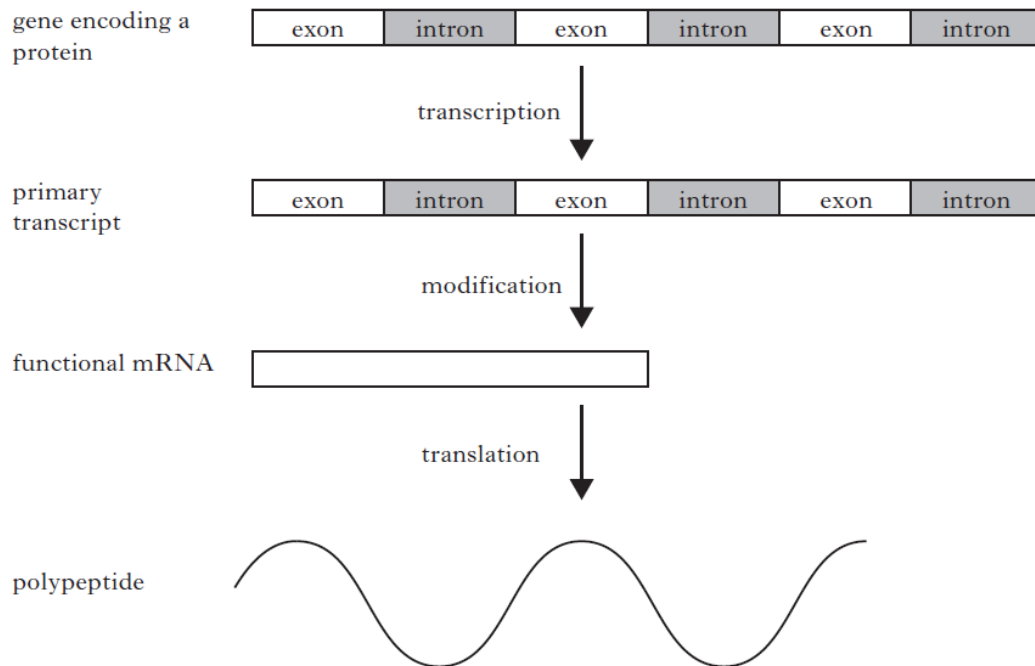


1. The diagram below shows stages involved in the transcription and translation of a gene. Both introns and exons are transcribed and then the primary transcript is modified to produce the functional mRNA which is then translated.



- a) State the difference between introns and exons. (1)
- b) Name the enzyme responsible for the synthesis of the primary transcript. (1)
- c) Name the process that involves the modification of the primary transcript to form the functional mRNA. (1)
- d) Describe how different functional mRNA molecules can be produced from the same primary transcript sequence. (1)
- f) Where in a cell do the following events that occur during protein synthesis take place?
- (i) transcription (1)
 - (ii) translation (1)

2. **Diagram 1** below shows a section of a chromosome and the locations of ten genes. **Diagram 2** shows the same chromosome but a mutation during cell division resulted in a change to the sequence of genes.

Diagram 1

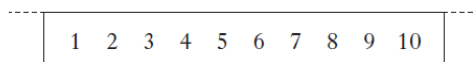
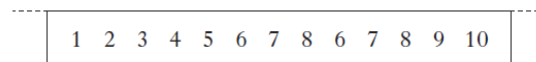


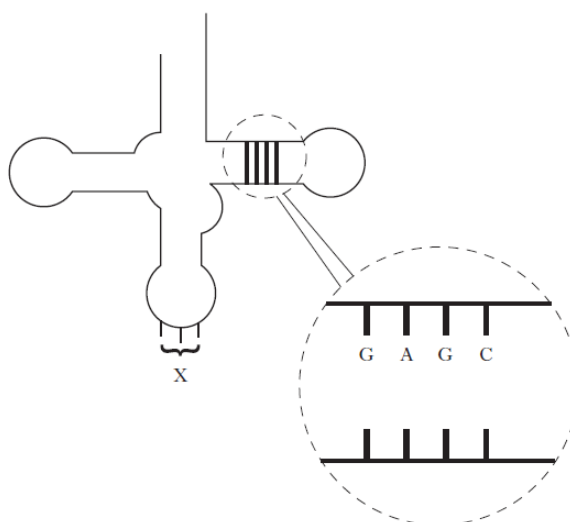
Diagram 2



Name the type of mutation shown above.

(1)

3. The diagram below shows a molecule of tRNA. A section of the diagram has been enlarged.



- a) State the order of the bases from left to right on the enlarged part of the diagram. (1)
- b) (i) Name part X. (1)
- (ii) Explain the importance of part X in the process of translation. (1)

