1. Give the purpose of each of the following steps in the process of protein synthesis.
   a) Ribosome moving along a mRNA: (1 mark)
   b) Adenine bonding to thymine: (1 mark)
   c) Forming of peptide bonds: (1 mark)

2. If adenine is located on strand Z as shown, then on strand X at the same location must be

3. Using the table below, list three structural differences between RNA and DNA. (3 marks)

<table>
<thead>
<tr>
<th>DNA</th>
<th>RNA</th>
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<tr>
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</tbody>
</table>

4. A section of DNA has the following sequence of nitrogenous bases: CGA TTA CAG

   Which of the following sequences would be produced as a result of transcription?
   A. CGT UUT CTG  B. GCT AAT GTC
   C. CGA UUA CAG  D. GCU AAU GUC

5. a) Define recombinant DNA. (1 mark)

   b) Describe two uses for recombinant DNA. (2 marks)
6.

| Three-letter codons of messenger RNA, and the amino acids specified by the codons |
|---------------------------------|---------------------------------|---------------------------------|---------------------------------|---------------------------------|
| AAU | Asparagine                  | CAU | Asparagine                  | GAU | Asparagine                  | UAU | Tyrosine                     |
| AAA | Lysine                      | CAA | Histidine                   | GAA | Glutamic acid                | UAA | Stop                          |
| AAG | Lysine                      | CAG | Glutamine                   | GAG | Glutamic acid                | UAG | Stop                          |
| ACU | Threonine                   | CCC | Proline                     | GCC | Alanine                       | UCU | Serine                        |
| ACC | Threonine                   | CCA | Proline                     | GCA | Alanine                       | UCC | Serine                        |
| ACA | Threonine                   | CGG | Proline                     | GCG | Alanine                       | UCA | Serine                        |
| ACG | Threonine                   | CGG | Proline                     | UCU | Serine                        |
| AGU | Serine                      | CGG | Arginine                    | UGC | Cysteine                      |
| AGC | Serine                      | CGG | Arginine                    | UGA | Stop                          |
| AGA | Arginine                    | CGG | Arginine                    | UGG | Tryptophan                    |
| AGG | Arginine                    | CGG | Arginine                    | UGU | Cysteine                      |

a) Given the DNA sequence **CACGTATGCAAATT**, use the table above to describe the primary structure of the protein it would transcribe.

b) A strand of DNA has the following bases: **CACGGCC**
If the adenine base was deleted, which amino acids would be coded for?

A. valine, proline  
B. glycine, alanine  
C. proline, arginine  
D. glycine, arginine

c) Determine the sequence of amino acids produced by this DNA sequence: **GGAGTTTTC**

A. Proline, Valine, Lysine.  
B. Glycine, Valine, Leucine.  
C. Proline, Glutamine, Lysine.  
D. Glycine, Glutamic acid, Leucine.

d) A tRNA molecule with the anticodon GCU would be carrying the amino acid

A. valine.  
B. alanine.  
C. tyrosine.  
D. arginine.

e) If the code for an amino acid is AGC on the DNA molecule, the anticodon on the tRNA would be

A. AGC  
B. TGC  
C. UCG  
D. UGC

f) If the triplet code on a DNA molecule changes from ACT to AGC, the result is called

A. mutation.  
B. metastasis.  
C. translation.  
D. transcription.

g) Read the strand of DNA from left to right: **T G A G C G C C T A A A T T**

a) Give the order of the bases in the m-RNA strand that would be transcribed from the above section of DNA. (1 mark)

b) Give the sequence of amino acids in the protein molecule that is synthesized from the above sequence of DNA. (2 marks)

c) If the underlined base C is deleted, what effect will this have on the protein being synthesized? (1 mark)

7. The molecule represented by the line labelled X is

A. DNA.  
B. tRNA.  
C. rRNA.  
D. mRNA.
8. Demonstrate your understanding of the structure of DNA by describing the following features of the DNA molecule. You may use drawings in your answers.
   a) Describe the **shape** of the DNA molecule. (1 mark)
   b) Describe the **structure** of the strands (backbone) of DNA. (1 mark)
   c) **Describe** complementary base pairing. (1 mark)
   d) **Describe** the bonding that occurs between bases. (1 mark)

9. Give **one** role of each of the following in the process of translation. (3 marks: 1 mark each)
   - tRNA:
   - Ribosome:
   - mRNA:

10. The process shown in the diagram is
    A. hydrolysis.  
    B. translation.  
    C. replication.  
    D. transcription.

11. a) DNA replication involves the breaking of bonds between
    A. bases.                                                   B. sugars and bases.  
    C. phosphates and bases.                       D. sugars and phosphates.

   b) When a foreign gene is incorporated into an organism’s nucleic acid, the resulting molecule is called
    A. ATP.                                                       B. recombinant DNA.  
    C. transfer RNA (tRNA).                             D. messenger RNA (mRNA).

12. 1. Uracil bonds with adenine.
    2. Complementary bonding between codon and anticodon.
    3. DNA unzips.
    4. mRNA joins with ribosome.

    The correct order of the above during protein synthesis is
    A. 1, 2, 4, 3                  B. 1, 3, 2, 4                      C. 3, 1, 4, 2                  D. 3, 2, 1, 4

13. The diagram above shows a part of the process of protein synthesis.
   a) Identify the following labelled structures. (4 marks)
   W
   X
   Y
   Z

   b) Where in the cell is X synthesized? (1 mark)
14. List two factors that could cause changes in the type of protein formed. Explain why each factor causes a change in the protein formed. (2 marks)

15. a) List the events which occur during the replication (copying) of DNA. (4 marks)

b) Why does DNA replication occur before cell division? (1 mark)

16. Give the location of the following processes in the cell:
   i) transcription (1 mark)
   ii) translation (1 mark)

17. Due to a mutation, one base pair is lost from a DNA molecule. Describe the effect this mutation has on the protein being synthesized. (1 mark)

18. Describe the role of each of the following in protein synthesis: (5 marks)
   a) DNA
   b) mRNA
   c) tRNA
   d) ribosome
   e) peptide bond

19. a) Name the process shown in the diagram. (1 mark)
   b) Give the letter of the strand that is identical to strand A. (1 mark)
   c) Name the molecule indicated by X. (1 mark)
   d) Where in a human cell does the process shown above occur? (1 mark)