3  End-of-chapter test

1  *The pancreas is both an endocrine and exocrine gland.* Explain the meaning of this statement.  [4]

2  Copy and complete the following account.

   The hormone adrenaline is secreted by the ________________ glands, which lie just above each ________________. Adrenaline is secreted when a person is exposed to a stressful situation, such as danger. It circulates in the blood, only affecting tissues with receptors for the hormone, known as ________________ tissues. In the case of adrenaline, the receptors are located in the ________________ of the cell.

   One effect of adrenaline is to increase the concentration of glucose in liver cells. Interaction of the adrenaline with its receptor causes a G-protein to split, in turn activating an enzyme called ________________. This enzyme converts ATP into a compound called ________________, which acts as a second messenger. This second messenger activates the first of a series of enzymes, eventually resulting in the conversion of ________________ into glucose, needed for the fight or flight response.  [7]

3  An investigation was carried out into the blood glucose concentration of a human volunteer. Half an hour after the start of the investigation, the volunteer ingested a meal rich in carbohydrate. Three hours after the start, she carried out a 15-minute period of vigorous exercise. At all other times, she rested. The results are shown in the graph below.

![Graph showing blood glucose concentration over time](image)

   a  What, approximately, is the normal concentration of glucose in the blood?  [1]
   b  Why does the blood glucose concentration not start to rise for 0.5 hours after the meal?  [1]
   c  Explain the reasons for the changes in glucose concentration over the time periods A, B, C and D.  [9]

4  a  Explain the difference between Type 1 and Type 2 diabetes.  [3]
   b  Both Type 1 and Type 2 diabetes have a genetic basis, but there are several risk factors associated with Type 2. State two of these.  [2]
   c  Diabetes can be treated by injections of insulin. The insulin may be obtained from the pancreases of pigs, or from genetically modified (GM) bacteria. What are the advantages of obtaining insulin from GM bacteria?  [3]
In one form of diabetes, the pancreas is unable to make sufficient insulin. In an investigation, 20 people were divided into two groups. Group A contained 10 people with this form of diabetes, while group B contained 10 people without diabetes (control group).

Blood samples were taken from each person at 30-minute intervals, and the amounts of glucose, insulin and glucagon measured. After 1 hour, each person ate a meal containing a large amount of carbohydrate. Mean concentrations were calculated for each substance at each sampling time.

The results are shown in the graphs below.

5

a  i  State one difference between groups A and B in the way in which glucagon secretion responds to the intake of carbohydrate.  
ii  State two differences between groups A and B in the way in which insulin secretion responds to the intake of carbohydrate.  

b  Explain the changes in blood glucose concentration in:
   i  group A  
   ii  group B.  

c  Suggest what would happen to the blood glucose concentration of people in group A if they ate no carbohydrate for another 24 hours. Explain your answer.  

6

Copy and complete the following account about the control of heart rate.

The rhythmic contractions of the heart muscle are initiated by a region of the heart called the ____________. This region is supplied with two sets of nerves. A branch of the vagus nerve, which is part of the ______________ nervous system, causes the heart rate to ______________. The other nerve, part of the ______________ nervous system, causes the heart rate to ______________. The sympathetic nerve secretes a neurotransmitter called _____________.  

Grade boundaries: 80% A, 70% B, 60% C, 50% D, 40% E