

Homeostasis in mammals

Question Paper 3

Level	International A Level
Subject	Biology
Exam Board	CIE
Topic	Homeostasis
Sub Topic	Homeostasis in mammals
Booklet	Theory
Paper Type	Question Paper 3

Time Allowed : 43 minutes

Score : / 36

Percentage : /100

Grade Boundaries:

A*	A	B	C	D	E	U
>85%	77.5%	70%	62.5%	57.5%	45%	<45%

- 1 Figs 3.1 and 3.2 show the concentration of glucose and insulin in blood plasma before and after a glucose drink.

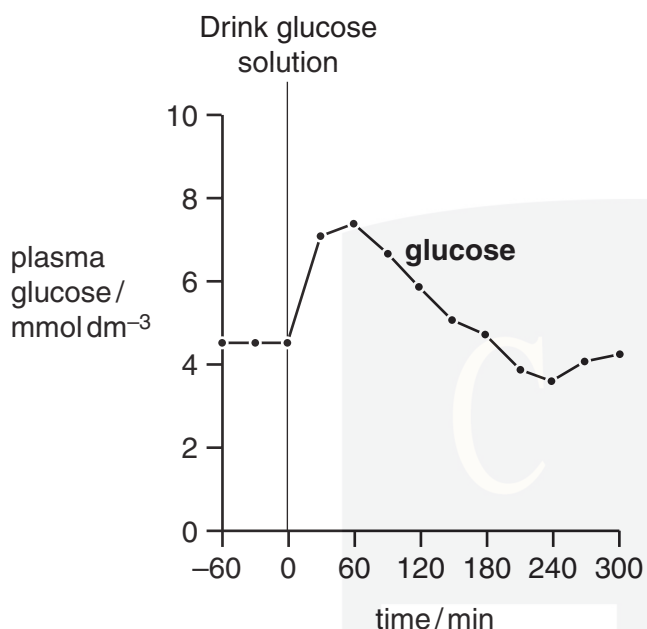


Fig. 3.1

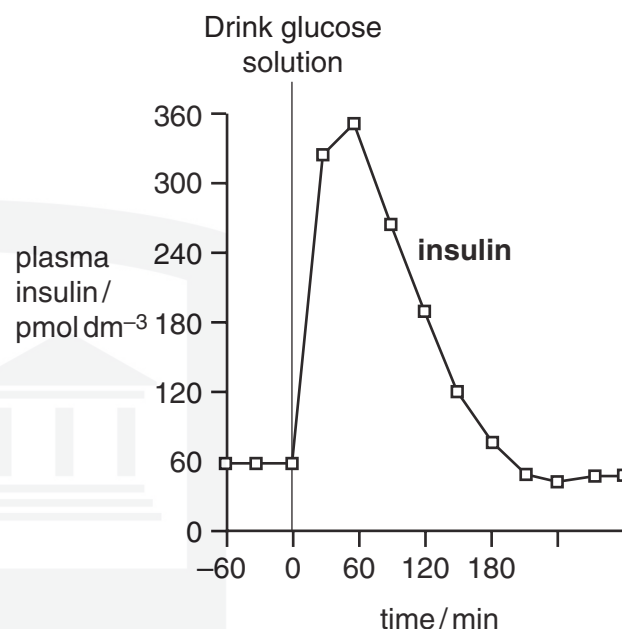


Fig. 3.2

- (a) With reference to Fig. 3.1, describe the changes in blood glucose concentration after the glucose drink.

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- (b) With reference to Fig. 3.1 and Fig. 3.2, explain how the changes in blood glucose cause:

- (i) an increase in the concentration of insulin in the plasma;

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- (ii) a subsequent fall in the concentration of insulin in the plasma.

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- (c) Describe the role of the hormone glucagon in maintaining the concentration of blood glucose.

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[Total : 10]



- 2 The mammalian liver is made up of lobules that consist of liver cells (hepatocytes) arranged in plates.

Between these plates of cells are enlarged leaky capillaries called sinusoids.

Blood from both the hepatic portal vein and the hepatic artery flows through these sinusoids to the central vein and eventually into the hepatic vein.

Inside the sinusoids are Kupffer cells.

Fig. 3.1 shows a section of a liver lobule and its associated blood vessels.

