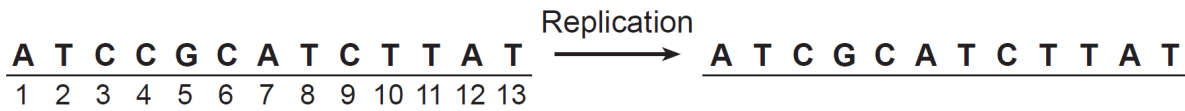


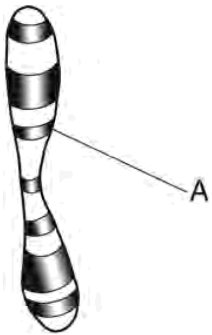
1. The diagram below shows an alteration that occurred during the replication process of a portion of a gene. The numbers identify the locations of specific bases in the sequence



This alteration is most likely the result of

- A) a substitution at base 2                      B) a deletion of base 2  
C) an insertion of base 3                      **D) a deletion of base 4**

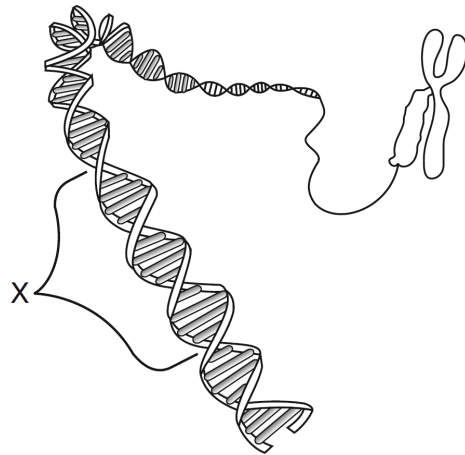
2. Human genetic material is represented in the diagram below.



The region labeled A is made up of a section of

- A) a protein that becomes an enzyme  
**B) DNA that may direct protein synthesis**  
C) a carbohydrate made from amino acids  
D) glucose that may be copied to make DNA

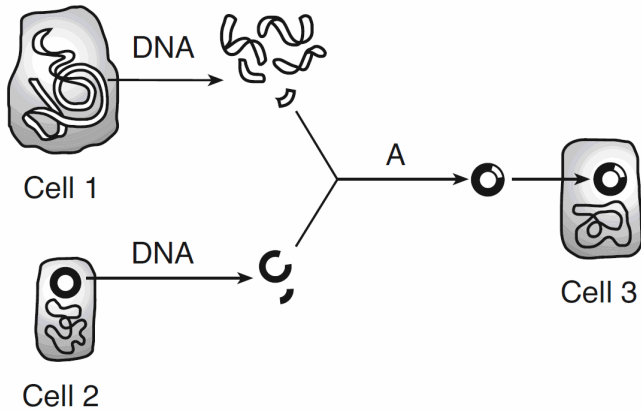
3. The diagram below represents genetic material.



The expression of the section labeled X may be modified by

- A) temperature, only  
B) asexual reproduction  
**C) the environment**  
D) pH, only

4. A laboratory technique is represented in the diagram below. Letter *A* represents a process.



Which specific chemicals are needed to successfully carry out the process shown at *A*?

- A) receptor molecules    B) carbohydrates  
C) **enzymes**                D) starch molecules
5. An alteration of genetic information is shown below.

A-G-T-A-C-C-G-A-T → A-G-T-G-A-T

This type of alteration of the genetic information is an example of

- A) **deletion**                B) insertion  
C) substitution            D) recombination
6. Changing one base in a gene could have the most direct effect on the
- A) function of the membrane of a cell  
B) **sequence of building blocks of a protein found in a cell**  
C) number of mitochondria in a cell  
D) type of carbohydrates synthesized by a cell
7. In a DNA sample, 15% of the bases are thymine (T). What percentage of the bases in this sample are adenine (A)?
- A) **15%**    B) 30%    C) 35%    D) 85%

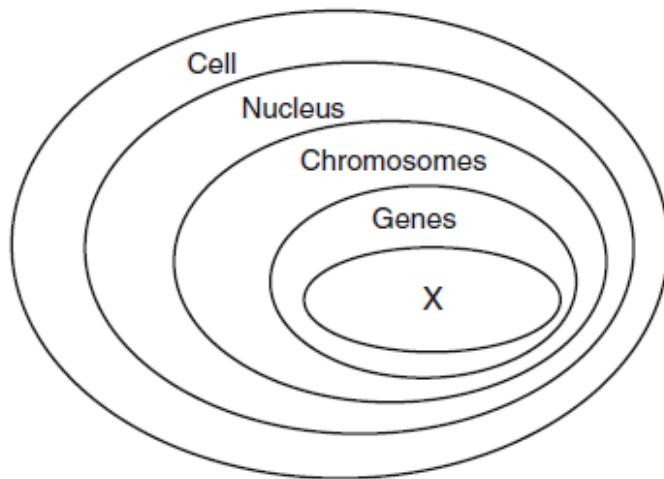
8. Four different segments of a DNA molecule are represented below.

