1947
Г. 1950
Д.1956
18.Telomeres are called ....
A.the ends of the arms of chromosomes.
B.spiralised in mitosis and despiralised in interphase sections of chromosomes.
C. the middle part of chromosomes.
D. secondary stretching of chromosomes.
E. permanently spiralised sections of chromosomes.
19.The structural basis of chromatids are .... fibrils.
A.nucleoprotein
B.chromomeric
C. chromonemic
D. chromatid
E.nucleosomal
20.Nucleosomes are formed from histone proteins of the classes ....
A.N2A, N2C, N3,N4.
B.H1, H2A, H2B
C.H1A, H2A, H4
D. H1B, H3, H4
E. H5, H, B, H4.
21.Karyotype is ...
A.homologous chromosomes.
B. non-homologous chromosomes.
C.haploid set of chromosomes of a cell.
D.the diploid set of chromosomes of the cell.
E.heterochromatin.
22.Each chromosome contains ....
A.only one DNA molecule.
B.two DNA molecules.
C.one circular DNA molecule.
D. two RNA molecules.
E. two circular DNA molecules
23.The chains in a DNA molecule are ...
A.are antiparallel.
B. parallel.
C. are not linked.
D.are linked by a phosphodiester bond.
E.are linked by a peptide bond.
24.The fixation of chromosomes to the nuclear matrix involves ....
A.telomeres.

B.centromeres.
C.centromere and shoulders.
D.telomeres and centromeres.
E. nuclei
25.Telomeres are densely packed and therefore belong to the ....
A. heterochromatin.
B. euchromatin.
C. heterochromatin and euchromatin.
D. single repeats
E. multiple repeats
26.The nucleosome does not include the following histone ....
A.H3.
B.H2A.
C.H2B.
D. H1.
E.H4.
27.In which period of the cell cycle do chromosomes acquire a doubled structure - ....
A.S.
B.G-0.
C.G-1.
D. G-2.
E.in mitosis.
28.Chromosomes can be in the following structural and functional states:
A.condensed (spiralised) and decondensed (despiralised).
B.spiralised, despiralised, neutral.
C.spiralised, neutral.
D.spiralised, euchromatic.
E.spiralised, thickened, heterochromatic.
29.Acrocentric chromosomes are ....
A.rod-shaped chromosomes.
B.small unequal-shouldered chromosomes.
C.large unequal-shouldered chromosomes.
D.large unequal-shouldered chromosomes.
E.chromosomes that have one arm longer than the other.
30.Autosomes are _____.
A.sex chromosomes.
B.all chromosomes.
C.non-sex chromosomes.
D. X and Y are chromosomes.
E. U chromosomes.
31.The chromosomes in the human karyotype are divided into - ....
A.6 groups.
B.7 groups.
C.4 groups.
Г. 5 groups.

D.9 groups.
32.Euchromatin is called - ....
A.spiralised in mitosis and despiralised in interphase sections of chromosomes.
B.secondary stretching.
C.permanently spiralised sections of chromosomes.
D.the edges of the shoulders.
E. the middle part of the chromosomes.

33.Sex chromatin is ....
A. a small inactive section of the X chromosome.
B. an inactive X chromosome.
C.inactive small and large arms of the X - chromosome.
D. a large inactive X chromosome.
| inactive U chromosome.
34.Metacentric chromosomes are ....
A. unequal-shouldered chromosomes.
B. Equal-shouldered chromosomes.
C.chromosomes that have no shoulders.
D.small equal-shouldered chromosomes.
E. stick-shaped chromosomes.
35.The centromeres of acrocentric chromosomes are located -.
A.closer to the telomere.
B.closer to the middle of the chromosome.
C. in the middle of the chromosome.
D.in the telomere.
E.in the satellite part of the chromosome.
36. The karyotype is ...
A.diploid set of chromosomes of a cell.
B.haploid set of chromosomes of the cell.
C.homologous chromosomes.
D.heterochromotin.
E.non-homologous chromosomes.
37.The function of the nucleus is to ....
A. p-RNA synthesis.
B.protein synthesis.
C. synthesis of carbohydrates.
D. fat synthesis.
E. DNA synthesis.
38.A pair of chromatids makes up a ...
A.a chromosome.
B.chromomere.
C. centromere.
D.chromoneme.
E. chromatid.
39.Heterochromatin are ...

