TEST CODE 002374

M TP 20231

MAY/JUNE 2000

CARIBBEAN EXAMINATIONS COUNCIL

P1

ADVANCED PROFICIENCY EXAMINATION

BIOLOGY

Paper 01

2 hours

In addition to the 2 hours, candidates are allowed a reading time of 15 minutes. Candidates may write in their answer booklets during this 15-minute period.

READ THE FOLLOWING INSTRUCTIONS CAREFULLY

1. Candidates must attempt ALL questions in this paper.
2. Answers are to be written in the spaces provided in this answer booklet.
3. EACH question is worth 10 marks

2. In a study of a silk-cotton tree, the following numbers of organisms were obtained at each trophic level:

Trophic Level	Number of Organisms
Producer	1
Primary consumer	200 000
Secondary consumer	85
Tertiary consumer	5

(a) Sketch a pyramid of biomass to represent this food chain.

[2 marks]

(b) Suggest TWO reasons to account for such a large difference between the numbers of primary and secondary consumers.

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[2 marks]

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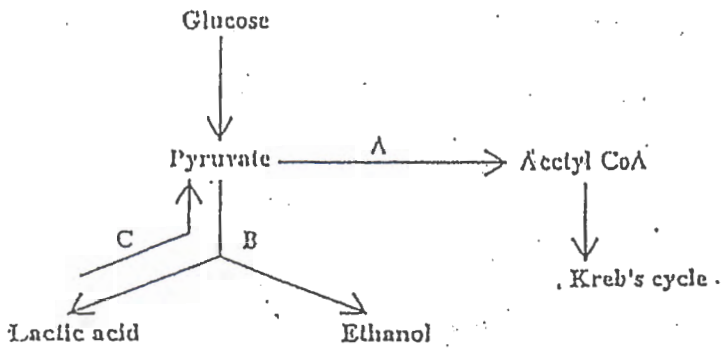

Figure 1

(a) Under what conditions do A and B occur?

A .....

B .....

[1 mark]

(b) In what types of organisms are (i) lactic acid and (ii) ethanol produced?

(i) .....

(ii) .....

[2 marks]

(c) How does the net production of energy differ between A and B?

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[2 marks]

(d) With reference to B and C in Figure 1 above, comment on the concept of oxygen debt.

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[3 marks]

(e) One of the products of the Kreb's cycle is hydrogen. State what happens to this hydrogen.

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[2 marks]

(a) Suggest a reason for the use of hydrogen carbonate solution instead of water in the experiment.

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[2 marks]

(b) Explain why discs rose to the surface when exposed to light.

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[2 marks]

(c) With reference to the data in Table 1, comment on the changes in photosynthetic rate between:

(i) 400 and 1 200 lux

.....

.....

[1 mark]

(ii) 1 200 and 2 800 lux

.....

.....

[1 mark]

(iii) 2 800 and 3 600 lux

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.....

[1 mark]

(d) (i) Predict the change in photosynthetic rate if the temperature were increased from 15 °C to 25 °C between 2 800 and 3 600 lux.

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[1 mark]

GO ON TO THE NEXT PAGE

(c) Describe how a pyramid of energy would differ from the pyramid of numbers obtained in this study.

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[2 marks]

(d) State TWO advantages of using pyramids of energy.

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[4 marks]

M.2 7.1, 2.2, 7.5 ... 11.1 6.1, 6.2, 6.3

Discs of equal area were punched from a leaf using a cork borer, and were placed in a 0.1 N potassium hydrogen carbonate solution. By means of a simple procedure, the gas filling the intercellular spaces of the leaf discs was withdrawn and replaced by the hydrogen carbonate solution. The specific gravity of the discs increased so they sank in the solution. Batches of 5 discs were then transferred to five separate test tubes containing similar hydrogen carbonate solution and were placed each under a different light intensity. All of the discs rose to the surface. The time taken for each disc to rise to the surface was noted and the mean time calculated. This was used as a measure of the photosynthetic rate and is presented in Table 1 below.

Tube	Light Intensity (lux)	Photosynthetic Rate 1/mean time (min) x 10^3
1	400	16
2	1 200	28
3	2 000	71
4	2 800	220
5	3 600	219

Table 1

GO ON TO THE NEXT PAGE

(c) Examine Figure 2 carefully and, from your knowledge of the requirements of the process of photosynthesis, show how the position and structure of the tissue, labelled C, and the tissue to which the cell, labelled G belongs, enable them to carry out their role.

