
Date _____

Name _____ Student No. _____

Teacher _____ School _____



Biology 12

Section Assignment 2.2

Remember to submit the following with this assignment:

Title	From	Marks
Part A: Protein Synthesis	2.2	22
Part B: Protein Synthesis	2.2	7
Part C: Mutations of DNA	2.2	20
Part D: Mutations of DNA	2.2	5

Section Assignment 2.2 Part A

Protein Synthesis

You have now examined the complex process of protein synthesis, from DNA to the final product—a protein. DNA is the source of all the genetic information required to create the numerous proteins, including enzymes that are essential to life.

Select the best answer. (2 marks each)

1. During transcription, hydrogen bonds form between which of the following?
 - A. amino acid pairs
 - B. mRNA and DNA
 - C. mRNA and ribosomes
 - D. sugar and phosphate molecules
2. Given the following three codons of an mRNA strand—UAC, GGG, AUA—what are the anticodons that will be paired to this strand?
 - A. ATG CCC TAT
 - B. ATA GGG TAC
 - C. AUG CCC UAU
 - D. UAC GGG AUA
3. What is produced during translation?
 - A. messenger RNA
 - B. steroid hormones
 - C. new DNA molecules
 - D. a polypeptide chain
4. A polyribosome consists of:
 - A. many ribosomes and many mRNA molecules
 - B. one ribosome and many tRNA molecules
 - C. one mRNA and many ribosomes
 - D. one tRNA and many ribosomes

5. What is the anticodon that corresponds to the DNA base sequence ACG?
- A. UGC
 - B. AGC
 - C. ACG
 - D. UCG
6. How many ribosomes are needed for the production of a polypeptide containing 30 amino acids?
- A. 1
 - B. 3
 - C. 10
 - D. 30
7. For the following sequence of mRNA bases—GCU UCU CCU—what sequence of amino acids will result after translation occurs?
- A. arginine, serine, stop
 - B. alanine, arginine, stop
 - C. alanine, serine, proline
 - D. arginine, arginine, glycine

For questions 8–11, match the nucleic acid to its function.

8. DNA

- A. carries amino acids to the ribosome
- B. a component of ribosomes
- C. contains the genetic code required to synthesize proteins
- D. transcribes genetic information and carries it to the ribosome

9. mRNA

- A. carries amino acids to the ribosome
- B. a component of ribosomes
- C. contains the genetic code required to synthesize proteins
- D. transcribes genetic information and carries it to the ribosome

10. tRNA

- A. carries amino acids to the ribosome
- B. a component of ribosomes
- C. contains the genetic code required to synthesize proteins
- D. transcribes genetic information and carries it to the ribosome

11. rRNA

- A. carries amino acids to the ribosome
- B. a component of ribosomes
- C. contains the genetic code required to synthesize proteins
- D. transcribes genetic information and carries it to the ribosome

Marks

22

Section Assignment 2.2 Part B

Protein Synthesis

1. For the following DNA base sequence—CCA GGA ATA CCT—describe the amino acid sequence that results from this DNA strand. (2 marks)
2. Describe how each of the following is involved in protein synthesis. (5 marks)
 - A. DNA:
 - B. Codon:
 - C. tRNA:
 - D. nucleolus:
 - E. ribosome:

Marks

Section Assignment 2.2 Part C

Mutations of DNA

Use your notes, the course material, and the resources listed in Lesson 2.2.C to answer the following questions.

Select the best response for the following multiple choice questions.
(2 marks each)

1. About 70% of mutations observed in cystic fibrosis patients result from the removal of three base pairs in a certain protein's nucleotide sequence. This causes loss of the amino acid phenylalanine in one location. This is an example of:
 - A. point mutation
 - B. frameshift mutation
 - C. base substitution
 - D. inversion
2. Which is NOT true about a point mutation?
 - A. A point mutation can be a base substitution.
 - B. A point mutation will always affect the amino acid coded by the codon containing the mutation, and all subsequent codons.
 - C. A point mutation may result in a misplaced stop codon that leads to premature termination of polypeptide synthesis.
 - D. A point mutation is the pairing of a non-complementary nucleotide.
3. A frameshift mutation will affect:
 - A. only the amino acid coded for by the mutated codon
 - B. all codons after the mutated codon, but not the codon itself
 - C. nothing, if the mutation is a silent mutation
 - D. the mutated codon and all subsequent codons
4. Which of the following scenarios represents the least possible damage to the final structure of a protein?
 - A. a base substitution occurring in the third base of a codon
 - B. deletion of one base pair in DNA
 - C. addition of three codons
 - D. a chromosome mutation

5. A strand of DNA has the following bases:

C C T G G C A

If the thymine base is deleted, which amino acids would be coded for?

- A. alanine, glycine
 - B. glycine, arginine
 - C. glycine, proline
 - D. arginine, glycine
6. A single base mutation causes the amino acid leucine to replace tryptophan in the primary structure of a protein. The base in the DNA that changes to cause this mutation is:
- A. cytosine
 - B. guanine
 - C. thymine
 - D. adenine
7. Which of the following is NOT an example of an environmental mutagen?
- A. UV light
 - B. radiation
 - C. plastic surgery
 - D. cigarette smoke
8. One example of a silent mutation in a DNA sequence is:
- A. CCG to CAG
 - B. GGA to GGT
 - C. AAT to AAU
 - D. CCG to ACG

9. Sickle-cell anemia is a genetic disease that occurs when the amino acid valine takes the place of glutamic acid during translation of a hemoglobin chain. Which of the following DNA mutations causes this disease?
- A. CTT changes to CAT
 - B. GAA changes to GUU
 - C. CUC changes to CAG
 - D. CAG changes to CTC
10. A missense mutation is a type of point mutation in which:
- A. there is no effect on mRNA codons or the resulting amino acid sequence
 - B. a prematurely placed stop codon ends transcription too soon
 - C. a base substitution codes for a different amino acid
 - D. more than one codon is affected

Marks

20

Section Assignment 2.2 Part D

Mutations of DNA

1. The following is a DNA base sequence: ACG CCT ATA CCA AGT

Explain what would occur during the translation of this gene if ATA underwent a mutation and was converted to ATT.

(3 marks)

Three-letter codons of messenger RNA, and the amino acids specified by the codons			
AAU } Asparagine AAC }	CAU } Histidine CAC }	GAU } Asparatic acid GAC }	UAU } Tyrosine UAC }
AAA } Lysine AAG }	CAA } Glutamine CAG }	GAA } Glutamic acid GAG }	UAA } Stop UAG }
ACU } Threonine ACC } ACA } ACG }	CCU } Proline CCC } CCA } CCG }	GCU } Alanine GCC } GCA } GCG }	UCU } Serine UCC } UCA } UCG }
AGU } Serine AGC }	CGU } Arginine CGC } CGA } CGG }	GGU } Glycine GGC } GGA } GGG }	UGU } Cysteine UGC }
AGA } Arginine AGG }			UGA— Stop UGG— Tryptophan
AUU } Isoleucine AUC } AUA }	CUU } Leucine CUC } CUA } CUG }	GUU } Valine GUC } GUA } GUG }	UUU } Phenylalanine UUC }
AUG— Methionine			UUA } Leucine UUG }

2. The DNA strand GAC ATG CAT TTT AGA undergoes a mutation in which the section that codes for the amino acid tyrosine is lost.
- Give the mRNA codon sequence that results from this mutation. (1 mark)
 - List, in the correct order, the amino acids that result from this mutation. (1 mark)

Marks