A.permanently spiralised sections of chromosomes.
B.spiralised in mitosis and despiralised in interphase sections of chromosomes.
C. the edges of the arms of chromosomes.
D. the middle part of chromosomes.
E.secondary stranding.
40.Telomeres are ...
A.the middle part of the chromosomes.
B.secondary tethering.
A.permanently spiralised sections of chromosomes.
The edges of the arms of chromosomes.
D. sections of chromosomes spiraled in mitosis and dispraised in interphase.
41.The sex U chromosome is a ...chromosome.
A. small acrocentric
B.medium acrocentric
C. metacentric
D. submetacentric
E. large metacentric
42.The "A" group of the karyotype includes ... chromosomes.
A.large acrocentric
B.small metacentric.
C. medium submetacentric
D. almost metacentric
E. small submetacentric.
43.The "B" group of the karyotype includes ... chromosomes.
A.large submetacentric.
B.small acrocentric.
C.medium submetacentric.
D.almost metacentric.
E.small submetacentric.
44.The "C" group of the karyotype includes ... chromosomes.
A. medium submetacentric
B.small acrocentric
C. almost metacentric
D. large submetacentric
E. small submetacentric.
45.The "D" group of the karyotype includes ... chromosomes.
A.medium submetacentric.
B.small acrocentric.
C.medium acrocentric.
D.nearly metacentric.
E.large submetacentric.
46.The "E" group of the karyotype includes ... chromosomes.
A.small submetacentric.
B.small acrocentric.
C.medium submetacentric.

D.nearly metacentric.
E. large submetacentric.
47.The "F" group of the karyotype includes ... chromosomes.
A.small metacentric.
B.small acrocentric.
C.medium submetacentric.
D.large submetacentric.
E. small submetacentric.
48.The "G" group of the karyotype includes ... chromosomes.
A. small acrocentric.
B.medium-sized submetacentric.
C.almost metacentric.
D.large submetacentric.
E. small submetacentric.

II.Cards:

Complete the table. Levels of chromatin compactisation

Fibril	Degree of shortening	Diameter nm.
DNA		**2**
Nucleosome structure		**10**
Elementary chromatin fibril, nucleomer		**30**
Quill-domain structure, chromomeric-chromoneme level, interphase chromoneme		**200-300**
Chromatids		**600-700nm.**
Metaphase chromosome		**600-1400**

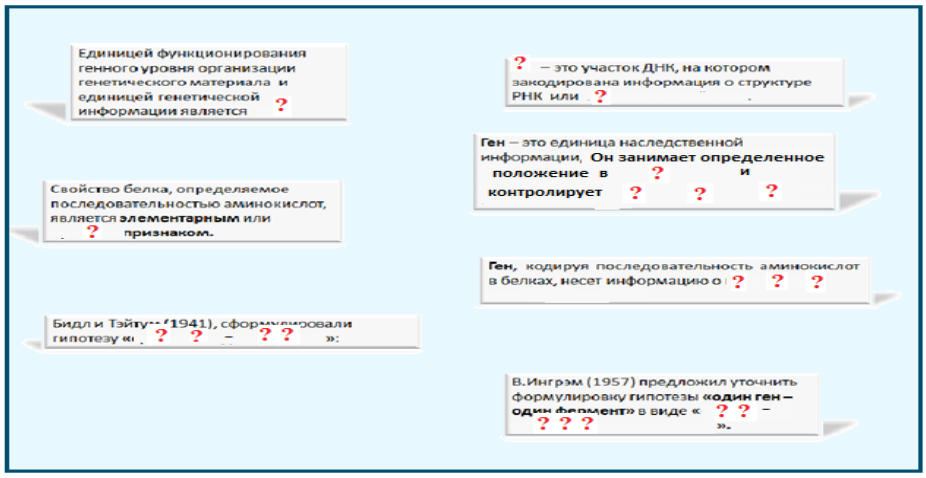
Fill in the table. Classification of chromosomes according to the Denver classification

Chromosome group	Karyotype number	Characterisation of chromosomes
A(I)		
B(II)		
C(III)		
D(IV)		

E(V)		
F(VI)		
G(VII)		
X chromosome (belongs to group III)		
Y chromosome		

Fill in the table.

