

AQA, OCR, Edexcel

A Level

A Level Biology

Gene Technology Questions

Name:

M M E

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Total Marks: /33

Gene Technology

Gene technology encompasses all techniques used to study and manipulate the function of genes.

1. Because the genome is so large, when scientists want to analyse a specific set of genes they must first break the DNA up into smaller fragments that contain the target genes of interest.
 - a) One of the techniques used in genetic engineering involves reverse transcription.
 - i) Explain the process of reverse transcription. (3 marks)
 - ii) Why is this technique more efficient than trying to obtain a DNA fragment containing the gene. (2 mark)
 - b) Using restriction endonuclease enzymes is another technique for obtaining DNA fragments.
 - i) Explain the mechanism by which restriction endonucleases create DNA fragments. (3 marks)
 - ii) *HindIII* is a restriction enzyme that cuts at AAGCTT, between two adenine bases. Using the section of DNA below, identify where *HindIII* digests the DNA and where the target fragment of DNA would be.
(2 marks)

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A A G C T T G A T C C A A A G C T T
T T C G A A C T A G G T T T C G A A

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- iii) Explain how the DNA fragments created by some restriction endonucleases can be joined to other DNA fragments. (2 marks)
- c) The Polymerase Chain Reaction (PCR) is used to amplify a sample of DNA.
- i) What must be present in the reaction mixture for PCR to take place? (2 marks)
 - ii) Explain the process of the polymerase chain reaction and the conditions required. (5 marks)
 - iii) Why is PCR useful in forensic science? (1 mark)
2. Insulin is a hormone secreted by β cells in the islets of Langerhans in the pancreas in response to an increase in blood glucose levels. People who suffer from Type 1 Diabetes do not produce insulin and must inject it daily (pictured below). This insulin is created through genetic engineering techniques involving bacterial vectors, previously insulin was extracted from animals such as pigs.
- i) What is a vector? (1 mark)
 - ii) To make artificial insulin, mRNA containing the insulin gene must be extracted from healthy β cells in the pancreas. Explain the processes that must then take place so that insulin can be inserted into a vector? (6 marks)
 - iii) Not all vectors ultimately contain the insulin gene. Explain how scientists ensure that only the plasmids containing the insulin gene are ultimately replicated for human use? (4 marks)
 - iv) Why is using insulin produced by gene technology more advantageous than the previous methods that used animal insulin? (2 marks)