FREE SAMPLE: THE FIRST QUESTION

Question One (15 marks)

(a) Part of the template (antisense) strand of a gene is shown, written 3′ to 5′:

3′ TAC AGG GGG CAG TAT AAA ATC 5′

(i) Write the base sequence of the mRNA transcribed from this strand (5′ to 3′) and state where transcription occurs in a eukaryotic cell.

(ii) Write the anticodon of each tRNA that pairs with the codons of the mRNA, up to but not including the stop codon.

(iii) Use the genetic code table supplied (below) to give the amino acid sequence of the polypeptide.

(iv) Explain the role of tRNA in translation.

Genetic code (mRNA codons): Phe = UUU, UUC; Leu = UUA, UUG, CUU, CUC, CUA, CUG; Ile = AUU, AUC, AUA; Met = AUG; Val = GUU, GUC, GUA, GUG; Ser = UCU, UCC, UCA, UCG, AGU, AGC; Pro = CCU, CCC, CCA, CCG; Thr = ACU, ACC, ACA, ACG; Ala = GCU, GCC, GCA, GCG; Tyr = UAU, UAC; His = CAU, CAC; Gln = CAA, CAG; Asn = AAU, AAC; Lys = AAA, AAG; Asp = GAU, GAC; Glu = GAA, GAG; Cys = UGU, UGC; Trp = UGG; Arg = CGU, CGC, CGA, CGG, AGA, AGG; Gly = GGU, GGC, GGA, GGG; Stop = UAA, UAG, UGA.

[8 marks]

(b) A salivary gland cell makes large quantities of the protein amylase.

(i) State where in the cell transcription and translation of the amylase gene take place.

(ii) Explain the role of the ribosome in the production of amylase.

(iii) Explain why two different cell types in the same person (for example a salivary gland cell

TEST PAPERS HUB NOT FOR RESALE OR REDISTRIBUTION

and a nerve cell) have the same genes but make different proteins.

[7 marks]

Free sample from NCEA Level 2 Biology 91159 Expression (paper 1 of the set). Full papers with a worked solution for every question: testpapershub.com/

THE WORKED ANSWER TO THAT QUESTION

Question 1 (15 marks) [Gene expression]

(a) Part of the template (antisense) strand of a gene is shown, written 3′ to 5′: 3′ TAC AGG GGG CAG TAT AAA ATC 5′ (i) Write the base sequence of the mRNA transcribed from this strand (5′ to 3′) and state where transcription occurs in a eukaryotic cell. (ii) Write the anticodon of each tRNA that pairs with the codons of the mRNA, up to but not including the stop codon. (iii) Use the genetic code table supplied (below) to give the amino acid sequence of the polypeptide. (iv) Explain the role of tRNA in translation. Genetic code (mRNA codons): Phe = UUU, UUC; Leu = UUA, UUG, CUU, CUC, CUA, CUG; Ile = AUU, AUC, AUA; Met = AUG; Val = GUU, GUC, GUA, GUG; Ser = UCU, UCC, UCA, UCG, AGU, AGC; Pro = CCU, CCC, CCA, CCG; Thr = ACU, ACC, ACA, ACG; Ala = GCU, GCC, GCA, GCG; Tyr = UAU, UAC; His = CAU, CAC; Gln = CAA, CAG; Asn = AAU, AAC; Lys = AAA, AAG; Asp = GAU, GAC; Glu = GAA, GAG; Cys = UGU, UGC; Trp = UGG; Arg = CGU, CGC, CGA, CGG, AGA, AGG; Gly = GGU, GGC, GGA, GGG; Stop = UAA, UAG, UGA.

(a) Answer: (i) mRNA AUG UCC CCC GUC AUA UUU UAG, nucleus; (ii) anticodons UAC, AGG, GGG, CAG, UAU, AAA; (iii) Met – Ser – Pro – Val – Ile – Phe

- Evidence level: Excellence (complementary base pairing: DNA template → mRNA (A→U, T→A, G→C, C→G), codon → anticodon, codon → amino acid).
- (i) mRNA (5′ to 3′): AUG UCC CCC GUC AUA UUU UAG; transcription occurs in the nucleus (catalysed by RNA polymerase).
- (ii) Anticodons (3′ to 5′): UAC, AGG, GGG, CAG, UAU, AAA.
- (iii) Codons AUG UCC CCC GUC AUA UUU UAG give: Met – Ser – Pro – Val – Ile – Phe (then the stop codon UAG ends translation; no amino acid is added)..
- Achievement: (iv) States that tRNA carries amino acids to the ribosome.
- Merit: Links to the codon: each tRNA has an anticodon that pairs with a specific mRNA codon.
- Excellence: Full explanation: each tRNA molecule carries a specific amino acid at one end and has an anticodon at the other that pairs by complementary base pairing with the matching mRNA codon on the ribosome; this ensures the amino acids are added in the sequence specified by the codons, and peptide bonds join them to form the polypeptide.

