

DNA and Protein Synthesis Concept Questions

1. What are nucleotides? Describe their structure.
2. Describe how the work of Hershey and Chase, Chargaff, and Wilkins and Franklin contributed to the discovery by Watson and Crick of the double helix.
3. While you're trying to enjoy your lunch one day, your friend says she is working on an art project about DNA and needs to understand a little bit about the structure. How would you describe it for her?
4. Why is DNA replication important for every cell?
5. Would you expect a brain cell and a muscle cell to have the same amount of DNA? Justify your answer.
6. a) Why is the making of exact copies of DNA called replication rather than duplication?
b) What is meant by saying that DNA replication is semi-conservative?
7. Why is replication on one strand of DNA continuous, while on the other strand the replication must be discontinuous?
8. If human DNA contains approximately 3×10^9 base pairs, and DNA polymerase can work at the rate of about 50 nucleotides per second, how can our DNA be replicated so quickly?
9. A certain chemical is known to fuse thymine with adenine in DNA. Comment on the expected effects of exposure to this chemical on DNA replication and transcription.
10. If 27 percent of the bases in a certain segment of DNA were adenine, what would be the percentages of thymine, cytosine, and guanine.
11. Proofreading enzymes scan DNA to check for base pairing errors. Explain why these enzymes are important.
12. Describe the technique of DNA profiling.
13. As a research biologist, you know of a bacterium that produces an antifungal molecule that is quite effective against a certain crop plant fungus. There would be great economic importance in enabling the plant to resist the fungus. How might you use DNA technology to accomplish this?
14. A segment of DNA providing instructions for the synthesis of one protein is a _____. Many genes are located on a piece of DNA called a _____.
15. Describe how DNA and RNA differ in their composition, structure, function, and location.
16. a) Briefly, what is accomplished by each of the two major steps in protein synthesis?
b) Where in the cell does each one occur?
17. Compare and contrast DNA replication and transcription.
18. Explain the role played by each of the following in protein synthesis.
 - a) coding strand of DNA
 - b) RNA codon
 - c) RNA polymerase
 - d) ribosome
 - e) rRNA
 - f) tRNA
19. a) During the process of translation what language change occurs?
b) How is it possible to put together a polypeptide with the correct sequence of amino acids?
20. For the DNA triplet CGT, write the complementary mRNA codon and the tRNA anticodon. What amino acid does the DNA triplet GCA represent?
21. a) How does a codon differ from a DNA triplet?
b) How does an anticodon differ from a DNA triplet?
22. a) Describe the effect if a mutation in DNA changed the start codon in the resulting mRNA?
b) Describe the effect if a mutation in DNA changed the stop codon in the resulting mRNA. What would be the effect on translation if the stop codon were changed by mutation?
23. What effect does the nucleotide sequence of DNA have on the cell?

24. Suppose that during protein synthesis, a cell is starved of uracil and another chemical of similar shape is supplied in its place. How will the proteins produced be affected by this substitution?
25. In eukaryotic cells, mRNAs have been found to have a circular shape with proteins holding one end of the mRNA near the other. How might this increase translation efficiency?
26. A molecular biologist discovers a drug that blocks the site of attachment of the ribosome to mRNA. How will the drug affect the functioning of the cell?
27. a) Name some common mutagens?
b) What effects can they have?
c) Where or when might one be exposed to them?