Fill in the blanks in the definitions:



Fill in the blanks in the definitions:

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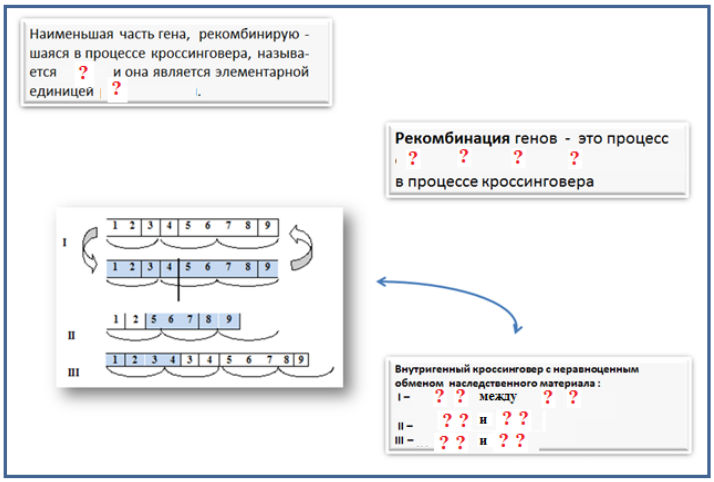

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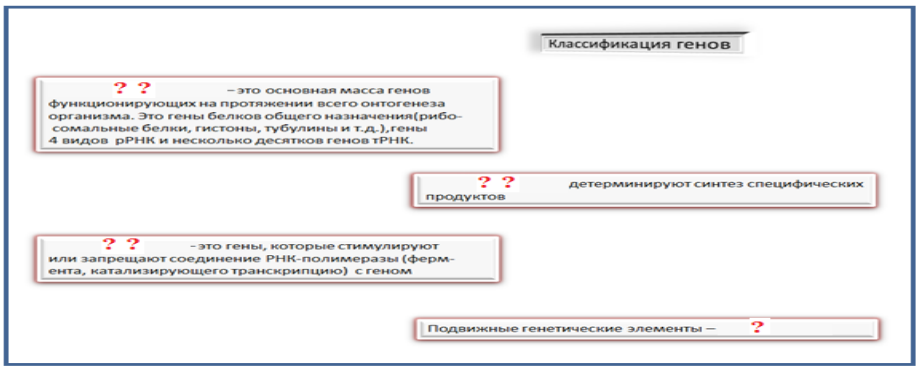
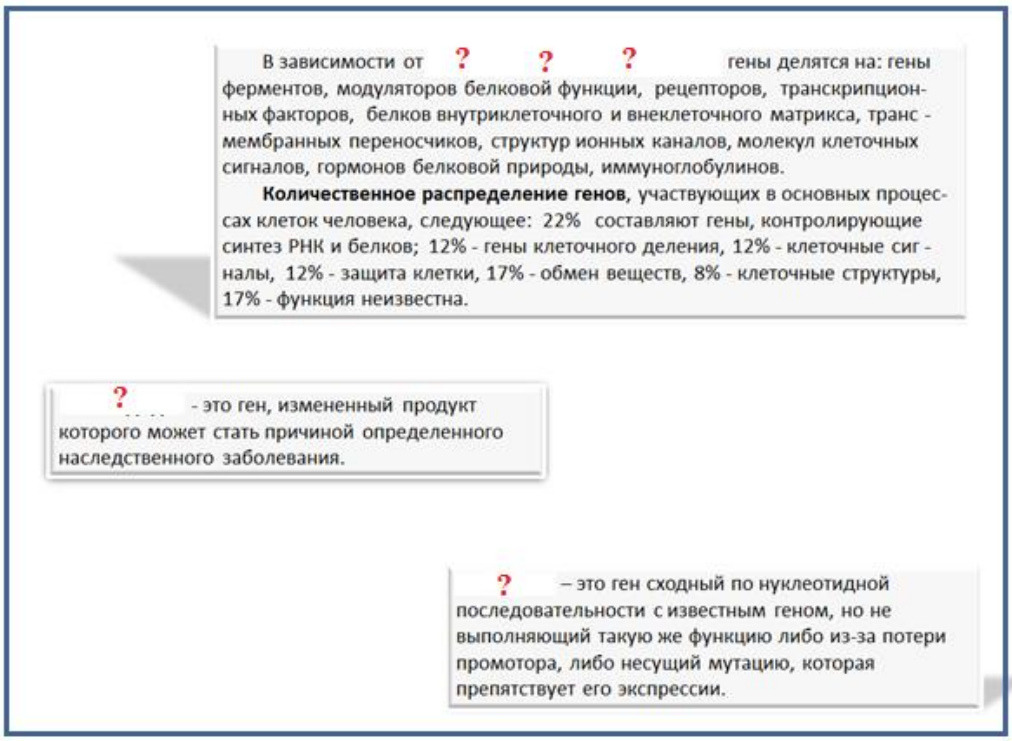
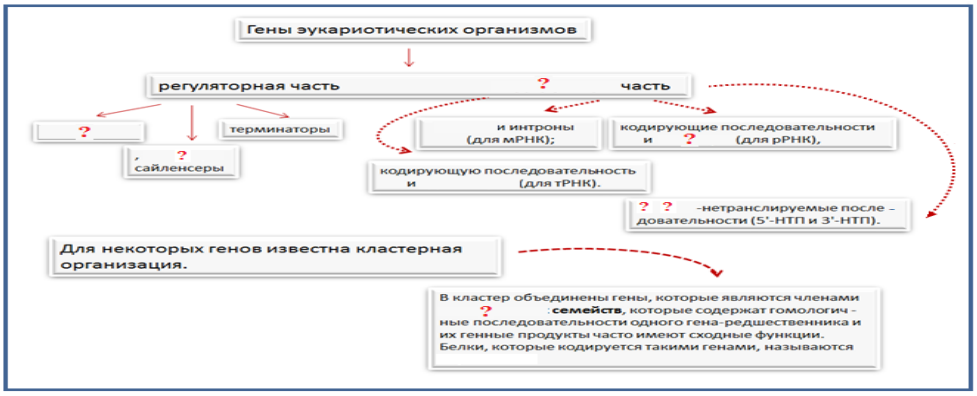