Segment 1	Segment 2	Segment 3	Segment 4
T-A-G-G-C	G-G-T-G-A	G-A-T-T-A	C-A-A-T-G
A-T-C-C-G	C-C-A-C-T	C-C-A-A-T	G-T-T-A-C

There is an error in the DNA molecule in

- A) segment 1, only  
B) segment 3, only  
C) segments 2 and 3  
D) segments 2 and 4

9. The diagram below represents levels of organization within a cell of a multicellular organism.



The level represented by X is composed of

- A) **four types of base subunits**  
B) folded chains of glucose molecules  
C) twenty different kinds of amino acids  
D) complex, energy-rich inorganic molecule

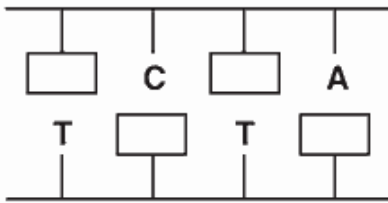
10. The molecule represented below is found in living things.



Which statement describes one characteristic of this molecule?

- A) **It is the template for the replication of genetic information.**  
B) Organic catalysts are made up of these molecules.  
C) It is different in each cell of an organism.  
D) Cell membranes contain many of these molecules.
11. Chromosomes can be described as
- A) large molecules that have only one function  
B) folded chains of bonded glucose molecules  
C) reproductive cells composed of molecular bases  
D) **coiled strands of genetic material**

12. The diagram below represents an incomplete section of a DNA molecule. The boxes represent unidentified bases.



When the boxes are filled in, what will the total number of bases represented by the letter *A* (both inside and outside the boxes) be?

- A) 1    B) 2    C) 3    D) 4
13. Hereditary traits are transmitted from generation to generation by means of
- A) **specific sequences of bases in DNA in reproductive cells**  
 B) proteins in body cells  
 C) carbohydrates in body cells  
 D) specific starches making up DNA in reproductive cells
14. The instructions for the traits of an organism are coded in the arrangement of
- A) glucose units in carbohydrate molecules  
 B) **bases in DNA in the nucleus**  
 C) fat molecules in the cell membrane  
 D) energy-rich bonds in starch molecules

15. The type of molecule represented below is found in organisms.



Which statement correctly describes the sequence of bases found in this type of molecule?

- A) It changes every time it replicates.  
 B) **It determines the characteristics that will be inherited.**  
 C) It is exactly the same in all organisms.  
 D) It directly controls the synthesis of starch within a cell.
16. The weakest bonds in a double-stranded molecule of deoxyribonucleic acid exist between the
- A) deoxyribose sugars  
 B) phosphate groups  
 C) **nitrogenous bases**  
 D) 5-carbon sugars
17. The diagram below represents a portion of a nucleic acid molecule.



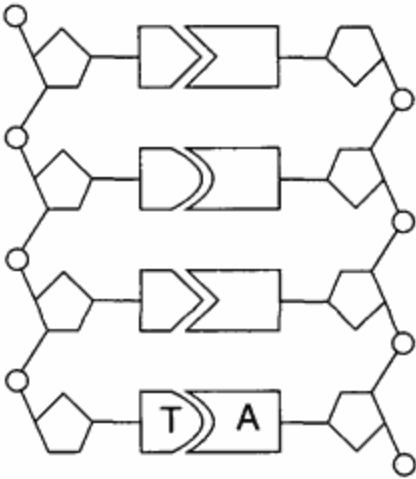
The part indicated by arrow *X* could be

- A) **adenine**                      B) ribose  
 C) deoxyribose                  D) phosphate

18. A DNA nucleotide may contain

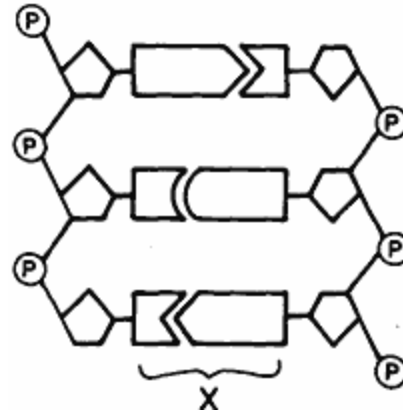
- A) deoxyribose, cytosine, and a lipid
- B) deoxyribose, thymine, and a phosphate group**
- C) ribose, uracil, and a polypeptide
- D) ribose, adenine, and thymine