KEY TAKEAWAY

Gene expression: the template strand is read to make mRNA by complementary pairing (T pairs with A, and A with U); each mRNA codon is matched by a tRNA anticodon, which brings its amino acid; a stop codon ends translation.

(b) A salivary gland cell makes large quantities of the protein amylase. (i) State where in the cell transcription and translation of the amylase gene take place. (ii) Explain the role of the ribosome in the production of amylase. (iii) Explain why two different cell types in the same person (for example a salivary gland cell and a nerve cell) have the same genes but make different proteins.

(b) Answer: (i) transcription in the nucleus, translation at ribosomes; (ii) the ribosome in translation; (iii) different genes are switched on in different cells

- Evidence level: Excellence (link each stage of gene expression to its location and its molecules).
- (i) Transcription occurs in the nucleus; translation occurs on ribosomes in the cytoplasm (on the rough endoplasmic reticulum for proteins that are secreted).
- Achievement: (ii) States that the ribosome is involved in translation.

TEST PAPERS HUB NOT FOR RESALE OR REDISTRIBUTION

• Merit: Links the role to the code: the ribosome binds the mRNA and the tRNAs, reads the codons in turn, and catalyses the formation of peptide bonds between the amino acids.

• Excellence: Full explanation: the ribosome binds the mRNA and the tRNAs, reads the codons in turn, and catalyses the formation of peptide bonds between the amino acids; this makes sure the sequence of bases in the gene is converted into the correct sequence of amino acids for amylase.

• Achievement: (iii) States that different genes are expressed.

• Merit: Links to regulation: not every gene is transcribed in every cell.

• Excellence: Full explanation: all the body cells of a person have the same DNA, but only some genes are switched on (transcribed) in each cell type; the salivary gland cell transcribes and translates the amylase gene, while a nerve cell does not, so the cells make different mRNAs and proteins and have different structures and functions.

KEY TAKEAWAY

Gene expression: transcription (nucleus) makes mRNA from the DNA template; translation (ribosome) builds the polypeptide; cells differ because different genes are expressed, not because they have different DNA.

LOS: Gene expression (91159)

Free sample from NCEA Level 2 Biology 91159 Expression (paper 1 of the set). Full papers with a worked solution for every question: testpapershub.com/

LIKED THIS SAMPLE?

The full paper is the real thing.

THIS FREE SAMPLE	THE FULL PAPER
A short extract: the opening questions of Paper 1, then their worked answers. 4 pages in all.	Three questions made of several multi-part problems answered in writing (constructed response, no multiple choice), with a worked solution for every part that shows whether it is aimed at Achieved, Merit or Excellence. 10 pages, with a worked solution for every question.

What you get with each paper

- A complete, timed paper in the real exam layout, not just a taste of it.
- A worked solution for every question: numbered steps, why each wrong option is wrong, and a key takeaway.
- 20 different papers in this set. Every one uses new questions, so each extra paper is new practice, not a repeat.
- An A4 PDF emailed straight after payment, made for printing.

Get Paper 1 now

A$11.99 one-off, instant PDF download. Tap or click here.

Or see all 20 NCEA Level 2 Biology 91159 Expression papers:
testpapershub.com/collections/ncea-level-2-biology-91159-expression/

Getting the most from a practice paper

1. Print it and set the timer shown on the cover. Answer every question before looking at any solution.
2. Mark it against the worked solutions and note the topics that cost you marks.
3. Retry the questions you missed a day later, then use the next paper to check the fix held.

Not sure which paper to start with, or have a question before you buy? Email support@testpapershub.com and a real person will reply, normally within one business day. These are original practice papers, not official past papers, and are not affiliated with any exam authority.