C .....

.....

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G .....

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[2 marks]

(d) What are the roles of ATP and NADPH in the process of photosynthesis?

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[2 marks]

2, 1, 2, 2, 2, 4 H, 1, 2, 2, 3, 3, 4 = 6

5. Control of various functions and mechanisms in animals is governed by chemical transmission, electrical impulses or a combination of both.

(a) Give an example of a process or action that is controlled by:

(i) Chemical transmission

.....

[1 mark]

(ii) Electrical impulses

.....

[1 mark]

(iii) Electrical impluses and chemical transmission

.....

[1 mark]

GO ON TO THE NEXT PAGE

(ii) Explain your answer to d(i) on page 5.

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[2 marks]

Figure 2 below is a drawing of a transverse section through a dicotyledonous leaf.

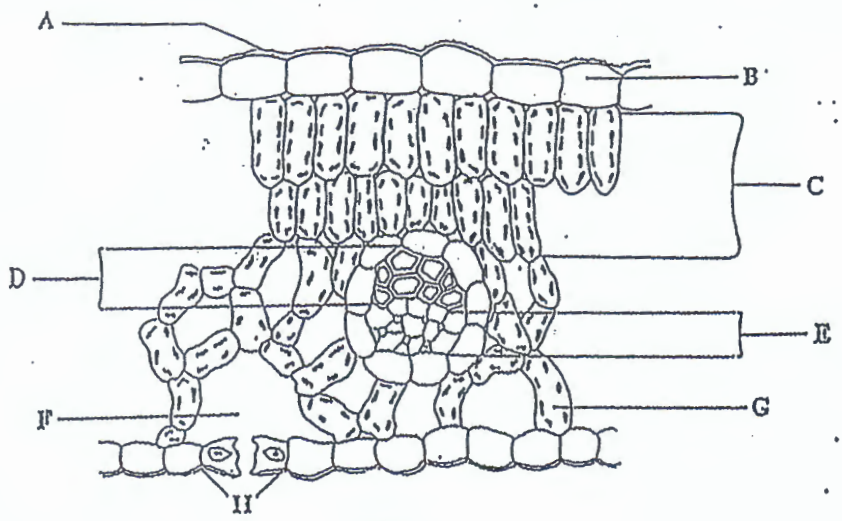

Figure 2

(a) Identify the tissues/structures labelled A to H.

A ..... D ..... G .....

B ..... E ..... H .....

C ..... F .....

[4 marks]

(b) What are the roles of the tissues/structures labelled D and H in the process of photosynthesis?

D .....

.....

H .....

.....

[2 marks]

(b) (i) What is the name given to chemicals such as those named at (a)(ii) on page 6?

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[1 mark]

(ii) State ONE way in which these chemicals differ from substances which show similar action in plants.

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[2 marks]

(c) Oestrogen, a hormone produced in mammals, helps to maintain bone strength. With age, particularly after cessation of menstruation in females, oestrogen production is significantly reduced leading to a weakening of the bones, a condition known as osteoporosis.

Compare the production and action of this hormone with that of ethylene produced by fruits.

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[4 marks]