19. Which statement best describes a portion of the molecule represented below?



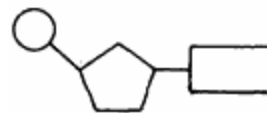
- A) It consists of many ribose sugars.
  - B) It unites with amino acids in the cytoplasm.
  - C) It contains uracil, which functions in protein synthesis.
  - D) It consists of alternating phosphate groups and deoxyribose molecules.**
20. A DNA nucleotide is composed of
- A) carbon, hydrogen, oxygen, nitrogen, and phosphorus**
  - B) carbon, hydrogen, nitrogen, sulfur, and calcium
  - C) calcium, hydrogen, oxygen, phosphorus, and iron
  - D) oxygen, hydrogen, phosphorus, sulfur, and iron

21. The diagram below represents a portion of a DNA molecule.



The letter *X* represents two nitrogenous bases that are

- A) identical and joined by hydrogen bonds
  - B) complementary and joined by hydrogen bonds**
  - C) identical and joined by ionic bonds
  - D) complementary and joined by ionic bonds
22. DNA is a polymer consisting of repeating units known as
- A) dipeptides
  - B) nucleotides**
  - C) amino acids
  - D) organic salts
23. Watson and Crick described the DNA molecule as a
- A) straight chain
  - B) single strand
  - C) double helix**
  - D) branching chain
24. The diagram below represents the building block of a large molecule known as a



- A) protein
- B) fatty acid
- C) carbohydrate
- D) nucleic acid**

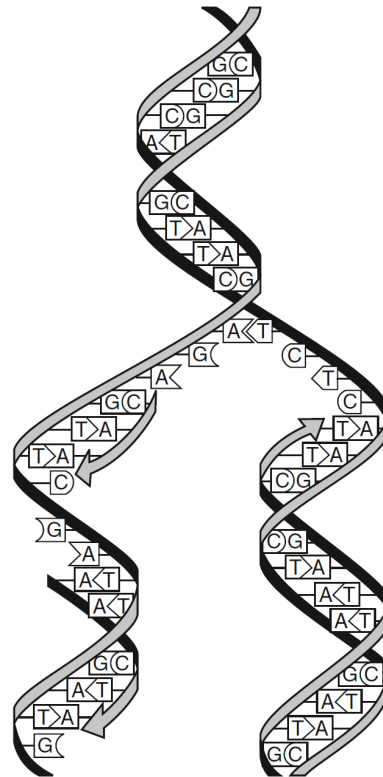
25. The diagram below represents a segment of a gene on two chromosomes.

Normal gene	A	T	A	C	C	T
Mutated gene	A	T	G	C	C	T

The change in the gene sequence is an example of

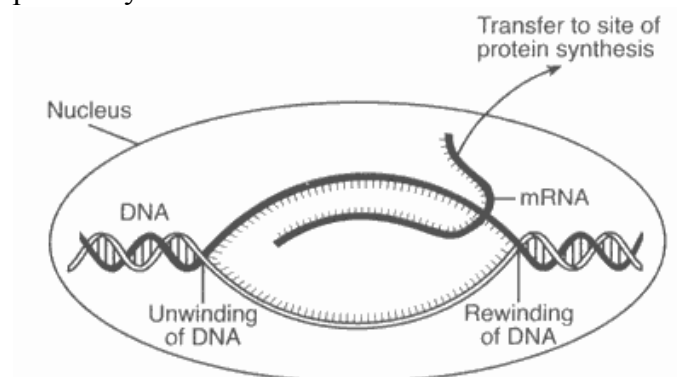
- A) an insertion                      B) a deletion  
**C) a substitution**                  D) a replication
26. What do the letters *A*, *G*, *C*, and *T* represent in nucleotides?
- A) phosphate groups  
 B) deoxyribose sugars  
**C) nitrogenous bases**  
 D) ribose sugars
27. Which is the sugar component of a DNA nucleotide?
- A) adenine                              **B) deoxyribose**  
 C) glucose                                D) phosphate
28. Before a cell divides, an exact copy of each chromosome is made by the process of
- A) genetic engineering  
**B) replication**  
 C) mutation  
 D) recombination

29. The process represented in the diagram below occurs in many cells.



The main function of this process is to

- A) provide an exact copy of the genetic code**  
 B) ensure genetic variation in a species  
 C) synthesize cellular proteins  
 D) produce antibodies to combat disease
30. The diagram below shows some of the steps in protein synthesis?



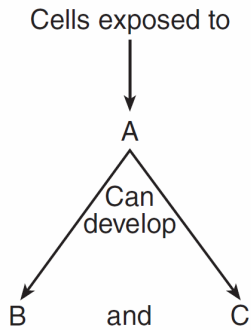
The section of DNA being used to make the strand of mRNA is known as a

- A) carbohydrate                      **B) gene**  
 C) ribosome                              D) chromosome

31. Some bacteria are unable to survive unless a certain nutrient is present in their food supply. After exposure to ultraviolet radiation, some of these bacteria are able to synthesize this nutrient. This change is most likely due to

- A) increased respiration
- B) exposure to an antigen
- C) an alteration in a gene**
- D) gamete formation

32. The diagram below can be used to illustrate cellular changes.



Which row of terms in the chart below best completes the diagram?