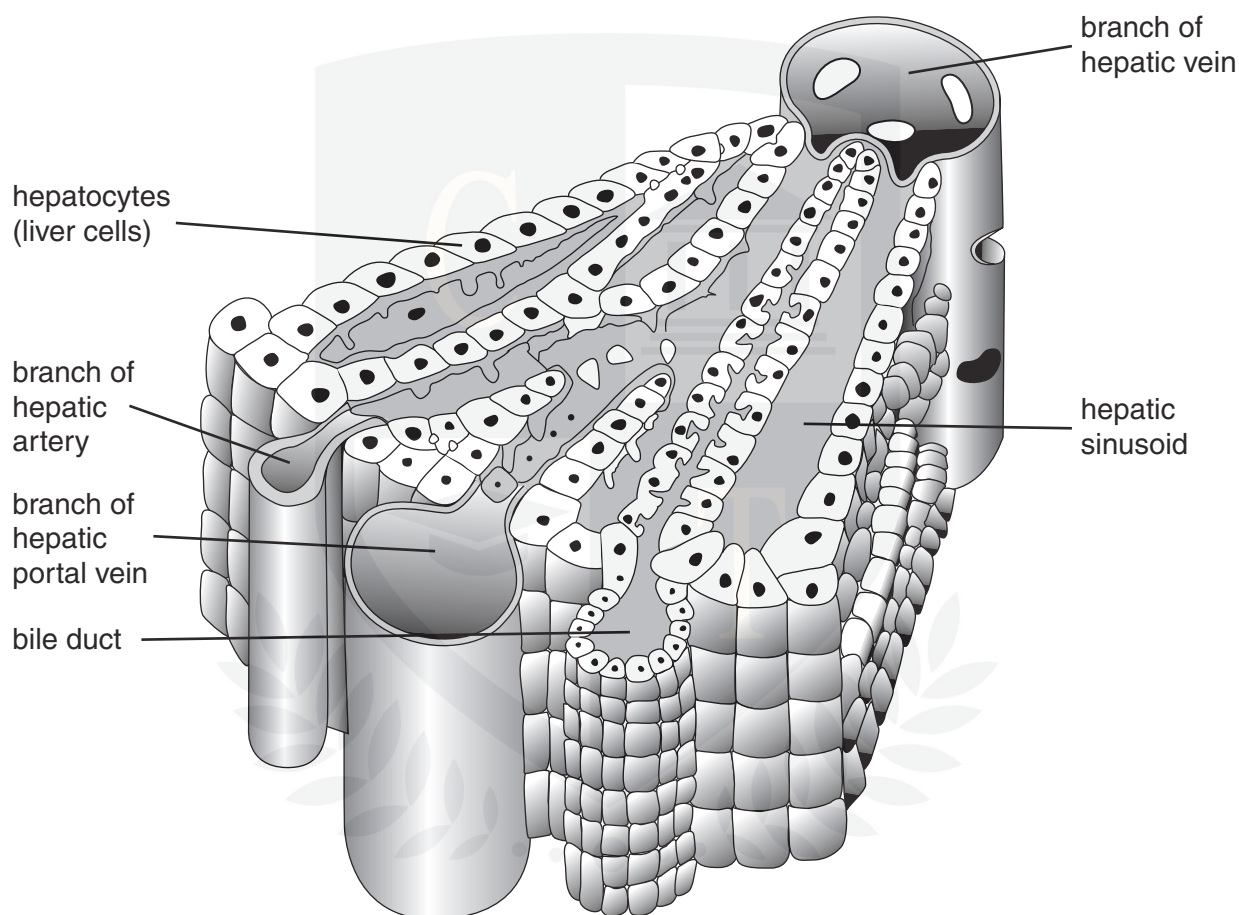


Fig. 3.1

- (a) Describe the role of the Kupffer cells in the homeostatic function of the liver.

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- (b)** State how liver cells are involved in fat metabolism.

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- (c)** Explain how urea produced by liver cells from the deamination of excess amino acids is transported to the kidney for excretion.

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- (d)** State how blood in the hepatic vein will differ after a heavy meal from blood in

- (i)** the hepatic portal vein;

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- (ii)** the hepatic artery.

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[Total : 11]

CHEMISTRY ONLINE
— TUITION —

- 3 The secretion of insulin by the islets of Langerhans in the pancreas stimulates the liver to reduce the blood glucose concentration.

(a) Describe how the **liver** reduces blood glucose concentration, when insulin is secreted.

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- (b) Almost all insulin used to treat type I diabetes is produced by genetically engineered bacteria or yeast. A summary of this procedure is shown in Fig. 4.1.