M1, 5, 2, 5, 3, 6, 5

M2. 7, 1, 7, 4, 6, 3

6. The graph in Figure 3 below shows the human oxygen dissociation curve of haemoglobin.

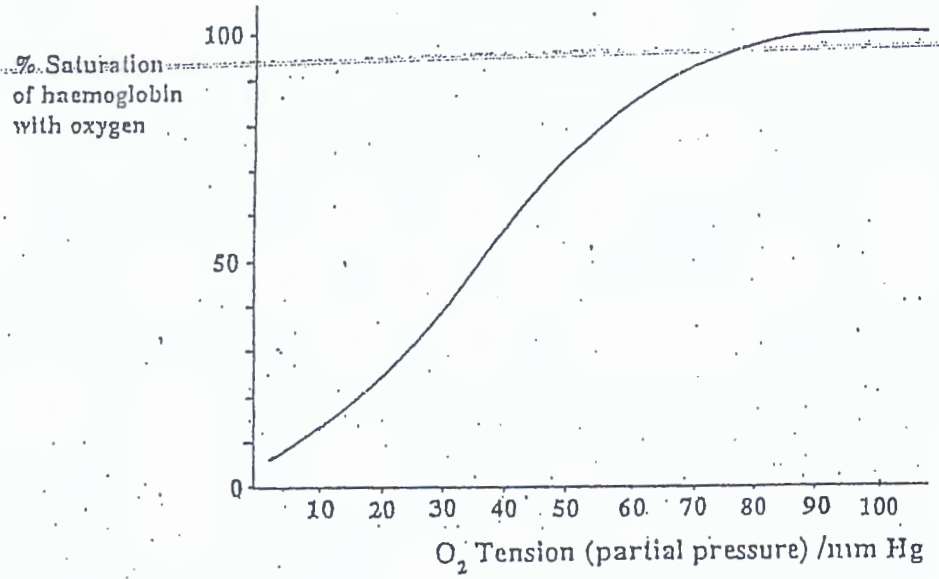

Figure 3

(a) In order to obtain experimental evidence to construct this curve, would biologists rely on *in vivo* or *in vitro* methods?

.....

[1 mark]

(b) At what oxygen tensions is haemoglobin

(i) 50% loaded? .....

(ii) 95% loaded? .....

[1 mark]

(c) Why does the curve level off after the 95% saturation point?

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.....

.....

[2 marks]

(d) Table 2 below shows the percentage composition of air in the atmosphere and lungs.

%	Inspired Air	Alveolar Air	Expired Air
O_2	20	13	16
CO_2	0.03	6	4
N_2	Approx. 80	Approx. 80	Approx. 80

Table 2

When the oxygen concentration is 20% of the air by volume, its partial pressure (or tension) is

$$\frac{20}{100} \times 760 = 152 \text{ mm Hg}$$

Calculate the partial pressure of O_2 in alveolar air, and state whether it is adequate to achieve 95% saturation of haemoglobin. (Show your calculations.)

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[2 marks]

(e) On the graph in Figure 3 on page 9, draw a curve to show the effect of high CO_2 tension on the oxygen dissociation curve.

[1 mark]

(f) What effect do high tensions of carbon dioxide in the tissues have on the oxyhaemoglobin in the tissue capillaries?

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[1 mark]

(g) (i) Exactly where in the body is the homeostatic response to high carbon dioxide levels initiated?

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[1 mark]

(ii) What action is taken to regain the set point of the CO_2 blood level?

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[1 mark]

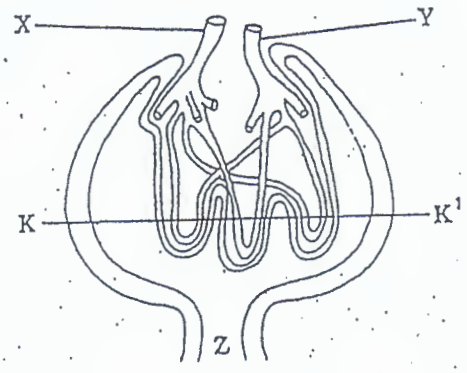

Figure 4. L.S. Bowmnn's capsule

If a cross section of another capsule were taken at position K-K¹ in Figure 4 above, which of the following three drawings would represent it?

(i) (ii) (iii)

(a) .....

[1 mark]

(b) On Figure 4 insert the pathways from Location X to Location Y or Z of:

(i) A molecule of glucose (use dashed line — — — →) [1 mark]

(ii) A molecule of urea (use a dotted line . . . . . →) [1 mark]

(iii) A molecule of globulin (use a dash/dot line — . — . — . →)

[1 mark]

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(c) Figure 5 below represents a nephron.