Row	A	B	C
(1)	atmospheric oxygen	mutations	increased mitochondria
(2)	radiation	cancer	mutations
(3)	salt water	more cytoplasm	two nuclei
(4)	less sunlight	extra genes	decreased mutations

- A) 1
- B) 2**
- C) 3
- D) 4



33. Base your answer to the following question on the portion of the mRNA codon chart and information below.

AUU } AUC } AUA }	<b>ILE</b> (Isoleucine)	ACU } ACC } ACA }	<b>THR</b> (Threonine)	AAU } AAC }	<b>ASN</b> (Asparagine)	AGU } AGC }	<b>SER</b> (Serine)
AUG }	<b>MET</b> (Methionine)	ACG }		AAA } AAG }	<b>LYS</b> (Lysine)	AGA } AGG }	<b>ARG</b> (Arginine)

Series I represents three mRNA codons. Series II includes a mutation of series I.

Series I AGAUCGAGU

Series II ACAUCGAGU

How would the amino acid sequence produced by the mutant strand (series II) compare to the amino acid sequence produced by series I?

- A) The amino acid sequence would be shorter.
- B) One amino acid in the sequence would change.**
- C) The amino acid sequence would remain unchanged.
- D) More than one amino acid in the sequence would change.

34. Synthesis of a defective protein may result from an alteration in

- A) vacuole shape
- B) the number of mitochondria
- C) a base sequence code**
- D) cellular fat concentration

35. In the portions of the DNA molecules below, *X* represents the base sequence of strand I in the original DNA molecule, and *Y* represents the base sequence of strand I in the newly formed DNA molecule.

*X*: A-T-G-C-C-A-T-A-G

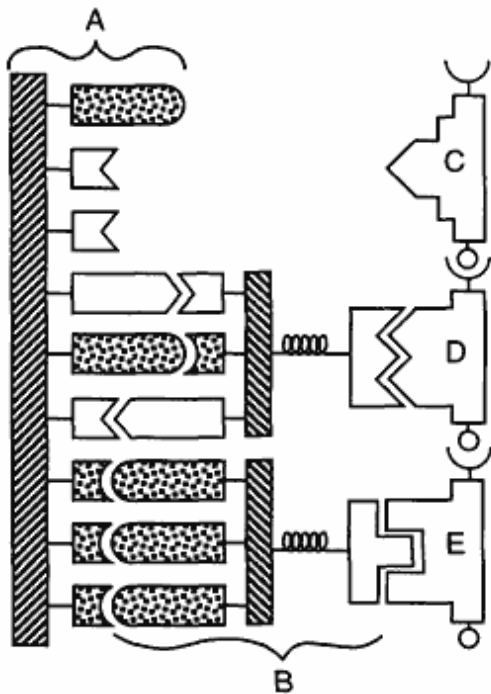
*Y*: A-T-G-C-C-A-A-T-G

The base sequence in *Y* is an example of

- A) polyploidy
- B) a chromosome deletion
- C) a gene mutation**
- D) translocation



Base your answers to questions 36 and 37 on the diagram below, which represents some components involved in cellular protein synthesis, and on your knowledge of Biology.



36. The type of molecule represented at *A* is synthesized according to a template found in

- A) DNA                      B) RNA  
C) dipeptides              D) amino acids

37. How many codons are located on the messenger RNA molecule in the diagram?

- A) 1      B) 6      C) 3      D) 9

38. In the synthesis of proteins, what is the function of messenger-RNA molecules?

- A) They act as a template for the synthesis of DNA.  
**B) They carry information that determines the sequence of amino acids.**  
 C) They remove amino acids from the nucleus.  
 D) They carry specific enzymes for dehydration synthesis.

39. A sequence of three nitrogenous bases in a messenger-RNA molecule is known as a

- A) **codon**                      B) gene  
C) polypeptide                D) nucleotide

40. Which base is normally used in the synthesis of RNA but *not* in the synthesis of DNA?

- A) adenine                      **B) uracil**  
C) cytosine                      D) guanine

41. If a portion of a messenger RNA molecule contains the base sequence A-A-U, the corresponding transfer RNA base sequence is

- A) A-A-U                      B) G-G-T  
C) T-T-C                      **D) U-U-A**

42. What is the complementary messenger-RNA sequence for the DNA sequence shown below?

C A A G G T

- A) C-A-A-G-G-U              B) G-T-T-C-C-A  
**C) G-U-U-C-C-A**              D) C-A-A-G-G-T

43. Which nucleic acid carries instructions from the nucleus to the cytoplasm?

- A) DNA, only  
**B) Messenger RNA, only**  
 C) Transfer RNA, only  
 D) DNA, messenger RNA, and transfer RNA

44. In a cell, the transfer of genetic information from DNA to RNA occurs in the

- A) cell membrane  
 B) endoplasmic reticulum  
**C) nucleus**  
 D) nucleolus

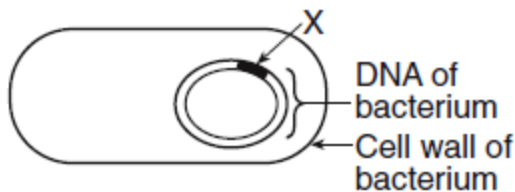
45. Which chemical components may be parts of a molecule of transfer RNA?

