1. Which of the following correctly represents the flow of genetic information in cells?
A) Protein → RNA → DNA
B) RNA → DNA → Protein
C) DNA → RNA → Protein
D) DNA → Protein → RNA

2. What is the role of mRNA during protein synthesis?
A) It transports amino acids to the ribosome.
B) It acts as a template for assembling amino acids into proteins.
C) It catalyzes peptide bond formation.
D) It unwinds the DNA double helix.

3. Which enzyme is responsible for synthesizing RNA during transcription?
A) DNA polymerase
B) RNA polymerase
C) Ligase
D) Helicase

4. Which codon signals the start of translation?
A) UAA
B) UAG
C) AUG
D) UGA

5. A mutation changes a codon from UUU to UUC. Both codons code for the amino acid phenylalanine. What type of mutation is this?
A) Missense
B) Silent
C) Nonsense
D) Frameshift

Section B: Short Answer

1. Describe the process of transcription, including the role of RNA polymerase.

2. Explain how a mutation in the DNA sequence can affect the protein produced. Provide an example of a substitution mutation and its potential effects.

3. Outline the differences between the roles of mRNA, tRNA, and rRNA during translation.

4. Compare the processes of transcription and replication by identifying three similarities and three differences.

Section C: Long Answer

1. The following sequence of DNA is part of a gene:
Template strand: 3'-TAC GGC TTT AAA TGC-5'

a) Write the corresponding mRNA sequence.
b) Identify the amino acid sequence encoded by this mRNA. Use a codon chart to assist.
c) If the second base in the DNA sequence changes from G to T, what is the new amino acid sequence? How does this mutation affect the protein?

2. Explain the role of the following in protein synthesis:

- Promoter region
- Codons
- Ribosome
- Peptidyl transferase

3. Describe how eukaryotic cells regulate gene expression during protein synthesis, including examples of transcriptional and post-transcriptional modifications.

Section D: Application and Analysis

1. A scientist isolates a segment of mRNA with the sequence:
5'-AUG CGA UUC GGC UAG-3'
a) Identify the start and stop codons.
b) Determine the amino acid sequence.
c) Predict the effect of deleting the second base in the mRNA sequence.

2. Certain antibiotics target bacterial ribosomes and inhibit protein synthesis. Explain how this mechanism affects bacterial cells but not human cells.

3. The disease sickle-cell anemia results from a single base substitution in the hemoglobin gene. Explain how this mutation leads to the disease symptoms, referring to the central dogma of molecular biology.