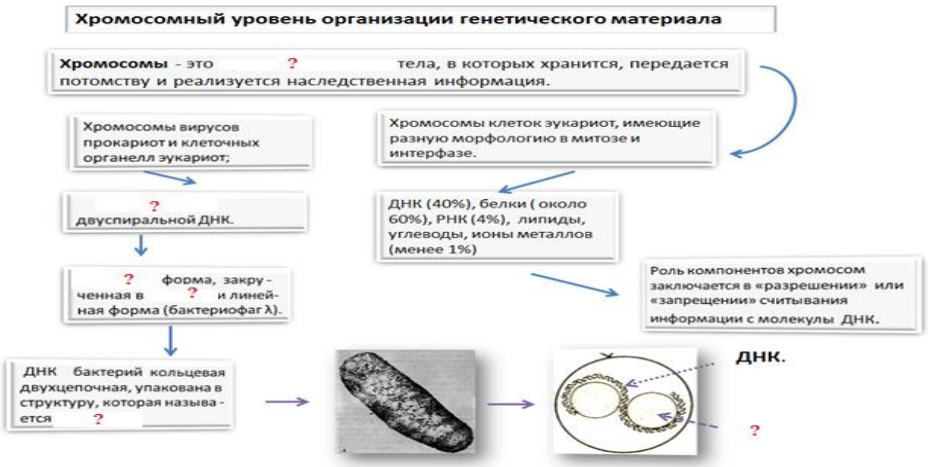
Fill in the blanks in the definitions:



Fill in the blanks in the definitions:



Fill in the blanks in the definitions:



Topic №7: Disorders of genetic homeostasis.

Assignment №1
Correlate:

I Level of occurrence	1.Generative
II By place of origin	2.Biochemical
III By type of allelic relationship	3.Lethal
IV By influence on the viability of the individual	4. Spontaneous
V By nature of manifestation	5.Amorphous
VI By phenotypic origin	6.Genomic
VII By origin	7.Induced
	8. Dominant
	9.Intermediate
	10.Harmful
	11.Somatic
	12.Antimorphic
	13.Neutral
	14.Physiological
	15.Recessive
	16.Hypomorphic
	17.Useful
	18.Morphological
	19.Chromosomal
	20.Genetic
	21.Neomorphic

Answers:

I include_____

II include _____

III include_____

to IV apply_____

to Vотносятся_____

to VIотносятся_____

to VII apply _____

Task № 2

Modification variation	Mutation variability

1.
Arise gradually, have transitional forms.
2.
Occur under the influence of the same factor.
3.
Occur in a discontinuous manner.
4.
May occur repeatedly.
5.
Are not transmitted from generation to generation.
6.
Are reversible.
7.
Can mutate the same and different genes, under the influence of the same factor.
8.
Transmitted from generation to generation.
9.
Phenotype is the basis of existence.
10.
Genotype is the basis of existence.

