2

SUPERVISOR'S USE ONLY

91159



Level 2 Biology, 2019

91159 Demonstrate understanding of gene expression

9.30 a.m. Tuesday 19 November 2019 Credits: Four

Achievement	Achievement with Merit	Achievement with Excellence
Demonstrate understanding of gene expression.	Demonstrate in-depth understanding of gene expression.	Demonstrate comprehensive understanding of gene expression.

Check that the National Student Number (NSN) on your admission slip is the same as the number at the top of this page.

You should attempt ALL the questions in this booklet.

If you need more space for any answer, use the page(s) provided at the back of this booklet and clearly number the question.

Check that this booklet has pages 2–12 in the correct order and that none of these pages is blank.

YOU MUST HAND THIS BOOKLET TO THE SUPERVISOR AT THE END OF THE EXAMINATION.

TOTAL

QUESTION ONE: EXPRESSION OF PHENOTYPE

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The expression of a gene is dependent on many factors. Experiments on twin lambs have demonstrated the importance of diet in producing healthy lambs. Each set of twins had functioning genes that produce enzymes for energy metabolism and red blood cell production. However, without Vitamin B12, these enzymes cannot function. The resulting phenotypes are shown in the table below.

The lamb on the left is suffering from B12 deficiency, while the lamb on the right is normal.

Source: https://teara.govt.nz/en/photograph/17535/cobalt-deficiency

	Phenotype of lamb	Diet of lamb
Twin #1	 Low red blood cell count Weak wool fibres Poor growth	Lacking vitamin B12
Twin #2	Normal red blood cell countStrong wool fibresNormal growth	Sufficient vitamin B12

(b)		cuss how this experiment demonstrates that the environment can change the phenotype hout changing the genotype of the lambs.	ASSESS USE O							
		In your answer include:								
	•	an explanation of why the study was conducted on twin lambs								
	•	a discussion of the way each lamb's genotype is expressed								
	•	a discussion of the relationship between environment, gene expression, and the resulting phenotypes of both twin #1 and twin #2.								
		There is more space for your answer to								

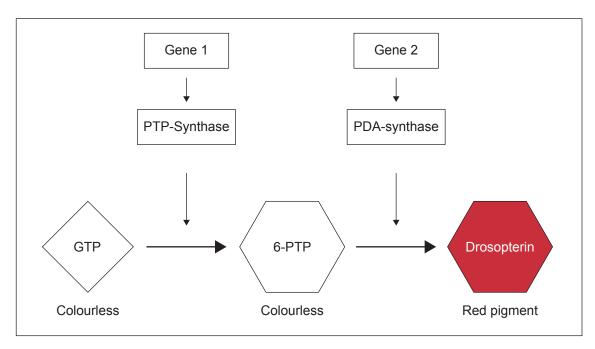
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The fruit fly, *Drosophila melanogaster*, is often used for genetic studies because the effect of mutations can be seen easily.



https://smallscienceworks.com/tag/drosophila

A simplified metabolic pathway that makes red pigment for eye colour in fruit flies is shown below:



When biologists expose red-eyed fruit flies to mutagens, they have found that different mutations produce the same phenotype of colourless eyes in their offspring.

(a)	Define metabolic pathway.	

(b)	Discuss how mutations can affect the presence, absence, or amount of specific metabolic products in the metabolic pathway for red eye colour in fruit flies.	ASSESSO USE ON
	In your answer, refer to the metabolic pathway on the previous page and include:	
	• a definition of both mutation and mutagen, AND give an example of a mutagen	
	an explanation of how genes influence metabolic pathways	
	a discussion of how red eye colour is produced AND how mutations to Gene 1 and Gene 2 in the metabolic pathway can produce colourless eyes.	
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QUESTION THREE: PROTEIN SYNTHESIS

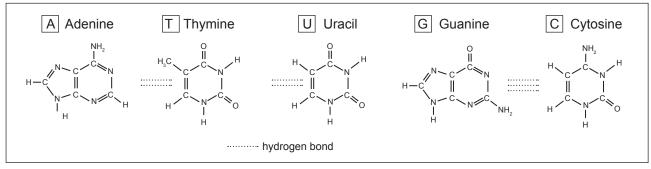
Describe the differences between DNA and RNA.

(a)

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The production of a functional protein relies on the accurate transcription of DNA into an mRNA molecule. Below are diagrams of the nitrogenous bases that make up part of nucleotides in DNA and RNA.

Nitrogenous Bases



Adapted from: www.ncbi.nlm.nih.gov/Class/MLACourse/Original8Hour/Genetics/nucleotide.html

Dise DN	cuss how the structure of DNA and RNA nucleotides ensure the accurate transcription A.
In y	your answer include:
•	a description of triplets and codons
•	an explanation of how the DNA molecule is transcribed
•	a discussion of the relationship between a gene, DNA, mRNA, and the final function protein.

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QUESTION NUMBER	Write the question number(s) if applicable.	
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