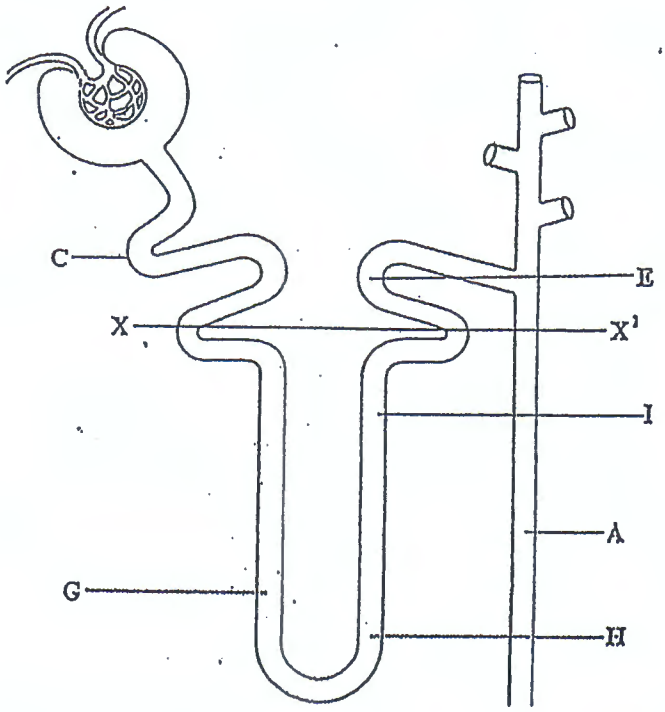

Figure 5

A section taken at Level X – X¹ in Figure 5 includes the structures shown in Figure 6 below.

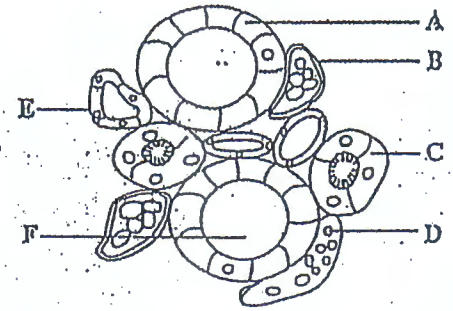

Figure 6

Identify the following structures labelled in Figure 6 above:

C ..... B .....

E ..... F .....

[2 marks]

3. Figure 7 below shows the components of a system to control the level of Amino acid, X, in the blood.

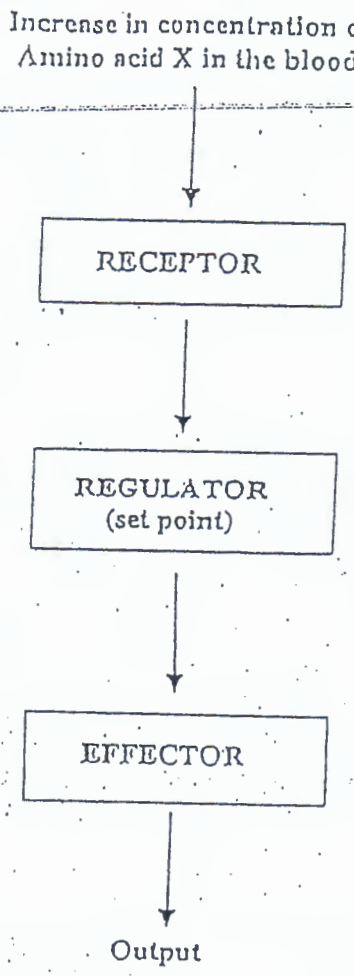

Figure 7

(a) Describe TWO processes that could bring about an increase in the blood of Amino acid, X.

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[2 marks]

(b) Explain what is meant by 'set point' and why it is important.

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[2 marks]

(c) (i) Which organ would be the effector in this case?

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[1 mark]

(ii) Explain precisely how it would carry out its function.

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[2 marks]

(iii) What would be the fate of the products formed from this activity of the effector?

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[2 marks]

(d) Explain what the "output" would be in this case.

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[1 mark]

GO ON TO THE NEXT PAGE

(d) Explain how the hormone, ADH, affects the cells of A in Figure 6 when the water potential of blood is low.

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[1 mark]

(e) How do cells, labelled D in Figure 6, assist with the removal of NaCl from Tubule I in Figure 5?

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[1 mark]

(f) How do cells in the wall of the tubule at G and H in Figure 5 differ in their permeability?

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[1 mark]

(g) Give ONE reason why glucose might be found at F in Figure 6.

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[1 mark]

Students at a local high school were offered the following two lunch selections.

A — Hamburger (2 slices bread, 1/4 lb beef, 2 slices cucumber, 1 slice tomato)
Orange juice
1 mango

B — Jam sandwich (2 slices bread, pineapple jam)
Orange soda
1 banana

(a) List the main nutrients present in EACH selection, giving the source of EACH nutrient.

A .....

.....

B .....

.....

[4 marks]

(b) State which selection, A or B, is more balanced, giving TWO reasons to support your choice.

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[2 marks]

(c) Select any TWO nutrients which are deficient in the less balanced diet and outline TWO functions of EACH in the body.

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[4 marks]

10. Agricultural productivity can be adversely affected by the incidence of pests and diseases among livestock and crop plants.