Task № 3

Modification variation	Mutation variability

Which trait is related to these mutations?

1. The phenotype is within the normal range of response.
2. the chromosomes are unchanged.
3. The form of variability is group.
4. law of homologous series of hereditary variability.
5. Useful changes lead to victory in the struggle for existence.
6. Contributes to survival.
7. DNA molecules are not subject to variability.
8. Selection factor is change in environmental conditions.
9. Inheritance of traits.
10. Increases or decreases productivity.

B1. Complete the expressions:

1. The limits of modification variability is called .....
2. The formation of new combinations of genes in offspring is called _____ variability.

B2*. Complete the expression:

Monosomy, trisomy and polysomy are cases of _____

B4. Relate the types of mutations to the nature of the changes.

CHANGES

TYPES OF MUTATIONS

A) Drosophila has shortened wings.
B) The baby has Down's disease
C) Potatoes produced significantly higher yields after colchicine treatment.
D) Six-fingeredness in humans
E) Albinism in a tiger
E) Klinefelter's syndrome in humans
1) Genetic

2) Genomic

<u>Give a detailed answer.</u>

C1. What are the biological regularities underlying combinatorial variability?

C2. What is the difference between genomic and gene and chromosomal mutations?

NW. What do the law of homological series of hereditary variability and the Mendeleev table have in common?

Control tests FOR THE THEME: "Laws of Variability".

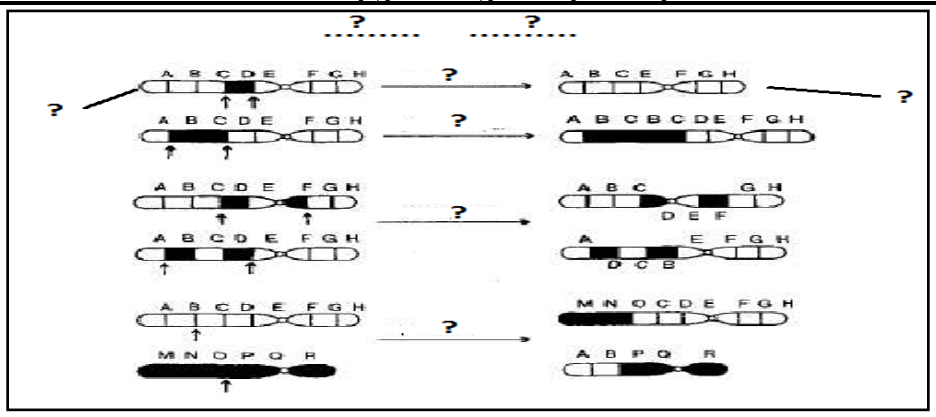
A1. The law of homological series of hereditary variability was formulated by:
1) I.V.Michurin
2)N.I.Vavilov
3)N.V.Timofeev-Resovsky
4) N.K. Koltsov
A2.Specify the incorrect statement:
1) mutations are always useful
2) modifications, as a rule, are useful
3) mutations can be harmful, indifferent and useful
4) combinations of genes do not change their structure
A3. A gene mutation will be characterised by:
1) replacement of a section of the chromosome
2) reversal of the chromosome by 180°
3) doubling of the chromosome set
4) replacement of a nitrogenous base
A4. The reason why a mutation may not manifest phenotypically in the next generation is:
1) its dominance
2) its recessiveness
3) the gene carrying it is in the spermine
4) the gene carrying it is in the ovum
A5. A trait of modification variability is its:
1) group character
2) individuality
3) inheritability
4) combinativity
A6. An attribute of a reaction norm is its:
1) individuality
2) non-inheritability
3) group character
4) maximal manifestation
A7. Select the correct statement:
1) there are 23 pairs of chromosomes in somatic cells of all healthy people
2) genes in all people of the Earth are identical in their manifestation
3) twins born on the same day are called identical.
4) Down's disease is associated with trisomy on the 23rd pair of chromosomes

A8. In autosomal inheritance phenotypic manifestation of recessive allele is possible if it is:
1) in a heterozygous state
2) homozygous state
3) sex-linked
4) in all these cases

