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NZQA

NEW ZEALAND QUALIFICATIONS AUTHORITY
MANA TOHU MĀTAURANGA O AOTEAROA

For Supervisor's use only

Level 3 Biology, 2008

90715 Describe the role of DNA in relation to gene expression

Credits: Four
9.30 am Monday 17 November 2008

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 answer 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.

For Assessor's use only	**Achievement Criteria**				
Achievement		**Achievement with Merit**		**Achievement with Excellence**	
Describe the role of DNA in relation to gene expression.		Explain the role of DNA in relation to gene expression.		Discuss the role of DNA in relation to gene expression.	
Overall Level of Performance					

You are advised to spend 40 minutes answering the questions in this booklet.

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QUESTION ONE

DNA and RNA are two types of nucleic acid.

(a) Complete the following table by giving the features of these two molecules.

	DNA	RNA
Bases present		
Relative length		
Sugar		
Location in eukaryote cell		

(b) Discuss how the arrangement of bases in the DNA molecule allows it to carry genetic information. Your answer **should** include information on the significance of:

- sequence of bases on the DNA
- nature of the code (codons)
- redundancy of the genetic code.

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QUESTION TWO

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Eukaryote genes include both **introns** and **exons**, but prokaryote genes contain neither.

(a) Describe what is meant by the terms **intron** and **exon**.

(i) intron:

(ii) exon:

(b) In eukaryotes the length of the mRNA molecule produced by transcription is less than the length of the gene itself. This is due to RNA splicing.

Explain why the length of an mRNA molecule transcribed from a eukaryote gene is shorter than the original gene's DNA sequence.

(c) Discuss how the mRNA transcript is translated into a polypeptide chain on the ribosome. You should include information about:

- tRNA
- codons and anticodons
- peptide bonds
- start and stop codons.

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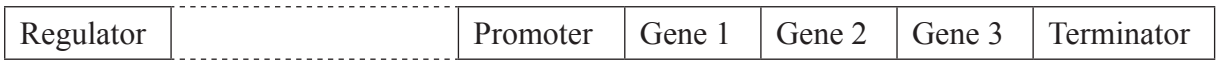
(d) In bacteria, the genes coding for proteins involved in lactose metabolism are grouped together in an operon. The following diagram of a length of DNA shows an operon and its related regulator gene site.



Describe the role of the **promoter**.

(e) The **lac** operon controls metabolism of the sugar lactose. The genes are not expressed unless lactose is present in the cell's environment.

Explain the role of lactose in expression of the lac operon.

QUESTION THREE

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A particular mutant allele produces mice with yellow fur. Scientists studying this mutation crossed yellow mice with pure-breeding grey mice. In the F1 generation, they obtained a phenotypic ratio of 1 yellow : 1 grey.

(a) Explain whether the yellow mice used in this cross were homozygous or heterozygous. You may use a Punnett square in your answer.

(b) Explain whether yellow fur is a dominant or a recessive trait.

(c) The scientists crossed two heterozygous yellow mice and examined their offspring. They expected to see a 3:1 yellow : grey phenotypic ratio. However, they found a 2:1 yellow : grey phenotypic ratio.

Discuss why the phenotypic ratio differed from what was expected.

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(d) Scientists studying the inheritance of skin colour in humans graphed their data as shown below:

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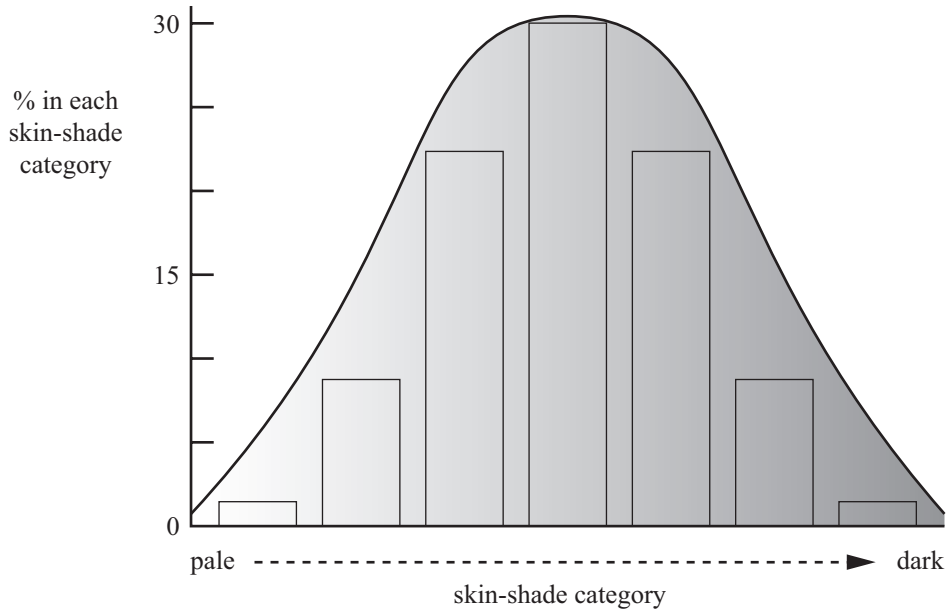

Identify and explain the pattern of inheritance shown in this graph.

Pattern of inheritance:

Explanation:

Extra paper for continuation of answers if required.
Clearly number the question.

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Question number