1.8 The Control of Gene Expression: 10-minute Pack

AQA 7402 · Calculator allowed · about 10 minutes

Total Marks

Name: _____ Date: ____ / ____ / _____

Answer ALL questions. Show all your working.

1 Mutations in coding sequences can alter protein products.

(a) Define a missense mutation and a nonsense mutation in coding DNA. One sentence each. **(2)**

(b) A coding sequence has 900 nucleotides. A single base substitution introduces a stop codon at nucleotide position 601 (counting from the first base of the start codon). How many amino acids long is the truncated protein? Show working. **(2)**

(Total for Question 1 is 4 marks)

2 Compare repressible and inducible operons in prokaryotes.

(Total for Question 2 is 4 marks)

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Mark scheme · 1.8 The Control of Gene Expression: 10-minute Pack

Question 1

(a) missense: single base change that alters a codon so it codes for a different amino acid oe **B1**

(a) nonsense: mutation that changes a codon to a stop codon, causing premature termination of translation oe **B1**

(a) Answer: Missense: a single base change that alters a codon so a different amino acid is incorporated. Nonsense: a mutation that converts a codon to a stop codon, causing premature termination.

(b) calculate number of complete codons before stop: codons = floor((601 - 1)/3) + 1? or simpler: nucleotide position 601 is in codon number 201, oe **M1**

(b) truncated protein length = 200 amino acids (if stop at codon 201, only 200 full amino acids before stop), cao **A1**

(b) Answer: 200 amino acids

Question 2

repressible operons are usually on by default and turned off by the corepressor binding to repressor (example: trp operon), oe **B1**

inducible operons are usually off by default and turned on by an inducer binding to repressor or activator (example: lac operon), oe **B1**

mechanism difference: repressible uses negative feedback when end product high; inducible responds to presence of substrate to allow expression **B1**

functional consequence: repressible prevents wasteful synthesis when product abundant; inducible allows rapid response to available substrate **B1**

Answer: Repressible operons are usually active and shut down when a corepressor binds the repressor (negative feedback); inducible operons are usually inactive and activated when an inducer prevents repressor binding or recruits activator. Repressible saves resources when product abundant; inducible allows expression only when substrate present.

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