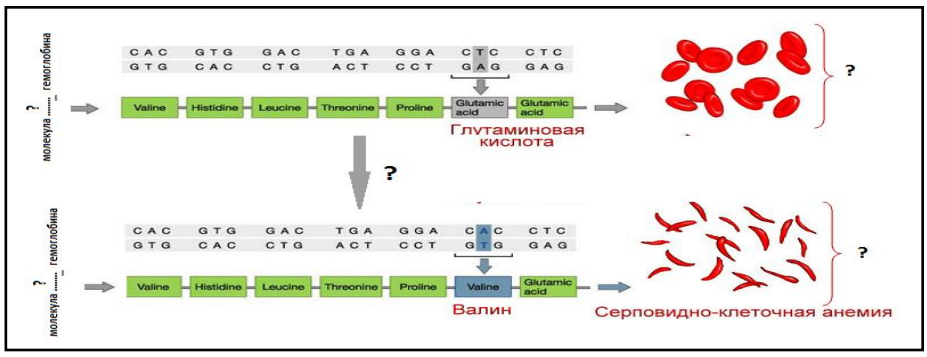
Give a detailed answer.

C1. Does damage to a gene always become a mutation?
C2. Is modification variability useful or harmful to an organism?
C3. Explain the concepts: "broad and narrow reaction norm".

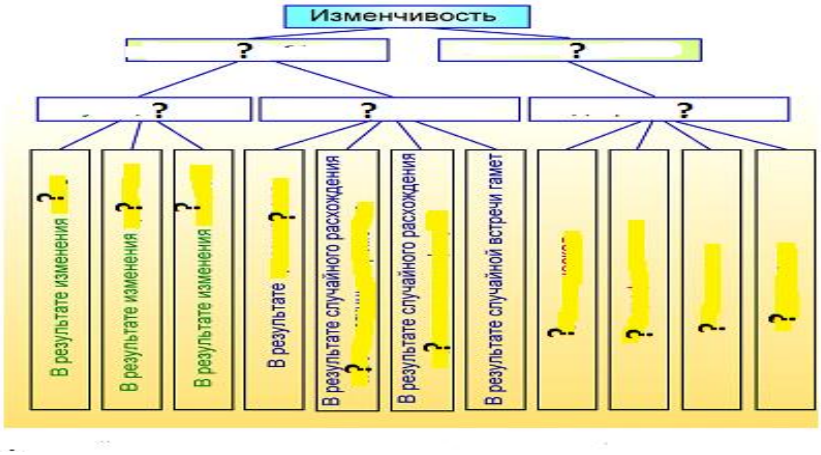
Denote what is indicated in the figure. Sign the parts of the structure indicated by numbers.



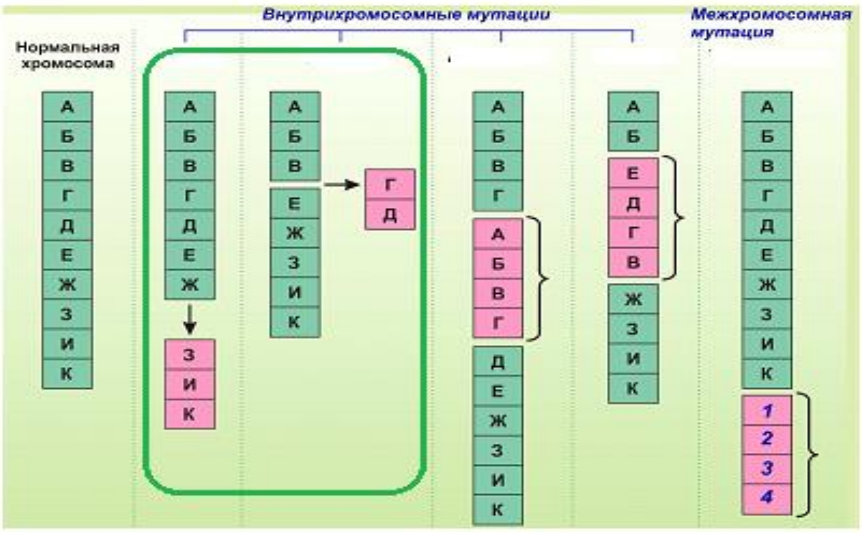
Label what is indicated in the figure. Sign the terms indicated by the questions and define them.