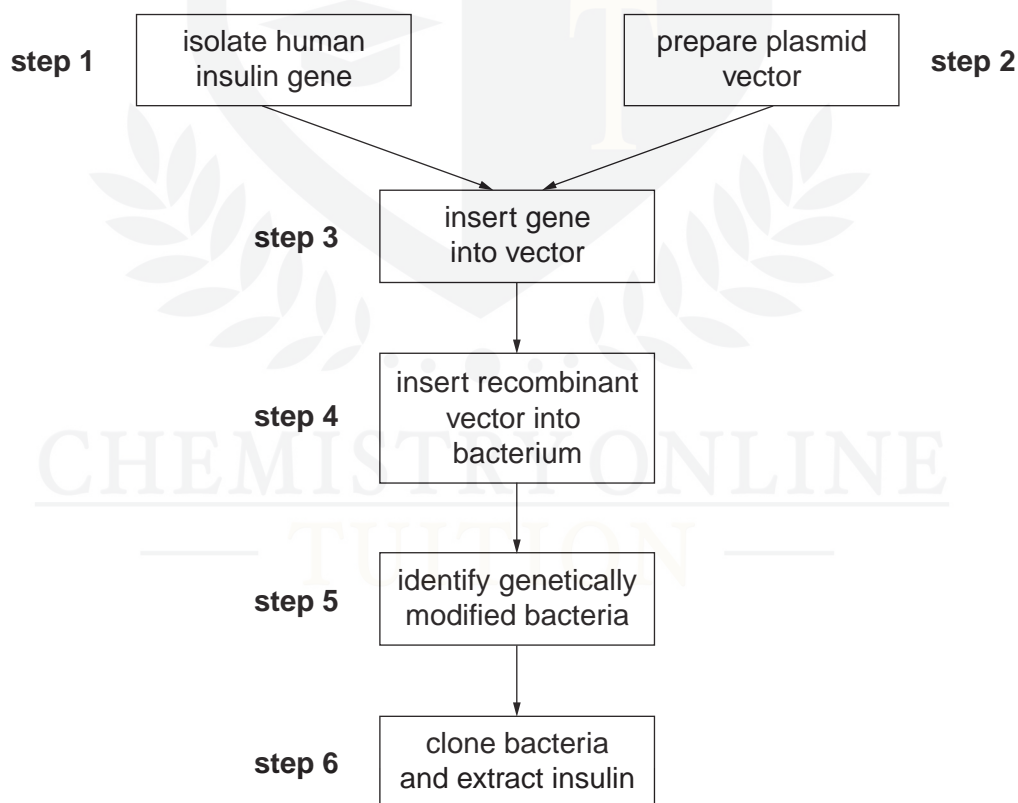


Fig. 4.1

- (i) One way of carrying out **step 1** is to collect mRNA from β cells from the pancreas. The relevant mRNA is then isolated and used to make DNA.

Suggest why isolating the mRNA coding for insulin in a β cell is easier than isolating the DNA for insulin in a β cell.

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- (ii) Outline the use of restriction enzymes in **step 2**.

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CHEMISTRY ONLINE
— TUITION —

- (c) Most people with type I diabetes inject insulin. A recent product contains insulin that can be administered using a nasal spray. The spray is inhaled and the insulin is taken up through the lungs.

Fig. 4.2 shows the concentration of insulin in the blood plasma in the 480 minutes after injecting or inhaling insulin. In both cases, the insulin was of the same type, obtained from genetically engineered *Escherichia coli*.

