

Name of the Student: _____

Max. Marks : 23 Marks

Time : 23 Minutes

Q1.

Describe the sequence of events involved in transmission across a cholinergic synapse.

Do **not** include details on the breakdown of acetylcholine in your answer.

(Total 5 marks)

Q2.

Alport syndrome (AS) is an inherited disorder that affects kidney glomeruli of both men and women. Affected individuals have proteinuria (high quantities of protein in their urine).

(a) Suggest how AS could cause proteinuria.

(2)

(b) AS results from a sex-linked mutation.

In a male with AS, where would the sex-linked mutation be located?

Tick (✓) **one** box.

The homologous section of a Y chromosome

☐

The homologous section of an X chromosome

☐

The non-homologous section of a Y chromosome

☐

The non-homologous section of an X chromosome

☐

(1)

Scientists investigated the use of transplanted stem cells to treat AS in mice.

The scientists set up four experimental groups.

Group **A** – 40 wild type* mice

Group **B** – 40 AS mice

Group **C** – 40 AS mice that received stem cells from AS mice

Group **D** – 40 AS mice that received stem cells from wild type mice

*Wild type mice are mice **not** affected by AS.

After 20 weeks, the scientists measured the quantity of protein in the urine using a scale from 0 (lowest quantity) to +++++ (highest quantity).

The results the scientists obtained are shown in below table.

Group	Maximum quantity of protein in urine at 20 weeks	Percentage of mice with this quantity of protein
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Q3.

- (a) Describe the role of glucagon in gluconeogenesis.

Do **not** include in your answer details on the second messenger model of glucagon action.

(2)

- (b) The gene that codes for glucagon is 9.531 kilobases in length. The DNA helix makes one complete turn every 10 base pairs. Every complete turn is 3.4 nm in length.

Use this information to calculate the length in micrometres (μm) of the gene for glucagon. Give your answer to 3 significant figures.

Answer = _____ μm

(2)

Metformin is a drug commonly used to treat type II diabetes. Metformin's ability to lower the blood glucose concentration involves a number of mechanisms including:

- increasing a cell's sensitivity to insulin
- inhibiting adenylate cyclase.

- (c) Explain how increasing a cell's sensitivity to insulin will lower the blood glucose concentration.

(2)

(d) Explain how inhibiting adenylate cyclase may help to lower the blood glucose concentration.

(3)

(Total 9 marks)