- A) ribose, phosphate group, uracil base**  
 B) deoxyribose, phosphate group, guanine base  
 C) glucose, amino group, thymine base  
 D) maltose, carboxyl group, uracil base

46. Which statement best describes messenger RNA?

- A) It transfers polypeptides to the nucleus.  
 B) It is chemically more complex than DNA.  
 C) It has one oxygen atom less than DNA.  
**D) It is composed of a single strand of nucleotides.**

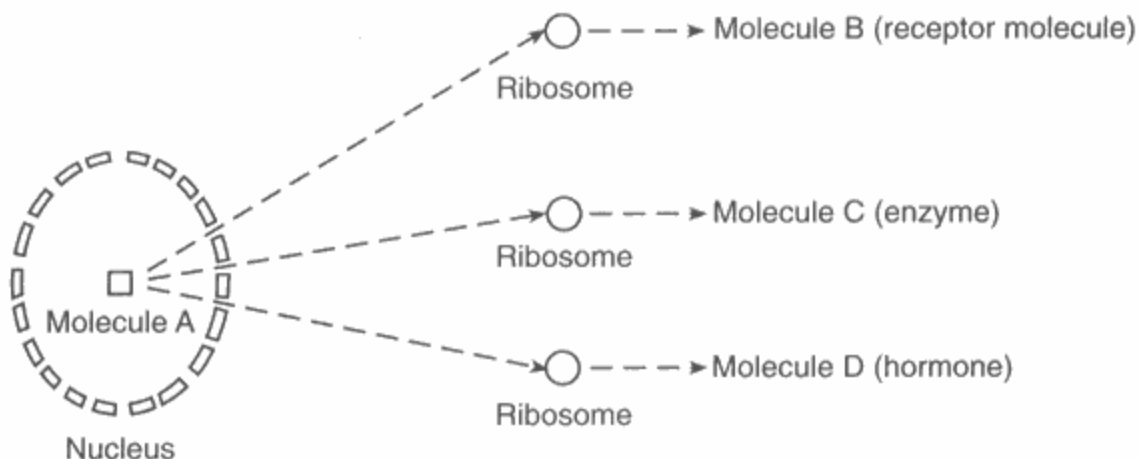
- 
47. Two types of RNA molecules are
- A) uracil and adenine
  - B) messenger RNA and transfer RNA**
  - C) cytosine and thymine
  - D) transfer RNA and translocation RNA
48. The diagram below shows some of the DNA in a bacterium into which a human gene, *X*, has been successfully inserted.



- The bacteria that result from reproduction of this cell will most likely have the ability to
- A) replicate all of the genetic instructions found in humans
  - B) produce vaccines to be used to immunize humans
  - C) produce a human blood cell according to instructions in gene *X*
  - D) produce the human protein coded for by gene *X***
49. The inability of an organism to produce certain proteins can occur when an organism is lacking an enzyme needed to combine
- A) oxygen molecules
  - B) simple sugars
  - C) amino acids**
  - D) biological catalysts
50. DNA is able to control cellular activities most directly by regulating the process of
- A) meiotic division
  - B) protein synthesis**
  - C) active transport
  - D) selective breeding
51. In a cell, protein synthesis is the primary function of
- A) ribosomes**
  - B) mitochondria
  - C) chloroplasts
  - D) vacuoles
-

