1. Define the term "genome" and describe its significance in molecular biology.

2. Explain the difference between the nuclear genome and mitochondrial genome in eukaryotic cells.

3. Describe how the Human Genome Project has advanced our understanding of genetic diseases. Provide one example of how this knowledge is applied in medicine.

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3. Which experiment demonstrated that DNA is the hereditary material?
    - A. Griffith's transformation experiment
    - B. Hershey-Chase experiment
    - C. Meselson-Stahl experiment
    - D. Watson and Crick's DNA model
4. Rosalind Franklin's contribution to the discovery of DNA involved:
    - A. Isolating DNA from cells
    - B. Producing X-ray diffraction images of DNA
    - C. Demonstrating semi-conservative replication
    - D. Identifying RNA as the genetic material
5. Summarize the key steps and findings of the Griffith experiment and explain how Avery, McLeod, and McCarty built upon this work to identify DNA as the transforming principle.

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5. Complete the following sentences about DNA replication by filling in the blanks with the appropriate terms:

    a) The _____ strand is synthesized continuously in the 5' to 3' direction.
    b) b. The _____ strand is synthesized in short segments, known as _____ fragments, which are later joined together.
    c) c. _____ is the enzyme responsible for unwinding the DNA double helix at the replication fork.
    d) d. The enzyme _____ synthesizes short RNA primers to provide a starting point for DNA synthesis.
    e) e. _____ is the enzyme that extends the new DNA strand by adding nucleotides to the primer.

6. Describe the role of DNA ligase in replication.

7. Why is DNA replication referred to as semi-conservative?

8. If a DNA strand has the sequence 5’-ATCGGATTC-3’, what will the complementary strand look like after replication? Indicate the 5’ and 3’ ends.

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8. **Fill-in-the-Blank**
   a. The enzyme _____ is responsible for synthesizing RNA during transcription.
   b. In eukaryotes, transcription occurs in the _____.

9. Explain how alternative splicing during transcription allows one gene to code for multiple proteins. Provide an example.

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11. What is the role of tRNA during translation?
    - A. To carry amino acids to the ribosome
    - B. To synthesize mRNA
    - C. To unwind the DNA strand
    - D. To form the peptide bond

12. The start codon for translation is:
    - A. UAA
    - B. AUG
    - C. UGA
    - D. UAG

13. Using the mRNA sequence 5’-AUGGCUAAACCC-3’, determine:
    a. The corresponding amino acid sequence (use a codon chart).
    b. What would happen if the first nucleotide in the sequence were deleted?

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13. What are telomeres, and why are they important for chromosome stability?

14. Explain the role of the enzyme telomerase in maintaining telomeres.

15. Telomerase is often active in cancer cells but not in most somatic cells. Explain how this contributes to the unchecked division of cancer cells.

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15. Define gene therapy and discuss two techniques used in its application. Provide an example of a disease that could be treated with gene therapy and discuss the risks and benefits.

16. A patient has a genetic disorder caused by a single defective gene. Explain how CRISPR-Cas9 could potentially be used to treat this condition. What ethical considerations should be addressed before applying this technology?

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17. How do transcription and translation differ in prokaryotes and eukaryotes? Explain one structural and one functional difference.
18. Design an experiment to demonstrate that DNA replication is semi-conservative. Include a hypothesis, procedure, expected results, and conclusion.
19. Match the following terms with their correct descriptions:

Genome	Enzyme that synthesizes new DNA strands
Telomerase	A triplet of nucleotides that codes for an amino acid
Codon	Enzyme that maintains chromosome ends
DNA polymerase	The complete set of genetic material in an organism
tRNA	RNA molecule that carries amino acids to the ribosome

20. Transcription occurs in the cytoplasm of eukaryotic cells.
21. Telomeres shorten after every cell division.
22. Introns are regions of DNA that code for proteins.