1) What is a definition of the term "gene"?
   A) a transfer-RNA nucleotide sequence specific for a particular amino acid
   B) three messenger-RNA nucleotides coded for a specific amino acid
   C) a sequence of nucleotides that directs the synthesis of a product, such as a protein
   D) the number of nitrogenous bases in a nucleotide

2) The parts of a DNA nucleotide are indicated in the chart below by letters A, B, and C. An X indicates which chemical elements are present in each part.

<table>
<thead>
<tr>
<th>DNA Nucleotide Parts</th>
<th>Elements</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>X X X</td>
</tr>
<tr>
<td>B</td>
<td>X X X</td>
</tr>
<tr>
<td>C</td>
<td>X X X X</td>
</tr>
</tbody>
</table>

Which diagram represents a DNA nucleotide?

A) 

B) 

C) 

D) 

3) Which statement best describes messenger RNA?
   A) It has one oxygen atom less than DNA.
   B) It transfers polypeptides to the nucleus.
   C) It is composed of a single strand of nucleotides.
   D) It is chemically more complex than DNA.

4) The correct order of molecules involved in protein synthesis is
   A) DNA, messenger RNA, transfer RNA, polypeptide
   B) transfer RNA, polypeptide, DNA, messenger RNA, DNA
   C) DNA, messenger RNA, polypeptide, transfer RNA
   D) messenger RNA, transfer RNA, DNA, polypeptide

5) The diagram below shows a portion of a DNA molecule.

The base sequence of the unlabeled strand shown in the diagram is most likely
   A) G-A-G-U
   B) C-U-C-A
   C) G-A-G-T
   D) T-C-T-G

6) Select the type of nucleic acid molecule that is best described by the phrase below.
   Carry genetic information from the nucleus to the ribosomes
   A) Neither DNA nor RNA molecules
   B) Both DNA and RNA molecules
   C) DNA molecules, only
   D) RNA molecules, only
7) Which chemical components may be parts of a molecule of transfer RNA?
   A) glucose, amino group, thymine base
   B) maltose, carboxyl group, uracil base
   C) deoxyribose, phosphate group, guanine base
   D) ribose, phosphate group, uracil base

8) In the section of a molecule of DNA below, structure 2 represents guanine and structure 5 represents adenine.

Which structures in the diagram represent a cytosine nucleotide?
   A) 1, 4, and 5  B) 1, 2, and 3  C) 6, 1, and 4  D) 3, 1, and 6

9) In the diagram below, which letter indicates a section of the molecule that includes all the components of a nucleotide?
   A) A  B) B  C) C  D) D
Questions 10 through 12 refer to the following:

The diagram below represents a biochemical process that occurs in a cell.

10) The arrangement of the nitrogenous bases at region Y was determined by the
   A) number of ATP molecules in the cytoplasm          C) type of amino acids present in the cytoplasm
   B) sequence of nucleotides in DNA                  D) concentration of enzyme in region Z

11) A change in the region labeled Y from U-C-G to U-G-C would most likely cause
   A) the formation of recombinant DNA                C) crossing-over
   B) the synthesis of a different polypeptide         D) polyploidy

12) The organelle labeled Z represents a
   A) Golgi body                                      B) mitochondrion
   C) nucleus                                         D) ribosome

13) Which pair of molecules, when bonded together, would most likely be found in a nucleotide of DNA?
   A) deoxyribose and uracil                         C) deoxyribose and guanine
   B) ribose and thymine                             D) ribose and adenine

14) Which diagram best represents a basic structural unit of DNA?

   **KEY:**
   P = Phosphate, D = Deoxyribose sugar, R = Ribose sugar, U = Uracil, A = Adenine
   A) P---R---A                                      B) P---R---U
   C) P---D---A                                      D) P---D---U

15) The DNA molecule has a ladder-type structural organization. Each rung of this ladder represents
   A) alternating phosphate and glucose molecules     C) a random organization of proteins and lipids
   B) ribose molecules                                D) a pair of nitrogenous bases
16) In the chart below, X indicates that a component is present within a substance.

<table>
<thead>
<tr>
<th>Components</th>
<th>Substance 1</th>
<th>Substance 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Compound A</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Compound B</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Cytosine</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Guanine</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Thymine</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Adenine</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Uracil</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Phosphate</td>
<td>X</td>
<td>X</td>
</tr>
</tbody>
</table>

Substances 1 and 2 are most likely
A) DNA and ATP  B) DNA and RNA  C) ATP and ICF  D) RNA and ATP

17) Select the type of nucleic acid molecule that is best described by the phrase below.

Consist of chains of nucleotides
A) Both DNA and RNA molecules  C) DNA molecules, only
B) Neither DNA nor RNA molecules  D) RNA molecules, only

18) The diagram below represents molecular structures involved in protein synthesis.

Structure 1 represents
A) part of a polypeptide chain  C) a portion of a DNA molecule
B) the building blocks of proteins  D) a portion of an RNA molecule
Questions 19 through 21 refer to the following:

The diagram below represents a DNA molecule.

19) Which substances would not be found in RNA?
   A) 3 and 1 B) 1 and C C) 1 and 4 D) 3 and G
20) Structure 3 represents a
   A) base B) phosphate C) ribose sugar D) deoxyribose sugar
21) The base sequence of strand X is
22) A DNA molecule is a polymer composed of subunits known as
   A) disaccharides B) nucleotides C) uracil molecules D) ribose sugars
23) In 1973, Stanley Cohen and Herbert Boyer inserted a gene from an African clawed frog into a bacterium. The bacterium then began producing a protein directed by the code found on the inserted frog gene. Analysis of the DNA from both the frog and the bacterium would reveal that
   A) frog DNA contains thymine, but bacterial DNA contains uracil
   B) DNA from both organisms contains the sugar ribose
   C) frog DNA is single stranded, but bacterial DNA is double stranded
   D) DNA from both organisms is composed of repeating nucleotide units
24) The diagram below represents a portion of an organic molecule.

In the diagram above, what is represented by ?
   A) simple sugar B) nucleotide C) codon D) nucleic acid
25) In recent research, a specific DNA code for an organic catalyst was removed from each of three different species of soil bacteria. Using these DNA codes, a single bacterium capable of synthesizing the three different organic catalysts was produced. Which technique was used to produce this new bacterium?
A) translocation  
B) mutagen screening  
C) hybridization  
D) genetic engineering

26) Which compound is not part of a DNA nucleotide?
A) ribose  
B) thymine  
C) deoxyribose  
D) adenine

27) Select the type of nucleic acid molecule that is best described by the phrase below.
May contain adenine, cytosine, guanine, and thymine
A) RNA molecules, only  
B) DNA molecules, only  
C) Neither DNA nor RNA molecules  
D) Both DNA and RNA molecules

28) In nucleotides, the letters A, G, C, and T represent
A) phosphate groups  
B) ribose sugars  
C) nitrogenous bases  
D) deoxyribose sugars

29) Select the type of nucleic acid molecule that is best described by the phrase below.
Are present in the nucleus of the cell
A) RNA molecules, only  
B) DNA molecules, only  
C) Both DNA and RNA molecules  
D) Neither DNA nor RNA molecules

30) Deoxyribonucleic acid molecules serve as a template for the synthesis of molecules of
A) lipids  
B) messenger RNA  
C) amino acids  
D) carbohydrates