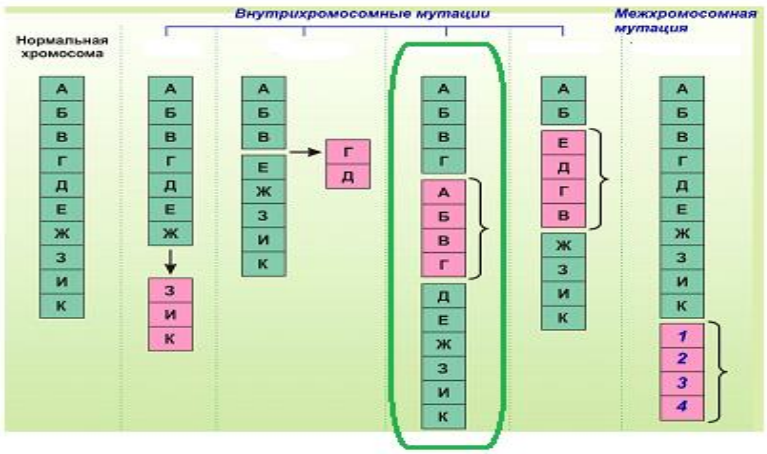
Identify the type of mutation shown in the figure. Sign the terms indicated by the questions and define them.



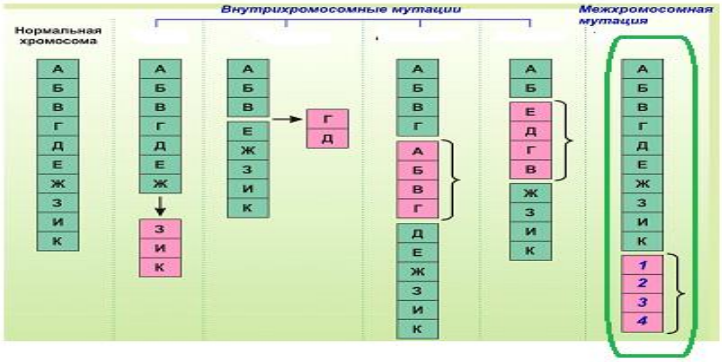
Define the term "variability". Sign the terms indicated by the questions and define them.



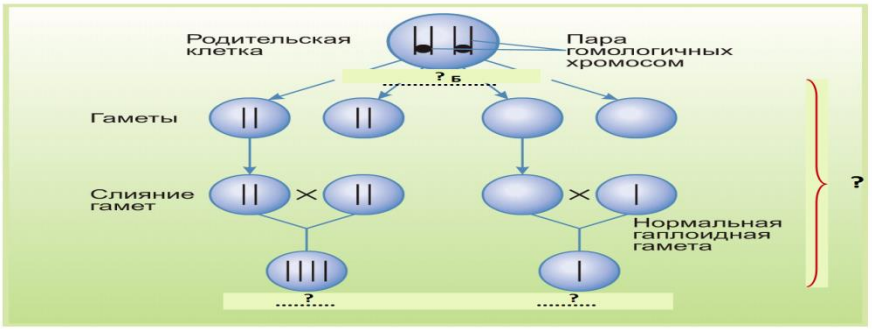
The figure shows the types of chromosomal mutations. Define the term "mutation", "chromosomal mutation" and the type of chromosomal mutation highlighted with an oval.



The figure shows the types of chromosomal mutations. Define the term "mutation", "chromosomal mutation" and the type of chromosomal mutation highlighted by the oval.



The figure shows the types of chromosomal mutations. Define the term "mutation", "chromosomal mutation" and the type of chromosomal mutation highlighted by the oval.



Indicate which processes are indicated in the figure under questions A and B. What disturbance of these processes is shown in the figure? What will the disturbance of these processes cause?

Topic №8: Molecular-genetic methods of genome research.

1.Name 3 main stages of laboratory methods of detection (diagnosis) of hereditary diseases?
2.What is the essence of Cytogenetic method?
3.Describe the Molecular Cytogenetic Method?
4.Molecular - genetic method is aimed at determining what research?
5.Give a diagram of the main steps of the Molecular Genetic Method?
6.What is Amplification and in what cases is it carried out?
7.What is Polymerase Chain Reaction (PCR) and what steps does it consist of?
8.Give a definition of Gel electrophoresis?
9.How does hybridisation of nucleic acids take place?
10. What is Southern blotting, Nostern blotting, Western blotting?
11.What components are necessary for PCR?
12.What are the direct and indirect methods ofDNA diagnosis?
13.What is Molecular Cloning and what steps does it consist of?

14.What organisms are called transgenic or transformed organisms?
15.What is Sequencing?
16. What is gene deletion?
17. Characterise Molecular Cloning Vectors?