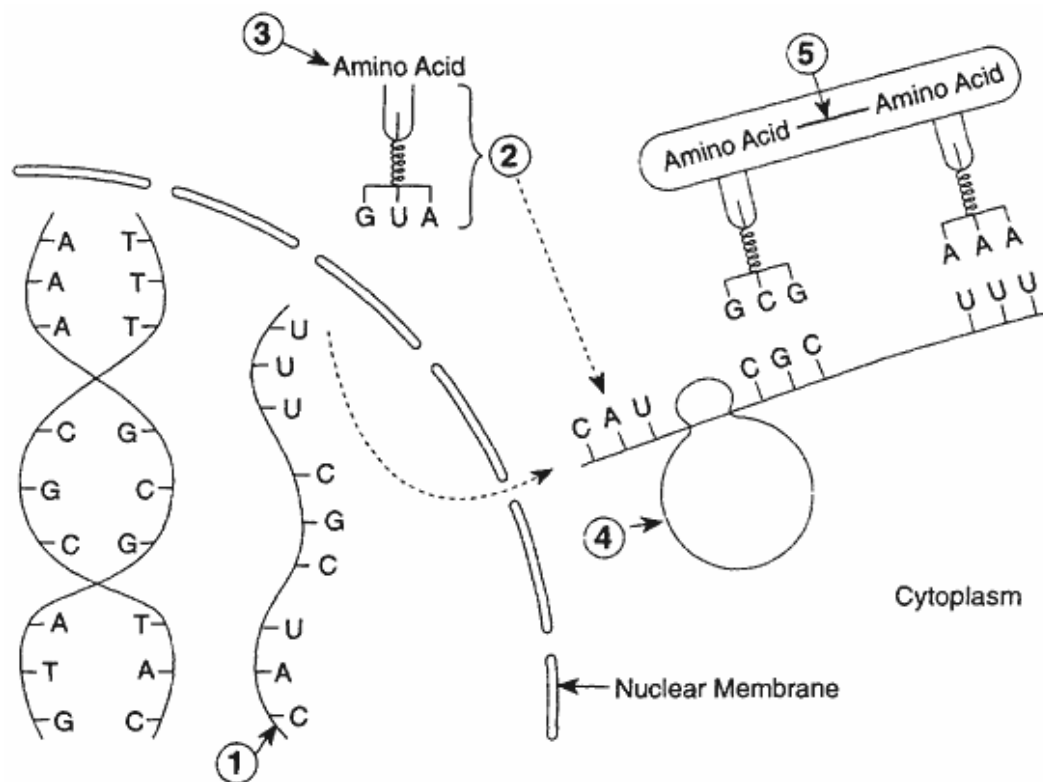
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Base your answers to questions 52 and 53 on the diagram below, which represents a sequence of events in a biological process that occurs within human cells and on your knowledge of biology.



52. Molecules B, C, and D are similar in that they are usually
- A) they are usually composed of genetic information
  - B) they are usually involved in the synthesis of antibiotics
  - C) they are usually composed of amino acids**
  - D) they are usually involved in the diffusion of oxygen into the cell
53. Molecule A contains the
- A) starch necessary for ribosome synthesis in the cytoplasm
  - B) organic substance that is broken down into molecules B, C, and D
  - C) proteins that form the ribosome in the cytoplasm
  - D) directions for the synthesis of molecules B, C, and D**
- 
54. A change in the order of DNA bases that code for a respiratory protein will most likely cause
- A) the production of a starch that has a similar function
  - B) the digestion of the altered gene by enzymes
  - C) a change in the sequence of amino acids determined by the gene**
  - D) the release of antibodies by certain cells to correct the error
-

Base your answers to questions 55 and 56 on the diagram below, which represents some biochemical reactions involved in a cellular process.



55. What is the bond labeled 5 known as?

- A) a peptide bond  
 B) a hydrogen bond  
 C) an ionic bond  
 D) a carboxyl bond

56. What is an example of a molecule produced by this type of process?

- A) glucose      B) glycogen      C) a fatty acid      **D) a protein**

57. Four stages in the production of protein molecules in a cell are listed below.

*A* – Transfer RNA molecules bring amino acids to the ribosome

*B* – DNA molecules serve as templates for messenger RNA molecules.

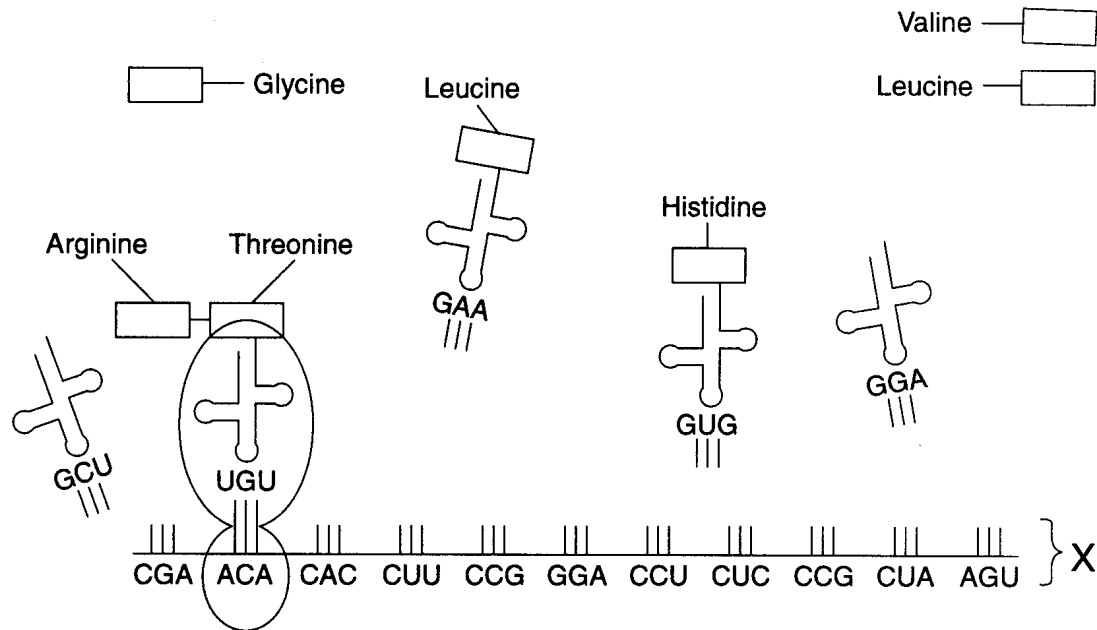
*C* – Messenger RNA molecules move to ribosomes.

