

DNA and Protein Synthesis Concept Questions

1. Describe the structure and function of nucleotides.
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. Describe it for her.
4. Explain why DNA replication is important for every cell.
5. Predict the amount of DNA you would expect to find in a brain cell compared to a muscle cell. Provide justification for your answer.
6. a) Provide reasoning for referring to the making of exact copies of DNA as replication rather than duplication.
b) Explain why DNA replication is referred to as semi-conservative.
7. Provide an explanation for the difference in the construction of DNA on the leading strand compared to that on the lagging strand.
8. In prokaryotes, DNA pol III constructs new DNA and DNA pol I replaces the RNA primer with DNA.
a) Predict the effect on DNA synthesis of exposure of a cell to a drug that completely inhibits DNA pol III.
b) Predict the effect on DNA synthesis of exposure of a cell to a drug that completely inhibits DNA pol I.
9. Human DNA contains approximately 3×10^9 base pairs and DNA polymerase can work at the rate of about 50 nucleotides per second. Given these facts, explain how your DNA can be replicated in only a few hours.
10. A certain chemical is known to fuse thymine with adenine in DNA. Predict the effects of exposure to this chemical on DNA replication and transcription.
11. A particular sample of DNA contains 27 percent adenine. Predict the percentages of thymine, cytosine, and guanine.
12. Explain the importance of the enzymes that identify and repair base-pairing errors in DNA.
13. Explain how DNA profiling can be used to match a person to a DNA sample.
14. 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. Describe how DNA technology could be used to accomplish this.
15. Describe the difference between a gene and a chromosome.
16. Describe how DNA and RNA differ in their composition, structure, function, and location.

17. a) Describe the purpose of each of the two major steps in protein synthesis.
b) Identify the location of each of the steps in the cell.
18. Identify the similarities and differences between DNA replication and transcription.
19. 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
20. a) Identify the language change that occurs during translation.
b) Explain how it is possible to construct a polypeptide with the correct sequence of amino acids.
21. For the DNA triplet CGT, write the complementary mRNA codon and the tRNA anticodon.
Identify the amino acid coded by the DNA triplet GCA.
22. a) Describe the difference between a codon and a DNA triplet.
b) Describe how an anticodon differs from a DNA triplet.
23. a) Describe the effect of a mutation in DNA that changed the start codon in the resulting mRNA.
b) Describe the effect of a mutation in DNA that changed the stop codon in the resulting mRNA.
c) Predict the effects of these mutations on the cell in which they occurred.
24. Describe the effect of the nucleotide sequence of DNA on the cell.
25. Cells are genetically modified to be unable to synthesize uracil. In an experiment, the cells are grown on a medium lacking uracil and a chemical of similar shape is supplied in its place.
Predict the effect on protein synthesis in these cells.
26. In eukaryotic cells, mRNAs have been found that have a circular shape with proteins holding one end of the mRNA near the other. Explain how this structure might increase the efficiency of translation.
27. A molecular biologist discovers a drug that blocks the site of attachment of the ribosome to mRNA. Predict the effect on a cell of exposure to this drug.
28. a) Identify some common mutagens.
b) Describe the effects they can have on protein synthesis.
c) Describe some situations in which one might be exposed to such mutagens.