4. Four possible types of gene mutations are listed below:

missence

nonsense

frameshift

splice-site

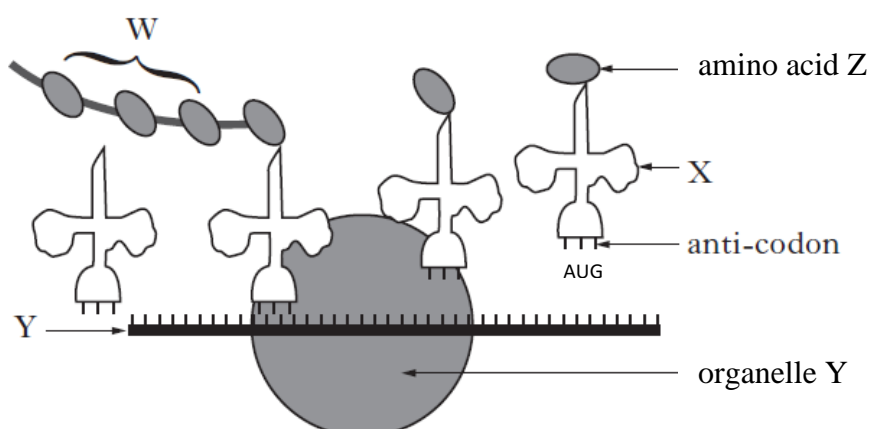
Use the list to identify the types of gene mutation described:

- a) In Duchenne Muscular Dystrophy (DMD) one amino acid codon is substituted with a stop codon. (1)
- b) In cystic fibrosis (CF) one base pair is deleted. (1)

5. Which of the following is **not** an example of a chromosome structure mutation?

A Insertion **B** Duplication **C** Translocation **D** Inversion (1)

6. The diagram below represents a stage in protein synthesis in a cell.



- a) (i) Name organelle Y. (1)
 (ii) Identify molecule X. (1)
 (iii) Name structure W. (1)
- b) What sequence of bases on a DNA molecule will code for the amino acid labelled Z? (1)
7. The following section of mRNA codes for a part of a polypeptide Molecule consisting of made of six amino acids.

G-C-U-G-C-U-A-G-U-A-G-U-C-G-A-A-G-U

- a) When the section of polypeptide was analysed, three types of amino acid were identified in the quantities shown in the table.

Amino acids		
Name (letter)	Number	Codon
Alanine (A)	2	GCU
Methionine (M)	1	
Serine (S)	3	

- (i) State the codon for methionine. (1)
 (ii) State the codon for serine. (1)
- b) Work out the amino acid sequence in this section of the polypeptide using the letters that have been used to represent each amino acid. (1)

8. Each strand of DNA molecule, which codes for amino acids present in A structural protein, consists of 936 nucleotides. How many amino acids does this protein contain?

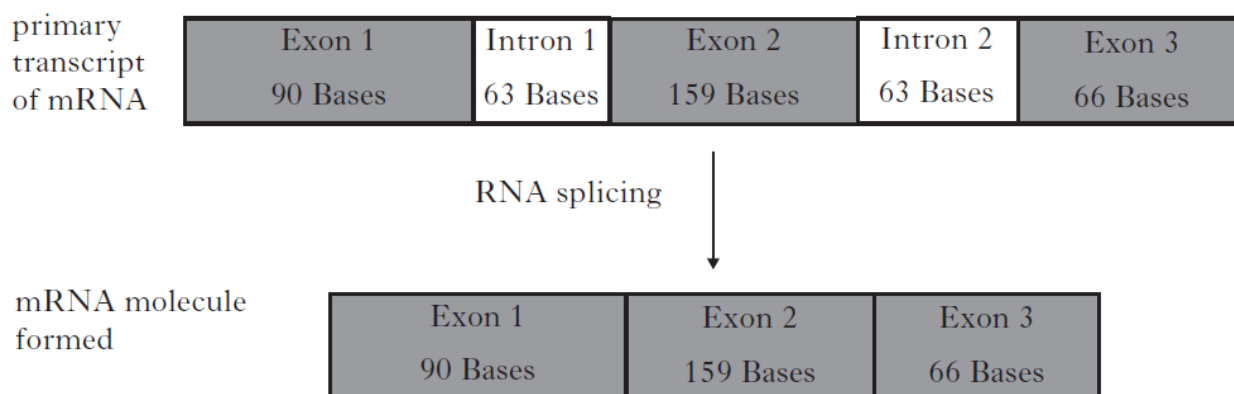
- a) **Copy** and **complete** the following sentences by choosing a word in the brackets to make the sentence correct.

mRNA is transcribed from a coding region on a gene called an (intron /exon). Transcription takes place in the (nucleus / ribosomes). (2)

- b) (i) Name the process used to remove the non coding regions from a primary transcript of mRNA. (1)

(ii) One way to produce a variety of proteins from the expression of the same gene is to remove different regions from the primary transcript of mRNA. Describe **one** other way that this can be achieved. (1)

9. The diagram below shows a primary transcript of messenger RNA (mRNA) with the number of bases in each exon and intron sequence and the mRNA molecule formed when the introns were removed during RNA splicing.



- a) Give the number of bases in the mRNA molecule which was formed after the introns were removed from the transcript. (1)
- b) The mRNA molecule with its introns removed will be translated and a polypeptide formed.
- (i) Give the location of mRNA translation in a cell. (1)
- (ii) State the number of bases in an mRNA molecule which code for an individual amino acid in a polypeptide. (1)
- (iii) State what causes the translation of an mRNA molecule to stop. (1)

- (iv) Describe the role of transfer RNA (tRNA) in translation of mRNA. (2)
10. a) Describe alternative RNA splicing. (1)
- b) Give the significance of RNA splicing for cells. (1)