*D* – Polypeptides are formed on ribosomes.

Which sequence best represents the correct order of these stages?

- A) *A* → *B* → *C* → *D*      **B) *B* → *C* → *A* → *D***  
 C) *C* → *B* → *A* → *D*      D) *D* → *B* → *A* → *C*

Base your answers to questions 58 through 60 on the diagram below of a biochemical process and on your knowledge of biology.



58. Which amino acid would be transferred to the position of codon CAC?
- A) leucine      B) glycine      C) valine      **D) histidine**
59. The synthesis of structure X occurred in the
- A) nucleus**      B) cytoplasm      C) lysosome      D) vacuole
60. The biochemical process represented in the diagram is most closely associated with the cell organelle is known as the
- A) nucleolus      **B) ribosome**      C) chloroplast      D) mitochondrion

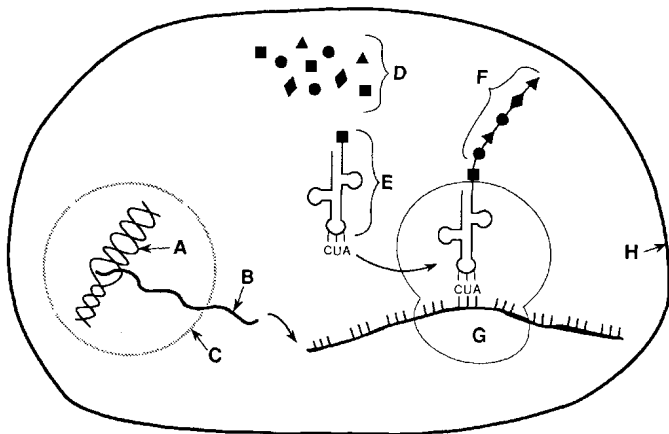
Base your answers to questions 61 and 62 on the chart below and on your knowledge of biology.

**Messenger RNA (mRNA) Codes for Selected Amino Acids**

Amino Acid	mRNA Code
Leucine	C-C-A
Arginine	C-G-A
Phenylalanine	U-U-U
Valine	G-U-U
Lysine	A-A-A

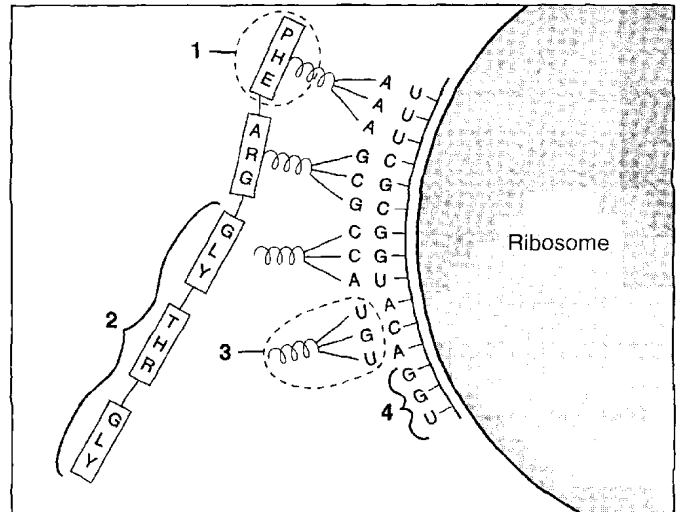
61. Which amino acid will be carried to a ribosome by a transfer RNA molecule containing the triplet code A-A-A?
- A) valine      B) lysine  
C) leucine      **D) phenylalanine**
62. Which base sequence of a DNA molecule produces a codon on an mRNA molecule that will allow the amino acid arginine to be incorporated into a protein?
- A) C-G-A      **B) G-C-T**  
C) C-G-U      D) G-C-U
63. Amino acid molecules are bonded together in a specific sequence on cell structures known as
- A) ribosomes**      B) vacuoles  
C) mitochondria      D) centromeres
64. Which of the following nucleic acids combines directly with amino acids?
- A) DNA, only  
B) Messenger RNA, only  
**C) Transfer RNA, only**  
D) DNA, messenger RNA, and transfer RNA

Base your answers to questions 65 through 67 on the diagram below which represents protein synthesis within a cell and on your knowledge of biology.