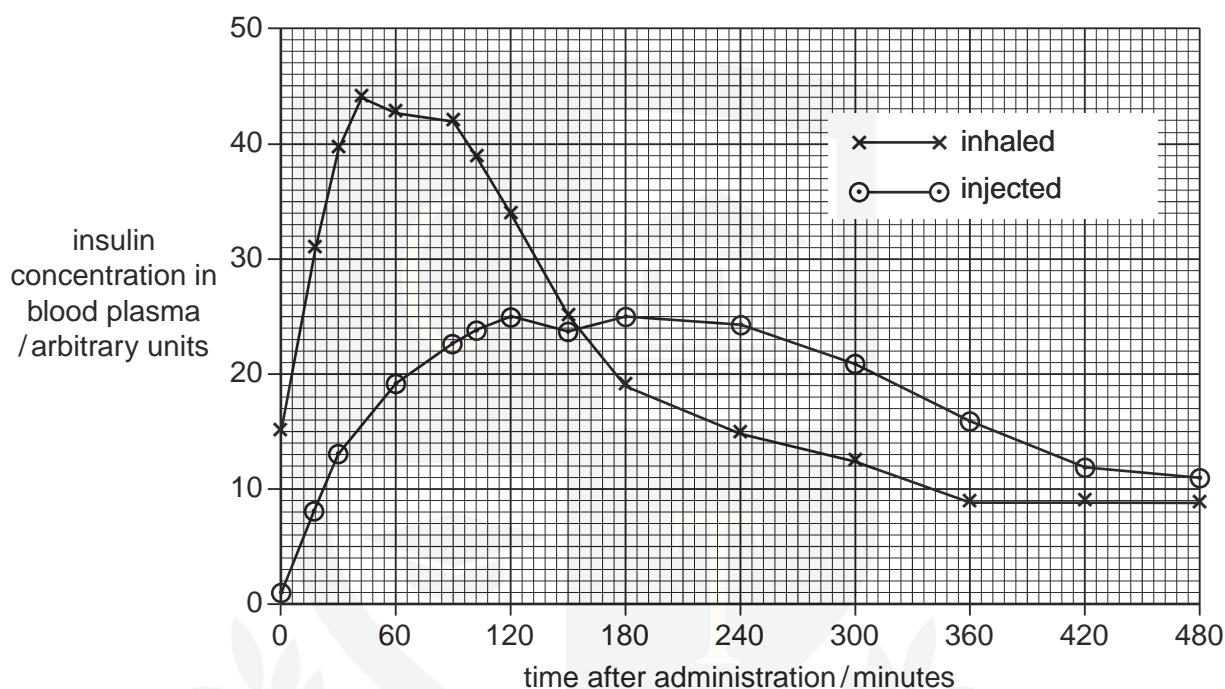


Fig. 4.2

Fig. 4.3 shows the concentration of glucose in the blood plasma in the 480 minutes after injecting or inhaling insulin.

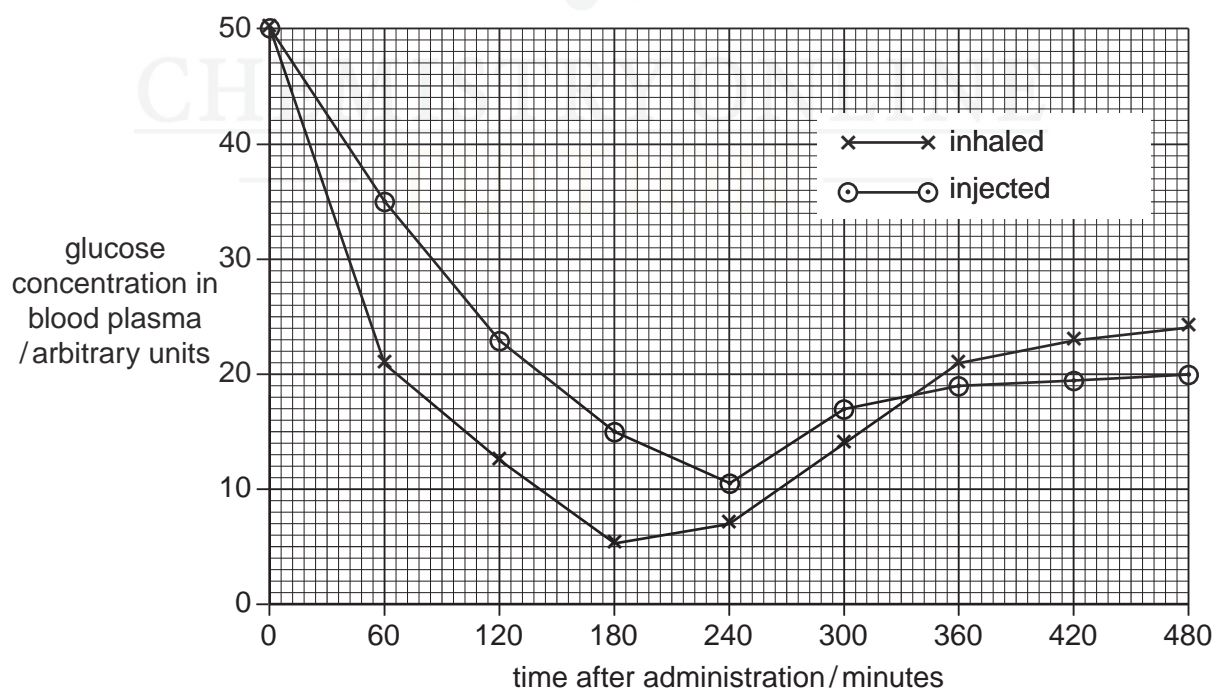


Fig. 4.3

- (i) Compare the results for injected insulin and inhaled insulin shown in Fig. 4.2.

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- (ii) With reference to Fig. 4.2, explain the differences in the blood glucose levels after injecting or inhaling insulin shown in Fig. 4.3.

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- (iii) With reference to Figs. 4.2 and 4.3, suggest one advantage and one disadvantage of inhaling insulin rather than injecting it.

advantage

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disadvantage

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[Total: 15]