(a) (i) Name a causal agent that accounts for a disease of a named crop plant in the Caribbean.

Causal agent .....

Crop plant .....

[2 marks]

(ii) Name a pest that causes disease in a named farm animal in the Caribbean.

Pest .....

Farm animal .....

[2 marks]

(b) State TWO methods that can be employed to reduce the incidence of a fungal disease in crop plants and briefly comment on a drawback of EACH method stated.

Method .....

Drawback .....

Method .....

Drawback .....

[4 marks]

(c) Bovine somatotrophin (BST) is a hormone that can be injected into cows to bring about an increase in milk production. Evidence suggests that the hormone-treated animals are more susceptible to disease and thus must be treated with drugs to boost their immune system.

State whether you consider it advisable to use the milk from such cows, giving a reason for your answer.

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[2 marks]

GO ON TO THE NEXT PAGE

1. (a) What do you understand by the term 'social disease'?

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[1 mark]

(b) Name a social disease, brought on by 'socialising', that can affect the liver.

.....

[1 mark]

(c) Suggest THREE social problems, other than the social disease, that may be brought about by the condition mentioned in (b) above.

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[3 marks]

(d) Organ transplant technology offers hope for a person whose liver has been damaged as a result of the social disease mentioned. Unavailability of a liver might be a drawback.

(i) Name ONE other serious drawback.

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[1 mark]

(ii) State the effects of the drawback mentioned in d (i) above.

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[3 marks]

(e) Name ONE clinical procedure that can be used to prevent the drawback mentioned in (d) (i) above?

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[1 mark]

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2. Figure 8 below shows death rate in relation to body weight for men of approximately the same height, aged 18 - 40 years.

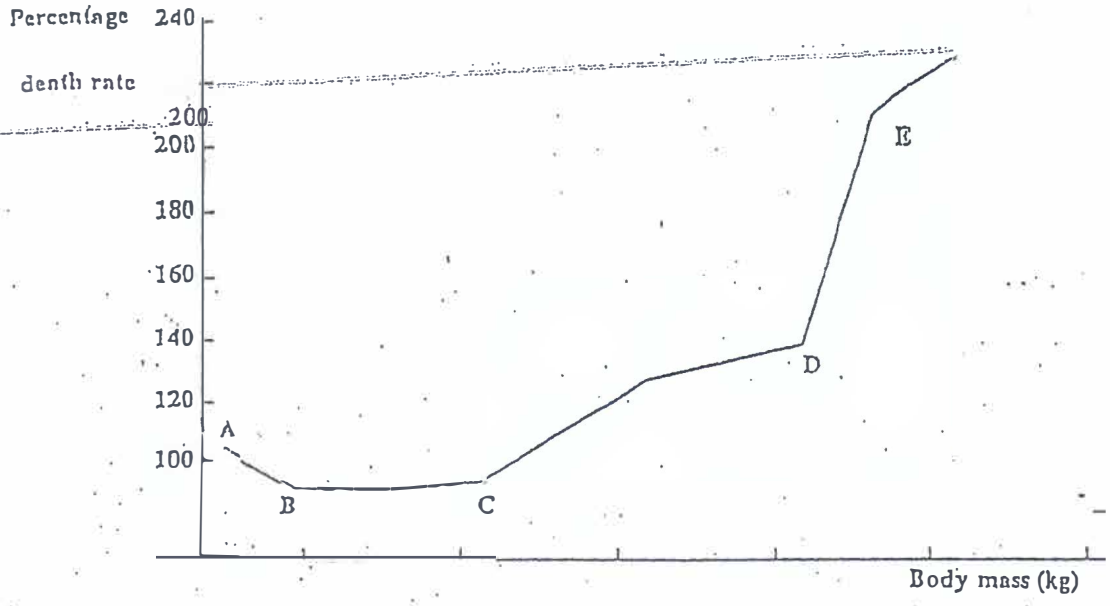

Figure 8

(a) At which points A, B, C, D or E in Figure 8, would you expect (i) starvation and (ii) obesity to have contributed to the deaths of the men?

Starvation .....

Obesity .....

[2 marks]

(i) With reference to Figure 8, between which points, A-E, does the range for ideal body weights for men 18 - 40 years exist?

.....

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[1 mark]

(ii) State TWO ways in which ideal body weight can be controlled.

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.....

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[2 marks]

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