Hormonal communication – 2021/20 GCE Biology A Component 01

1. Nov/2021/Paper_H420/1/No.17

The pancreas produces digestive enzymes and is also involved in the regulation of blood glucose concentration.

(a) **Fig. 17**, **in the insert**, shows a light micrograph of a section of mouse pancreas.

Identify the structures labelled **K** and **L** in **Fig. 17**.

K .....

L .....

[2]

(b) Scientists investigated the effect of the drug nifedipine on the secretion of insulin from pancreas cells in culture.

Pancreas cells were first incubated with glucose at a concentration of 3 mmol dm^{-3}. The concentration of glucose was then increased to 20 mmol dm^{-3} in the presence or absence of nifedipine.

The scientists then measured the amount of insulin secreted by the cells. They recorded their results as a percentage of the total insulin content of the cells. Each experiment was repeated seven times.

The results are shown in the table.

Condition	Mean insulin secreted (%)
Without nifedipine	7.8 ± 0.78
With nifedipine	0.8 ± 0.15

(i) Name the cells that secrete insulin.

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(ii) Explain why it was necessary to increase the concentration of glucose surrounding the cells before they measured insulin secretion.

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(iii) Suggest and explain which statistical test the researchers would have used to analyse their data.

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(iv) The statistical test gave a value of $p < 0.001$. Use the words 'chance' and 'probability' to draw a conclusion from the result of the statistical test.

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(v) Nifedipine blocks Ca^{2+}-channels.

Explain how blocking calcium channels could inhibit insulin secretion.

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(c)* Type 1 diabetes has been treatable for many years, but treatments are always improving.

Evaluate the treatments for type 1 diabetes that have been used in the past as well as current and potential future treatments.

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..... **[6]**

2. Nov/2020/Paper_H420/03/No.1(c, d)

(c)* Water reabsorption in the kidney is controlled by the endocrine and nervous systems.

Aldosterone and ADH are hormones that act on the kidney.

Aldosterone causes sodium ions to be pumped from the collecting duct cells into tissue fluid.

Describe how the endocrine **and** nervous systems work together to increase water reabsorption from the collecting duct.

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..... **[6]**

(d) Diuretics are drugs that decrease the reabsorption of water into the blood from the kidney.

Diuretics can change the concentration of ions and other molecules in the blood.

Some diuretics are used to treat high blood pressure.

The table below lists three different diuretics, **X**, **Y** and **Z**, and some of their effects in the body.

	Without a diuretic	**With a diuretic**		
		X	**Y**	**Z**
Rate of urine production ($ml\,min^{-1}$)	1	3	13	8
Blood chloride ion concentration ($mmol\,dm^{-3}$)	60	15	150	150
Blood potassium ion concentration ($mmol\,dm^{-3}$)	15	60	12	25
Blood glucose concentration ($mmol\,dm^{-3}$)	6	6	9	8

(i) Suggest which of the diuretics, **X**, **Y** or **Z**, would be the most effective at reducing a person's blood pressure. Explain your choice.

diuretic.....

explanation.....

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[1]

(ii) Suggest which of the diuretics, **X**, **Y** or **Z**, would be the most appropriate for use by a person with type II diabetes. Explain your choice.

diuretic.....

explanation.....

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[1]