65. Which letter indicates the building blocks of a protein?  
 A) *E*    B) *B*    C) *G*    **D) *D***
66. Which letter indicates part of a polypeptide chain?  
 A) *A*    B) *E*    **C) *F***    D) *G*
67. Which letter indicates the site of protein synthesis?  
 A) ***G***    B) *H*    C) *C*    D) *D*
- 
68. What is the function of transfer RNA molecules in the synthesis of proteins?  
 A) They provide nucleotides for messenger RNA production.  
 B) They carry genetic instructions to the nucleus.  
**C) They pick up and transport amino acids to the ribosomes.**  
 D) They are chemically changed into amino acids.
69. The correct order of molecules involved in protein synthesis is  
 A) messenger RNA, transfer RNA, DNA, polypeptide  
 B) DNA, messenger RNA, polypeptide, transfer RNA  
 C) transfer RNA, polypeptide, DNA, messenger RNA, DNA  
**D) DNA, messenger RNA, transfer RNA, polypeptide**

Base your answers to questions 70 through 72 on the diagram below and on your knowledge of biology.



70. Number 4 represents a  
 A) gene    B) nucleotide  
**C) codon**    D) sugar
71. Number 2 indicates part of a compound known as a  
 A) nucleic acid    B) polysaccharide  
 C) lipid    **D) polypeptide**
72. The DNA code for structure 1 is  
 A) U-U-U    B) T-T-T  
**C) A-A-A**    D) P-H-E
- 
73. What is the relationship between an organism's DNA and protein specificity?  
 A) DNA becomes a specific part of the protein structure.  
 B) DNA determines the ribosomal RNA sequence that becomes part of the protein structure.  
 C) DNA determines which RNA molecules are incorporated into protein molecules.  
**D) DNA determines the amino acid sequence of each protein.**
74. The genetic code for one amino acid molecule consists of  
 A) five sugar molecules  
 B) two phosphates  
**C) three nucleotides**  
 D) four hydrogen bonds

**Answer Key**  
**DNA and Protein Synthesis**

- |     |          |     |          |     |          |
|-----|----------|-----|----------|-----|----------|
| 1.  | <u>D</u> | 37. | <u>C</u> | 73. | <u>D</u> |
| 2.  | <u>B</u> | 38. | <u>B</u> | 74. | <u>C</u> |
| 3.  | <u>C</u> | 39. | <u>A</u> |     |          |
| 4.  | <u>C</u> | 40. | <u>B</u> |     |          |
| 5.  | <u>A</u> | 41. | <u>D</u> |     |          |
| 6.  | <u>B</u> | 42. | <u>C</u> |     |          |
| 7.  | <u>A</u> | 43. | <u>B</u> |     |          |
| 8.  | <u>B</u> | 44. | <u>C</u> |     |          |
| 9.  | <u>A</u> | 45. | <u>A</u> |     |          |
| 10. | <u>A</u> | 46. | <u>D</u> |     |          |
| 11. | <u>D</u> | 47. | <u>B</u> |     |          |
| 12. | <u>C</u> | 48. | <u>D</u> |     |          |
| 13. | <u>A</u> | 49. | <u>C</u> |     |          |
| 14. | <u>B</u> | 50. | <u>B</u> |     |          |
| 15. | <u>B</u> | 51. | <u>A</u> |     |          |
| 16. | <u>C</u> | 52. | <u>C</u> |     |          |
| 17. | <u>A</u> | 53. | <u>D</u> |     |          |
| 18. | <u>B</u> | 54. | <u>C</u> |     |          |
| 19. | <u>D</u> | 55. | <u>A</u> |     |          |
| 20. | <u>A</u> | 56. | <u>D</u> |     |          |
| 21. | <u>B</u> | 57. | <u>B</u> |     |          |
| 22. | <u>B</u> | 58. | <u>D</u> |     |          |
| 23. | <u>C</u> | 59. | <u>A</u> |     |          |
| 24. | <u>D</u> | 60. | <u>B</u> |     |          |
| 25. | <u>C</u> | 61. | <u>D</u> |     |          |
| 26. | <u>C</u> | 62. | <u>B</u> |     |          |
| 27. | <u>B</u> | 63. | <u>A</u> |     |          |
| 28. | <u>B</u> | 64. | <u>C</u> |     |          |
| 29. | <u>A</u> | 65. | <u>D</u> |     |          |
| 30. | <u>B</u> | 66. | <u>C</u> |     |          |
| 31. | <u>C</u> | 67. | <u>A</u> |     |          |
| 32. | <u>B</u> | 68. | <u>C</u> |     |          |
| 33. | <u>B</u> | 69. | <u>D</u> |     |          |
| 34. | <u>C</u> | 70. | <u>C</u> |     |          |
| 35. | <u>C</u> | 71. | <u>D</u> |     |          |
| 36. | <u>A</u> | 72. | <u>C</u> |     |          |
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