2

SUPERVISOR'S USE ONLY

91159



Level 2 Biology, 2018

91159 Demonstrate understanding of gene expression

9.30 a.m. Friday 23 November 2018 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 2–10 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

ASSESSOR'S USE ONLY

QUESTION ONE: MUTATIONS AND PROTEIN SYNTHESIS Describe the terms **triplet** and **codon**. (a) Frameshifts and silent mutations can be caused by certain point mutations. (b) Discuss the consequences of frameshift mutations and silent mutations during protein synthesis, and on the final protein. In your answer include: a description of the point mutations that cause frameshifts AND silent mutations an explanation of how a frameshift AND silent mutation affect the mRNA produced an explanation of how a frameshift AND silent mutation affect translation a discussion of how a frameshift AND silent mutation affect the final protein.

| ASSESSOR |
|---------------------|
| ASSESSOI USE ONL |
| |
| |
| |
| |
| |
| |
| |
| |
| |
| |
| |
| |
| |
| |
| |
| |
| |
| |
| |
| |
| |
| |
| |
| |
| |
| |
| |
| |
| |
| |
| |
| |
| |
| |
| |
| |
| |
| |
| |
| |
| |
| |
| |
| |
| |
| |
| |
| |
| |
| |
| |
| |
| |
| |
| |
| |
| |
| |
| |
| |
| |
| |
| |
| |
| |
| |
| |
| |
| |
| |
| |
| |
| |
| |
| |
| |
| |
| |
| |
| |
| |
| |
| |
| |
| |
| |
| |
| |
| |
| |
| |
| |
| |
| |
| |
| |
| |
| |
| |
| |
| - [|
| |
| 1 |

QUESTION TWO: PHENOTYPE

ASSESSOR'S USE ONLY

Cystic fibrosis (CF) and chronic obstructive pulmonary disease (COPD) both show similar phenotypes.

| Disease | Cause | Phenotype | Cure |
|---------|---|--|---|
| CF | Mutation to cystic fibrosis transmembrane conductance regulator (CFTR) gene, which produces a dysfunctional protein in the cell membrane. | May include (but not limited to) excess mucus in airways, chronic cough, chronic bacterial infections, persistent airway inflammation. | No cure, but medical treatment can reduce phenotype. |
| COPD | Ongoing environmental exposure to coal dust and pollution. | Excess mucus in airways, chronic cough, chronic bacterial infections, persistent airway inflammation. | Sometimes can be cured by stopping exposure to coal dust and pollution. Phenotype greatly reduced when not exposed to coal dust and pollution. |

Analyse the table above to discuss why CF and COPD produce similar phenotypes but are caused by different factors.

In your answer include:

- a description of which disease is inherited AND an explanation of which disease can be passed on to offspring
- a description of a mutation and an environmental factor AND an explanation of how they influence an organism's genotype
- an explanation of the factors that cause the phenotype of an organism

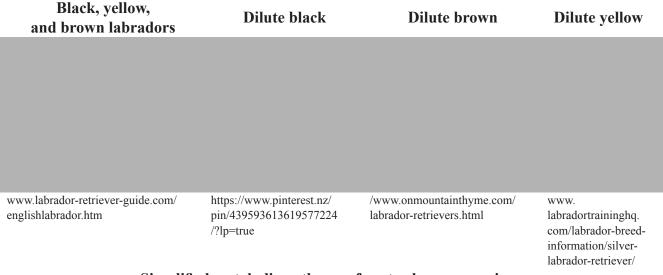
| discussion of why CF can never be cured, but COPD can be cured. | | | | |
|---|--|--|--|--|
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |

| ASSESSOR'S USE ONLY |
|------------------------|
| 002 ONE1 |
| |
| |
| |
| |
| |
| |
| |
| |
| |
| |
| |
| |
| |
| |
| |
| |
| |
| |
| |
| |
| |
| |
| |
| |
| |
| |
| |
| |
| |
| |
| |
| |
| |

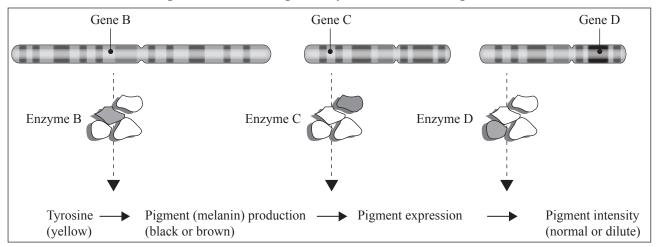
QUESTION THREE: METABOLIC PATHWAY

ASSESSOR'S USE ONLY

Labrador coat colour is caused by a metabolic pathway. The main coat colours are black, yellow and brown. However, a pigment intensity gene (Gene D) controls the intensity of pigment in the hair shaft. A mutation to Gene D causes any pigment present to dilute (decrease intensity).



Simplified metabolic pathway of coat colour expression



Discuss how the presence or absence of products from a specific point in the metabolic pathway produces the expression of coat colour in Labrador dogs.

In your answer, you should reference specific points and include:

- a description of the function of gene B and enzyme B
- a description of the function of gene C and enzyme C
- an explanation of a metabolic pathway
- a discussion of which genes and enzymes need to be functioning to produce black, yellow, and brown coat colour
- a discussion of which genes and enzymes need to be functioning to produce dilute black, dilute yellow, and dilute brown coat colour.

| There is more space for your answer to Question Three on the following page. |
|--|
| |
| |
| |
| |
| |
| |
| |
| |
| |
| |
| |
| |
| |
| |
| |
| |
| |
| |
| |
| |
| |
| |
| |
| |
| |

| <i>F</i> | ASSESSOR'S USE ONLY |
|----------|------------------------|
| | USE ONLY |
| | |
| | |
| | |
| | |
| | |
| | |
| | |
| | |
| | |
| | |
| | |
| | |
| | |
| | |
| | |
| | |
| | |
| | |
| | |
| | |
| | |
| | |
| | |
| | |
| | |
| | |
| | |
| | |
| | |
| | |
| | |
| | |
| | |
| | |
| | |
| | |
| | |
| | |
| | |
| | |
| | |
| | |
| | |
| | |
| | |
| | |
| | |
| | |
| | |
| | |
| | |
| | |
| | |
| | |
| | |
| | |
| | |
| | |
| | |
| | |
| | |
| | |
| | |
| | |
| | |
| | |

| | | Extra space if required. | |
|--------------------|---|---|--|
| QUESTION | I | Write the question number(s) if applicable. | |
| QUESTION NUMBER | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |

| | Extra space if required. | |
|--------------------|---|--|
| QUESTION NUMBER | Write the question number(s) if applicable. | |
| NUMBER | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |