OCR
Oxford Cambridge and RSA

Thursday 16 June 2016 – Afternoon

A2 GCE BIOLOGY

F214/01 Communication, Homeostasis and Energy

Candidates answer on the Question Paper.

OCR supplied materials:
None

Other materials required:
- Electronic calculator
- Ruler (cm/mm)

Duration: 1 hour 15 minutes

Candidate forename		Candidate surname	

Centre number						Candidate number				

INSTRUCTIONS TO CANDIDATES

- Write your name, centre number and candidate number in the boxes above. Please write clearly and in capital letters.
- Use black ink. HB pencil may be used for graphs and diagrams only.
- Answer **all** the questions.
- Read each question carefully. Make sure you know what you have to do before starting your answer.
- Write your answer to each question in the space provided. If additional space is required, you should use the lined page(s) at the end of this booklet. The question number(s) must be clearly shown.
- Do **not** write in the bar codes.

INFORMATION FOR CANDIDATES

- The number of marks is given in brackets **[ ]** at the end of each question or part question.
- The total number of marks for this paper is **60**.
- Where you see this icon you will be awarded marks for the quality of written communication in your answer.
- You may use an electronic calculator.
- You are advised to show all the steps in any calculations.
- This document consists of **20** pages. Any blank pages are indicated.

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Answer **all** the questions.

1 **(a)** Fig. 1.1 is a diagram representing the mammalian pancreas and associated structures.

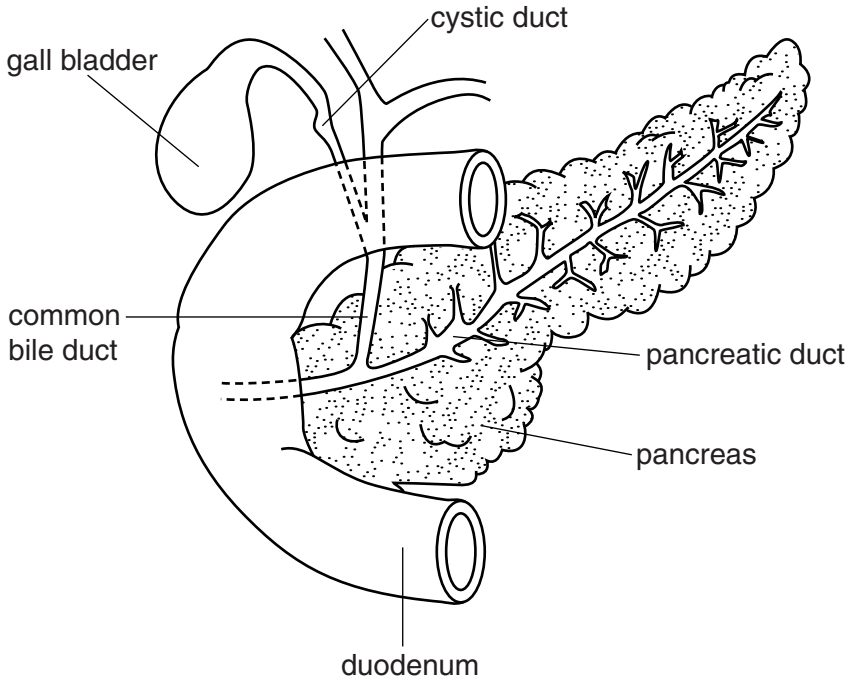


Fig. 1.1

The pancreas is an exocrine and an endocrine gland.

How does Fig. 1.1 indicate that the pancreas has an **exocrine** function?

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..... **[2]**

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(b) Fig. 1.2 represents a cross-section of part of the pancreas.

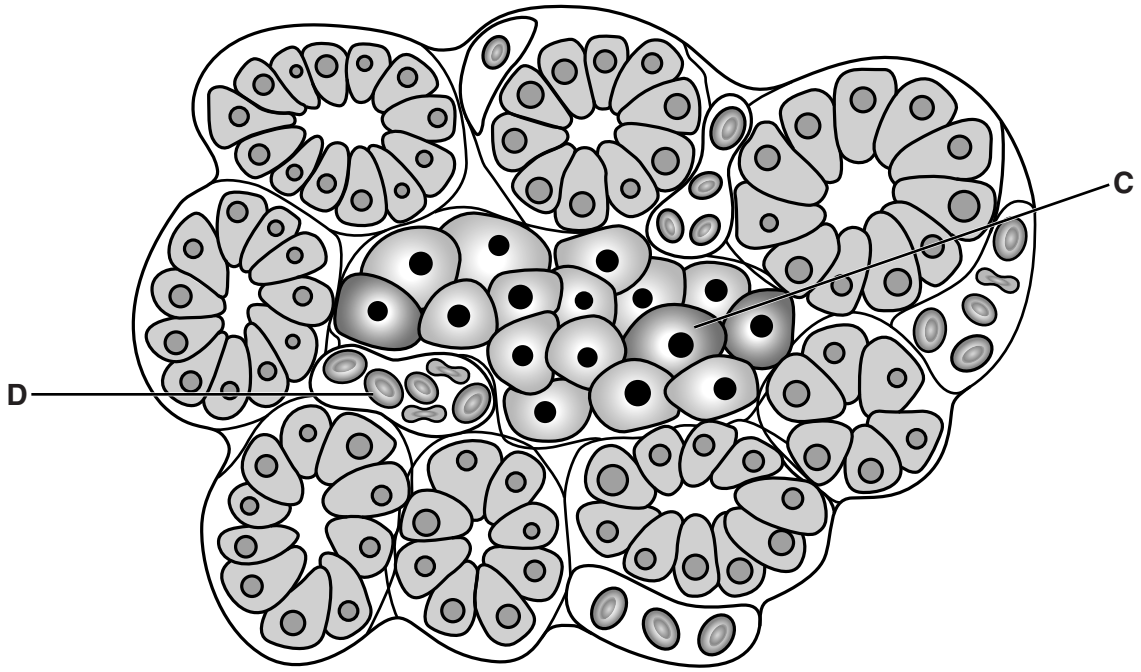


Fig. 1.2

(i) Name the **group** of cells that include the cell labelled **C**.

..... **[1]**

(ii) Identify the structure labelled **D**.

..... **[1]**

(c) Fig. 1.3 shows the concentrations of glucose and insulin in the blood of an individual before and after a meal.

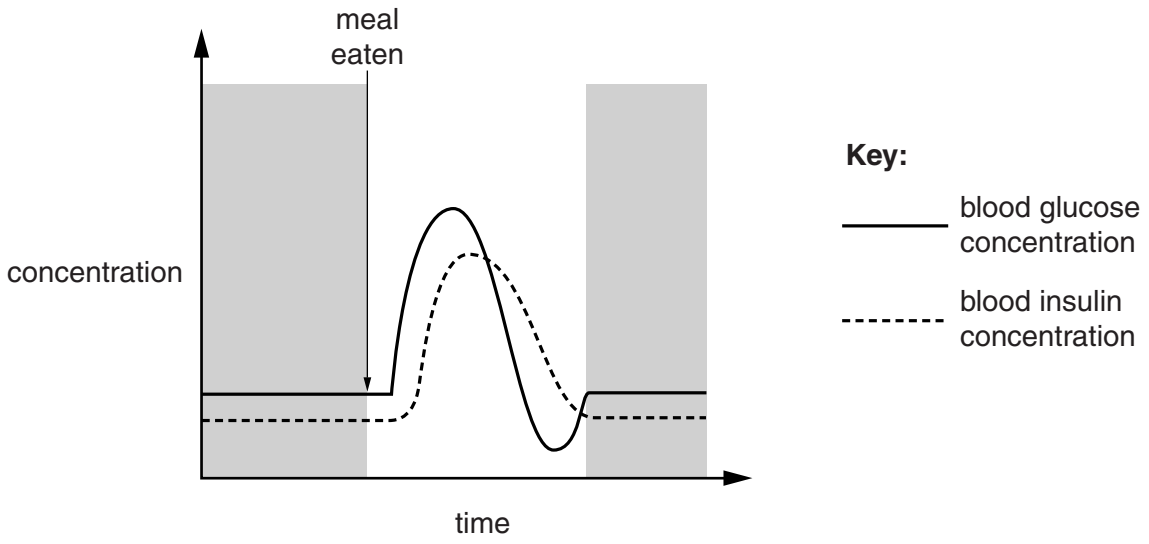


Fig. 1.3

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(i) After the meal, the concentrations of glucose and insulin in the blood increase.

Explain why there is a delay in the increase of insulin concentration following the increase in blood glucose concentration.

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..... **[2]**

(ii) The shaded parts of the graph in Fig. 1.3 are over-simplified representations of the blood glucose and insulin concentrations.

Describe **and** explain how these concentrations should be represented on the graph accurately.



In your answer, you should use appropriate technical terms, spelled correctly.

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..... **[4]**

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(d) The published Glycaemic Index value (GI) of a carbohydrate-containing food, rates the food on a scale from 0 to 100 according to how much it raises blood glucose concentration after it is eaten.

To determine the GI value of a test food:

- 10 healthy people fast overnight
- the test food containing 50 g of carbohydrate is eaten
- blood samples are taken every 15 minutes for the next two hours and blood glucose concentrations are measured
- a value known as the iAUC is obtained from these measurements
- the GI value is calculated by dividing the iAUC for the test food by the iAUC for glucose and multiplying by 100
- the mean of the GI values from all 10 people is the published GI value for that food

(i) Why is it necessary for the people to fast overnight before the start of the test?

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..... **[1]**

(ii) The **iAUC for glucose** is used to calculate the GI value of the test food. For this calculation to be valid, a number of variables must be controlled when determining the iAUC for glucose.

Suggest **two** variables and **how** they may be controlled.

1 .....

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2 .....

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..... **[2]**

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(iii) Why does the procedure use the mean of the GI values to obtain the published GI value for the food?

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..... **[1]**

[Total : 14]

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2 Much biological knowledge is obtained and verified through observation.

(a) A biologist has a small pond containing goldfish in her garden.

On a sunny day, more pondweed is at the surface of the water but on a cloudy day, less pondweed is at the surface.

Suggest an explanation for this observation.

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..... **[2]**

(b) A pump stands in the pond to circulate the water. In cold weather, the fish gather around the pump.

Suggest an explanation as to why the fish gather around the pump in cold weather.

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..... **[2]**

[Total : 4]

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3 **(a)** ATP is described as the 'universal energy currency'.

Describe how the structure of ATP is similar to **and** differs from the structure of a DNA nucleotide.



In your answer, you should use appropriate technical terms, spelled correctly.

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..... **[5]**

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(b) ATP is produced in cells by the process of respiration. Some of the reactions involved in the process of respiration are outlined in Fig. 3.1.

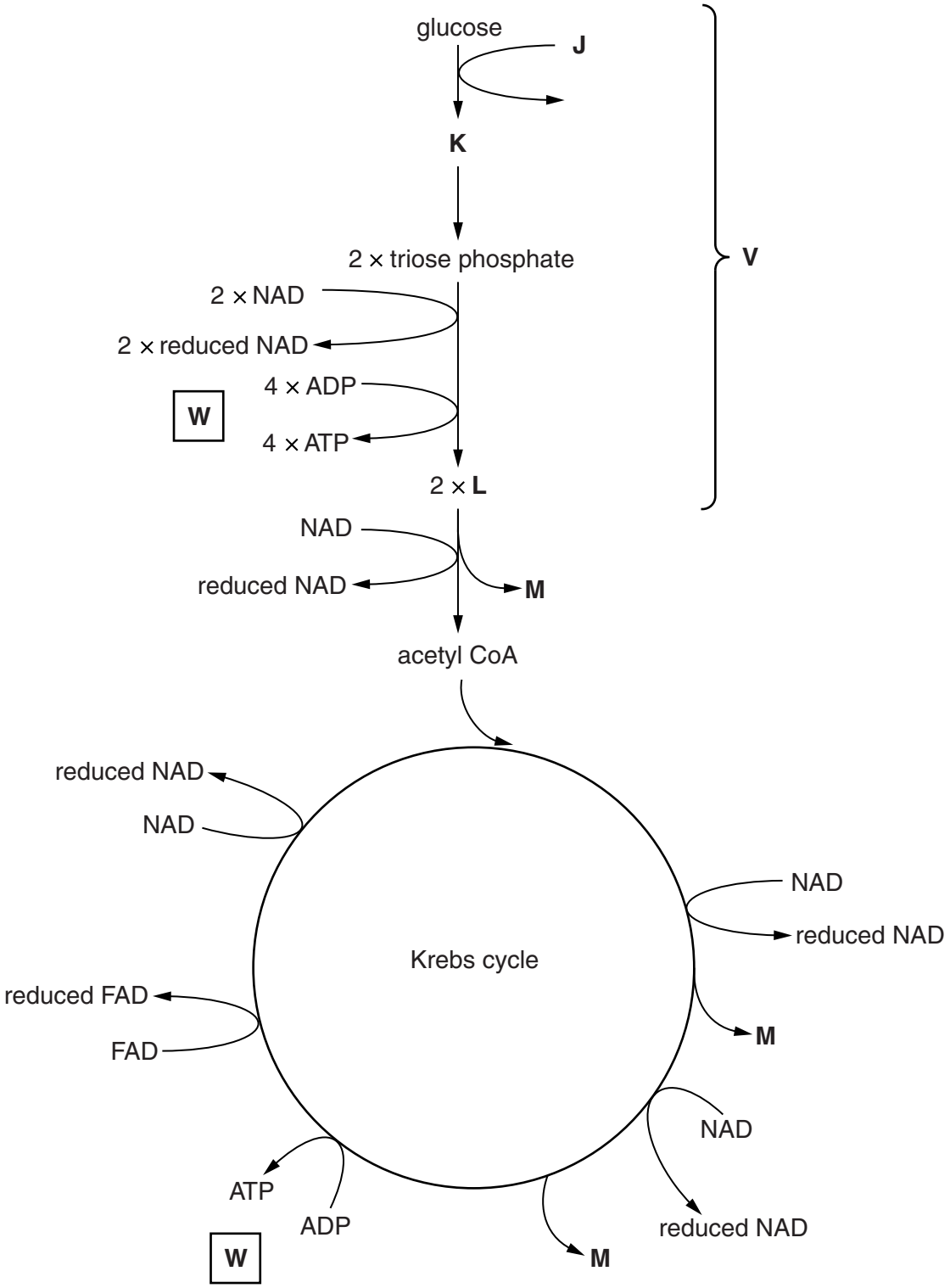


Fig. 3.1

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(i) Compound **J** is required for the reaction pathway to start.

Identify compound **J**.

..... **[1]**

(ii) Identify compounds **K** to **M**.

K .....

L .....

M .....

[3]

(iii) Name the pathway labelled **V**.

..... **[1]**

(iv) ATP is produced in two different ways during respiration.

- Some ATP is produced at the points labelled **W** on Fig. 3.1.
- ATP is also produced using reduced NAD and reduced FAD on the inner mitochondrial membrane.

Outline the differences in the two ways by which ATP is produced in respiration.

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..... **[3]**

[Total : 13]

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4 **(a)** The rate of photosynthesis is affected by different factors.

An experiment was carried out to investigate the effect of temperature and carbon dioxide concentration on the rate of photosynthesis.

- Plants were supplied with air (0.04% CO_2) and with air enriched with carbon dioxide (0.19% CO_2).
- The rate of photosynthesis was measured at different leaf temperatures.

The results are shown in Table 4.1.

Leaf temperature (°C)	**Rate of photosynthesis (a.u)**	
	in air with 0.04% CO_2	**in air with 0.19% CO_2**
10	8.0	8.0
15	12.3	16.8
20	15.0	24.4
25	16.2	30.0
30	14.3	34.7
35	8.3	38.2
40	—	29.3
45	—	13.2

Table 4.1

(i) Describe the effect on the rate of photosynthesis of increasing leaf temperature.

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..... **[3]**

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(ii) Calculate the percentage increase in the rate of photosynthesis at **30 °C** as the carbon dioxide concentration is increased from 0.04% to 0.19%.

Show your working and give your answer to **3 significant figures**.

Answer = ... % **[2]**

(iii) Use the information in Table 4.1 to state **one other** effect of an increased concentration of carbon dioxide on the rate of photosynthesis.

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..... **[1]**

(iv) Suggest why there are no results for 0.04% CO_2 at 40 °C and 45 °C.

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..... **[2]**

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(b) As a leaf ages, the ribulose bisphosphate carboxylase (rubisco) content of the leaf changes.

Fig. 4.1 represents the amount of rubisco present, the synthesis of rubisco and the breakdown of rubisco as the leaf ages.

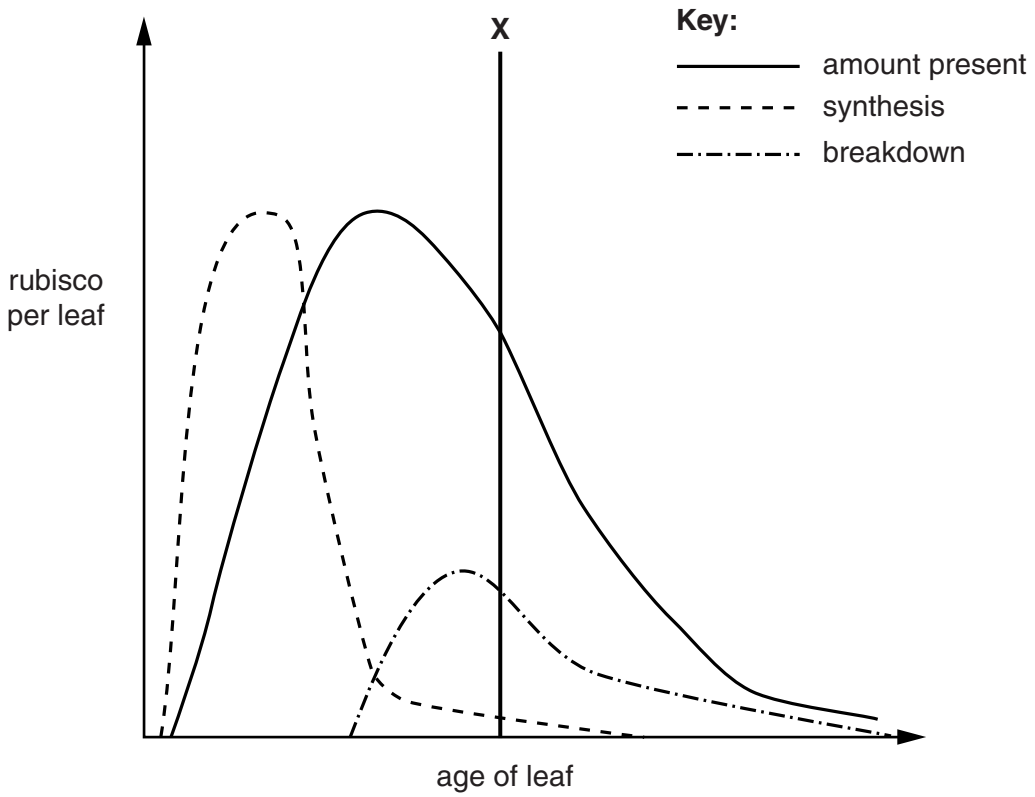


Fig. 4.1

Explain the effect that the levels of rubisco would have **on the rate of photosynthesis** as the age of the leaf increases beyond the line labelled **X**.

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..... **[3]**

[Total : 11]

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5 **(a)** Fig. 5.1 represents the voltage across the membrane of an axon and the changes that take place during the generation and transmission of an action potential.

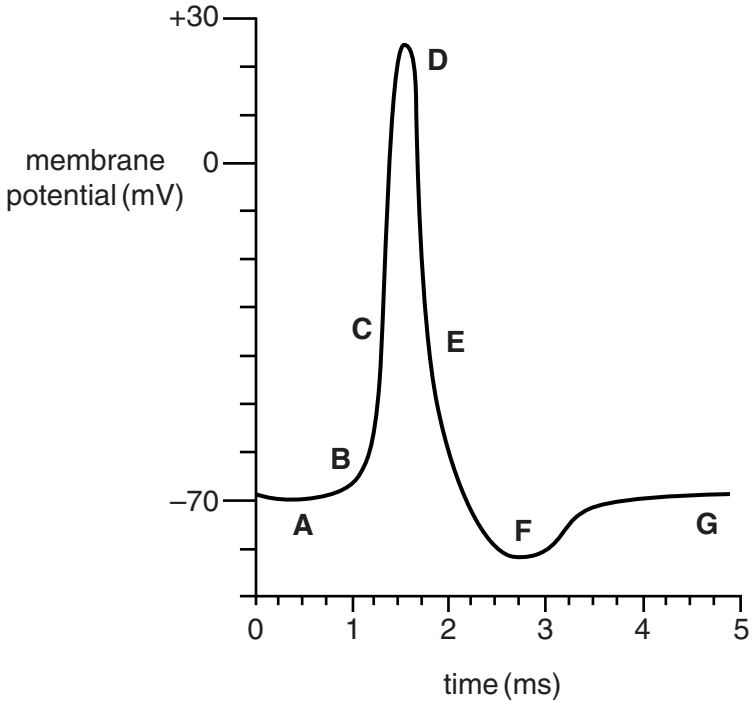


Fig. 5.1

Using Fig. 5.1, indicate the **letters**, **A** to **G**, when each of the following occurs.

A letter may be used once, more than once or not at all.

(i) Voltage-gated sodium ion channels are open.

..... **[1]**

(ii) Repolarisation.

..... **[1]**

(iii) Sodium ions are actively pumped out of the neurone.

..... **[1]**

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(b) Heart rate is controlled by nervous and hormonal mechanisms.

(i) For each of the following statements, indicate whether the statement is true or false.

Statement	True or False
Heart rate is accelerated by stimulation from the vagus nerve.	
Stimulation by the sympathetic and parasympathetic nerves have opposite effects on the heart rate.	
The vagus nerve releases acetylcholine.	

[2]

(ii) Hormonal control of heart rate is achieved by hormones acting on the sino-atrial node (SAN).

Using your knowledge of the way in which heart action is coordinated, suggest why it can be deduced that hormones act on the SAN rather than on individual cardiac muscle cells.

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..... **[2]**

(iii) Suggest how adrenaline brings about a response inside the cells of the SAN.

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..... **[2]**

[Total : 9]

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6 Most excess amino acids are metabolised in the liver, resulting in products that are relatively harmless to the body.

(a) Fig. 6.1 outlines the first step in the metabolism of amino acids in the liver.

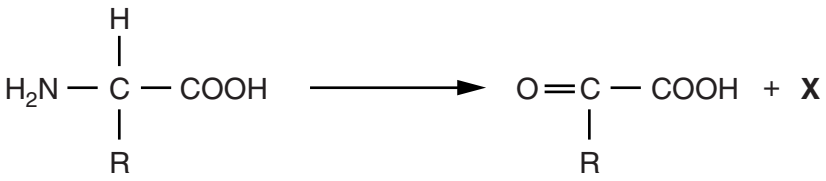


Fig. 6.1

(i) State the name given to this reaction.

..... **[1]**

(ii) Identify the toxic product of the reaction.

..... **[1]**

(b) Complete the following passage by inserting the **most suitable** word or term.

Fig. 6.1 shows the first step in the metabolism of amino acids in the liver. The next step involves a series of reactions known as the ..... cycle. The toxic product **X** enters the cycle together with ..... , resulting in the formation of the final nitrogenous product ..... The nitrogenous product is transported to the ..... and then via the ureter to the ..... where it is stored as ..... before leaving the body. **[6]**

(c) In addition to the reaction shown in Fig. 6.1, liver cells also use amino acids for protein synthesis.

Suggest **one** other use of amino acids in liver cell metabolism.

..... **[1]**

[Total : 9]

END OF QUESTION PAPER

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ADDITIONAL ANSWER SPACE

If additional space is required, you should use the following lined page(s). The question number(s) must be clearly shown in the margin(s).

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