

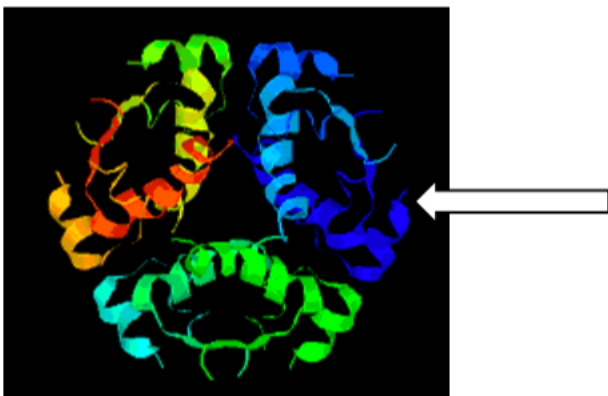
Question 2

In the development of Type 1 Diabetes some beta cells of pancreas receive signals from cytotoxic T-cells to undergo Apoptosis.

- Give a definition of Apoptosis and example of a disease which can occur if it malfunctions. (2 Marks)
- Name the type of apoptotic pathway occurring in Type 1 Diabetes. (1 Mark)
- Outline the main steps in this apoptotic pathway. (3 Marks)

Question 3

Insulin is a peptide-based hormone, composed of multiple peptide chains, as shown below in **Diagram 1**. An arrow points to a type of secondary structure.



- a. Give the name of the structure indicated by the arrow. (1 Mark)

- b.
- c. Explain what is meant by the tertiary and quaternary structure of a protein by referring to **Diagram 1**. (2 Marks)
- d. Name the reaction by which the monomers of the insulin polypeptide are combined to form the primary structure. (1 Mark)
- e. With regards to the production and transport of insulin, what are the roles of the Endoplasmic Reticulum and Golgi Apparatus? (2 Marks)
- f. Name the process by which Insulin leaves the cell it was synthesised in and enters the blood stream (1 Mark)

Question 4

In humans, the Insulin prorepolypeptide molecule is synthesised as a consequence of instructions encoded in a gene, INS.

- a. Name the type of gene INS is and draw its structure. (3 Marks)



- b. Name and outline the process by which information encoded in INS is converted in mRNA. (3 Marks)

Question 5

The length of the coding region of the INS gene is 3000 nucleotides. A VCE Biology Student hypothesised that the length of INS mRNA molecule must also be 3000 nucleotides.

With reference to your answer to 7, explain why the student has hypothesised this and why this hypothesis is not correct. (3 Marks)

Question 6

In another VCE Biology Class the same student says, “Two individuals may have the different DNA nucleotide sequences at the INS locus, but produce the same Insulin propeptide.”

- a. Is this statement correct? Why or why not? (2 Marks)

- b. *In healthy individuals, Insulin is released into the blood stream when blood glucose levels are high. When Insulin reaches its target cells it increases the uptake of glucose, a moderately sized polar molecular, from the blood into the cell. It achieves this by increasing the number of GLUT4 proteins, a glucose specific channel protein, in the cell membrane.*

Name the type of transport by which glucose is entering the target cells and explain, with reference to the above paragraph, how you know this. (3 Marks)

- c. Insulin, unlike the steroid hormone Testosterone, travels in the blood stream without a carrier protein. Explain why. (2 Marks)

Question 7

Outline the process of signal transduction, with reference to Insulin. (4 Marks)

Question 8

Briefly compare the mode of transmission of Serotonin (a neurotransmitter), bombykol (a pheromone) and Insulin. (3 Marks)

Question 9

Insulin inhibits the enzyme glucose-6-phosphatase, which is normally responsible for catalysing the final step of producing glucose from glycogen.

Assuming Insulin is a non-competitive inhibitor, show using a diagram how Insulin prevents glucose-6-phosphatase from producing glucose from its substrate, glucose 6- phosphate. (3 Marks)



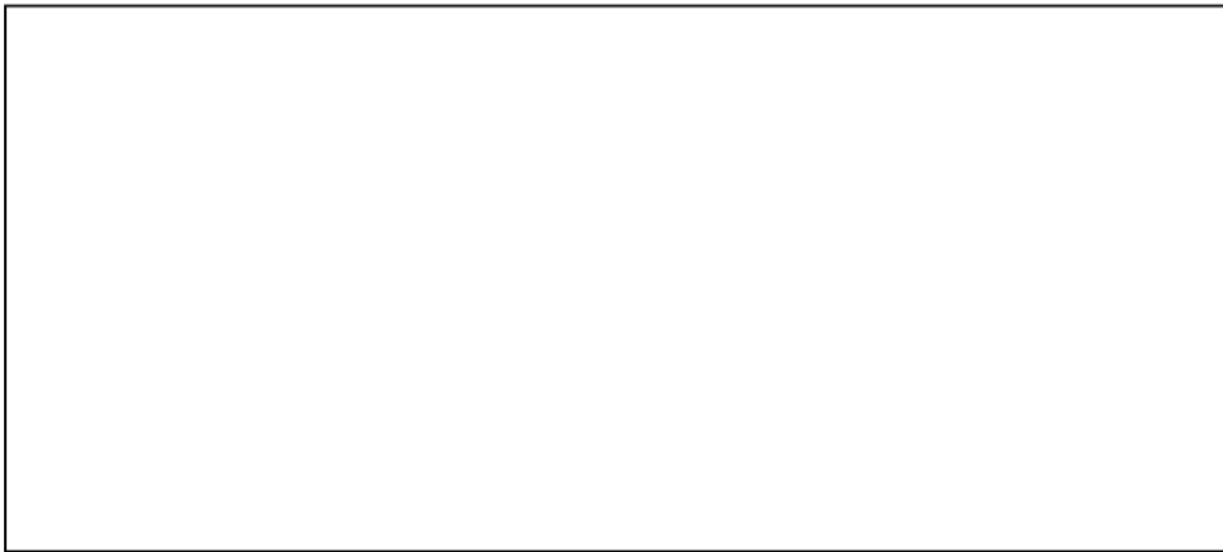
Question 10

Glucose is an output in an important process in plants. Name this process and where it occurs (2 Marks)

Question 11

A scientist interested in enzyme kinetics isolates insulin, glucose 6-phosphate and glucose-6-phosphatase.

- a. If only glucose 6-phosphate and glucose-6-phosphatase are mixed together at 37 degrees Celsius, draw a graph of how the concentration of glucose changes over time. (Exact quantities of time or concentration are not required) (2 Marks)



- b. Would this graph change if the temperature was increased to 150 degrees? Why? (2 Marks)

- c. In another experiment, the scientist mixes glucose 6-phosphate, glucose-6-phosphatase and bacterial cells in a test tube, at 37 degrees Celsius. The tube is left uncovered for 5 hours, as shown below. They notice that the mixture form bubbles and that the concentration of glucose in the test tube decreases over time.

Explain why the mixture forms bubbles (4 Marks)

ASHA Lectures